ĐẠI HỌC QUỐC GIA TP. HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC BÁCH KHOA

KỶ YẾU TÓM TẮT
HỘI NGHỊ KHOA HỌC VÀ CÔNG NGHỆ LẦN THỨ 16

15/10/2019

BOOK OF ABSTRACTS OF THE 16th SCIENTIFIC CONFERENCE OF HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY
October 15, 2019

NHÀ XUẤT BẢN ĐẠI HỌC QUỐC GIA TP. HỒ CHÍ MINH

LỜI NÓI ĐẦU

Kính thưa Quý vị đại biểu,

Thay mặt Ban Giám hiệu trường Đại học Bách Khoa - Đại học Quốc gia Tp. HCM, chúng tôi rất vui mừng chào đón quý vị đại biểu, các nhà nghiên cứu trong và ngoài nước, các cơ quan truyền thông đã đến tham dự hội nghị khoa học và công nghệ lần thứ 16 của trường Đại học Bách Khoa được tổ chức tại Thành phố Hồ Chí Minh trong ngày hôm nay - 15/10/2019.

Thưa quý vị đại biểu, trải qua gần 62 năm xây dựng và phát triển, đến nay trường Đại học Bách Khoa đã có nhiều thành tựu đáng tự hào trong lĩnh vực đào tạo, nghiên cứu và chuyển giao công nghệ ở phía Nam, đồng thời là trường đại học trẻ trung năng động trong tư duy và hành động. Để có được những thành tích như vậy, nhà trường đã luôn luôn theo đuổi và cố gắng hoàn thành sứ mạng của mình là cung cấp nguồn nhân lực và dịch vụ khoa học công nghệ chất lượng cao cũng như thực hiện trách nhiệm xã hội và phục vụ cộng đồng cho mục tiêu công nghiệp hóa và hiện đại hóa đất nước. Trên cơ sở sứ mạng này, rất nhiều mục tiêu phấn đấu đã được đề ra nhằm đảm bảo cho các hoạt động khoa học công nghệ sẽ mang lại các lợi ích thiết thực, đáp ứng tốt nhất cho nhu cầu xã hội. Để từng bước hiện thực hóa điều này, trường Đại học Bách Khoa đã và đang phấn đấu để trở thành một trường đại học sáng tạo, tiên phong và chủ động hội nhập quốc tế với các mục tiêu chiến lược quản trị hiệu quả các nguồn nhân lực, thu hút và đãi ngộ cán bộ viên chức có chất lượng cao, xuất sắc trong đào đạo và xuất sắc trong khoa học – công nghệ. Với phương châm này, trong thời gian gần đây, các nguồn lực tài chính (từ ngân sách nhà nước đến các dự án hợp tác) chủ yếu được nhà trường tập trung đầu tư vào việc xây dựng và nâng cấp các phòng thí nghiệm trọng điểm, phát triển các nhóm nghiên cứu mạnh, đào tạo đội ngũ nhân sự, xây dựng cơ sở dữ liệu chung và cải tiến các quy trình quản lý hoạt động khoa học công nghệ. Thành tựu thu được từ quá trình đầu tư liên tục, có định hướng và có chiều sâu đó chính là các kết quả nghiên cứu khoa học có chất lượng cao được cộng đồng quốc tế công nhận, các hướng nghiên cứu đa dạng, bám sát các nhu cầu của xã hội, các sản phẩm công nghệ phong phú, có khả năng chuyển giao cho các doanh nghiệp và đáp ứng nhu cầu của xã hội.

Việc tổ chức các hội nghị khoa học cũng nằm trong các chiến lược để thực hiện sứ mạng đã nêu ra ở trên. Qua các hội nghị này, với sự tham gia của các nhà khoa học trong và ngoài nước cũng như các doanh nghiệp sẽ là một cơ hội tốt để nhà trường có thể tổng kết, đánh giá, hoạch định các hướng nghiên cứu thích hợp, cũng như quảng bá hình ảnh, năng lực và phổ biến các kết quả nghiên cứu khoa học đến với cộng đồng. Với tinh thần này trong suốt quá trình phát triển của mình, Trường Đại học Bách Khoa đã thường xuyên tổ chức các hội nghị khoa học và công nghệ theo định kỳ 2 năm một lần. Đến thời điểm hiện tại, hội nghị này đã được diễn ra được 15 lần và lần này là lần thứ 16.

Hội nghị khoa học công nghệ lần thứ 16 này diễn ra hôm nay 15/10/2019. Đến với hội nghị này, bên cạnh sự hiện diện đông đủ của các nhà khoa học từ các trường đại học, viện nghiên cứu trong nước, còn có sự tham dự của nhiều nhà khoa học đến từ các nước Đông Nam Á, Anh, Úc, Pháp, Nhật, Hàn Quốc v.v. Tổng số bài báo được chấp nhận đăng trong kỷ yếu của hội nghị là 684 bài. Ngoài ra, các báo cáo điển hình của các chuyên gia có nhiều uy tín từ trường đại học và cơ quan quản lý Nhà nước với các đề tài có nội dung tổng quan về tình hình và các định hướng nghiên cứu mới trong các lĩnh vực về thành phố thông minh và nông nghiệp thông minh cũng được trân trọng mời thuyết trình tại hội nghị. Trong hội nghị lần này, các lĩnh vực nghiên cứu cũng được trải rộng hơn và phong phú hơn, thể hiện qua con số 74 phân ban từ 11 khoa chuyên ngành của trường và một phòng thí nghiệm trọng điểm cấp quốc gia. Ngoài 22 phân ban trong nước như Vật lý Kỹ thuật, Khoa học Máy tính, Tài nguyên Trái đất, Năng lượng bền vững, Công nghệ và Phát triển bền vững v.v., còn có 52 phân ban quốc tế như Cơ – Điện tử và Robot, Logistics và Chuỗi cung ứng, Vật liệu Năng lượng & Ứng dụng, Vi mạch và Hệ thống, Kỹ thuật Điều khiển và Tự động hóa, Hội nghị quốc tế ACOMP, Năng lượng và Tài nguyên Trái Đất cho phát triển bền vững .v.v. Trong khuôn khổ chương trình của hội nghị, còn có sự kết hợp với việc tổ chức triển lãm để các cá nhân, doanh nghiệp và các đơn vị trong và ngoài trường có thể trưng bày các sản phẩm của thành tựu nghiên cứu mới nhất của mình trong thời gian gần đây.

Để có buổi hội nghị diễn ra như ngày hôm nay, chúng tôi đã nhận được rất nhiều sự đóng góp từ các tác giả, các nhà khoa học cho công tác phản biện, biên tập các bài báo cũng như các đơn vị tài trợ đã hỗ trợ kinh phí tổ chức hội nghị. Thay mặt ban tổ chức, chúng tôi muốn gửi lời cảm ơn chân thành đến tất cả quý vị vì sự giúp đỡ tận tình này.

Sau cùng, chúng tôi kính chúc hội nghị diễn ra thành công tốt đẹp. Hy vọng quý đại biểu sẽ gặt hái được nhiều điều thú vị và bổ ích trong hội nghị khoa học công nghệ lần này. Kính chúc quý vị đại biểu dồi dào sức khỏe, hạnh phúc và nhiều thành đạt.

PGS. TS. Mai Thanh Phong
HIỆU TRƯỞNG
TRƯỜNG ĐẠI HỌC BÁCH KHOA TP. HCM

PREFACE

Dear distinguished Guests, Ladies and Gentlemen,

On behalf of the Rectorate Board of Ho Chi Minh City University of Technology – Vietnam University - Ho Chi Minh City, we are very pleased to welcome all the distinguished guests, domestic and international researchers, and media organizations to The 16th Scientific Conference of Ho Chi Minh City University of Technology held in Ho Chi Minh City today - October 15, 2019.

Ladies and gentlemen, for nearly 62 years of construction and development, Ho Chi Minh City University of Technology has achieved much proud success in training, scientific research, and technology transfer in Southern Vietnam as a young and active university in thinking and action. To obtain those achievements, we have persistently pursued and fulfilled our mission to provide high quality human resources and scientific and technological services as well as perform our responsibility to the society and serve the community for the purpose of industrialization and modernization of our country. From this elevated assignment, many targets have been set to ensure that all scientific and technological activities will bring practical benefits, meeting the social demands. To gradually realize this expectation, Ho Chi Minh City University of Technology has been striving to become one creative, pioneering, and proactive university to the international integration with the strategic goals of effectively managing human resources, attracting and treating high-quality officials and employees, excellence in training and excellence in scientific and technological research. This is the reason why all the financial resources from the state budget as well as the joint projects are largely focused on investing in the establishing and upgrading key laboratories, developing excellence research groups, training human resources, building a common database, and improving management processes of science and technology activities. The obtained achievements from the process of continuous, oriented and in-depth investment are those the results of high-quality scientific research are recognized by the international community; the research directions are diverse and closely follow the needs of the society; and technological products are rich and transferable to businesses and meet the needs of society.

The organization of scientific conferences is also a part of the strategies for carrying out the mission outlined above. Through these conferences, the participation of domestic and foreign scientists as well as businesses will offer a good opportunity for our university to review, evaluate, and plan the appropriate research directions, as well as promote the image, capacity, and dissemination of scientific research results to the community. With this spirit throughout its development, Ho Chi Minh City University of Technology regularly organizes scientific conferences every two years. So far, the conference has been held 15 times and this time is the 16th time.

This 16th scientific conference takes place today 15th October, 2019. Participating to this conference, in addition to the presence of scientists from universities and research institutes in the country, there are also many scientists from Southeast Asia and the UK, Australia, France, Japan, Korea, etc. The total number of accepted articles published in this conference proceedings is 684. In addition, key note speeches from prestigious experts from universities and State management agencies with topics of overview of the situation and new research orientations in different fields of Smart Cities and Smart Agriculture are also delivered at this conference. In this conference, the research fields are also more widespread and diversified, showing by the number of 74 divisions from 11 faculties of the university and one national key laboratory. In addition to 22 domestic divisions such as the Engineering physics, Computer science, Earth resources, Sustainable energy, Technology and Sustainable development, etc., there are also 52 international divisions such as Mechatronics and Robot, Logistics & Supply chain, Energy Materials and Application, Integrated circuits and Systems, Control engineering and Automation, Advanced computing and Applications, Earth resources and Sustainable energy, etc. During the conference, an exhibition of scientific and technological achievements will be also organized to allow all individual, faculties, centers in the university as well as other companies to introduce their latest research products in the recent years.

In order to organize the conference today, we have received much contribution from many authors and scientists for reviewing and editing all papers as well as sponsors for supporting and funding the conference. On behalf of the organizing committee, we would like to express our sincere thanks to all of you for this dedicated help.

Finally, we wish the conference a great success. We hope the delegates will gain many interesting and useful things in this conference. We wish you all good health, happiness, and great success.

Assoc. Prof. Dr. Mai Thanh Phong
Rector
Ho Chi Minh City University of Technology

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(SESSION: SMART & GREEN MATERIALS)

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(SESSION: COMPUTATIONAL MECHANICS)

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(SESSION: WIND LOAD AND DYNAMICS OF STRUCTURES)

PHÂN BAN: TẢI TRỌNG GIÓ VÀ ĐỘNG ĐẤT

(SESSION: WIND LOAD AND EARTHQUAKE)

PHÂN BAN: KẾT CẤU THÉP VÀ NHÔM

(SESSION: STEEL AND ALUMINUM STRUCTURES)

PHÂN BAN: KẾT CẤU BÊ TÔNG VÀ COMPOSITE

(SESSION: REINFORCED CONCRETE AND COMPOSITE STRUCTURES)

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(SESSION: LATEST ADVANCES IN STRUCTURAL HEALTH MONITORING)

PHÂN BAN: CÔNG NGHỆ MỚI TRONG KẾT CẤU XÂY DỰNG
(SESSION: RECENT ADVANCES IN TECHNOLOGIES FOR CIVIL ENGINEERING)

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(SESSION: ARCHITECT)

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(SESSION: CONSTRUCTION MANAGEMENT)

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(SESSION: INFRASTRUCTURE ENGINEERING)

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(SESSION: HYDRAULICS AND COASTAL ENGINEERING)

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(SESSION: GEOMATICS)

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FACULTY OF

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SESSION: MECHATRONICS AND ROBOTICS

DESIGN OF REAL-TIME CONTROLLER IN THE INDUSTRY

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Abstract: In the era of great scientific and technical development, the design constraints and specifications are increasingly advanced. The controllers are completed in a traditional way that does not meet the requirements to ensure processing time, avoid communication errors such as delay, data loss, and contribute to reducing errors caused by incidents. The real-time controller scheme is proposed to address outstanding issues. Based on real-time communication standards, the CPU can transmit or send data to devices or slaves to execute instructions. On the other hand, the microcontroller also has the ability to monitor the entire operation in the real time system. This helps improving the reliability of the control system. The controller tests are experimentally conducted on machine tools to check the feasibility, correctness and application according to requirements. From these experimental results, the controller will be perfected and widely applied in practice.

Keywords: *theory of control, servo system, real-time system, embedded controller.*

RESEARCH ON DESIGNING THE CONTROL SYSTEM OF 3D PRINTERS BASED ON DLP TECHNOLOGY

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Abstract: Nowadays, Additive manufacturing technology (also called 3D Printing in Vietnam) is the national topic. Most countries have their national strategy in research, development and application of designing and employing 3D printing technology for all sectors, organizations and people. Additive manufacturing technology has been applied in more and more industries, such as: Automotive, Aviation, Aerospace, Health, Construction, Electronics... At present, 3D printing systems based on DLP (Digital Light Processing) technology on the market are imported from Chinese and Korean manufacturers ... and their cost are very high. The paper presents a research to apply the engineering design process to design the control system of the 3D printer based on DLP technology with lower cost and comparable quality to other models on the market.

Keywords: *Engineering design, Control system, 3D Printer, Photosensitive material, Digital Light Processing Technology.*

RESEARCH ON DESIGNING THE CONTROL SYSTEM OF 3D PRINTERS BASED ON FDM TECHNOLOGY BY USING MODULARITY DESIGN METHOD

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Abstract: Nowadays, Additive Manufacturing (AM) is becoming more and more popular in industries and life. AM technology uses material that are linked with each other or crystallized by layers under computer control to create three-dimensional parts. AM technology has many categories, in which, the process that uses the nozzle to extrude the molten material ((FDM - Fused Deposition Modeling) is more common. Machines using this method are now very popular in the market, with the ability to work in accordance with many types of objects, from personal scale to company. However, the design and manufacture of these machines are carried out by traditional methods, which has many limitations. The research applied the design for assembly method using the analysis results of FDM technology 3D printer design by using the modularity design method in [5] to design its control system to reduce costs and improve product reliability.

Keywords: *3D Printer based on FDM Technology; Modularity Design; Control System Design.*

NON-CONTACT CONTROL OF AN AXIALLY MOVING BEAM BY VARYING TENSION FORCE

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Abstract: In this paper, a control algorithm to suppress transverse vibrations of an axially moving beam is presented. The equations of motion of the axially moving beam are derived by using Hamilton's principle. The proposed control algorithm is designed based on the linearization input-output approximate method, which is obtained in a reduced order of the axially moving beam systems using the Galerkin method. The advantage of the proposed control law is to regulate the transverse displacement of the moving beam without applying external force to the material surface directly and therefore, to prevent damage of the material surface. The effectiveness of the proposed control algorithm is verified by numerical simulations.

Keywords: *Axially moving systems, roll-to-roll system, input-output approximate linearization, Galerkin method*.

DESIGN AND CONTROL OF THE AUTOMATIC TENSION MEASUREMENT SYSTEM APPLYING IN THE TEXTILE ENGINEERING

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Abstract: Nowadays, Clothing industry is one of the fastest-growing industries in the world. In this field, product quality is always classified as the first priority due to the strict requirements and standards set by foreign businesses and consumers. Therefore, yarn tension control is a vital parameter in Garment Manufacturing Technology for quality and efficiency in textile processes such as winding, twisting and cabling, and in subsequent processes such as weaving and knitting. Although some systems have been developed (mainly in China), there is still various conundrums and considerable potentials for development of new and improved tension measurement as well as combining controllable function in future textile processing.

Keywords: *Tension, measurement, yarn, sensors.*

A STUDY ON DESIGN AND CONTROL OF THE REID VAPOUR PRESSURE SYSTEM FOR CONDENSATE

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Abstract: This research focuses on development a position control system of Scara Robot Arm with the fast respond and accuracy position by using Neural – PIDs Controller. Firstly, a new configuration of a modeling for Reid Vapor Pressure machine for Condensate is proposed. Modeling of the Controller based position control system is then derived based on the standard ASTM D323. Based on the derived model, an optimal design problem for the control system is built and the optimal solution is obtained based on Lagrangian Formulation of Dynamic. After that, the Scara Robot Arm based PID controller to control the position is designed and implemented. Experiments on position control of the fix load is then obtained and presented with remark discussions.

Keywords: *Reid Vapor Pressure, Scara Robot Arm, Neural – PID control, ASTM D 32.*

A STUDY ON DESIGN AND CONTROL OF THE HOME HYDROPONICS SYSTEM

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Abstract: Hydroponics system is the most popular in-home vegetable planting systems at current time. People are fond of this type of hydroponics because of this can supply the vegetable for their home and also be the decoration system for their living room. The paper represents a hydroponics system at home with main objective is completely automation farming process from seedling to harvest. In order to operate this system, we need to pay attention to the control of the temperature, the light, the nutrition quantities, the humidity and also the characteristic of the plants.

Keywords: *Hydroponics, Fresh vegetable, Indoor.*

THE DESIGN AND CONTROL OF A FISH ROBOT ACTUATED BY WIRING SYSTEM

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Abstract: In recent years, many studies about robotic fishes have been made, but their performances are lower than that of real fishes mainly because of their mechanical structure. This study gives a different design by combining wiring system with compliant material to create the adulatory swimming motion. The robot is consisted of three parts: The rigid head which housing all the electrical components, the wire-driven active body, and the compliant tail. Multi-pseudo-link model is used for compliant tail modelling. This design has some advantages compare to previous designs: high swimming velocity with lower power consumption, good manoeuvrability.

Keywords: *Fish robot, active and compliant propulsion mechanism, undulatory swimming*.

A STUDY ON DESIGN AND CONTROL OF THE AUTOMATIC JUICE SPRAY DRYING SYSTEM

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Abstract: Organic material like foods (fruits, vegetables…) or their ingredients (spices, colors…) are highly demanded for variety of purposes. However, its natural form is hard and expensive to transport or preserve since organic substance can be easily decomposed under the influences of temperature, virus, bacteria or mold. Spray drying technique is introduced as a inexpensiver solution to produce dry organic powder without excessively change it characteristic. Spray drying is a continuous operation that produce dry powders from a liquid, a slurry, or low viscosity paste through spraying the feed into a hot gaseous drying chamber.

Keywords: *Droplets, drying, spraying, hot air, powder.*

DESIGN AND CONTROL OF THE AUTOMATIC SHRIMP WEIGHTING AND PACKING SYSTEM

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Abstract: Nowadays, the weighting and packing system is used in a lot in the industries such as the food industries in particular. It ensures the volume of packaging products and quality and preserved standard for products. With the need of current situation of some seafood companies, our BioMech Lab has researched about the system of combining automated weighting and packing for the frozen shrimp export industry. Currently in Vietnam, the weighting and packing systems are semi-automatic, giving average capacity and a high rate of defective or non-standard products. In this paper, we present the method of designing, manufacturing and operating the system combining automatic weighting and packing of frozen shrimp.

Keywords: *Weighting and packing system, vacuum, thermal seal, quantitative balance.*

PHÂN BAN: CƠ HỌC MÁY

SESSION: MECHANICS OF MACHINES

EXPERIMENTAL RESEARCH EFFECTS OF TECHNOLOGY PARAMETERS ON THE TENSILE STRENGTH OF THE BAMBOO PARTICLE BOARD BILLET

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Abstract: The use of bamboo by-products such as bamboo branches to recycle and produce bamboo particle board, perfectly replaces the monolithic wood panel with artificial wood from bamboo powders to ensure raw material, protect environment, also bring economic benefits ... is an urgent task in Vietnam. The paper presents a study of the effect of technological parameters on the tensile strength of the bamboo particle board billet.

Keyword: *Bamboo by-products, Tensile strength, Technological parameters, Bamboo particle board billet.*

OPTIMIZE LIFT OF A FLEXIBLE NANO AIR VEHICLE BASED ON ANALYSING OF BENDING AND TWISTING RESONANCES

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Abstract: In recent decades, the prospect of exploiting the exceptional flying capacities of insects has prompted much research on the elaboration of flapping-wing nano air vehicles (FWNAV). However, when designing such a prototype, designers have to wade through a vast array of design solutions that reflects the wide variety of flying insects to identify the correct combination of parameters to meet their requirements. To alleviate this burden, the purpose of this paper is to develop a suitable tool to analyze the kinematic of a resonant flexible-wing nano air vehicle. The proposed tool uses a Bond Graph formalism because it is well suited to simulating multi-physical systems. Moreover, the prototype studied combines two resonant vibration modes – bending and twisting – to reproduce insect wing kinematics. This could be considered as the key to optimize the generated lift.

Keywords: *Flapping wing nano air vehicle, power, energy, Bond Graph, flexible structure*.

NGHIÊN CỨU ẢNH HƯỞNG THÔNG SỐ CÔNG NGHỆ ĐẾN BIÊN ĐỘ RUNG ĐỘNG VỚI CÁC DẠNG QUY HOẠCH THỰC NGHIỆM BẬC 2 KHÁC NHAU

Nguyễn Hữu Lộc*, Nguyễn Phước Hưng

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Abstract: For CNC machines, the machining accuracy is extremely important, it determines the quality of the product. Vibration amplitude and stiffness are the key factors that determine the machining accuracy of the CNC machine. Before that situation, the study of the structure stiffness and the effect of technological parameters to the vibration amplitude of the CNC router spindle with various Second-order designs to improve machining accuracy are the important problems. The content of the article includes: experimental research with 3 methods of response surface design of experiments; experimental factors affecting the vibration amplitude of CNC router and making conclusions for the whole article.

Keywords: *CNC router structure, design of experiments, vibration amplitude, stiffness.*

DYNAMIC RESEARCH OF SCOOPING PROCESS ON THE SIDE DUMP BUCKET LOADER MCV E500-1 FOR TUNNEL CONSTRUCTION BY THE DRILL AND BLAST METHOD

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Abstract: The article presents the process building the dynamic models of the material loading and dumping process in the working cycle of the side dump bucket loader. Based on the built model, the dynamic characteristics of the equipment will be considered and surveyed to meet the post-drilling conditions of rock environment and the working space in the tunnel. At the same time, it is the basis for equipment selecting for exploitation or new design of this loader in accordance with environmental characteristics, the space of tunnels constructed by drill and blast method.

Keywords: *The side dump bucket loader, working equipment, dynamic model.*

OPTIMAL DESIGN PARAMETERS FOR 3-RRR COMPLIANT PARALLEL MECHANISMS WITH MAXIMAL STIFFNESS PROPERTY

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Abstract: Any compliant parallel mechanism (CPM) must perform high flexibility in actuating axes and high stiffness in other directions to achieve its desired degrees-of-freedom (DOF). Thus, maximizing stiffness ratios between actuating and non-actuating stiffness is essential during the synthesis process of CPMs. This paper provides the optimal design parameters for 3-DOF planar-motion CPMs developed based on the 3-revolute-revolute-revolute (3-RRR) configuration to achieve maximal stiffness behavior. The stiffness property of the CPM is analytically derived and parameters representing the position/orientation of each flexure joint are considered as design variables. Genetic algorithm (GA) is employed as the solver of the optimization process with the objective function being formulated by stiffness ratios. Using the obtained results, a novel design of 3-RRR CPM with large workspace and maximal stiffness performance is archived. A 3D printed prototype of the optimized CPM is built and several testings are also carried out to evaluate the elastic deformations of the 3D printed CPM in desired direction in order to demonstrate the correctness of the proposed results.

Keywords: *Compliant mechanism, flexure mechanism, 3-RRR, optimization, stiffness property.*

DESIGN OF FEED PELLETING MACHINE 25 TONS/HOURS

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Abstract: Use of mixed feeding is convenient, reduce production costs in the stages of feeding, processing, preserving and reducing labor, use less food but high productivity to bring high economic efficiency inlivestock.Therefore,the pelleting process is an indispensable process in the current feed production line. With pressing requirements from the manufacturing market with industrial scale, it is necessary to manufacture pellet presses with large capacity to response the huge demand of the market, so designing a pellet machine is one necessaryrequirements to meet the current needs of the market. In this article, perform calculations for maximum productivity of 25 tons / hour.

Keywords: *Feed pelleting machine, animal feed, automation.*

DESIGN DEVELOPMENT OF THE BALL AJUSTED ARTIFICIAL SPINE DISC

Nguyễn Trọng Pul, Lê Nhựt Linh, Trần Đức Toàn,Võ Đình Thái, Tô Ngọc Giô Na, Huỳnh Thiên Tường, Nguyễn Văn Tùng, Trần Minh Tâm, Trương Văn Tiển, Phan Chu Tấn, Trịnh Quốc Hùng, Nguyễn Tấn Khánh, Trần Nguyên Duy Phương*, Vy Đức Kiệm

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Abstract: This paper presents the design development of the ball adjusted artificial spine disc for patients with bone cancer based on the existing spine disc design to increase abrasion resistance as well as increase the lifespan of details. Moreover, the design is also geared towards fabricating with CNC technology.

Keywords: *The adjusted artificial spine disc, the ball adjusted artificial spine disc, bone cancer.*

RESEARCH ON OPTIMIZING THE TECHNOLOGICAL PARAMETERS BY THE REGRESSION EQUATION OF DIMENSIONAL ERROR IN DEPTH ORIENTATION WHEN MANUFACTURING SHEET MATERIAL BY HOT SPIF PROCESS

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Abstract: Single Point Incremental Forming technology (SPIF) has become more and more popular in sheet forming industry, especially in one-off production and prototype production in the field of health. However, if the sheet materials have high hardness and durability, it is difficult to deform and shape them because of their high elasticity. In that case, if we determine the appropriate value of main technological parameters, such as temperature $T(^0C)$, the horizontal feed rate V_{xy}(mm/ph), the length of step in depth Δz(mm) and forming tool diameter D (mm), we apply HOT SPIF technology at high temperature to manufacture these materials. The paper presents a study to optimize the main technological parameters when processing non-alloy titanium sheet with HOT SPIF technology to obtain the minimum dimensional error of depth orientation ΔH.

Keywords: *HOT SPIF, Sheet Metal Forming, Technological Parameter, Optimization, Dimensional Error.*

DESIGN AND CONTROL OF THE AUTOMATIC SHRIMP WEIGHTING AND PACKING SYSTEM

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Abstract: Nowadays, the weighting and packing system is used in a lot in the industries such as the food industries in particular. It ensures the volume of packaging products and quality and preserved standard for products. With the need of current situation of some seafood companies, our BioMech Lab has researched about the system of combining automated weighting and packing for the frozen shrimp export industry. Currently in Vietnam, the weighting and packing systems are semi-automatic, giving average capacity and a high rate of defective or non-standard products. In this paper, we present the method of designing, manufacturing and operating the system combining automatic weighting and packing of frozen shrimp.

Keywords: *Weighting and packing system, vacuum, thermal seal, quantitative balance.*

DEVELOPMENT OF VIETNAMESE BANANA LEAF CAKE MAKER MACHINE

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Abstract: Automatic machines for food industry and home appliance are one of the needs and trends that are applying around the world. However, the application of the automation system for making Vietnamese local food is very limited. The banana leaf cake is one of the specialty food of Central Vietnam and is enjoyed by many Vietnamese and foreign tourists. However, Vietnamese banana leaf handmade cakes with disadvantages like all the steps are handmade include making powder, fillings and package that can take a lot of time, effort and employees. Recognizing these disadvantages, we decide to design and manufacture the “Vietnamese banana leaf cake maker machine” with the desire to improve efficiency and reduce the cost of employees. This machine is developed from the order of a local restaurant that can completely put all the ingredients in a banana leaf and fold it to make the final product. The main parts of the system consist of conveyor, flour and filling inserter, folding mechanism and controller. The controller of the system consists of Arduino Mega microcontroller for controlling the whole process, optic sensor for detecting banana leaf, and relays in combination with valves for controlling the pneumatic pistons. The machine is on testing phase and give very promising results.

Keywords: *Food industry; Automation system; Banana leaf cake; Arduino Mega.*

DAMPING SYSTEM FOR TOOL HOLDER OF TURNING PROCESS

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Abstract: Silent tool has long been a well-known product and attracted much interest in the field of metal cutting tools. When working, it is necessary to reduce the vibration so that the surface of the grinding wheel has a high gloss. Using a shock absorber, when the vibration occurs and develops, it activates the damping system, producing a force against vibration, absorbing the energy that causes the vibration, destroy resonance and reduce the amplitude of oscillation. Using a anti-vibration halt is possible to achieve the surface finish level of 9 with a ra value of 0.2834 µm that improved completely when compared to a common halt (level 8 in surface finish). Thereby showing the reduction of vibration when using the shock absorber you can increase the value of the cut mode parameters while still ensuring the safety and minimizing vibration tolerance, dimensional tolerances and surface quality. Increased metal removal productivity thereby minimizing production costs.

Keywords: *Damping, ribration, silent tool, gloss, cut mode parameters.*

STUDY ON THE EFFECT OF LOADING STRESS ON FLEXURAL FATIGUE STRENGTH OF INJECTION MOLDING PRODUCT

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Abstract: In this paper, the the effect of loading stress on flexural fatigue strength was researched with specimens of ASTM D790. ABS materials were used in this study. In the study, the flexural strength of plastic injection molding products decreases when the impact cycle load value increases. When the melting temperature increases, the flexural fatigue strength increased. When the packing pressure was increased from 38 MPa to 40 MPa, the fatigue strength increased. However, when the packing pressure was higher than 40 MPa, the fatigue strength decreased. The flexural fatigue strength was only increased when the packing time varied from 0.2s to 0.8s, if continuously increasing the packing time, the fatigue strength will get the negative effect.

Keywords: *Injection molding, flexural fatigue, loading stress, molding parameter.*

INFLUENCE OF LAYER PARAMETERS IN 3D PRINTING FDM PROCESS ON TENSILE STRENGTH OF PRODUCT

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Abstract: 3D printing is a promising digital manufacturing technique that produces parts, layer by layer. Fused deposition modeling (FDM) is a widely employed 3D printing technology that produces components by heating, extruding and depositing filaments of thermoplastic polymers. The properties of FDM-produced parts are significantly influenced by the processing parameters. These processing parameters have conflicting advantages that need to be investigated. This paper investigates the effect of process parameters on the tensile properties of components produced by FDM technique. The study is carried out on Polylactic acid (PLA), by using full factorial design of experiment to analyze the effects of process parameters on the tensile properties of the model. For the investigation, three parameters – layer height, solid layers Top, first layer height – are considered. From the investigation, it is observed that, among the considered parameters, only one parameter (layer height) insignificantly influence the tensile properties of the model.

Keywords: *3D Printing, Fused deposition modeling (FDM), Layer*

PHÂN BAN: KỸ THUẬT CHẾ TẠO

SESSION: MANUFACTURING ENGINEERING

DESIGN OF THE ADJUSTED ARTIFICIAL SPINE DISC

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Abstract: This paper presents the design of the adjusted artificial spine disc for L4 vertebrae and L4-L5 intervertebral discs to replace the cancerous vertebrae, for specific patients, suitable for a variety of cases lead to better cosmetic and functional results than old methods. Finally, offer manufacturing options, including 3D printing technology.

Keywords: *The artificial spine disc, the adjusted artificial spine disc, bone cancer.*

THIẾT KẾ HỆ THỐNG ĐỊNH VỊ VÀ ỔN ĐỊNH HỘP SỌ TRONG PHẪU THUẬT SỌ NÃO

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Abstract: Hệ thống cố định đầu trong phẫu thuật sọ não (Cranial Fixation & Stabilization System) là công cụ hỗ trợ quan trọng trong phẫu thuật thần kinh, giúp cố định tư thế đầu và ổn định phẫu trường trong không gian tạo thuận lợi trong việc tiếp cận các mục tiêu phẫu thuật và phối hợp với các thiết bị định vị chuyên dùng (navigation), tay vén não tự động... Trên thế giới, loại thiết bị này đã được sản xuất và sử dụng rộng rãi ở các bệnh viện chuyên ngành ngoại thần kinh. Tuy nhiên giá thành chế tạo tương đối cao. Trong nước, trang bị phương tiện này tại các tuyến bệnh viện cơ sở còn khá hạn chế, cũng như chưa được quan tâm nghiên cứu chế tạo cho phù hợp với người Việt Nam. Song song với phát triển kinh tế, xã hội và đặc biệt là công nghệ khoa học và kỹ thuật hình ảnh học y khoa trong thời gian gần đây đã không ngừng thúc đẩy nhu cầu phát triển trong lĩnh vực phẫu thuật bệnh lý thần kinh, như vậy, mức độ trang bị như vậy không đáp ứng được yêu cầu của các bệnh viện. Một số bộ phận của thiết bị chưa phù hợp với kích thước hộp sọ của người Việt đặc biệt là trẻ em nên có gây ra một số tổn thương nhất định. Nghiên cứu này dựa trên cơ sở đánh giá phân tích các hư hỏng của thiết bị trong quá trình sử dụng và các thông số sinh trắc học để thiết kế lại cho phù hợp với điều kiện Việt Nam. Một hệ thống cố định hộp sọ trong phẫu thuật sọ não được tính toán, thiết kế, đánh giá khả thi dựa trên mô phỏng máy tính trước khi tiến hành chế tạo thực nghiệm.

Keywords: *Cranial Fixation & Stabilization System, Head Frames, Skull Clamp.*

EXPERIMENTAL RESEARCH EFFECTS OF TECHNOLOGY PARAMETERS ON THE TENSILE STRENGTH OF THE BAMBOO PARTICLE BOARD BILLET

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Abstract: The use of bamboo by-products such as bamboo branches to recycle and produce bamboo particle board, perfectly replaces the monolithic wood panel with artificial wood from bamboo powders to ensure raw material, protect environment, also bring economic benefits ... is an urgent task in Vietnam. The paper presents a study of the effect of technological parameters on the bending strength of the bamboo particle board billet.

Keywords: *Bamboo by-products, Bending strength, Technological parameters, Bamboo particle board billet.*

RESEARCH ON OPTIMIZING THE TECHNOLOGICAL PARAMETERS BY THE REGRESSION EQUATION OF DIMENSIONAL ERROR IN RADIAL ORIENTATION WHEN MANUFACTURING SHEET MATERIAL BY HOT SPIF PROCESS

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Abstract: Single Point Incremental Forming technology (SPIF) has become more and more popular in sheet forming industry, especially in one-off production and prototype production in the field of health. However, if the sheet materials have high hardness and durability, it is difficult to deform and shape them because of their high elasticity. In that case, if we determine the appropriate value of main technological parameters, such as temperature T(^{0}C), the horizontal feed rate V_{xy}(mm/min), the length of step in depth Δz(mm) and forming tool diameter D (mm), we apply HOT SPIF technology at high temperature to manufacture these materials. The paper presents a study to optimize the main technological parameters when processing non-alloy titanium sheet with HOT SPIF technology to obtain the minimum dimensional error of radial orientation ΔD.

Keywords: *HOT SPIF, Sheet Metal Forming, Technological Parameter, Optimization, Dimensional Error.*

DESIGN OF THE ADJUSTED ARTIFICIAL SHOULDER JOINT

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Abstract: The status of degenerative joint or joint injuries causes many difficulties for patient's activities. Up to now, there have been many methods of recovery of shoulder joint mobility in the world. Among them, artificial joint replacement method is one of the most commonly used measures for severe patients and the elderly. But most of the artificial joints are designed according to a large point of view, so they are only relatively appropriate. The paper presents the adjusted artificial shoulder joint design for patients with shoulder joint and bone problem.

Keywords: *The artificial shoulder joint, the adjusted artificial shoulder joint, bone cancer.*

OPTIMIZING THE CONTROLLING MOTOR PARAMETERS IN OPERATING THE STACKER CRANE OF THE AUTOMATED WAREHOUSE

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Abstract: Calculating and optimizing the motor controlling input parameters in installing and operating machinery are capable of minimizing the cost, improving the productivity of all firms. Thus, it is especially indispensable to the object of this research: Controlling motors of stacker crane in Automated Warehouse. The inputs are the distance of X, Z directions and the limited accelerator along X, Z directions. The automated warehouse in this research has 2 nine-shelf rows, each shelf has 6 spaces for pallet. The requirements are: simultaneously optimizing the time controlling in operating of both X and Z motors and minimizing the dead time during the process of loading/unloading in 108 positions. Then, the outputs are the increasing/decreasing velocity period, the constants velocity period and the maximum velocity of direction X, Z motors - in trapezoidal profile. In this study, a program written in MATLAB is utilized to create the multidimensional array in storing parameters and the loop in solving the equations. Therefore, the efficient of the automated warehouse will be supervised, in the meantime, the optimal input parameters are determined.

Keywords: *Controlling parameters optimization, multidimensional array, automated storage.*

DESIGN DEVELOPMENT OF THE BONE STRUCTURE OF THE ADJUSTED ARTIFICIAL SPINAL DISC

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Abstract: The paper presents the design development of the bone structure of the adjusted artificial spinal disc to ensure loading ability and compatibility, best-fitting with the natural bone of the body. In addition, the designs also integrate manufacturing feasibility, such as CNC machine and 3D printing.

Keywords: *The artificial spine disc, the artificial bone structure, the adjusted artificial spinal disc.*

RESEARCH AND MANUFACTURING THE MOLDING MACHINE IN MEDICAL

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Abstract: In Vietnam, there exist various problems in the healthcare system due to expensive devices, high operating cost or lack of national investment. The domestic demands become more serious because the number of patients has increased rapidly. In this paper, a design of prototyping mold cutter machine is proposed to help poor patients in hospital. The mechanical structure and electrical design are demonstrated to clarify the internal components. Especially, the programming environment is based on open-source software. It can be easily to control and develop in future. From the experimental results, the effectiveness and feasibility of proposed design have been validated and verified.

Keywords: *mechanical manufacturing, automation, control, molding.*

INVESTIGATION THE EFFECT OF TOOLPATH STRATEGIES ON CUTTING FORCE DURING POCKET MILLING

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Abstract: Cutting force is the most important factor to reflect the rough milling process. Cutting force affects machining accuracy, heat generated during machining, durability of cutting tools. The objective of this paper is to examine the shear forces generated by four toolpaths, zig zag, contour parallel, morph spiral and true spiral on two pocket shapes, round and square. The experiment was performed on a 3-axis vertical CNC milling machine combined with eto for cutting force. The results show that the cutting force value increases rapidly at the positions in the tool that start the milling process, at the corners of the pocket, at the position of the toolpath changing direction. In addition, processing time is also considered to evaluate the productivity of the toolpath. The toolpath has a large cutting force, giving a short machining time, high productivity.

Keywords: *Cutting force, machining time, milling toolpath , pocket milling.*

DESIGN AND MANUFACTURING OF A NON-STANDARD CHAIN PARTS FOR A CHAIN CONVEYOR FOR A HARVEST SHALLOT: A CASE STUDY

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Abstract: This paper presents a complete case study for designing and manufacturing chain parts for chain conveyor use for a harvest shallot for a real. The process of harvesting shallot in Vietnam is being done manually. Mechanization, automation of the harvest process has been demanded by farmers. In the harvest shallot equipment, the chain conveyor system is used to handling the desired orbit to the packing position. Shallots are uneven in size, distributed in a certain size range. Chain conveyor systems with the chain was non-standardized were choiced. Therefore, a complete design is required to meet requirement. The design procedures are: (1) calculation of the expected loads that exert on the chain during operation, (2) selection of materials, (3) designing the different parts of the chain taking into account safety, assembly process and economic considerations. The final design was justified and validated. The chain of chain conveyor system is working properly and safety under real conditions.

Keywords: D*esign chain, harvest shallot, optimization design, materials handling, case study.*

ANALYSIS PROCESS MANUFACTURING INJECTION MOLD COOLING BY WAAM METHOD

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Abstract: The article "Analysis Process Manufacturing Injection Mold Cooling By WWAM Methood" is done mainly researching and experimenting forming process when 3D printing metal cooling grooves. In-mold applied by Wire Arc Additive Manufacturing (WAAM). The paper is researched and practical experience of 3D printing metal groove making process in mold by WAAM method with forming devices such as CNC machine, driver noise and MIG / MAG welding machine, the implementation process is divided. complete tasks step by step until the product is complete

Keywords: *WAAM : Wire Arc Additive Manufacturing, MIG/MAG: Metal Inert Gas/ Metal Active Gas, CNC: Computer Numerical Control.*

INFLUENCE OF 3D PRINTING FDM PROCESS PARAMETERS ON TENSILE STRENGTH OF PRODUCT

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Abstract: 3D printing is a promising digital manufacturing technique that produces parts, layer by layer. Fused deposition modeling (FDM) is a widely employed 3D printing technology that produces components by heating, extruding and depositing filaments of thermoplastic polymers. The properties of FDM-produced parts are significantly influenced by the processing parameters. These processing parameters have conflicting advantages that need to be investigated. This paper investigates the effect of process parameters on the tensile properties of components produced by FDM technique. The study is carried out on Polylactic acid (PLA), by using full factorial design of experiment to analyze the effects of process parameters on the tensile properties of the model. For the investigation, three parameters – material, infill density, infill pattern – are considered. From the investigation, it is observed that, among the considered parameters, only one parameter (infill pattern) significantly influence the tensile properties of the model.

Keywords: *Fused deposition modeling (FDM)* - *Polylactic acid (PLA)* - *ABS (acrylonitrile butadiene styrene)* - *PETG (Polyetylen Terephthalate).*

VERIFYING THE GAS HEATING METHOD FOR INJECTION MOLD

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Abstract: Today, for manufacturing the plastic product, injection molding is one of the most popular methods. In this research, for heating the cavity surface, an external gas-assisted mold temperature control (Ex-GMTC), with the gas temperature varies from 200 °C to 400 °C, was applied for the injection mold. The result shows that with 3 types of gas temperatures, the heating get a high efficiency at the first 20 s with the highest heating rate could be reached to 8.25 °C/s with the 400 °C gas. In this case, although there is a limitation in the raising temperature, however, the mold surface was reached to 172.2 °C, this temperature is high enough for almost the melt flow easily into the cavity.

Keywords: *Injection molding, mold heating, external gas-assisted mold temperature control, thin wall product, melt flow length.*

PHÂN BAN: THIẾT KẾ VÀ PHÁT TRIỂN SẢN PHẨM

SESSION: PRODUCTS DESIGN AND DEVELOPMENT

NUMERICAL STUDY OF AUTONOMOUS UNDERWATER VEHICLE MOVEMENT

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Abstract: Nowadays, autonomous underwater vehicle is applied wordwide. It can be applied in the field of remote sensing, oceanographic research, environmental control, territorial protection,…The ability to automatically control and flexibly react of autonomous underwater vehicle has been affirmed in the role of submarine industrial base development. In this trend, the study investigates on simulating the effect of fluid flow on the profile of an autonomous underwater vehicle by computational fluid dynamics method. The numerical results indicate that an autonomous underwater vehicle profile determines the drag and the largest stress occurs at the head of autonomous underwater vehicle when it moves. In addition, the effect of wing profile on the drag and rotation angle of autonomous underwater vehicle is also explored in this study.

Keywords: *Autonomous Vehicle, Computational Fluid Dynamics, AUV Wing, Drag.*

RESEARCH ON DESIGNING THE MECHANICAL SYSTEM OF 3D PRINTERS BASED ON DLP TECHNOLOGY

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Abstract: Nowadays, Additive manufacturing technology (also called 3D Printing in Vietnam) is the national topic. Most countries have their national strategy in research, development and application of designing and employing 3D printing technology for all sectors, organizations and people. Additive manufacturing technology has been applied in more and more industries, such as: Automotive, Aviation, Aerospace, Health, Construction, Electronics... At present, 3D printing systems based on DLP (Digital Light Processing) technology on the market are imported from Chinese and Korean manufacturers ... and their cost are very high. The paper presents a research to apply the engineering design process to design the mechanical system of the 3D printer based on DLP technology with lower cost and comparable quality to other models on the market.

Keywords: *Engineering design, Mechanical system, 3D Printer, Photosensitive material, Digital Light Processing Technology.*

DESIGNING AND MANUFACTURING AUTOMATIC SEEDING MACHINES ON VEGETABLE BEDS

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Abstract: The article introduces the results of designing and manufacturing automatic seeding machines on vegetable beds. Through the principles and products already on the market, improve the seed cluster and general structure of the machine. Since then the machine can overcome some problems such as not sowing many types of seeds, many particle spacing or machine production costs are too high compared to the needs of Vietnam market. Specifically, the machine is designed to easily change between three fixed particle distances, which is common particle distance. And the machine also achieves the basic requirements of size and performance, productivity.

Keywords: *Seeding machines on vegetable beds, vacuuming seed cluster, vacuuming seed cluster by drum suction mechanism*.

OPTIMIZATION OF MOLD TEMPERATURE AND MELT TEMPERATURE USING DESIGN OF EXPERIMENTS FOR KIDS CHAIR MOLD

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Abstract: Plastic injection molding is the most popular production of plastic products, they are widely used in industries and lifeTherefore, improving the quality of injection molding products is essential. To produce good quality products, it is necessary to control the quality characteristics of the product.There are many factors affecting product quality such as material parameters, temperature, pressure, time, mold quality. Melt temperature and mold temperature are two process parameters that play an important role in product manufacturing. Using the Autodesk Moldflow 2019's Design of experiments tool to investigate the effect of mold temperature and melt temperature on injection molding technology. Specifically, analytical products are kids chair mold using polypropylene (PP). The results of simulation analysis show that, in the analytical temperature range tmold = [40, 80]^oC and tmelt = [180, 220]^oC, the melt temperature has a great impact on the criteria for evaluating quality of product(sink mark depth, volumetric shrinkage, deflection) and the criteria for evaluating product cost(time at end of packing, total part weight), and melt temperature has a major impact on deflection and time at end of packing. The best result is at 180^oC melt temperature and 60^oC mold temperature.

Keywords: *Injection molding, mold temperature, melt temperature, polypropylene, design of experiments.*

DESIGN, DEVELOPMENT LEATHER PRODUCTS AND ANALYSIS CUSTOMERS' SATISFACTION OF ECO-FASHION IN VIETNAMESE MARKET

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Abstract: Eco-fashion is one of the trends of sustainability which implements environment and social responsibility from the creation and production processes of fashion products. Besides, the fashion industry is facing a ruthless threat due to environmental impacts. Leather products including footwear, garment and leather goods is highly fashion oriented with an important export rank for many developing countries as well as Vietnamese market. Therefore, we conducted a study on design, development and analysis satisfaction of consumers with "Green", "Sustainable" or "Eco" practices in the entire fashion industry supply chain and in the entire life cycle of leather products.

In this research, we measured elements of customers' satisfaction for leather products like understanding expectations, finding out the failure of products, measuring the emotional aspects, and assessing the loyalty in Vietnamese market. Meanwhile, survey was also conducted to collect the customers' satisfaction through several ways such as emails and use of phone calls in order to get credible feedback. The monitoring and survey were conducted in both offline and online conversation including chat communications, automated phone interactions, feedback cards and etc.

The results show that customers 'satisfaction in the field of eco-fashion for leather products in Vietnamese market is influenced by perceived quality and expectations of the product or service. Findings from this research can serve as basically measured of customers' loyalty when a customer satisfies the fashion products, recommends to a friend, family members as well as for the design of leather products due to environment impacts.

Keywords: *Eco-fashion, Fashion industry, Leather products, Sustainability, Vietnamese market.*

DESIGN DEVELOPMENT OF THE BONE STRUCTURE OF THE ADJUSTED ARTIFICIAL SHOULDER JOINT

Nguyen Van Tung, Tran Minh Tam, Tran Duc Toan, Truong Van Tien, Nguyen Trong Pul, Le Nhut Linh, Phan Chu Tan, Trinh Quoc Hung, Nguyen Tan Khanh, Tran Nguyen Duy Phuong [*], Vo Đinh Thai, To Ngoc Gio Na, Huynh Thien Tuong, Vy Duc Kiem

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Abstract: The paper presents the design development of the bone structure of the adjusted artificial shoulder joint to ensure and able to improve loading ability and compatibility, best-fitting with the natural bone of the body. In addition, the designs also integrate manufacturing feasibility, such as CNC machine and 3D printing.

Keywords: *The artificial shoulder joint, the artificial bone structure, the adjusted artificial shoulder joint.*

DESIGN DEVELOPMENT OF THE BALL ADJUSTED ARTIFICIAL KNEE JOINT

Vo Dinh Thai, To Ngoc Gio Na, Huynh Thien Tuong, Nguyen Van Tung, Tran Minh Tam, Nguyen Trong Pul, Le Nhut Linh, Nguyen Tan Khanh, Dương Bao Chieu, Phan Chu Tan, Trinh Quoc Hung, Tran Nguyen Duy Phuong *, Tran Đuc Toan, Truong Van Tien, Vy Duc Kiem

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Abstract: The ball adjusted artificial knee joint is a structure which replaces for a damaged knee joint. It is used for specific cases such as osteosarcoma in the tibia, femur and osteoarthritis or after injury. Currently, in Vietnam, cancer cases increase highly due to daily living lifestyle. In particular, tibia bone osteosarcoma is at risk of most of all age groups. The proportion of men who are infected more than women. The solution to that treatment is to change the artificial knee joint to adjust, in addition to chemotherapy and radiation therapy. The replacement of the artificial knee joint adjusts to the area of bone tumors that we decide to remove the cancerous bone. Since then, we have an exclusive knee joint design for each patient. In this paper, the authors present an artificial knee joint design that adjusts for each specific patient case.

Keywords: *The artificial knee joint, the ball adjusted artificial knee joint, bone cancer.*

THIẾT KẾ TỐI ƯU THÂN MÁY CNC GIA CÔNG GỖ

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Abstract: Optimization is a powerful tool for engineers as well as product designers. Using optimization help us to find out new concept designs which get the requires about funtions, and aestheticism; material, cost, and time saving. This paper gives an overview of structural optimization and its effects to design process. Application of two optimization methods including topology optimization design and size optimization design to design the body structure of CNC Router. The results have built the optimization design process of CNC Router structure, material reduction, improved shape and size of CNC Router structure

Keywords: *Structural Optimization, Structural Design, CNC router, CAD/CAE Systems.*

THIẾT KẾ HỆ TRUYỀN ĐỘNG VÀ KẾT CẤU CỤM DI CHUYỂN VÀ CỤM CHẢI CỦA THIẾT BỊ HÚT CHẤT THẢI TRONG AO NUÔI TÔM

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Abstract: The technologies development in automation help to improve the working performance in recent decades. Cleaning water in Shrimp pond have a big affect to the shrimp quality also quantity. The purpose of this research is to develop an automatic instrument working in the aquatic environment in order to clean the pond's water.

Keywords: *Brush cluster, Move cluster, Shrimp pond, Waste remover.*

THIẾT KẾ CỤM HÚT CỦA THIẾT BỊ HÚT CHẤT THẢI TRONG AO NUÔI TÔM

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Abstract: This paper introduce the designing and manufacturing processes of suck cluster in the sludge removal instrument using in Shrimp pond. Suck cluster consist of a propeller equipped directly to the beam shaft of DC motor which is covered by water resistant box, shaft and propeller are equipped inside the cylinder tube in which has the similar structure as the vessel's propeller out water pipe. Some of the main contents cover about the 3D model building of suck cluster simulating the performance of suck cluster to verify the design, choose designing specifications such as profile and the size of input and output tube, propeller rotating rpm, the suitable motor power in order to meet the requirement of 20 m^3/h. The design must qualify the performance of removing sludge in the Shrimp pond.

Keywords: *Filter bag, Sucks cluster, Sludge removal, Shrimp pond.*

DESIGN AND CONTROL OF THE AUTOMATIC TENSION MEASUREMENT SYSTEM APPLYING IN THE TEXTILE ENGINEERING

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Abstract: Nowadays, Clothing industry is one of the fastest-growing industries in the world. In this field, product quality is always classified as the first priority due to the strict requirements and standards set by foreign businesses and consumers. Therefore, yarn tension control is a vital parameter in Garment Manufacturing Technology for quality and efficiency in textile processes such as winding, twisting and cabling, and in subsequent processes such as weaving and knitting. Although some systems have been developed (mainly in China), there is still various conundrums and considerable potentials for development of new and improved tension measurement as well as combining controllable function in future textile processing.

Keywords: *Tension, measurement, yarn, sensors.*

RESEARCH ON THE EFFECT OF TECHNICAL ATTRIBUTES ON THE TENSILE STRENGTH OF FDM PRODUCTS

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Abstract: Nowadays, Fused Deposition Modelling (FDM) method has been growing rapidly, which can be used to fabricate complex parts within a reasonable time. The fabrication principle of FDM method is “layer by layer” so that the previous layer and subsequent layer don’t deposit each other to create the interface between two adjacent layers. Thus, the tensile strength of FDM product along building direction depends on several various process parameters. In this study, five important process parameters such as layer thickness, build orientation, build style, infill density, and print temperature are considered. The effect on tensile strength is evaluated based on the tensile test of Polylactic acid (PLA) part. The Design of experiment (DOE) based on the Central Composite Design (CCD) to consider the relationship between the process parameters and their response through the experimental data aregathered. The suitability of model is validated by Analysis of Variance (ANOVA) and t-test. Moreover, Artificial Neural Network (ANN) is also applied to predict the response for experimental model and compared with regression equation obtained from Response surface analysis (FCCCD). The results show that the predict value of ANN model is very closed to experiment value (R^2=0.964), and the mean absolute error (MAE) of ANN model is smaller than those of FCCCD model. This proved that ANN model is a potential alternative to predict accurately the relationship between the process parameters and their response.

Keywords: *Fused Deposition Modelling (FDM), Face centred central composite design (FCCCD), Artificial neural networks (ANNs), PLA, ANOVA.*

PHÂN BAN: MÁY VÀ CƠ CẤU
THIẾT BỊ CÔNG NGHIỆP

SESSION: MECHANISMS AND INDUSTRIAL MACHINES

STUDY OF THE FACTORS AND OPTIMIZATION ON THE PROCESS OF ELECTROLYTE POLISHING OF METAL

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Abstract: Electrolyte polishing or Electropolishing is a widely applicable method used to improve the surface of metals due to its advantages. This process is used to polish, passivate and deburr many metals and alloys; as a result, their surface become smoother, brighter and less chemically corroded than the original. One of the most important parameters that affect electropolishing is the electrolyte. In this experiment, H_3PO_4, $HClO_4$, HNO_3, metanol, glycerol are used as common electrolyte. Other parameters could be implied as: anodic current density, time, cathode's materials, initial surface roughness. The experimental metal, which is served as the anode, is submerged into a electrolyte-bath where a direct current go through; by doing this, we can specify and utilize the parameters which are used to polishing some common materials, such as stainless steel, aluminum and its alloys, copper and its alloys. The results of the experiment are evaluated by the microstructure and the surface roughness of the metals. Through this experiment, the surface of metals are brightened, smoothened and the suitable electrolyte, parameters are also specified and utilized.

Keywords: *Electropolishing, Electrolyte, Microstructure, Roughness, Metal.*

RESEARCH ON DESIGNING BAMBOO-POLYMER FIBER EXTRUSION MACHINE USED ON FDM 3D PRINTER

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Abstract: Nowadays, additive manufacturing (also called 3D Printing in Vietnam) has been applied in more and more industries, such as: Automotive, Aviation, Aerospace, Health, Construction, Electronics... AM technology has many categories, in which, the method that uses the nozzle to extrude the molten material (FDM - Fused Deposition Modeling) is more poppular in Vietnam. Generally, 3D printing filaments are purchased from Chinese, Korean manufacturers... The paper presents a research to apply the engineering design process to design a bamboo-polymer fiber extrusion machine to take advantage of environmentally friendly bamboo wood powder raw materials.

Keywords: *Engineering Design, Extrusion Machine Design, Bamboo-polymer fiber, Fused deposition modeling (FDM) technology.*

EXPERIMENTAL IDENTIFICATION OF DYNAMIC CHARACTERISTICS OF ROTATING MACHINERY

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Abstract: Rotating machinery is a simple mechanic including motor, rotor and bearings. The idenfication of dynamic characteristics of rotating machinery based on simulation and experiment has being attracted researchers over the World. The calculation of dynamic characteristics of rotating machinery such as natural frequency, mode shapes, stiffness and damping coefficients is very important process and must be carried out first in the design of any machines. The fail estimation of these characteristics can lead to reducing the longevity or damaging of machinery. In this paper, dynamic characteristics of a simple rotating machinery were estimated using experiment. The rotating machinery consists of a rigid rotor, two bearings, an elastic coupling and two disks. The proximity probes were installed at the bearing housing to measure the vibration of the shaft in the horizontal and vertical direction. Signal in the time domain is converted in the frequency domain using a keyphasor. The natural frequencies, orbit of the shaft and the vibration of the shaft during the test are presented and discussed here.

Keywords: *Rotating machinery, experiment, dynamic features, frequency domain.*

DESIGNING, MANUFACTURING AND TESTING A SEMI-AUTOMATIC CUTTING MACHINE FOR SLICING BANANA TREE

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Abstract: The paper presents the results of calculation, design, manufacture and testing of semi-automatic cutting machine for slicing banana tree. The machine consists of main parts such as 1.5 kW electric motor with rotary speed of 1450 RPM, chassis, feeder, transmission system, cutting chamber, knifes and fixed plate, protection box, infrared sensor, control system and product outlet chanel. It can work with two modes of Manual/Semi-Automatic. By semi-automatic mode, the electric motor can automatically on/off to drive the knife exis when having the banana tree in the feeder while Manu mode is used in case of Semi-Automatic control system had problems. During the test, the cutting speed was changed with three speeds of 20, 24, 28 m/s to evaluate the machine performance. The result shows that the machine can slice banana tree with slices ranging from 3 - 4mm thickness were obtained and machine capacity reach of 1000 kg/h at cutting speed of 24 m/s. The machine has a simple structure, easy operation, stable and safe operating. It can be used to develop of the livestock mechanization in the field of the production of fresh-green feed for livestock farms and households in Vietnam.

Keywords: *Arduino Nano, semi-automatic, infrared sensor, banana tree, cutting machine.*

RESEARCH ON DESIGNING SEMI-AUTOMATIC SMALL TYPE BOTTLE WASHING MACHINE

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Abstract: Currently the demand for small capacity bottle washing machines in the market is increasing. Therefore, the content of the article focuses on research on mechanical design and controller of semi-automatic bottle washing machines. The content of the paper revolves around two main issues: mechanical design solutions and circuits design solutions. On the mechanical side, the team studied the mechanical design to suit users to interact with the machine in the most comfortable way to improve productivity. In addition, the control circuit solution is selected so that it is less expensive and still satisfies the stability for the job.

Keywords: *Bottle washing machine, mechanical design, electronics design.*

NGHIÊN CỨU ẢNH HƯỞNG CỦA TẤM PHẢN XẠ ĐẾN ĐỘ BAO PHỦ CỦA MỐI HÀN VẢY THIẾC SIÊU ÂM

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Tóm tắt: Bài báo này trình bày thí nghiệm nghiên cứu cácyếu tố ảnh hưởng đến chất lượng mối hàn vảy thiếc có hỗ trợ siêu âm trên các sợi dây nhôm –nhôm, nhôm –đồng đường kính nhỏ hơn 3 mm hoặc trên tấm nhôm –nhôm có độ dày 1 mm. Sử dụng thiết bịhàn tần số20kHz và công suất 2000 W. Nhiệt độ nóng chảy của thiếc hàn là 320°C và thời gian hàn là 1.5s. Kết quả nghiên cứu cho thấy hàn siêu âm có sử dụng tấm phản xạ giúp thiếc hàn có thể bám vào bềmặt, mối hàn có chất lượng khác biệt rõ so với hàn không có tấm phản xạ.

Từ khóa: *Hàn siêu âm, hàn vảy thiếc, hàn dây, hàn tấm,đồng –nhôm, tấm phản xạ.*

THIẾT KẾ CỤM HÚT CỦA THIẾT BỊ HÚT CHẤT THẢI TRONG AO NUÔI TÔM

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Abstract: This paper introduce the designing and manufacturing processes of suck cluster in the sludge removal instrument using in Shrimp pond. Suck cluster consist of a propeller equipped directly to the beam shaft of DC motor which is covered by water resistant box, shaft and propeller are equipped inside the cylinder tube in which has the similar structure as the vessel’s propeller out water pipe. Some of the main contents cover about the 3D model building of suck cluster simulating the performance of suck cluster to verify the design, choose designing specifications such as profile and the size of input and output tube, propeller rotating rpm, the suitable motor power in order to meet the requirement of 20 m^3/h. The design must qualify the performance of removing sludge in the Shrimp pond.

Keywords: *Filter bag, Sucks cluster, Sludge removal, Shrimp pond.*

NGHIÊN CỨU VÀ ỨNG DỤNG CÁC YẾU TỐ TÁC ĐỘNG TRỰC TIẾP ĐẾN QUÁ TRÌNH NÂNG CẤP TỰ ĐỘNG HOÁ THIẾT BỊ MAY CHI PHÍ THẤP

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Abstract: In order to meet the demand of automation in Garment Industry, to solve the finance capacity problems when investing garment automated equiptment, our team conducted the research named “ Research and apply direct factors affected on upgrading process to low-cost automated sewing machine. Contents of this research focuses on direct factors affected on upgrading automation equiptment process to provide scientific bases for the following researches. The research subjects are the structure and operating principle of single lockstitch sewing machine which is the common sewing machine in Garment enterprise. The article includes: implementation process, achieved result, difficulties, differences compared with initial expectations, new discoveries and new challenges when expanding bulk production, profit and significance.

Keywords: *Automation, Garment Industry, welt pocket sewing machine, machine- Zipper.*

EXPERIMENTAL RESEARCH EFFECTS OF TECHNOLOGY PARAMETERS ON THE WATER ABSORPTION AND THICKNESS SWELLING OF THE BAMBOO PARTICLE BOARD BILLET

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Abstract: The use of bamboo by-products such as bamboo branches to recycle and produce bamboo particle board, perfectly replaces the monolithic wood panel with artificial wood from bamboo powders to ensure raw material, protect environment, also bring economic benefits ... is an urgent task in Vietnam. The paper presents a study of the effect of technological parameters on the water absorption and thickness swelling of the bamboo particle board billet, to improve the bamboo-wood particle boarrd billet for manufacturing civil products and take advantage of environmentally friendly bamboo wood raw materials.

Keywords: *Bamboo by-products, Water absorption, Thickness swelling, Technological parameters, Bamboo particle board billet.*

INFLUENCE OF SHELL PROPERTIES IN 3D PRINTING FDM PROCESS ON TENSILE STRENGTH

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Abstract: 3D printing is a promising digital manufacturing technique that produces parts, layer by layer. Fused deposition modeling (FDM) is a widely employed 3D printing technology that produces components by heating, extruding and depositing filaments of thermoplastic polymers. The properties of FDM-produced parts are significantly influenced by the processing parameters. These processing parameters have conflicting advantages that need to be investigated. This paper investigates the effect of process parameters on the tensile properties of components produced by FDM technique. The study is carried out on Polylactic acid (PLA), by using full factorial design of experiment to analyze the effects of process parameters on the tensile properties of the model. For the investigation, three parameters – vertical shell, solid layers top, solid layers bottom – are considered. From the investigation, it is observed that, all of the considered parameters significantly influence the tensile properties of the model.

Keywords: *3D Printing, Shell Properties, Tensile Strength.*

ESTIMATE THE INTERNAL INDUCTION HEATING FOR INJECTION MOLD TEMPERATURE CONTROL

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Abstract: In this paper, an induction heating system was applied for the heating step in injection molding process. By simulatin and experiment, the heating process was estimated by the temperature distribution and the heating rate. In simulation, the mold temperature was increase from 30 ^{o}C to 180 ^{o}C in 9s. So, the heating rate was higher than 16 ^{o}C/s. This is a bright result in the field of mold heating. In addition, the temperature distribution shows that the higher temperature focuses on the gate area, the lower temperature appears near the outside of mold cavity. The experiment was achived with the same psrameters as in simulation. The simulation and experiment results show a good agreement.

Keywords: *Induction Heating, Injection Molding, Mold Temperature Control, Flow Length to Thickness Ratio.*

PHÂN BAN: KỸ THUẬT TẠO HÌNH VẬT LIỆU

SESSION: MATERIAL FORMING ENGINEERING

DESIGN OF AFM SYSTEM FOR DEBURRING

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Abstract: Surface treatments and deburring are one of the important areas after machining. Burrs is formed during machining and has many harmful effects such as injuring, accuracy, damaging machinery during operation. Burrs in intersecting holes is very difficult to deburr because the tools are difficult to reach areas and cannot be observed. Deburring is done by hand such as using mechanical toos, portable grinders, sandpaper or advanced methods such as ball blasting, thermal energy method (TEM), ultrasonic, and abrasive flow machining (AFM). The deburring at the intersection holes using abrasive flow machining was applied effectively. This paper will present the design of abrasive flow system with two-way flow type. The study focuses on analyzing the hydraulic pressure for removing burss, mechanical system design, hydraulic system design, control algorithm and manufacturing the model for experiments of abrasive flow machining.

Keywords: *AFM, Abrasive Flow Machining, Burrs, deburring.*

OPTIMIZATION OF THE MACHINING PARAMETERS IN BALL BURNISHING PROCESS ON 6061 ALUMINUM

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Abstract: Burnishing process is a method of finishing and hardening machined parts by plastic deformation of the surface. This process provides a good surface finish, and an increment of superficial hardness, which in turn improves wear resistance, increases corrosion resistance, improves tensile strength, maintains dimensional stability and improves the fatigue strength of the workpiece. In this study, the ball burnishing process of 6061 Al workpiece conducted on a HAAS TL1 CNC lathe machine using a stainless steel ball is simulated by ABAQUS software. The results of the simulation processes are analyzed to determine the optimal burnishing condition for the best surface roughness.

Keywords: B*all-burnishing process, simulation, surface roughness, plastic deformation.*

DEVELOPMENT AND VALIDATION OF THE 3D NUMERICAL MODEL FOR SIMULATING THE SHOT PEENING PROCESS ON THE LOW ALLOY STEEL

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Abstract: Shot peening is a cold working process which is widely used to improve the mechanical properties of mechanical parts in industries ranging from aerospace, automotive to construction. In this paper, a new 3D numerial modelis developed to simulate the shot peening process on the surface of the low alloy steel. The model then is validated with the reference pulished model. The simulation results indicate that the coverage, velocity,and radius significantly affect the residual stress distribution of the material. The higher pressure has a greater impact effect.

Keywords: *Shot peening, low alloy steel, simulation, plastic deformation.*

EFFECTS OF ULTRASONIC VIBRATION ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ALUMINUM ALLOY ADC12 IN PERMANENT MOLD CASTING

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Abstract: Microstructure of castings involves mechanical properties, in which grain size is one of the important parameters. Thus, in order to improve the quality of castings, it is necessary to support the crystallization process to limit the formation of dendrite, grain refinement and disperse impurities in casting alloy. The objective of the research is to study the effect of high-frequency mechanical vibrations (ultrasonic) on the microstructure, internal defects and mechanical properties of aluminum alloy castings. In this study, ultrasonic vibrations with a frequency of 20 kHz and a power of 1500W will be transmitted directly into the mold during solidification. Design of sonotrode, casting mold, simulation of oscillation type and natural frequency are carried out to optimize the vibration transmission efficiency into the cast. Parameters such as pouring temperature and ultrasound transmission time are chosen appropriately by exploration experiment. The result indicated that the dendrite structures reduced significantly in quantity and size, fine grain, the phases in the alloy were distributed evenly. The porosity inside the casting decreases and the tensile strength of cast samples with ultrasonic is higher than without ultrasound samples.

Keywords: *Ultrasonic mold vibration, gravity-fed permanent mold casting, Solidification.*

EXPERIMENTAL AND SIMULATION RESEARCH OF THE PROCESS OF CASTING RV95 ENGINE BODY BY THE FENOTEC PLASTIC SAND MOLD METHOD

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Abstract: Fenotec plastic sand casting technology (called ALPHASET technology) was used about 30 years ago in the casting industry. Fenotec plastic sand casting technology was invented to improve the disadvantages of Furan sand casting technology, there are many good advantages for the environment, so it is selected by many casting factories. Fenotec plastic sand molding technology forms sand with curing of phenolic alkaline resin with ester catalyst. In about 30 years of formation and development, Fenotec plastic sand molding technology has been improved both in technology and machinery. Today, Fenotec plastic sand casting technology is applied in mass production with various types of casting products of various sizes. This article introduces Fenotec sand casting technology, fabricates details of RV95 engine body by this method, thereby observes the defects on details, while simulates the process of casting for comparison between experimental and simulation results.

Keywords: *Fenotec casting, sand casting, casting detail defects.*

MECHANICAL PROPERTIES OF PMMA/PC BLEND BY INJECTION MOLDING PROCESS

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Abstract: Polycarbonate (PC) has a high impact strength, whereas Polymethylmethacrylate (PMMA) possesses a high tensile strength. Both of them have been widely used for optical elements in illumination. This paper aims to investigate mechanical properties including tensile and impact strengths of PMMA/PC blend with 50 percent of PC concentration by injection molding process. Tensile and impact specimens were designed following ASTM, type V and were fabricated by injection molding process. Taguchi technique was employed to figure out the optimal process conditions for maximum tensile and impact strengths. The processing conditions such as melt temperature, mold temperature, packing pressure and cooling time were applied and each factor has three levels. As a results, melt temperature has been found to be the most significant parameter for both tensile and impact strengths and cooling time is the least significant parameter for the mechanical properties.

Keywords: *PC, PMMA, tensile strength, impact strength, Taguchi method.*

STUDYING EXPERIMENTAL PROCESS OF SHOOTING SPHERICAL BALL UP TO DETAILED SURFACE BY ULTRASONIC SHOT PEENING

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Abstract: Currently there are many methods to increase fatigue strength for mechanical parts, one of the methods to meet the above requirements is to shoot the ball by ultrasonic shot peening method. Ultrasonic shot peening is a mechanical surface treatment in which spherical balls are fired on the treated metal surface, spherical balls will be accelerated by vibrating chamber by ultrasonic source. This paper presents the effect of the shooting time on the surface coverage and the roughness of the treated aluminum sheet, the results will help us evaluate the impact of the method on the detailed surface.From there, make conclusions and applications in practice and industry. This research will be of great value if the research results are successful.

Keywords: *Ultrasonic shot peening, ball firing process, mechanical properties.*

EFFECT OF MINIMUM QUANTITY LUBRICATION TO PREDICTION OF CUTTING TEMPERATURE DISTRIBUTION IN TURNING MATERIAL AISI-1045

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Abstract: This paper presents a prediction of cutting temperature in turning process, using a continuous cutting model of Johnson-Cook (J-C). An method to predict the temperature distribution in orthogonal cutting is based on the constituent model of various material and the mechanics of their cutting process. In this method, the average temperature at the primary shear zone (PSZ) and the secondary shear zone (SSZ) were determined for various materials, based on a constitutive model and a chip-formation model using measurements of cutting force and chip thicknes. The J-C model constants were taken from Hopkinson pressure bar tests. Cutting conditions, cutting forces and chip thickness were used to predict shear stress. Experimental cutting heat results with the same cutting parameters using the minimum lubrication method (MQL) were recorded through the Testo-871 thermal camera. The thermal distribution results between the two methods has a difference in value, as well as distribution. From the difference, we have analyzed some of the causes, finding the effect of the minimum quantity lubrication parameters on the difference.

Keywords: P*rediction of cutting temperature, cutting temperature, minimum quantity lubrication, Johnson–Cook Constitutive Model.*

EFFECTS OF ULTRASONIC VIBRATION ON THE COOLING PROCESS OF ARC WELDING POOL

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Abstract: The microstructure of the welding joint affects to the quality of welding structure, the grain size is one of the most important parameters affecting to the mechanical properties of welding joints. In order to change the grain size, the cooling process of the welding pool must be controlled carefully. Normally, the welding pool is cooled down without any treatment after welding process. Therefore, the microstructure of the welding joint is similar to the one of the casting object. In this work, the ultrasonic vibration is utilized during the cooling process. Depending on the amplitude and the frequency of the vibration, the microstructure of the welding joint is changed significantly. Using 20 kHz and 1500 W of ultrasonic system, the microstructure of the cross-section of the welding joint is investigated. The microscope images of cross-section of welding joint with and without ultrasonic vibration are compared. With ultrasonic vibration, the grain size is changed and the mechanical properties are improved significantly.

Keywords: *Ultrasonic vibration, welding joint, grain size, microstructure images.*

LOCAL TEMPERING FOR THE SHAFT PART

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Abstract: The tempering process will increase the hardness of part surface, this step is very important in mechanical product maufacturing. This paper shows out the process of local tempering with the complex surface. In this process, the temperature distribution has a strong influence on the surface hardness. The experiment shows that the tempering process support a high thermal power at the product surface. In addition, the surface temperature and coil velocity will effect on the distribution of the surface hardness. The experiment result show that when the coil velocity varies from 0.2 to 0.5 m/s, the 0.3 mm/s is the best value for the local tempering process.

Keywords: *Local tempering, temperature distribution, coil velocity, shaft part.*

STUDY ON THE EFFECT OF INJECTION MOLDING PARAMETERS ON THE WELDLINE STRENGTH OF HANDBRAKE MOTORBIKE

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Abstract: Injection molding is a popular technology used to produce plastic products. For a two gates or a hole-forming product, it will create the weld line on the product where the two flows meet together. In the injection molding process, mold temperature where weld line was formed, injection pressure, packing pressure and packing time, they affect the reliability of the weld line. In this study, we will survey the reliability of the weld line through the handbrake motorbike was injected form polymer composite with the effect of the four parameters above. The study results show that when increasing packing time, packing pressure and mold temperature where weld line was formed are proportional to the reliability of the weld line. Injection pressure will be inversely proportional to the reliability of the weld line.

Keywords: *Plastic injection molds, local heating, reliability of the weld line.*

EFFECT OF WELDING PARAMETERS ON TENSILE STRENGTH OF THE WELD-DEPOSITION LAYER

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Abstract: The general strength and tensile strength of the product is one of the important factors to evaluate the quality of a product. In this study, samples are created by WAAM technology (Wire Arc Additive Manufacturing). WAAM technology is a combination of the MAG welding technology and CNC technology to create the product with near - net shape as desired. Experimental process parameters such as welding speed and welding current are two input parameters to carry out the deposited layer test. Samples are deposited layer -upon-layer and subsequently face milled to ensure a high dimension before the next depostion. Then, the tensile strength of the sample will be tested with a specialized test device to obtain specific data. Using statistical methods to process data and show the influence of parameters on the tensile strength of the sample.

Keywords: *WAAM, the deposition layer, the tensile strength of the weld-depostion layer.*

KHOA CÔNG NGHỆ VẬT LIỆU

FACULTY OF MATERIALS TECHNOLOGY

PHÂN BAN: VẬT LIỆU KIM LOẠI

SESSION: METALLIC MATERIALS

RESEARCH ON AEROELASTICITY PHENOMENON A FLAT COPPER ALLOY PLATE

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Abstract: Aeroelasticity is a science to study interaction between aerodynamic force, elastic force and inertial force. Flutter, which is one of the most dangerous aeroelasticity phenomena, is defined as the dynamic instability of an elastic body in an airstream. Reason is unsteady aerodynamic forces generated from elastic deformations of structure. It can lead to a disastrous structural failure. This paper examined aeroelasticity properties of a flat copper alloy plate by combining simulation methods using ANSYS software and experimental methods with help of subsonic wind tunnel with M = 0.1. First, this thin plate was tested for elastic properties with vibrational experiments and modal method to determine the specific vibration frequencies. Then the flat plate was checked for aeroelasticity properties at three different attack angle of 0^o, 5^o and 10^o. Final goal, instability phenomenon of this flat plate was investigated within limited experimental conditions to be able to select objects and experimental solutions to be feasible and effective.

Keywords: *Thin plate, Flutter, Modal Method, FSI, ANSYS.*

STRENGTH ANALYSIS OF MAIN ROTOR BLADES OF HELICOPTER UAV

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Abstract: Unmanned Aerial Vehicle (UAV) is widely used in the world not only in military but also in civil applications due to its dynamic and flexible. For agriculture, UAV used to spray pesticide was researched and designed with purpose of greatly reducing manpower, limited direct contact of human with toxic substances, reducing time working in parallel with improving quality and yield. This research focused on helicopters UAV (HUAV) due to its advantages of vertically take-off/landing, hover and to laterally fly. The main rotor blades of HUAV with 15 kg usefulload were first designed and then numerically validated by using computational fluid dynamic (CFD) tool in ANSYS software. The aerodynamics characteristics of main rotor blades of HUAV such as pressure, velocity, thrust, drag …were carried out at hovering flight mode. Finally, strengthen analysis of main rotor blades were checked using computational solid dynamic (CSD) tool in ANSYS software. The aim of this paper was to check whether the designed blades of main rotor were durable enough or not to continue the next design steps.

Keywords: *Main Rotor, Helicopter, UAV, Strength Analysis, ANSYS.*

EFFECT OF GAS NITRIDING CONDITIONS ON THE SURFACE MICROSTRUCTURE AND PROPERTIES OF MARTENSITIC STAINLESS STEEL AISI 420

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Abstract: The effect of gas nitriding conditions on the nitriding potential and the surface microstructure and properties of AISI 420 stainless steel was investigated in this study via optical microscope (OM), scanning electron microscope (SEM), energy dispersive x-ray (EDS), X-ray diffraction (XRD), and hardness test. Results showed that the hardness of this steel after it was quenched with oil at 1,020 °C for 30 min was 48 HRC. After the steel was tempered at 550 °C for 1 h, its hardness was 45 HRC. The surface hardness of this steel could be improved and increased to 58 HRC via gas nitriding with a nitriding potential of 1.8 atm$^{-1/2}$ at 460 °C for 5 h in 75% N_2 + 25% NH_3 gas mixtures. Nitriding potential increased as the flow rate of pure ammonia, the nitriding temperature, and the flow rate ratio of ammonia and nitrogen increased.

Keywords: *AISI 420 stainless steel, gas nitriding, nitriding potential, compound layer, N_2 and NH_3 gas mixtures.*

MANUFACTURING OF 6201 ALUMINIUM ALLOY REDRAW ROD BY BILLET-ON-BILLET EXTRUSION

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Abstract: This paper reports on the manufacturing of 6201 aluminium alloy redraw rod by billet-on-billet extrusion. Type 6201 aluminium alloys are made by melting aluminium ingot (99.8% Al), master alloy Al-Si, master alloy Al-Fe, and copper wire (99.97% Cu) into a graphite crucible under covering flux within an electrical resistance furnace. Type 6201 aluminium alloy melts were grain refined by a Al-5Ti-1B master alloy and poured into the iron mold.

The production of redraw rod performed by billet-on-billet extrusion utilized a 300 ton Cincinnati Milacron hydraulic extrusion press. The chemical composition of 6201 aluminium alloy was analyzed by optical emission spectrometer (SPECTROLAB M12). The microstructure of 6201 alloy was examined with optical microscope (OLYMPUS MPE3). The tensile properties of 6201 alloy redraw rod and wire produced from redraw rod were assessed by tensile testing machine (model UTM-1000).

After grain refinement with Al-5Ti-1B master alloy, the 6201 aluminium alloy developed a fine equiaxed grain structure. Type 6201 alloy redraw rod is produced by billet-on-billet extrusion with uniform quality. From the redraw rod, suitable 6201 aluminium alloy wire can be produced without a separate quenching solution operation.

Keywords: *6201 alloy, aluminium alloy rod, aluminium alloy wire, billet-on-billet extrusion.*

EFFECTS OF THE HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF 6201 ALUMINIUM ALLOY WIRE

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Abstract: Type 6201 aluminium alloy wires are produced by drawing 4.7 mm diameter billet-on-billet extruded redraw rod down to 2.7 mm diameter wires. Before drawing, the first group of redraw rod coils was annealed at 480^{o}C for 4 hours to reduce the hardness of the redraw rod. The second group of redraw rod coils was drawn without annealing. With each group of redraw rod, after drawing, some wire coils were solution heat treated, then artificially aged or naturally aged. The other wire coils were artificially aged or naturally aged without solution heat treatment. Mechanical properties of the wires were assessed by a tensile testing machine (model UTM-1000)

With suitable aging temperature and aging time, wires produced from each group of redraw rod coils with or without solution heat treatment attain tensile requirements of ASTM B398, but wires produced with solution heat treatment attain higher elongation than wires produced without solution heat treatment.

Keywords: *6201 aluminium alloy, Aluminium alloy wire, Aluminium alloy cable.*

A MICROWAVE-ABSORBING ABILITY OF SUPER-PARAMAGNETIC ZINC-NICKEL FERRITE NANOPARTICLES IN THE FREQUENCY RANGE OF 8 – 12 GHZ

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Abstract: Microwave-absorbing samples were fabricated using carbon black, super-paramagnetic $Zn_{0.8}Ni_{0.2}Fe_2O_4$ dispersed into a SiO_2 matrix, epoxy resin and hardener. The mixture was then coated onto a steel substrate. Super-paramagnetic zinc nickel ferrite $Zn_{0.8}Ni_{0.2}Fe_2O_4$ nanoparticles were obtained by using hydrothermal method and then, dispersed into a SiO_2 matrix. The effect of super-paramagnetic $Zn_{0.8}Ni_{0.2}Fe_2O_4$ nanoparticles content (0 – 1.75 wt.%) and differents coating thickness (1 – 2.5 mm) on microwave absorption ability in the X band frequency range (8 – 12 GHz) had been studied. The results showed that sample containing only carbon black (20 wt.%) and epoxy resin (80 wt.%) expressed the low microwave absorption ability at 10 GHz centered frequency (≈ 67%). A super-paramagnetic $Zn_{0.8}Ni_{0.2}Fe_2O_4$ content strongly affected on the microwave absorption. A sample of 1.5 wt.% super-paramagnetic $Zn_{0.8}Ni_{0.2}Fe_2O_4$ content exhibited highest absorption at 10 GHz (≈ 99% power attenuation). The higher coating thickness led to the greater of microwave absorption and reach a very high absorption of 2 mm thickness (≈ 99% at 10 GHz).

Keywords: *carbon black, epoxy, microwave absorption, microwave absorbing nanoparticles, super-paramagnetic zinc-nickel ferrite nanoparticles, X band frequency range.*

PHASE FIELD SIMULATION OF POLARIZATION SWITCHING IN COMPOSITIONALLY GRADED FERROELECTRIC THIN FILMS

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Abstract: In this study, a new phase field model is developed for compositionally graded ferroelectrics (cgFEs) based on the Ginzburg–Landau theory. The developed phase field model is applied to investigate the association between the microstructural characteristics and the gradient of material compositions in ferroelectric thin films. Polarization switching in cgFE thin films subjected to an electric field is also investigated. The obtained results show that both microstructural characteristics and polarization switching behaviors are strongly influenced by the gradient of material compositions. In addition, phase field simulations indicate that the macroscopic coercive field and remanent polarization can be tailored by the gradient of material compositions. On the other hand, the domain structure evolution during the ferroelectric switching process in the cgFE thin films exhibits a vastly different response in comparison to that in homogeneous ferroelectric thin films. Furthermore, the frequency of applied electric field is demonstrated to strongly affect the switching behavior of domain structure in cgFE thin film. The present study, therefore, provides an incisive approach for investigations on cgFEs, which may bring new understanding and unique insights into these complex materials, as well as novel potential applications.

Keywords: *Compositionally graded ferroelectric, Phase field model, Domain structure, Polarization switching, Thin film.*

ADSORPTIVE REMOVAL OF CHROMIUM (VI) FROM MINE WATER RUN-OFF USING MAGNETIC ZEOLITE-CHITOSAN NANOCOMPOSITE (nMZC)

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Abstract: This study investigates the adsorption capacity of the synthesized magnetic zeolite-chitosan nanocomposite (nMZC) as an inexpensive and effective adsorbent for Cr (VI) remediation. The synthesized nMZC was characterized using Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray (EDX) and Fourier Transform Infrared Spectroscopy (FT-IR). The application of the synthesized nMZC was demonstrated by remediating hexavalent chromium from simulated water and real wastewater samples. The extraction efficiency of the material was assessed by varying the amount of the adsorbent dose, initial concentration, and the incubation time. The optimized result shows that it is most effective with an adsorbent dose of 0.1 g, an initial concentration of 15 ppm, and the optimum incubation time of 90 minutes. Using the simulated water sample, a maximum of 99.47% adsorption efficiency was obtained. Application to real wastewater run-off was also conducted using the optimized condition, and 92.73% adsorption efficiency was attained. The results obtained show that indeed the material is effective in sequestering hexavalent chromium both in the simulated sample and in real wastewater samples. This further demonstrates the potential applicability of this material for remediation of hexavalent chromium in a real wastewater sample.

Keywords: *magnetic nanoparticles, zeolite-chitosan nanocomposite, hexavalent chromium, remediation.*

SIZE CONTROLLED SYNTHESIS OF GOLD NANOPARTICLES USING *SARGASSUM CRASSIFOLIUM* EXTRACT WITH VARYING MOLAR CONCENTRATION OF GOLD IONS

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Abstract: Nanoparticles have received considerable attention because of their structure and properties differ significantly from those of atoms and molecules as well as those of bulk materials. In this work, we report on the green synthesis of gold nanoparticles (GNPs) by simple procedure using *Sargassum crassifolium* (*SC*) extract without extra surfactant, capping agent and template. The polyol components and the heterocyclic components of *SC* extract were believed to be responsible for the reduction of gold ions and the stabilization of gold nanoparticles, respectively. Transmission electron microscopy (TEM) revealed that the mean size distribution of gold nanoparticles, ranging from 8.77 nm to 13.8 nm with truncated triangles, spherical and hexagonal, could be facilely controlled by varying the concentration of gold ions. Moreover, the UV-Vis spectra of the synthesized GNPs with varying amount gold ions revealed absorbance peaks around 500 nm to 538 nm and exhibit red-shift as the amount gold ions increases. Calculation results of the absorbance peak using Mie theory is in good agreement with the experimental results. It is believed that the increase in average diameter as the amount of molar concentration increase can be explained using nucleation theory. This easy and cost effective biosynthesis route can be a good alternative method for mass production of GNPs for industrial and medical applications.

Keywords: *Nanoparticles, gold nanoparticles, green synthesis, and Sargassum crassifolium.*

SIC BASED COIL IN COMMERCIAL VCO DESIGN REPLACING GAN BASED COIL

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Abstract: Low phase noise is one of the most important criteria for a good VCO design. In typical VCO design, a high Q tank circuitry must be used to achieve a good phase noise performance. As part of the effort to achieve high Q, GaN Based Coil is used in favors to SiC Based Coil. Here, we propose the possibility of using SiC Based Coil yet maintaining a good phase noise performance. By using SiC Based Coil, design cost and area will be saved. However to adopt this concept, some design guidelines must be followed and they will be discussed. In this paper, a cost-saving concept for a good discussed will be presented.

Keywords: *Gallium Nitride (GaN), Silicon Carbide (SiC), Voltage Controlled Oscillator (VCO)*

THE MICROSTRUCTURAL REVOLUTION OF TI-6AL-4V SPECIMENS FABRICATED BY SELECTIVE LASER SINTERING OF PRE-ALLOYED POWDERS

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Abstract: Selective laser sintering (SLS) is known as a cutting-edge technique to manufacture the complex shape products. Among various kinds of materials, Ti-6Al-4V is one of the most popular materials for the SLS process. The as-built Ti-6Al-4V products were widely applied in many applications such as aerospace, automobile, and especially in medical and implant parts. The purpose of this research is to investigate the microstructure and other properties of Ti6Al4V pre-alloyed powders produced by selective laser sintering technique. Through this research, the direct fabrication of Ti6Al4V metal object by SLS machine has been carried out using MetalSys250 machine. Different parameters of SLS process were used to produce 1cm x1cmx1cm cubic samples and then microstructure and mechanical properties of the as-built samples was investigated.

Keywords: *Ti-6Al-4V, Microstructure, 3D-printing, Selective laser sintering, Laser patterns.*

THE INFLUENCE OF HEAT TREATMENT PROCESS ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIGH MANGANESE AUSTENITIC STEEL ALLOYING BY CHROMIUM

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Abstract: High manganese austenitic steel (also called Hadfield steel) is widely used because it is combined high toughness and ductility in center with high work-hardening capacity in the surface layer when it worked under pressure of impact loads. However, the ability to work under abrasion resistance of ordinary high manganese steel is unstable. To improve mechanical properties, ordinary high manganese steel is alloying by chromium, combined a suitable heat treatment process to maintaining good toughness under impact loads and increase the abrasion wear resistance. After researching the influence of heat treatment technique, the aging at 650^{o}C and the solution treatment at 1050℃ holding 180 minutes shows that it is easier to dissolve completely carbides at the grain boundaries and achieve carbide free gains into austenite matrix.

Keywords: *Alloying by chromium, Hadfield steel, heat treatment, mechanical properties, microstructure.*

PREPARATION OF NICKEL NANOWIRES AND EFFECTS OF SYNTHESIS CONDITIONS ON THEIR MORPHOLOGY

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Abstract: Nickel nanostructures prepared by various methods have received considerable attentions due to their numerous applications. In this study, one-dimensional nickel nanowires (NiNWs) were synthesized by the reduction of nickel (II) chloride in polyol medium. Poly (vinylpyrrolidone) (PVP) served as the surfactant and hydrazine hydrate was used as the reductant. The effects of different experimental parameters, i.e. concentration of Ni^{2+}, volume of N_2H_4, concentration of PVP and reaction temperature on the formation and morphology of NiNWs were studied. The structure, composition and surface morphology of the materials were characterized by X-ray diffraction (XRD) and transmission electron microscopy (TEM). The results showed that the morphology as well as the diameter of NiNWs could be effectively controlled by adjusting parameters of the synthesis process.

Keywords: *nickel, one-dimensional, nanowire, morphology control, polyol method.*

EFFECT OF EXPERIMENTAL PARAMETERS ON STRUCTURE AND PROPERTIES OF MOLYBDENUM DISULFIDE SYNTHESIZED BY HYDROTHERMAL METHOD

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Abstract: In this study, molybdenum-disulfide (MoS_2) nanostructures were synthesized by a facile hydrothermal process, using ammonium heptamolybdate tetrahydrate ($(NH_4)_6Mo_7O_{24}$) and thiourea (CH_4N_2S) as the reactants. The effects of experimental parameters including reaction temperatures and reaction times on the structure and morphology of MoS_2 were primarily studied. The as-synthesized materials were analyzed by using X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), Raman scattering, energy dispersive spectroscopy (EDS), photoluminescence (PL) spectroscopy.

Keywords: *MoS_2, optical property, hydrothermal method.*

EFFECTS OF TEMPERATURE ON THE STRUCTURE AND PROPERTIES OF FE_2O_3/GRAPHENE NANOCOMPOSITES SYNTHESIZED BY HYDROTHERMAL METHOD

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Abstract: A simple and straightforward approach was used to prepare Fe_2O_3/graphene nanocomposites with different temperature condition. The nanocomposites were characterized by X-ray diffraction (XRD), Raman spectroscopy, field emission scanning microscopy (FE-SEM), transmission electron microscopy (TEM), energy dispersive spectroscopy (EDS), photoluminescence (PL). The results show that Fe_2O_3 nanoparticles with size in range of 60-100 nm are anchored on the surface and filled between the graphene nanosheets at hydrothermal reaction.

Keywords: *Fe_2O_3/graphene, nanocomposite, graphene, hydrothermal method.*

SYNTHESIS, STRUCTURE, AND PROPERTY OF UNIFORM GOLD NANOPARTICLES BY MODIFIED POLYOL METHOD

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Abstract : In our present research, gold (Au) nanoparticles have been synthesized by polyol methods with $NaBH_4$ at high temperature. The important characterization of as-prepared Au nanoparticles has been investigated by UV-vis-NIR spectroscopy, X - ray diffraction (XRD), and transmission electron microscopy (TEM). The controlled synthesis of Au nanoparticles under size and shape control by new, simple, inexpensive, improved, and modified polyol methods has been introduced. The size, the shape, and the structure of Au nanoparticles were studied in detail. The surface plasmon resonance (SPR) phenomenon of the pure Au nanoparticles in ethanol as solvent has been studied according to their various shapes and morphologies, which can be potentially used for next-generation sensors. Therefore, the results' our research group of Au nanoparticles will be possible potentially used in the area of surface plasmon resonance (SPR), surface enhanced Raman spectroscopy (SERS), and tip-enhanced Raman spectroscopy (TER), and their novel applications for next-generation SPR, SER, and TER next-generation sensors.

Keywords: *Polyol method, $NaBH_4$, PVP, Gold nanoparticles.*

SYNTHESIS AND CHARACTERIZATION OF SILICA COATED MAGNETIC IRON OXIDE NANOPARTICLES

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Abstract: Advances in nanotechnology in recent years have led to a number of diverse applications of nanomaterials. Magnetic iron oxide nanoparticles (Fe_3O_4 NPs), a representative of magnetic nanomaterials, have gained much attention of many researchers all over the world due to their unique properties such as superparamagnetism, biocompatibility and high magnetic saturation. With such properties, Fe_3O_4 NPs can be exploited in many fields, particularly biomedicine related fields such as cellular therapy, tissue repair, drug delivery, magnetic resonance imaging, hyperthermia and magnetofection. However, owing to their self-aggregation of Fe_3O_4 NPs, it is necessary to coat Fe_3O_4 NPs with a stable and biocompatible silica layer. Therefore, in this report, Fe_3O_4 NPs were synthesized via a co-precipitation method using iron (II)/ iron (III) chloride, ammonia and trisodium citrate. Then, the silica layer was coated onto Fe_3O_4 NPs through the hydrolysis and condensation of tetraethyl orthosilicate (TEOS) in ethanol. The as-synthesized samples were charaterized with the infrared (IR) spectroscopy, X-ray diffraction (XRD) spectroscopy, thermogravimetric analysis (TGA), vibrating sample magnetometer (VSM), transmission electron microscopy (TEM) and dynamic light scattering (DLS). The results proved that silica was successfully coated on Fe_3O_4 NPs. The particle sizes measured by TEM were found to be about 12 nm in diameter for Fe_3O_4 NPs and 45 nm in diameter for silica coated Fe_3O_4 ($SiO_2@Fe_3O_4$) NPs, while the dynamic diameters measured by DLS for Fe_3O_4 NPs and $SiO_2@Fe_3O_4$ NPs were 15.7 and 65.8 nm, respectively. Both Fe_3O_4 NPs and $SiO_2@Fe_3O_4$ NPs were superparamagnetic materials in which Fe_3O_4 NPs have higher magnetic saturation (45.8 emu/g) than the other (13.4 emu/g).

Keywords: *Fe_3O_4 nanoparticles; silica; superparamagnetic.*

STATIC, FATIGUE AND CORROSION PROPERTIES OF DISSIMILAR FRICTION STIR WELDED 6061-T6/5083-H116 ALUMINIUM ALLOYS

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Abstract: In this study, dissimilar metal welded joints between heat treatable AA6061-T6 and non heat treatable AA5083-H116 aluminium alloys were produced using friction stir welding (FSW) process with AA6061-T6 located in advancing side (AS). Friction stir welding was conducted using various rotational speeds of 910, 1500 and 2280 rpm whereas the transverse speed was maintained constant at 30 mm/min. Metallurgical, mechanical, fatigue and corrosion characteristics of the friction stir welds were studied experimentally. Results show that an increase in tool rotational speed moves the location of tensile fracture from stir zone (SZ) to heat affected zone (HAZ) of AA6061-T6 consistent with the hardness measurements. At a low tool rotational speed, the SZ region is characterized by inhomogeneous material as the result of inadequate material intermixing whereas high tool rotational speed leads to softening on the AA6061-T6. The material flow mechanism in SZ is complex and the presence of inhomogeneity is likely to be responsible for increasing corrosion rate and corrosion-fatigue crack growth rate of the welds by providing local galvanic cell.

Keywords: *FSW, dissimilar aluminium alloys, static and fatigue properties, corrosion.*

PHÂN BAN: VẬT LIỆU NĂNG LƯỢNG VÀ ỨNG DỤNG

SESSION: ENERGY MATERIALS AND APPLICATION

DEPOSITION OF CHITOSAN/ANTIMICROBIAL AGENT USING ELECTROPHORETIC DEPOSITION SILVER (AG) THIN FILM ON STAINLESS STEEL 316L AS METHOD

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Abstract: Stainless Steel 316L (SUS316L) is commonly used for medical applications. However, some bacterial often still bonds on the device surface then causes some infections after implantation surgery. Unfortunately, the material does not have antimicrobial property to prevent the bonding of bacteria on surface. The aim of this research is to deposit chitosan/silver (Ag) as antimicrobial agent on stainless steel 316L using electrophoretic deposition method. Chitosan and silver are known that they have antimicrobial properties. The voltage of rectifier during the deposition was set as constant 10 volt with suspension pH variation of 2,7 to 5,1. The effect of suspension pH variation to chitosan/Ag thin film on physical, mechanical, and antimicrobial properties were analyzed. The structure and morphology were investigated by X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Fourier-Transform Infrared (FTIR). The inhibition of antimicrobial was tested using Kirby-Bauer antimicrobial test. The results show that increase of suspension pH leads to increase of chitosan/Ag thin film thickness, size and agglomeration. The maximum thickness is 5,265 µm during deposition using pH 5,1 suspension. The best antimicrobial agent is obtained at pH 3,5 suspension sample with inhibition zone diameter of 4 mm

Keywords: *Chitosan/Ag; antimicrobial; SUS316L; Electrophoretic Deposition.*

GaN AND SiC PLASMA SPUTTERING ON MAGNETRON CATHODE EFFECTS LOW POWER MICROWAVE POWER GENERATION EFFICIENCY

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Abstract: Plasma sputtering on magnetron's cathode surface using semiconductors such as GaN and SiC has been performed for microwave power generation enhancement intended for modulated microwave power transmission. This process includes plasma grown on magnetron's cathode surface using GaN and SiC through a semiconductor deposition process. Several parameters examined to produce the best quality of sputtering, such as deposition period and temperature. Magnetron efficiency dropped significantly when it used to generate low power microwave using high frequency due to power losses during generation. The primary purpose of plasma sputtering on magnetron's cathode is to enhance the efficiency of the magnetron to generate low power microwave with high frequency. Enhancement of magnetron through cathode sputtering has reduced the losses of microwave power significantly and exhibits a better power quality as proven experimentally.

Keywords: *Gallium Nitride (GaN), Silicon Carbide (SiC), Microwave Power Generator (MPG), Magnetron Cathode.*

SYNTHESIS OF COPPER NANOPARTICLES WITH VARIOUS SIZES TOWARDS IMPROVING THE ELECTRICAL CONDUCTIVITY OF COPPER FILMS AT LOW SINTERING TEMPERATURE

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Abstract: The synthesis of CuNPs by surfactant-assisted chemical reduction method was studied aiming to identify the content of PVP-surfactant corresponding to the size of copper particles. The crystallite size and phase of CuNPs were determined by X-ray diffraction (XRD) analysis while transmission and scanning electron microscopy (TEM and SEM) were used to characterize the size of copper particles. The copper films were fabricated by the doctor-blade technique on PI and Al_2O_3 substrates. The effect of sintering temperature on conductive properties of the copper film after sintering was investigated. The electrical conductivity of copper films was measured by using the four-point probe method. The electrical resistivity of copper films achieved stable values at the low sintering temperature above 200°C about 0.22 mΩ.cm and 0.63 mΩ.cm for that of Al_2O_3 and PI substrates respectively.

Keywords: *copper nanoparticles, low sintering temperature, chemical synthesis.*

IMMERSION-BASED CORROSION TESTING ON UNS S30400 USING A BLEED-AND-REFILL CYCLE METHODOLOGY

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Abstract: In this study, a commercial 10% ethanol-gasoline blend was used in an immersion test that deviates from ASTM G31 and SAE J1747. Set-up was designed to accommodate effect of phase separation so that target metal is exposed to the heavier than bulk ion-rich layer. Immersion test utilized airtight containers of austenitic steel (UNS S30400) which were subjected to 38 °C, immersion lengths of 4, 8 and 12 weeks, and a weekly bleed-and-fill process to refresh the air and ion supply of the liquid. Corrosion response was evaluated using EIS on a 3-electrode setup with UNS S30400 samples, Pt wire, and an AgCl reference electrode. Equivalent circuit analysis was used to estimate corrosion rates from polarization resistances. A slight decrease in corrosion rate was observed in increasing lengths of immersion. It is suggested to utilize a Pt mesh embedded in the setup and a LiCl in ethanol as electrolyte for reference electrode better conductivity and signal-to-noise ratio.

Keywords: *Bioethanol, Corrosion, EIS. Fuel Blend, Immersion.*

RECOVERY OF COPPER NANOPARTICLES FROM DISCARDED PRINTED CIRCUIT BOARDS THROUGH A LEACHING/ELECTROWINNING PROCESS IN AMMONIUM-BASED SOLUTION

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Abstract: Printed circuit boards (PCBs) are the key and valuable component of discarded electronic devices containing high concentration of various recoverable metals. In this work, a facile combination of leaching/electrowinning methods was conducted for copper recovery from PCB in ammonium-based solution. The effect of voltage, current density and concentrations of CTAB on morphology and particle size of the deposited copper were investigated. The samples were collected and characterized by ICP, AAS, X-ray diffraction, SEM-EDS and TEM imaging. The results exhibit an ability of electrochemical method for recovering high quality end-product metals from PCBs. Beside obtaining large amount of high purity copper, insignificant contents of rare earth elements (REE) were also quantified.

Keywords: *printed circuit boards (PCB), nanoparticles, copper recovery, leaching/electrowinning, electrochemical method, rare earth elements (REE).*

THE INFLUENCE OF THE SPUTTERING CURRENTS ON STRUCTURAL, OPTICAL AND ELECTRICAL PROPERTIES OF $CuCr_{0.95}Mg_{0.05}O_2$ THIN FILMS

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Abstract: has emerged as a p-type semiconductor because it is owning the lowest resistivity in delafossite family. In this report, the $CuCr_{0.95}Mg_{0.05}O_2$ thin films were deposited on soda-lime glass substrate at the substrate temperature of 450°C from a 3 inch target of $CuCr_{0.95}Mg_{0.05}O_2$ material using dc magnetron sputtering system. From the XRD results, all films exhibit the significant existence of delafossite structure with the (110) orientation regardless the sputtering currents and relatively low substrate temperature. There is a strong correlation between the structural and electrical properties of thin films as a function of the sputtering currents in which the higher integrated intensity of (110) orientation is, the lower the resistivity of the films is reached. The film deposited at current of 350 mA has the lowest resistivity of 4×10^{-2} Ω.cm.

Keywords: *$CuCr_{0.95}Mg_{0.05}O_2$ thin films; delafossite; low resistivity p-type materials; magnetron system; sputtering current*

TEMPERATURE-DEPENDENT PHOTOLUMINESCENCE STUDY OF POROUS GaP

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Abstract: This paper reports on the temperature-dependent photoluminescence of porous GaP under the 355-nm excitation. Porous GaP was formed by electrochemical anodization of the (111)-oriented bulk material. Photoluminescence taken from the porous GaP at room temperature shows a narrow green emission band peaking at 550 nm (2.25 eV) and a broad red emission one peaking at 770 nm (1.65 eV). In the temperature range from 25 K to 275 K intensity from the green emission gradually decreases with increasing temperature. Additionally, the red-shift of the green luminescence band with increasing temperature exhibits the same that of the GaP band gap narrowing with temperature. This means a contribution of the phonons and the lattice dilatation with the increse of temperature.

Keywords*: porous GaP, temperature-dependent photoluminescence.*

HIGH-EFFICIENT TRIBOELECTRIC NANOGENERATORS (TENGs) BY MECHANICAL SYSTEM DESIGNS

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Abstract: Triboelectric nanogenerators (TENGs) are mechanical to electrical energy conversion systems that work on the principles of contact electrification and electrostatic charge induction. The output performance of TENGs depends on several factors including motion amplitude, motion velocity and material durability. Through the use of mechanical energy conversion systems (MECS) such as gear-train, slider-crank, cam-follower, flywheels, mainspring, cantilever spring, and coil spring, it is possible to control the motion characteristics of the TENG thereby controlling its output performance. In order to make the TENG technology mainstream, the integration of MECS with TENGs is critical and it is therefore important to understand the interactions between the various system components. Thus, in this work we explore several MECS designs integrated with the TENG in order to control its kinematic and vibrational behavior. Through our achievements, we hope to provide better understanding of these systems and promote the growth of MECS integrated TENGs.

Keywords: *Triboelectric Nanogenerators, Kinematics, Motion Control, Vibration, Resonant System.*

PHÂN BAN: VẬT LIỆU POLYME VÀ COMPOSITE

SESSION: POLYMER AND COMPOSITE MATERIALS

EXTRACTION AND CHARACTERIZATION OF BIOPOLYMER FROM OKRA POD

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Abstract: Okra pods contain a useful natural polymer that possesses promising characteristics and excellent properties as it is eco-friendly, low-cost, non-hazardous, and easily decomposed in the natural environment. These properties give this natural polymer substantial advantages over synthetic polymers. In this study, the okra biopolymer was extracted using the isolation method, and the mucilage was purified using distilled water. The thermal and physical properties were characterized using differential scanning calorimetry (DSC), field emission scanning electron microscopy (FESEM), and energy dispersive x-ray (EDX). The biopolymer matrix nanocomposite was investigated in-depth for use in electrical applications, for example, in sensors, supercapacitors, and microelectronic packaging. The biopolymer matrix nanocomposite thin films were fabricated using the cast solution method. The different weight percentages for the used graphene oxides ranged from 1 wt.% to 5 wt.% for the biopolymer matrix nanocomposite fabrication. Penetration testing was carried out using a universal testing machine to study the mechanical strength of the biopolymer matrix nanocomposites. The hardness of the thin films increased with the increase in the weight percentage of the graphene oxide.

Keywords: *Biopolymer, Isolation Method, Morphology, Okra, Mechanical Strength.*

OIL ABSORBENT FROM NATURAL RUBBER FOAM

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Abstract This research focuses on preparation of oil absorbent foam from NR-based foam. Natural rubber latex (NRL) was mixed with surfactant, crosslinking agent, activator and accelerator with speed of 500, 800, 1200 rpm. The different amounts of surfactant at 0.5, 1.0, 1.5 and 2.0 phr were investigated on foam density and absorbability. The various amount of crosslinking agent at 0.5, 1.0, 2.0 and 3.0 phr were applied. The results show higher stirring speed decreased foam density as air volume increased. The foam density could imply to cell size; the lower density is probably a larger cell size. The efficient amount of surfactant should be applied over 1.0 phr. The optimum amount which gave good oil absorption behavior was at 1.5 phr. The lower amount of crosslinking agent presented higher absorption. This is because lower crosslinking allows more oil permeated through cell wall compared to higher crosslinking. Moreover, it might because at very low crosslinking density. However, the selection of absorbent should be also considered base on the characteristics of the absolute.

Keywords: *oil absorption, NRL foam, absorptive materials, micelle formation, latex foam.*

POLYLACTIDE NANOFIBERS WITH SUPER-HYDROPHOBICITY AND OLEOPHILICITY FOR OIL/WATER SEPARATION

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Abstract: Polymeric nanofibers with super-hydrophobic property have attracted vast interest in various applications, especially oil/water separation. In this work, super-hydrophobic PLA nanofibers have been fabricated by an electrospinning process and a treatment with a hydrophobic agent, ketene dimer-containing (KDC) compound. As KDC consists of a functional group that is specifically reactive toward hydroxyl group, glycerol is employed as a template providing the functional groups for the PLA matrix. Chemical structures and properties of the materials were then characterized by FTIR spectroscopy, SEM, water contact angle measurement, and oils absorption ability. Oil/water separation efficiency of the degradable nanofibers was examined for their potential use in oil-contaminated water treatment. As these materials are derived from degradable polymer, environmental-friendly approached can be applied in their disposal after use, which are of greater advantages over conventional materials.

Keywords: *Polylactide (PLA), Super-hydrophobic, Nanofiber, Oil/water separation.*

3D PRINTING OF GELATIN-CHITOSAN FOR TISSUE ENGINEERING APPLICATIONS

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Abstract: Three-dimensional (3D) printing technology has been used in the field of tissue engineering to fabricate hydrogel scaffolds. Natural hydrogels are a potential scaffold material due to their biocompatibility and bioactivity, to provide support for cells in tissue regeneration. However, hydrogels need to be crosslinked in mild conditions to provide a biocompatible environment for cells to proliferate. In this study, a combination of gelatin and chitosan is used as a bio-ink for 3D-printed scaffolds. Gelatin is used as the main component of the hydrogel scaffold due to its ability to promote cell adhesion and accelerate the gelation time at a temperature below 25 °C. Chitosan is added to improve the hydrogel viscosity and mechanical strength. This study investigates the printability of gelatin-chitosan hydrogels with a customized 3D extrusion-based printer (Rostock-Delta) by varying the gelatin concentrations from 4 to 10 wt.%. The scaffold with 10 wt.% gelatin and 0.1 wt.% chitosan provides the optimum conditions for a bio-ink. The printed scaffold is subsequently crosslinked with the enzyme transglutaminase, to improve its structural integrity. The crosslinked scaffolds show a greater ability to resist thermal degradation and better pH stability.

Keywords: *3D printing, Bio-ink, Chitosan, Gelatin, Scaffolds, and Transglutaminase.*

MECHANICAL PROPERTIES OF UNSATURATED POLYESTER $CaCO_3$/KENAF HYBRID COMPOSITE

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Abstract: A hybrid composite made from unsaturated poluester (UPR)/$CaCO_3$/Kenaf fiber has been succesfully. The purpose of this study was to observe the effect of variations in the composition of the addition of kenaf fiber and $CaCO_3$ powder derived from industrial waste as reinforcing material on the mechanical and physical properties of polyester composite hybrid composites. Hybrid composite in this research was made by the Hand Layup method. It designed with unsaturated polyester (UPR) resin to kenaf fiber ratio about 80:20 with different $CaCO_3$ compositions (2.5, 5, 7.5, 10 and 20 per hundred ratios). Mechanical testing such as tensile, bending, impact and hardness testing were done by using appropriate standard instruments. The results showed that 5% weight hybrid composite $CaCO_3$ had the highest tensile strength and hardness. Composite 0% by weight $CaCO_3$ shows the highest flexural strength and impact strength. There is an OH moity observed on the FTIR peak of composite that indicate a bonding between fiber and the UPR resin.

Keywords: *Hybrid Composites, Kenaf Fiber, $CaCO_3$, Unsaturated Polyester.*

PERFORMANCE OF EPOXY GROUT AS AN INFILL MATERIAL IN PIPELINE COMPOSITE REPAIR SYSTEM: A REVIEW

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Abstract: Reducing the composite wrapping layer is one of the main interests in pipeline composite repair industry. As infill material is one of the repair components in the repair system, this material has become the centre of attention for the researcher to achieve this ultimate goal. As an initial step towards optimizing the current composite repair design, appropriate epoxy grouts need to be selected, explored and examined for their properties and determine its suitability as a component in composite repair. Thus, the role of epoxy grout as infill material in pipeline composite repair is very significant to be understood especially on its engineering properties. Therefore, this paper elaborates on the performance and behaviour of epoxy grout and its influence on the overall performance of the repair system in order to ensure satisfactory repair performances. Thus, the review will benefit pipeline operators by providing useful information on selecting the appropriate infill material based on the performance requirement of the composite repair systems, thereby improving the efficiency of repair works and minimizing possible further damages.

Keywords: *Composite repair, Pipeline, Infill material, Epoxy grout, Mechanical properties.*

DESIGN OF A 3D-PRINTED THREE-FINGER ROBOTIC GRIPPER END-EFFECTOR

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Abstract: This paper aims to design a 3D-printed three-finger robotic gripper end-effector. The proponents incorporated various considerations in the design such as grip reliability and stability, maximization of grip force, and ability to grasp wide objects. The components of the three-finger gripper assembly are modularized to make these parts easily machined and reusable. The proposed design was 3D-printed using polylactic acid (PLA) and thermoplastic polyurethane (TPU) materials. Lastly, additional tolerances were considered in the modeled design to account the possible expansion and shrinkage of the material during the 3D printing process. This study serves as the pre-implementation of the actual three-finger robotic gripper that will be fabricated by the proponents of this research.

Keywords: *Three-Finger Gripper, 3D-Printed Materials.*

ISOLATION AND CHARACTERIZATION OF NANOCELLULOSE FROM PILI (*CANARIUM OVATUM*) PULP

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Abstract: Intensive studies on the synthesis and characterization of nanocellulose from different biomass have been conducted and continuously explored nowadays. Synthesis techniques and sources significantly affect the properties of nanocellulose produced along with its suitable applications. Using a rapid method of cellulose isolation and sulfuric acid hydrolysis, the thermal and suspension stability, and optical band gap of the synthesized nanocellulose from Pili pulp are determined in this study. Pili pulp is a biomass which comes from the extraction process in the production of Pili essential oil, from which nanocellulose are synthesized. Thermal analysis showed that nanocellulose has higher thermal decomposition at the range of 280-340 °C. This thermal stability was attributed to the presence of sulphate groups (O-SO_3) attached to the surface of the nanocellulose, which causes the sample to be resistant to carbonization. Surface charge analysis showed that the synthesis technique used yields a stable nanocellulose suspension having a zeta potential value of -26.59 mV at neutral conditions. Using Tauc's relation, spectral analysis on the nanocellulose produced exhibited an optical band gap of 5.35 eV which indicates its capability to oxidize at higher photon and UV absorption.

Keywords: *Nanocellulose, Optical property, Pili pulp, Solution stability, Thermal stability.*

CEFTIOFUR HYDROCHLORIDE-CONTAINING CHITOSAN MICRO/NANO PARTICLES VIA ELECTROSPRAYING METHOD AS AN EFFICIENT DRUG DELIVERY SYSTEM

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Abstract: In this work, chitosan micro-, nano-particles with narrow size distributions are synthesized via an electrospraying method. Effect of preparing parameters such as chitosan concentration, acetic acid concentration, working distance, and applied voltage on size and morphology of the chitosan particles are systematically investigated. The results reveal that the particles prepared with a 18 G needle at an applied voltage of 12 kV, working distance of 12 cm from nozzle to collector, flow rate of 0.1 mL/h, and chitosan concentration of 0.2 wt.% in 80 wt.% aqueous acetic acid solution, are uniform. The particles have a spherical shape with diameter of ~367 nm. Importantly, the chitosan particles, which are loaded with ceftiofur hydrochloride (CEF) at concentrations of 13.04 and 16.67 wt. %, demonstrated no burst of release phenomenon at the beginning stage and the drug release depended extensively on the decomposition of chitosan polymer. The promising release property indicates that CEF effectively encapsulated by chitosan. This work may pay the way to produce drug/protein encapsulated chitosan miro-, nano-particles as an efficient delivering therapeutic medicines (cancer or diabetes) to right target.

Keywords*: electrospraying; micro/nano chitosan, ceftiofur hydrochloride.*

INVESTIGATING EFFECT OF CERIUM OXIDE ON PROPERTIES OF LOW-PROTEIN VULCANIZED NATURAL RUBBER

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Abstract: Natural rubber latex is considered as a “green material” due to its natural origin and a sustainable choice as well as it minimizes environment impacts so that it has become an integral part of our daily lives. However, natural latex may contain allergenic proteins which need to be removed and this process effects to the properties of vulcanized material. In this study, we investigate the mechanical properties of the low-protein vulcanized natural rubber such as tensile modulus 100% (M100), tensile modulus 300% (M300), tensile strength, tear strength and study the effect of cerium oxide on its properties.

Keywords: *Cerium oxide, deproteinized natural rubber, natural rubber latex, , mechanical properties.*

UTILIZATION OF SINGLE-USE PLASTIC LAMINATE AS MATRIX IN GLASS FIBER-REINFORCED COMPOSITE

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Abstract: Comprising the 80% of the total plastic wastes, single-use laminates are made up of different polymeric materials of micron-level thickness. This makes the recycling by polymer segregation difficult. An alternative is to use it as a composite. The composition of the laminates was verified using Fourier transform infrared spectroscopy, while the thermal properties were obtained using differential scanning calorimetry. The binding capability of the matrix system was determined by incorporating glass fiber as fillers and assessing the homogeneity of the matrix and fillers using digital microscopy. The effect of fiber loading to the mechanical properties of the composite filament extruded from a single-screw extruder was measured by obtaining trends in the tensile strength, elastic modulus, toughness, and yield strength. The distribution of matrix and filler at the cross-section of the filament seemed homogenous. However, along the longitudinal filament length, the curves and cusps show poor homogeneity. Moreover, because of the presence of defects such as voids and unmelt laminates, a decrease in elastic modulus was observed. Furthermore, the elastic modulus increased for PET-PE, but for PET-VMPET-PE and PET-Al foil-PE it decreased indicating poor matrix-fiber interaction. The tensile strength increased for PET-PE and PET-Al foil-PE, but it decreased for PET-VMPET-PE. In combining all three laminate types, the highest tensile strength was obtained. For the other combinations, the tensile strength values are more likely the same. For further studies, the use of a compatibilizer is recommended. Lastly, other properties such as compressive, flexural, and thermal could be assessed. The water uptake could also be done.

Keywords: *composites, glass fiber, plastic laminates, recycling, single-use plastics, waste management.*

ANTI-ODOUR TREATMENT ON 100% WOOL FABRIC USING COLORANTS FROM COFFEE GROUND RESIDUES

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Abstract: Ground coffee residues are considered as biomass and organic wastes that can be used for further applications due to their deodorant properties. The purpose of this study is to confer anti-odour treatment on 100% wool fabric by bi-functional dyeing process with the colorant extracted from ground coffee residues. The extraction was carried out using water at 100ºC at different extracting ratios. Knitted wool fabrics were IR dyed with extracting solutions at 80ºC, in 90 minutes then dried at 60ºC for 30 minutes. Treated wool fabrics were evaluated by colour strength K/S and FT-IR spectra. Colour fastness to hand-washing was tested according to AATCC standard, and the results exhibited good grade of 4-5. The anti-odour effect was also evaluated according to AATCC method for textile materials after laundering. The results confirmed deodorization of fabrics treated by ground coffee residues extraction, even with strong odour like onion.

Keywords: *Coffee, biomass, wool, anti- odor, fabric.*

A STUDY OF SUSTAINABLE COLORATION OF LYOCELL FABRICS USING EXTRACTS OF TROPICAL ONION SKINS

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Abstract: Lyocell is considered as a new fiber that represents a milestone in the development of environmentally sustainable textiles. Lyocell is spun from wood pulp cellulose via a green chemical process with NMMO (N-methylmorpholine-N-oxide) solvent. Following the concept of lower the environmental impact of fashion clothing, this study aims to determine the suitable natural dyes recipes with the color extracting from tropical onion skins. Colorants were extracted by dissolving crushed dried onion skins with boiled in water at 100ºC for 20-25 minutes. The ratio of extracting and dyeing are 1:25 and 1:30 respectively. The optimal dyeing condition was found out at 80ºC, 45 minutes with 75% v/v. In addition, a variety of the most commonly used mordants including Potassium aluminum sulfate, Copper (II) sulphate and Iron (II) sulphate were used for mordanting in order to compare the differently mordanted and unmordanted dyed fabrics via color strength (K/S) and CIE L*a*b* color values. It was found that mordant type had an effect on color strength and the color coordinates of fabric dyed with onion skin, which can supply variety of color choices for the same colorants.

Keywords: *lyocell, natural dyes, onion, colors, mordant.*

ANTIBACTERIAL FINISHING ON COTTON 100% AND CVC FABRICS WITH TANNIN FROM PIPER BETLE EXTRACT

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Abstract: Following the recent trend of using natural ingredients from bio-macromolecules, biomaterials, plant extract in textile chain, this research aims to develop an antibacterial textiles finishing with Tannin extracted from piper betle plant. The extracting processes were carried out with different solvent: distilled water, Ethanol 30%, Ethanol 50%, Ethanol 70% in 60 minutes. Two important types of fabric, including Cotton and CVC (Cotton/Polyester) were padded with piper betle extracts, then dried at 60ºC in 5 minutes. The presence of tannin on fabric after treatment was determined by $FeCl_3$ test and FT-IR spectrum. The antibacterial effect of finished fabrics was proved according to ASTM 2149-01 standard. The test was performed with Escherichia Coli ATCC 25922 and Staphylococus aureus ATCC 6538. The final results exhibited good antibacterial activity of 83.02%, 65,33% against the bacteria Ecoli and 93.88 %, 85.14% against the bacteria S.Aureus on cotton and then CVC fabrics.

Keywords: *Cotton, fabric, Piper betle, Tannin, antibacterial.*

MECHANICAL PROPERTIES AND THERMAL STABILITY OF SYNTHESIZED WATERBORNE POLYURETHANE/POLYANILINE-OXALIC ACID/ZINC OXIDE PROTECTIVE COATING

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Abstract: This study aims to synthesize composite filler polyaniline (PANI) doped with Oxalic Acid (OA)-grafted-Zinc Oxide (ZnO) for waterborne polyurethane (WPU) protective coating. OA-doped anilinium has been polymerized via in-situ emulsion polymerization in the presence of ZnO nanorods with ammonium persulfate forming PANI-OA/ZnO additives. The synthesized filler were blended to WPU at varied loading, obtaining a coating complex solution of polyol, dispersing agent, defoamer, wetting agent, and rheolate. The effect of synthesized filler loading to mechanical properties and thermal property of the coating were evaluated using Universal Testing Machine and Thermogravimetric Analysis, respectively. It was observed that hardness of the WPU/PANI-OA/ZnO composite coating increased with filler loading. Elastic modulus and break stress have the same increasing trend with increased filler weight percent. Among the composites, the 3wt% PANI-OA/ZnO has the highest elastic modulus and break stress of values. Meanwhile, with increasing filler content, thermal curves shift to a higher temperature with increasing filler loading and revealed that the highest thermal stability was obtained at 3wt% PANI-OA/ZnO in WPU coatings.

Keywords: *nanocomposite, waterborne, coating, polyurethane, polyaniline.*

CHARACTERIZATION OF THE TECHNICAL PARAMETERS OF THE EPOXY RESINS AND APPLICATION IN AUTOMOTIVE INDUSTRY

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Abstract: In this work, we report on the characterization of viscosity, gel time, and gel content of an *DER 331 Epoxy* using Triethylenetetramine (TETA), P5, and their mixtures as curing agents. In addition, the effect of curing agents on the mechanical properties of the thermoset cured epoxy including bending strength, tensile strength, and impact strength are systematically investigated. The results show that the thermoset epoxy achieves the best mechanical performance when it is cured with 13 wt. % TETA, or 50 wt.% P5, or mixture TETA and P5 with TETA/P5 ratio of 03/97. The research provides a basic understanding and a guide for properly using the curing agents for *DER 331 Epoxy* which is essential for mass-producing the expoxy-based composites by the Vacuum Assisted Resin Transfer Molding (VARTM) process and applications in automotive industry.

Keywords: *Teachnical parameters, composite materials, epoxy resin, automotive industry.*

EFFECT OF CELLULOSE NANOWHISKERS EXTRACTED FROM PINEAPPLE (*ANANAS COMOSUS*) LEAVES FOR EPOXY COATINGS

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Abstract: Nanocellulose is very abundant material from plant sources which have good physical property, thermal stability, biocompatibility and biodegradability. Industrial applications utilizing agricultural cellulosic wastes have been attracted interest due to its promising properties. In this work, we report on cellulose nanowhiskers extracted from pineapple leaves using alkali treatment with aqueous sodium chlorite then followed by bleached treatment using acetate buffer and aqueous sodium chlorite. Transmission electron microscope image revealed about 10nm size of nanocellulose was observed. Fourier transform infrared (FTIR) spectra revealed that the absorbance of the vibrational mode corresponding to the interaction of nanocellulose and epoxy matrices significantly increase as the nanocellulose loading ratio increased. Furthermore, thermogravimetric analysis (TGA) curve showed that the thermal stability improved significantly as the nanocellulose content increased indicates that there was good reinforcement of the nanocellulose in the epoxy resin. Moreover, EIS result revealed the ability of nanocellulose to alter the corrosion protection performance in steel coatings. Higher impedance values were recorded for the coating systems that contain epoxy/nanocellulose nanocomposite. The nanocellulose incorporated into the epoxy matrices helped to improve their properties physically, thermally and chemically. This further supports our claim that epoxy/nanocellulose nanocomposite coatings enhanced the barrier properties as anti-corrosion protection. The results obtained from electrochemical impedance spectroscopy (EIS) studies revealed that epoxy/nanocellulose nanocomposite coating system with 2% nanocellulose exhibit the best anticorrosion performance and have demonstrated an intact behavior over all the immersion period without any sign of coating damage or degradation.

Keywords: *Nanocellulose, nanocomposite, anti-corrosion coatings, and pineapple leaves.*

SYNTHESIS OF SULFUR-CONTAINED MICROCAPSULES AND POTENTIAL APPLICATION IN RUBBER

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Abstract: In recent times, microcapsule-based material is potentially utilized in a variety of fields such as pharmaceuticals, food, biology, self-healing materials, etc. More remarkedly, in the rubber-related fields, this outstanding material is able to have a crucial role to play as an alternative of sulfur in compounding and vulcanizing process with regard to the self-healing ability after cracking. In this research, the interface polymerization was applied to generate microcapsules, whose shell was synthesized from Urea-formaldehyde pre-polymer modified by 0.25 wt% melamine (p-MUF) containing sulfur (S) as a core substance. When the synthesizing process was carried out at 80°C and stirring rate of 300 rpm in 2 hours, the microcapsule product was spherical with the average size of 115 µm and contained 60% of core content that was examined by FTIR, DLS, SEM, TGA and experimented the potential application. As a result, the amount of 8 phr of produced microcapsules utilized in NBR rubber compounds necessitated a longer time to vulcanize rubber at 160°C compared to using 5 phr free S. Besides, the mechanical strength of the microcapsules-contained product was insignificantly changed but bloom-like phenomenon on the rubber surface was markedly improved. It is noticeable that the vulcanized NBR rubber with the presence of these microcapsules are well able to heal its crack or cut when heated up to 150°C in 10 minutes while the free S-vulcanized NBR rubber is definitely unable to be self-healing in the same conditions.

Keywords: *melamine urea-formaldehyde, microcapsules, self-healing, sulfur.*

SYNTHESIS AND BLEND OF BIO-BASED BENZOXAZINES FROM CARDANOL AND DIPHENOLIC ACID

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Abstract: In this study, two benzoxazine monomers, namely m-alkylphenyl-3,4-dihydro-2H-benzoxazine (CA-Bz) and 4,40-Bis-[6-(3-phenyl-3,4-dihydro-2H-1, 3-benzoxazine)] pentanoic acid (DPA-Bz) were successfully synthesized from fully bio-based phenols (cardanol and diphenolic acid). Their structures were confirmed by FTIR and NMR spectroscopy. CA-Bz/DPA-Bz blend was prepared at weight ratio of 3:1. Polymerization behavior of the blend was investigated by DSC. The ring-opening polymerization temperature of CA-Bz was found to decrease significantly by incorporation of carboxyl groups in DPA-Bz showing thereby the catalytic effect of acid functionality. The modified polybenzoxazine also showed an enhancement of thermal properties.

Keywords*: Diphenolic acid, cardanol, ring-opening polymerization, benzoxazine blend.*

RESEARCH ON PRODUCING TEMPERATURE INDUCED COLOR CHANGE IN FUCTIONAL RUBBER COMPOUNDS

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Abstract: Today, the rubber is used not only in technology products but also in household products. In this study, thermochromic rubber exhibiting the available color changing property with the ambient temperature alteration is fabricated. The effects of thermochromic pigment content and silica filler on the mechanical properties and color-changing durability of the rubber compound are investigated. The results show that the introduction of thermochromic pigment of 1 wt.% into the rubber phase does not adversely affect the mechanical property, while creating the novel color-changing property of the rubber compond. Furthermore, the color-changing durability of the rubber compound maintains after more than 100 cycles, while the original color does not change compared to before the durable test.

Keywords*: rubber, thermochromic pigment, color, vulcanization.*

COMPARATIVE STUDY ON BIODEGRADABLE AND ANTIMICROBIAL PROPERTIES OF BIOWASTE CHITIN-POLYVINYL ALCOHOL BLENDED FILM

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Abstract: In this study, the film forming ability of chitin was blending with polyvinyl alcohol (PVA).The hydrogel films were prepared a series of nine different ratios of CT: PVA, (10:90, 20:80,30:70, 40:60, 50:50, 60:40, 70:30, 80:20, 90:10 v/v) using 2 % chitin solution and 10 % polyvinyl alcohol solution. All prepared blended films have smooth surfaces, highly transparent and pale yellow colour. The prepared hydrogel films were determined the physical parameters, the physicomechanical properties, the degree of swelling and water uptake. The swelling and water uptake of blend membrane has a higher degree of hydration, as measured by swelling and water uptake, which can be altered by varying the weight percent of PVA in the membrane matrix. Comparative characterization of the prepared blended films included FT IR, and TG -DTA analysis.From FT IR analysis, the characteristic absorption peaks of CT-PVA blended film clearly showed that the two polymers are blended. According to TG-DTA analysis, thermal stability of the CT-PVA blended was found to be slightly lower. The property of various types of CT-PVA blended films were tested on antimicrobial activity using agar disc diffusion method. From these results, all of the prepared CT-PVA blended film showed effective antimicrobial activities. Consequently, the biodegradable nature of the prepared CT-PVA blended films was studied by soil burial test. Finally, the prepared CT-PVA blended films may be intended to use in burning dressing and in packaging materials.

Keywords: *chitin, polyvinyl alcohol, physicomechanical properties, antimicrobial activity, biodegradable nature.*

EVALUATION ON COLUMN BUCKLING BEHAVIOUR OF DIFFERENT MYANMAR BAMBOOS

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Abstract: Bamboo, a fast-growing natural material is widely useful construction material in South East Asia. Because of a high strength-to-weight ratio, it provides an environmentally friendly alternative for building construction materials. After that, bamboo is the natural growing materials and it can't be controlled for desired exactly size and shape of bamboo including node. As bamboo structures are generally constructed by local people based on their intuition and experience without any structural design, the strength behaviour of bamboo is necessary to investigate. In this research, column buckling is investigated as the critical modes of failure in bamboo structure, because it is one of important facts in overall collapse. This paper is comparison on column buckling behaviour of three different Myanmar bamboo species. Moreover, buckling strengths of bamboo columns as a function of slenderness ratio are plotted according to the experimental results. The experimental results show that the failure patterns are both compression behavior and buckling behaviour. For pin-ended connection of bamboo column, the effective length factor (K) has small deviation from theoretical value in high slenderness ratios. For long column, the theoretical value is a little smaller than experimental results where its value is greater than experimental results in short column.

Keywords: *Column Buckling, Sustainable Structural Materials, Slenderness Ratio, Three Species of Myanmar Bamboos.*

EXPERIMENTAL INVESTIGATION ON THE EFFECT OF PRESERVATION IN THE PROPERTIES OF SUSTAINABLE MYANMAR BAMBOOS

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Abstract : Because of the rapid growth and maturation rate of bamboo as well as its good strength properties and global accessibility, bamboo is popular as a promising non-conventional sustainable building material resource. However, due to limited standardization and design criteria, bamboo has often been relegated to non-engineered and marginally-engineered construction. Moreover, bamboos need specialized bamboo preservation techniques because they have a low resistance to biological degrading. Consequently, the experimental study on the properties of popular bamboo species in Myanmar has been investigated based on ISO- 22157. The geometric, physical and mechanical properties for six kinds of bamboo species in Myanmar have been discussed for structural design criteria. After that, how the preservation can effect on the properties of bamboo material mainly on mechanical properties has been examined. The basic density of treated bamboo is lower than untreated ones with reduction of moisture content. Due to preservation, treated bamboos possess higher capacity of mechanical properties than untreated ones except flexural strength.

Keywords: *Geometric Properties, Mechanical Properties, Physical Properties, Six Bamboo Species, Treated and Untreated.*

STUDY ON THE CHARACTERISTICS AND ADSORPTIVE CAPACITY OF WATER HYACINTH (*EICHHORNIA CRASSIPES*) ROOTS FOR DYE WASTE TREATMENT

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Abstract: These investigation were conducted to observe the characterization and the adsorptive capacity of aquatic plant roots (water hyacinth roots) for the removal of methylene blue in dye wastewater by batch type process under the influence of various parameters such as initial dye concentration (100-500 ppm), adsorbent dosage (1-5 g/L), pH (3-11) and contact time (15-90 min) on operating conditions. Positive charges elements constituents and irregular surface patterns of water hyacinth roots resulted from XRD and SEM indicated cationic exchange reaction and supported undisturbed adsorption process. Moreover, findings from qualitative analysis FTIR also constant with above quantitative XRD measurements due the existence of numerous functional groups in water hyacinth roots.. The optimum dye removal efficiency 99% was detected at a pH 7 by using 5g/L of adsorbent dosage during 45 min operation time for 100 ppm initial dye concentration solution. Moreover, the adsorption isotherms of this observation were studied by using Langmuir and Freundlich adsorption models in order to interpret the mathematical description of the sorption equilibrium. The equilibrium data were more fitted in langmuir isotherm.

Keywords: *Water Hyacinth, Methylene Blue, Adsorption, Isotherm, Analysis.*

EFFECT OF VARIOUS PLURONIC-CONJUGATED GELATIN COPOLYMERS ON QUERCETIN LOADING EFFICIENCY IN ITS SELF-ASSEMBLY NANOGEL

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Abstract: In this study, to overcome the poor dissolution and bioavailability of quercetin (QU), the phytochemical is loaded in a series of the grafted copolymers (gelatin-pluronic P123, F127, F87 or F68; noted as GP-P123, GP-F127, GP-F87 or GP-F68) under ultrasonic power in a microemulsion phase. Regarding the method, the GP copolymers play a role as the amphiphilic platforms for encapsulating QU in their nanogel via self-assembly process. Their structures were characterized by 1H-NMR. The grafting efficiency of copolymers was characterized by TGA. It was interesting that a higher hydrophobicity of the grafted pluronic leads to a better QU loading efficiency. The Pluronic P123-grafted gelatin exhibited the highest entrapment efficiency up to 94 wt.% of the feed QU. The size distribution of the QU-loaded GP nanogels ranged from 20 to 70 nm which was obtained from Transmission Electron Microscopy (TEM). Our obtained results indicated that the QU-loaded GP nanogels performed a sustained slow release ability of QU remove compared to Pluronic-based micelles. The preliminary results could pave a way to incorporate the QU-loaded GP system with anti-cancer drugs for chemotherapy.

Keywords: *Quercetin, gelatin-pluronic, nanogel, drug delivery, chemotherapy*.

DESIGN OPTIMIZATION OF TYPE 2 COMPOSITE OVERWRAPPED PRESSURE VESSEL WITH GLASS FIBER REINFORCED PLASTIC

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Abstract: Recently, as regulations for the environment have been strengthened internationally, interest in hydrogen gas in the automobile market has begun to gain attention. Hydrogen gas is an eco-friendly, non-polluting fuel that does not generate CO or CO_2 at all and is expected to replace existing hydrocarbons. However, since hydrogen fuel is highly flammable, it is important to store it safely. Therefore, researches on pressure vessels using composite materials are actively carried out to safely and lightly store hydrogen fuel. In this paper, the optimal design of lightweight Composite Overwrapped Pressure Vessel (COPV) for hydrogen fuel tank with 156.6L storage capacity and 70MPa operating pressure was performed by using Finite Element Method (FEM). FEM was executed under static load condition, 70MPa pressure load inside container. The FEM process was topology optimization through Free Size Optimization, Size Optimization and Shuffle Optimization of carbon fiber. As a result, the weight was reduced by about 2.25% compared to the TYPE 1 lightweight model, and the generated stress was reduced by 1.25% compared with the conventional model, and it was found that the composite material can be more effectively reduced in weight.

Keywords: *Composite Material, Composite Overwrapped Pressure Vessel, Glass Fiber Reinforced Plastic, Pressure Vessel, Composite Optimization.*

PREPARATION AND CHARACTERIZATION OF CHITOSAN/POLYANILINE/Fe_3O_4 COMPOSITE FOR REMOVAL OF REACTIVE RED DYE

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Abstract: In this study, chitosan-polyaniline/Fe_3O_4 (CS/PANI/ Fe_3O_4) nanocomposite was synthesized and used as an adsorbent to remove Reactive Red 198 dye (RR 198) from aqueous solution. The synthesized CS-PANI/ Fe_3O_4 nanocomposite was fully characterized using Fourier Transform Infrared Spectroscopy (FT-IR), FE-Scanning Electron Microscopy (SEM), and X-ray Diffraction (XRD). The effect of various factors on the removal of RR 198 such as contact time, initial dye concentration, pH, and adsorbent dose was investigated. The maximum percentage of removal was found to be 96.16% as CS-PANI/ Fe_3O_4 of 0.1 g, in 50 mL of 50 ppm RR 198 dye solution, contact time of 120 min, and pH of 7. The results indicated that the percentage of removal of RR 198 dye was increased with increasing contact time and reached up to 99.16%. Langmuir model showed satisfactory fit to the equilibrium adsorption data of CS-PANI/ Fe_3O_4 nanocomposite.

Keywords: *Chitosan, PANI, textile dye, composite*

EFFECTS OF THERMAL ANNEALING ON THE PROPERTIES OF POLYPYRROLE AND BENTONITE COMPOSITE PREPARED VIA IN SITU POLYMERIZATION

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Abstract: The effects of thermal annealing at 200°C for 3 hours on the morphological, structural and electrical properties of polypyrrole/bentonite composite powders have been investigated. Polypyrrole/bentonite powders were prepared via in situ polymerization of pyrrole in the presence of bentonite powders using Ferric Chloride hexahydrate ($FeCl_3$•$6H_2O$) as the oxidant and hydrochloric acid solution (HCl) as the solvent. SEM-EDX analysis revealed that the morphology of the composite, which is dominantly the morphology of bentonite clay grains, have not changed after annealing. Both samples did not exhibit the globular microspherical grains of PPy on its surfaces which indicated successful incorporation by the coating of PPy in the bentonite clay powders. FTIR results, on the other hand, verified the presence of the polypyrrole ring in bentonite on both samples. However, IR spectra of the annealed samples presented a transmission peak at around 2358.78 cm^{-1} which resulted from the possible decomposition of PPy at 200°C. This decomposition is further confirmed by SEM analysis of annealed PPy alone which showed coalescence of globules to form larger structures. The obtained as-grown polypyrrole/bentonite composite was electrically conductive however no conductivity can be obtained on the thermally annealed samples. The polypyrrole/bentonite composite powders obtained in this study shows promising potential in conductive ceramics applications.

Keywords: *Annealing, Bentonite, Clay, Composites, Polymerization, Polypyrrole.*

EXTRACTION OF LIGNIN FROM SUGARCANE BAGASSE BY DEEP EUTECTIC SOLVENTS (DESs)

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Abstract: Lignin plays a crucial role as a structural material of plant cell walls and is also known as a significant renewable resource that has the potential to be a raw material for producing high value chemicals. The article aimed to research on the extraction of lignin from sugarcane bagasse by environmental method using deep eutectic solvents (DESs) containing choline chloride and formic acid. In the process, lignins dissolved in DES were isolated from the solution by dilution with water and ethanol. The obtained lignin samples were characterized with UV - Vis (Ultraviolet – visible spectroscopy), FT-IR (Fourier-transform infrared spectroscopy), GPC (Gel permeation chromatography), and ^{1}H-NMR (Proton nuclear magnetic resonance). The initial results showed that the extracted lignin obtained adequately distinct functional groups and the weight average molecular mass of the lignin was about 11787 g/mol.

Keywords: *deep eutectic solvents, DES - soluble lignin, extraction, lignin, sugarcane bagasse.*

PHÂN BAN: VẬT LIỆU SILICAT

SESSION: CERAMIC MATERIALS

EFFECT OF Β-TCP FOAM GRANULAR SIZE TOWARDS HYDROXYAPATITE FORMATION ON POROUS Β-TCP FOAM GRANULES CEMENT

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Abstract: The aim of this study is to investigate the effect of β-TCP foam granular size towards hydroxyapatite (HAp) formation on porous β-TCP granules cement. Porous β-TCP granules cement were obtained after exposing different size of β-TCP foam granules (300-600 µm and 600-1000 µm) with an acidic calcium phosphate solution for 60 mins. Then, the specimens were soaked in deionized water for 1, 3 and 7 days. XRD and SEM analyses were performed in order to understand the phase composition and morphology of HAp formation on the specimens. Compositional analysis using XRD shows that large amount of HAp phase formed in the specimens made from the small size of β-TCP foam granular. SEM observation shows that small amount of needle-like HAp crystals was spot on the surface of porous β-TCP foam granular cement made from 300-600 µm granules. This small amount of needle-like HAp crystals transformed into spherical shape HAp crystals and partially covered the surface of the specimen after being exposed at physiological body condition up to 3 days. After 7 days, the surface of porous β-TCP foam granular cement made from 300-600 µm granules were fully covered by these small spherical shaped of HAp crystals. In fact, the amount of HAp crystals formed in the specimens obtained from the small size of β-TCP foam granular is higher than large-sized granules. These results demonstrated that the small size of β-TCP foam granular induced faster HAp formation in comparison with the large granular size.

Keywords: *Bioceramic, Ceramic coating, Calcium Phosphate, Bone remodeling, Ceramic material.*

STUDY THE EFFECTS OF SUBSTITUTION OF 5% GYPSUM OR 5% LIMESTONE ADDITIVE ON THE STRENGTH OF PCB50 FICO CEMENT

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Abstract: The substitution of 5% cement clinker by 5% gypsum or 5% limestone additive as well as the fineness of limestone was studied about its effects on the strength of cement. The study show that the gypsum additive of 5% increase the strength of cement at the time of 1, 3, 7, 28 days (R= 55.1 MPa of cement with 5% substituted additive comparable to R= 45.3 MPa of cement with 100% clinker at the time of 28 days). The limestone additive of 5% increase the strength of cement at the early time of 1, 3, 7 days (R= 46.0 MPa of cement with 5% limestone additive comparable to R= 31.6 MPa of cement with 100% clinker at the time of 7 days). As well as, the strength of cement increase when the fineness of limestone increase.

Keywords: *Gypsum, limestone, additive, strength, PCB_{50} Fico cement.*

INNOVATIVE CONSTRUCTION REINFORCEMENT MEDIUM USING CRUSHED GLASS: AN EXPERIMENTAL RISK-WASTE REDUCTION RESEARCH

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Abstract: Several places in the Philippines have been considered as major contributors in producing by-product waste materials; one of these materials is waste glass. Traditional glass is manufactured for different functions such as container of foods, liquor bottles, and broken glassware or also known as “post-consumer material”. It has been found that large amount of waste glass is produced daily wherein it became a problem in disposal and control of landfill; therefore, promoting a way wherein it can be both beneficial to our environment and different engineering aspects is essential. Since there is limited resources for fine aggregates, having crushed waste glass as an alternative will somehow enhance the productivity of concrete making it more economical. Thus, crushed glass still possessed interfacing problems when mixed in concrete such as the alkali-silica reaction, flexural and compressive strength of the glascrete, and crushed glass being full replacement to fine aggregates. The main objective of this research is to promote risk-waste reduction while developing an innovative construction medium with the used of crushed glass; giving benefit to both environment and engineering aspects. From the conventional concrete mix, the sand is used as one of components then fully replaced this into crushed glass for the glascrete mix. During the testing, the highest compressive and flexural strength were acquired during the 28^{th} day for both mixes but higher results were obtained for the concrete contaiing crushed glass as compared to conventional mix.

Keywords: *Crushed Glass, Concrete, Glass Concrete, Flexural Strength, Compressive Strength.*

ANTIBACTERIAL AND PHOTOCATALYTIC ABILITY OF THE Ag/TiO_2 COATING ON THE GLASS SURFACE

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Abstract: The coating on the glass surface was made by heating the mixture of resinate Ag and tetra-n-butyl orthotitanate (TBO) at 570°C for 1 hour. The characteristics and structure of the mixture Ag/TiO_2 with the content of Ag : TiO_2 from 0 – 8 (% mol.) were studied by the methods such as XRD, FTIR, UV-viz, SEM, EDS. The research results of antibacterial ability and the degradation of blue methylene (MB) were shown that this coating can be used for antibacterial and photocatalytic ability.

Key words: *coating on the glass surface, Ag/TiO_2 , antibacterial, photocatalytic ability.*

THE MELTING TEMPERATURE OF THE GLAZES IN THE SYSTEM SiO_2 – Al_2O_3 – B_2O_3 – Na_2O – Li_2O – K_2O – ZnO DETERMINED BY HEATING MICROSCOPY

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Abstract: Heating microscopes (HM) plays an important role in material science and engineering thanks to their wide field of application. The HMs are used in both industry and research in many different fields. The HM techniques can be successfully applied to determine characteristics during heat treatment of powders of glazes, glasses, frits… for continuous firing techniques. It is very hard a full understanding of the physicochemical properties of these materials because of their complexity. For example, chemical elements may be contained in a ceramic glaze at least about 10. Usually, the temperature characteristics of a glaze were to be calculated by their oxide compositions. From experimental analysis data of the HV can be determined the mathematical equations for calculating the temperature characteristics of the glazes of the system SiO_2 – Al_2O_3 – B_2O_3 – Na_2O – Li_2O – K_2O – ZnO. The temperature characteristics of these glazes in the range of studied temperature will be calculated faster thanks to these equations. Moreover, the effect of each oxide on the temperature characteristics of the glaze indicated in these empirical equations.

Key words: *Heating Microscopy (HM), glaze, temperature characteristic, mathematical equation.*

NEW APPROACHING TO USE THE GUM EXTRACTED FROM GREWIA POLYGAMA AS AN ADMIXTURE FOR CALCIUM SULFOALUMINATE (CSA) CEMENT

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Abstract: In Myanmar have a lot of valuable plants as natural resources and the production of value added products from plants are essential. The motivation of this research is to extract the gum from the *Grewia* (*Grewia polygama*), to characterize the extracted gum and to add the extracted gum in preparation of high performance CSA concrete. For the maximum yield percent of gum, Box-Behnken Design (BBD) with three independent variables, reaction time (2-4) h, temperature (40-80) ºC and weight ratio of water to *Grewia* (10-20) g/g, were used. The moisture contents of fresh *Grewia* was 67%, the maximum yield percent after drying was 7.5 % based on fresh weight and 22.725 % based on dry weight. The extracted gum was characterized Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetric analysis (TGDTA), Scanning Electron Microscope (SEM), X-ray Fluorescent (XRF) and physicochemical analysis. Moreover, concretes prepared with *Grewia* gums were tested setting time and compressive strength as mechanical analysis. Analysis and experimental results showed that the extracted gum from *Grewia polygama* has acceptable properties as an admixture of high performance concrete.

Keywords: *Extracted Gum, Grewia polygama, CSA Cement, Box-Behnken Design, Admixture.*

HYDROGEN-PLASMA-TREATED NANO TiO_2 FOR PHOTOCATALYTIC OXIDATION OF VOCs IN AIR STREAM

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Abstract: Unlike water treatment processes, the photocatalytic oxidation of VOCs in air stream exhibits many challenges. This study will develop the hydrogen-plasma-treated TiO_2 with improvement in photocatalytic activity. The hydrogen-plasma-treatment was carried out in the non-thermal atmospheric pressure reactor at room temperature or above. The catalysts were prepared and analyzed by advanced techniques such as X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and N_2 adsorption at low temperature (77 K) for surface area analysis. The photocatalytic activity of the catalyst has been investigated under UV light with various reaction conditions such as different initial toluene/formaldehyde concentrations and water content. Significantly, the conversion of toluene by a plasma-treated sample was 1.5 times higher than the non-treated TiO_2 in similar reaction condition.

Keywords*: Plasma, TiO_2, VOCs removal, Hydrogen treatment, photocatalysis.*

USING RED MUD (RM) AS AN ADDITIVE FOR AUTOCLAVED AERATED CONCRETE (AAC)

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Abstract: Autoclaved aerated concrete (AAC) is a lightweight construction material produced from a mixture of sand, gypsum, limestone, cement, water, and aluminum powder cured in a high-pressure autoclave at a temperature of 180^0C. AAC is widely used an insulating concrete material for both indoor and outdoor structures. In addition to the good thermal insulation capacity of AAC, it also has the advantage of fast fabrication, easy installation for materials, easy cutting, chiseling, and drilling. The experimental results when using red mud (RM), a non-hazardous waste in the process manufacturing of aluminum, replacing a part 15 – 40 % weight of sand in AAC was introduced in this paper.

Keywords: *Autoclaved aerated concrete (AAC), red mud (RM), eco-material.*

SOIL-SAND STABILIZATION AND IMPROVEMENT THROUGH MICROBIAL INDUCED $CACO_3$ PRECIPITATION USING BACILLUS SUBTILIS

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Abstract: In general, the term of microbially induced $CaCO_3$ precipitation (MICP) links to the process of bacterial metabolism with the presence of nutrition and high humidity in the surrounding environment. We also named the latest mechanism as biomineralization and focus on different potential applications in self-healing concrete, geotechnical engineering, or bio-bricks as an alternative to kiln-fired bricks… In this study, we investigated the use of *Bacillus subtilis* and its performance of ureolytic metabolism for soil-sand stabilization and improvement. Experiments were based on the variation of different parameters such as the capacity of $CaCO_3$ precipitation with the concentration of bacteria, the particles size of soil-sand specimens, the proportion of sand/soil and other environmental factors. We tested the composition and microstructure of soil specimen after solidifying by analysis technique XRD and SEM. Physico-mechanical properties included water permeability, water absorption, density, and mechanical resistance, were also characterized in lab condition. Much discussions on the relevant results of the above studies allow us to follow the next phase of the study in the geotechnical condition. To apply this promising technique for soil-sand stabilization and improvement might be considered with its sustainability.

Keywords: *Biomineralization, microbial induced calcium carbonate precipitation, bacteria metabolism, soil-sand stabilization.*

CHARACTERIZATION OF CARBONATED STEELMAKING SLAG AND ITS POTENTIAL APPLICATION IN CONSTRUCTION

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Abstract: In the south of Vietnam, steelmaking slag is commonly considered a normal category of solid waste. And they exist the fact that slag occupies the ground for dumping and may lead to serious environmental issues due to their high content of heavy metal and fine dust. In this paper, we aim to analyze the influence of the accelerated carbonation condition in the laboratory on the physio-chemical properties of carbonated steel slag. Materials composition was characterized by using different analysis techniques of XRD, SEM, TG and others measurement of the physio-properties (density, loss on ignition L.O.I.) were also realized with regard to the requirement of national standard TCVN 7570:2006 for concrete aggregate. In conclusion, we will discuss on the effect of reaction condition and on the feasibility of implementing this specific treatment method on the industrial scale.

Keywords: *steelmaking slag, solid waste, CO_2 sequestration, accelerated carbonation, concrete aggregate.*

MICROSTRUCTURE AND CHARACTERISTIC PROPERTIES OF POROUS ACTIVE CALCITE PREPARED BY SALT LEACHING METHOD

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Abstract: Porous calcite ($CaCO_3$) with interconnecting porous structure suitable for implantation purpose was prepared in this study from Gypsum precursor via salt leaching method at low temperature. Templates such as salt (NaCl) granules were used to make porous calcite with interconnecting pores. X-ray diffraction (XRD) and Scanning electron microscope (SEM) were used to characterize phase composition and structure. The results indicated that pure calcite block consisting of interconnecting pores with pore size about 50-200 µm in diameter could be obtained. Mechanical strength was evaluated in term of Dimentral Tensile Strength (DTS). Porous calcite had a mean DTS value of 2.1 ± 0.05 MPa and an average porosity of approximately 30%. It could be expected that this porous calcite was bioactive since it was fabricated at low temperature. Hence, that would be beneficial as using for bone substitute as well as for the precursor of carbonate apatite fabrication.

Keywords: *Interconnected pores, Porous calcite, and Salt leaching method.*

CHARACTERIZATION AND ENRICHMENT OF COAL BOTTOM ASH: POTENTIAL SOURCE OF RARE EARTH ELEMENTS

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bstract: The growing demand for rare earth elements (REEs) has led to the increased researches in alternative resources, such as coal fly ash and coal bottom ash. In this study, we explored the potential of coal bottom ash from coal-fired power plant which generates significant amount of coal ash waste. While the characterization and enrichment of REEs in coal fly ash are significantly progressing, studies on its bottom ash counterpart waste are limited. Hence, we examined the characterization and enrichment of REEs from bottom ash using physical separation through particle size and dry magnetic separation. Particles with size less than or equal to 125 µm contained the highest REEs concentration among other particles sizes being considered. The distribution of REEs in the magnetic and non-magnetic fractions indicated that increasing the magnetic susceptibility had no significant effect on the enrichment of REEs at magnetically separated fractions. Further, REEs are enriched in the non-magnetic fraction and associated with non-magnetic minerals. The outlook coefficient and percentage critical content of the coal bottom ash sample is greater than 0.7 and 30% respectively. Following Seredin and Dai's criteria in assessing the potential of coal for REEs source, the coal bottom ash is categorized as Cluster II – Promising which means "promising REEs raw materials for economic development".

Keywords: *Coal ash, physical separation, rare-earth elements*.

INVESTIGATION ON CHARACTERISTICS OF MYANMAR LATERITE FOR USE AS A CATALYST IN BIOMASS GASIFICATION PROCESS

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Abstract: The characterization of laterite samples founded in Bago Division, Myanmar, was conducted to be used as a catalyst for tar cracking in the gasification process of biomass. In this study, the natural laterites with the particle sizes of < 75 µm were calcined and investigated the effect of calcination process on the characteristics of laterites, resulting in catalytic activity and stability in gasification process of biomass. Calcination experiments were carried out at the different temperatures (300 to 700°C). The alterations of physiognomies of laterite due to thermal treatment were examined using various analytical techniques. The thermal decomposition manner of natural laterite samples was observed using thermogravimetric and differential thermal analysis (TGA/DTA) and the chemical compositions were estimated using energy dispersive X-ray fluorescence (ED-XRF). The structural changes and phase transformation of the calcined laterite samples in the calcination processes were determined by fourier-transformed infrared spectrometry (FTIR) and X- ray diffraction (XRD). The physical properties of laterite samples such as surface area, pore size and total pore volume were determined by the N_2 adsorption-desorption method. The calcined laterite samples are expected to be the active catalysts because of their large surface areas, porosity grains and high content of hematite (Fe_2O_3).

Keywords: *Laterite, Calcination, Characterization, Hematite, Goethite.*

FABRICATION OF SILICA COATING ON COPPER SUBSTRATE USING COCONUT OIL AS MEDIUM DISPERSE

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Abstract: The object of this study is to develop an easy and simple technique to fabricate the coating solution of Vietnam rice hush ash-derived water glass (VRHA-WG) and Vietnam coconut oil (VCO). The coating solution with different mixing ratio of VRHA-WG and VCO such as 1: 5 and 1:10 (v/v) can be coated on copper substrate. After coating, the substrate are heated at 500°C for 2 hours to enhance the adherence of silica layer and substrate. The characterization of the coating layer are studied by Xray Diffaraction (XRD) and Xray Fluorescence (XRF) while the surface morphology of the substrate before and after coating is study be scanning electron microscope (SEM). Electricity resistant of the substrate after coating increase up to 33.33% compare without coating.

Keywords: *rice hush ash, silica, coconut oil, coating, environment materials.*

FLUORIDE REMOVAL IN GROUNDWATER IN NINH HOA DISTRICT, KHANH HOA PROVINCE BY APPLYING GYPSUM

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Abstract: Fluoride contaminated groundwater in Ninh Hoa District, Khanh Hoa Province is higher than the standard, ranges from 2.15 to 10.85 mg/l from 26 taken samples. The standard of drinking water is 1.5 mg/l. Almost local people are using groundwater for their livings. The local people have fluorosis teeth, particularly the children over 7 years old. This study tried to apply the easier method to remove fluoride in groundwater to reach the drinking standard. We applied a prototype that applying gypsum to remove the fluoride in groundwater. With 4 experiments, (1) with 1 gypsum column and flow rate Q= 0.52 ml/s, (2) with 1 gypsum and flow rate Q= 3.52 ml/s, (3) with 2 gypsum columns and flow rate Q = 3.52 ml/s; (4) addition 2g $Na_3PO_4.12H_2O$ to the 2 gypsum columns and flow rate Q = 3.52 ml/s, the results showed that, the changing of flow rate did not affect so much to the outcome of fluoride in water and the two columns of gypsum as well. The significant removal of fluoride when we added sodium phosphate to the gypsum, the fluoride reduced less than the drinking water standard.

Keywords: *fluoride, groundwater, gypsum.*

HIGH STRENGTH STEEL FIBRE REINFORCED CONCRETE BEAMS UNDER PURE TORSION

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Abstract: The high strength concrete has highly brittle behaviour and consequently adding steel fibres as secondary reinforcement improve the ductility of failure mechanism. Structural steel fibre reinforced concrete (SFRC) applications differ mainly from well-known fibre applications like floors and pavements. In structural applications, steel fibres are the primary or secondary reinforcement to take up bending moments, the shear and torsional stresses. Steel fibres also improve some other mechanical properties of concrete such as residual tensile strength and fracture energy. This paper presents the experimental investigation on the behaviour of steel fibre reinforced concrete under pure torsional actions. The influence on the presence of high-performance tri-end hooked fibres on the torsional behaviour is discussed including its behaviour curves, the cracking and ultimate torsional moments, fracture toughness and the corresponding twists.

Keywords: *high strength concrete, steel fibre reinforced concrete, pure torsion.*

SYNTHESIS AND CHARACTERIZATION OF Fe AND CO-DOPED AKERMANITE CERAMICS

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Abstract: In the present study, iron (Fe) and cobalt (Co)-substituted akermanite ceramics were successfully synthesized by solid-state sintering of raw materials. The effect of Fe and Co dopants on the structural, physico-mechanical and in vitro bioactivity were investigated. The X-ray diffraction patterns showed that the incorporation of Fe and Co did not change the phase composition of akermanite. The physico-mechanical evaluation revealed that the density and mechanical properties of akermanite were enhanced. Finally, the *in vitro* bioactivity test showed the Co-doped akermanite induced the growth some apatite crystals while Fe-doped akermanite showed apatite formation with needle-like morphology after 21 days of soaking in simulated body fluid (SBF) solution.

Keywords: *Akermanite, solid-state sintering, mechanical properties, bioactivity, apatite formation.*

INVESTIGATION OF APPLYING WILD BACILLUS SPECIES FOR SAND STIFFENING

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Abstract: Microbially induced calcium carbonate precipitation is a biomineralization process that has various applications in remediation and restoration. In the present study, calcifying bacteria, *Bacillus subtilis* and *Bacillus megaterium* isolated from soil (Vietnam). These species were investigated for sand stiffening using syringe set-up with daily nutrient addition at 7, 14 and 28 days. The stiffened sand samples were tested the physical and chemical properties. Mineralogical compositions and crystalline morphologies of calcium carbonate produced by *Bacillus subtilis* and *Bacillus megaterium* were analyzed by Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDS), X-ray diffraction (XRD). These results show that both of the *Bacillus* species could make consolidation through calcite precipitation at the alkaline pH rate of 9, increased the impact strength of the stiffened sand samples (white sand 0.3 mm, white sand 0.6 mm and yellow sand 0.6 mm) compared with the control. Furthermore, the higher calcite concentration and tensile strength were obtained from the samples using the isolated *B. megaterium;* therefore, this species is potential as bio-sealant to enhance the durability of green building materials (soil-cement blocks). This paper contributes to the development of bio-cement applications using Vietnam isolated species for sustainability.

Keywords: *Bacillus subtilis, Bacillus megaterium, calcite, sand stiffening*

SURVEYING THE EFFECTS OF POROSITY ON THE HIGH STRENGTH CONCRETE

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Abstract: Surveying the effects of porosity on the high strength concrete is problem that researchers are always prioritize before calculating aggregation and construction. Because of the porosity that directly determines the strength of concrete, it affects the scope of application for buildings, special items that requires high quality and harsh working conditions. The greater the porosity, the lower the intensity of concrete and vice versa. This topic presents the initial survey results on the combination of crushed sand and fine sand to select the optimal aggregate, then combine fly ash and Hoa Phat blast-furnace slag available in Vietnam as a cement replacement in making High Strength Concrete. After 28 days old, it reaches 109 MPa, not separating water, ensuring good construction. To produce this concrete, a very high mount of cement must be used, about 900÷1000 kg/m^3. By using mineral additives (Hoa Phat blast-furnace slag, fly ash) to replace cement, which helps us reduce economic costs, utilize industrial waste such as iron and steel in the form of particles, minimize environmental pollution. This is a very important result for the sustainable development in concrete production industry.

Keywords: *The High Strength Concrete, Porosity, Fly Ash, Blast-furnace Slag.*

KAOLINITE/ZIRCONIA COMPOSITES

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Abstract: This research aims to investigate a ceramic matrix compositewith starting materials of kaolinite and zirconia. The kaolinite powder was obtained from Sigma-Aldrich. The zirconia used is a zirconia stabilized with 5.4 %wt of Y_2O_3 obtained from Goodfellow UK. The kaolinite powder was mixed with various content of zirconia powder (0, 10, 20, 30, 40 and 50)% weight. Each composition was wet-mixed in a form of slurry with alcohol medium using a turbula mixer for 1 hour. The mixed-slurry was dried in an oven for 2 hours. Each composition was then uniaxially compacted with a pressure of 10 MPa to form cylindrical green bodies with a diameter of 15 mm. The green bodies were pressureless sintered in air at 1450^{o}C for 2 hours. The bulk density was measured using Archimedes method with mercury medium. XRD was used to investigate the phases of the powders and the sintered bodies. The mechanical properties measured in this experiment were Vickers hardness and compressive strength. SEM was used to observe the microstructures. After sintering, the composites transformed into mullite, zircon, tetragonal zirconia and silica with the composition depending on the initial amount of kaolinite and zirconia content. The mass shrinkage decreases with increasing of zirconia content. The Vickers hardness increases with increasing of zirconia as starting material content from 381 MPa (for 0%wt zirconia content) to 750 MPa (for 50%wt zirconia content). The compressive strength increases with increasing zirconia content from 26 MPa (for 0%wt content of zirconia) to 69 MPa (for 50% wt zirconia).

Keywords: *kaolinite, zirconia, zircon, mullite, silica, composites.*

UTILIZATION OF AGRICULTURAL WASTES IN SYNTHESIS OF ECO-FRIENDLY CEMENT-LIKE MATERIALS FOR FABRICATION OF LIGHT-WEIGHT CEMENT BLOCKS

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Abstract: Production of cement is responsible for significant environmental impacts. Utilization of agricultural waste as alternative raw materials for cement production is a route to eliminate these detrimental effects. This research aims at synthesizing eco-friendly cement-like materials and producing light-weight cement blocks. Since Ordinary Portland Cement (OPC) consists of calcium and silica-rich compounds, agricultural wastes containing high calcium and silica contents were potential raw materials for cement-like powder production. X-ray fluorescence analysis indicated that calcium oxide contents ranging from 90 to 96 wt% were present in eggshells and cockleshells, whereas 96 wt% of silica was found in rice husk ash. In addition to waste utilization, a fuel-efficient solution combustion technique was employed in synthesis of the cement-like powder. Phase analysis indicated that tri-calcium silicate, di-calcium silicate, tri-calcium aluminate, and tetra-calcium aluminoferrite which are main constituents of OPC, were obtained.

To fabricate light-weight cement blocks, the powder was mixed with OPC, rice husk ash and water, and cast into blocks. Compressive strength and density values of the cement blocks were in an acceptable range defined by Thai Industrial Standards Institute and American concrete institute (ACI 213,2001). Effects of rice husk ash content, water-to-binder ratio and processing technique on strength and density were examined. An increase of high rice husk ash content and water-to-binder ratio resulted in reduction of compressive strength and density. To enhance compressive strength while maintaining low density, curing of the cement blocks in high-pressure streams was conducted. An increase of compressive strength by more than twofold was observed in the cement blocks subjected to an autoclave-assisted curing process.

Keywords: *Cockleshell, combustion synthesis, eco-friendly, eggshell, light-weight cement block, rice husk ash.*

KHOA ĐIỆN – ĐIỆN TỬ

FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING

PHÂN BAN: VI MẠCH VÀ HỆ THỐNG

SESSION: INTEGRATED CIRCUITS AND SYSTEMS

A 12-BIT 33-MW AND 96-MHZ DISCRETE-TIME SIGMA DELTA ADC IN 130 NM CMOS TECHNOLOGY

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Abstract: The paper presents a 12-bit discrete-time third-order Sigma Delta (ΣΔ) analog-to-digital converter (ADC) for Sub-GHz transceiver applications. In the designed ADC, a ΣΔ modulator with 74.76 dB SNR was implemented. The modulator consumes approximate 33 mW from a 3.3 V supply and operates at 750 kHz with an oversampling ratio of 64 and a single-bit quantizer. Digital decimation filter including CIC filter and FIR filter is integrated with the analog ΣΔ modulator for the full ADC operation. The filter achieves a cut-off frequency of 750kHz and operates at a data rate of 12 Msps or 6 Msps. The ADC circuit has been implemented using 0.13 um CMOS technology. At a supply voltage of 3.3 V, the maximum ENOB is simulated to be 12.12 bit which corresponds to a resolution of 12 bit. The simulations on each corner confirm that the modulator satisfies the specifications even in the worst case.

ASYNCHRONOUS 2-PHASE LEVEL-ENCODED CONVENTION LOGIC (LCL)

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Abstract: Asynchronous Quasi-Delay-Insensitive (QDI) circuits, especially Null Convention Logic (NCL), has recently become a very active research area in digital logic design. NCL methodologies eliminate problems related to the distribution of clock trees and can also significantly reduce power consumption, noise and electromagnetic interference (EMI). It has been shown to be the most robust methodology for asynchronous design with an ease-of-use design framework, high level of optimization and integration ability. However, NCL is based on a 4-phase protocol which requires 2 round-trip communications per transaction (one for the data phase and one for the reset phase). Using a 4-phase protocol has the benefit of a relatively simple hardware implementation but leads to lower throughput and higher power consumption which must account for the reset phase. Those limitations prevent a 4-phase approach such as NCL to be applied for high-throughput systems, such as network-on-chip. Our research develops a new NCL-based 2-phase logic template which can operate asynchronously without returning to the reset phase. This novel logic template is called Level-Encoded Convention Logic (LCL). In this paper, the microarchitecture for basic logic elements and the circuit framework of this new template are presented. Furthermore, we will also provide a simple LCL example design, which has been successfully implemented and verified.

LOW-LOSS 6-BIT SUB-7 GHZ DIGITAL STEP ATTENUATOR

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Abstract: A low-loss, wide-band 6-bit monolithic microwave integrated circuit (MMIC) digital step attenuator (DSA) for 5G communications is presented. The reduced T-type and switched-path topologies are used to minimize insertion loss and achieve wide-band operation with small attenuation errors. The designed DSA is fabricated using 250nm Gallium Arsenide (GaAs) pHEMT process with a bare-die size of 2.4 mm x 1.3 mm. On-wafer measurement results in 2.4-7 GHz band show that the DSA exhibits a maximum attenuation range of 31.5 dB with steps of 0.5 dB, corresponding to 64 attenuation states. The insertion loss is better than 3.3 dB with maximum Root-Mean-Squared (RMS) attenuation error of 0.5 dB. Maximum phase variation over all attenuation states is 29.1o. Measured input third-order intercept point (IIP3) is higher than 31.73 dBm.

A Ka-BAND GaN HIGH POWER AMPLIFIER

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Abstract: A Ka-band MMIC high power amplifier (HPA) design with high efficiency is presented. A 150 nm GaN HEMT three-stage HPA is fully matched to 50 Ohm at the input and output pads. The electromagnetic simulation results show that the HPA exhibits output power of 40.8 dBm to 39.5 dBm, power added efficiency of 24 % to 20.3 % and power gain of 18.8 dB to 17.5 dB in 35-37 GHz frequency band under continuous wave operation. The designed HPA has a chip size of 4.3 x 4.275 mm2 and consumes a dc current of 1.76 A from 28 V drain voltage.

PHÂN BAN: ĐIỆN TỬ VÀ HỆ THỐNG NHÚNG

SESSION: ELECTRONIC AND EMBEDDED SYSTEMS

ELECTROMYOGRAPHY ACQUISITION SYSTEM USING GRAPHENE-BASED E-TEXTILES

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Abstract: The research outlined in this paper investigates the use of graphene-based electromyograph (EMG) fabric sensor as a comparable alternative to commercial Ag/AgCl wet electrodes. Our present work encompasses an EMG compression sleeve based on edge-oxidized graphene oxide (EOGO) coated PET fabric, without any post-application reduction processes. EMG measurements carried out on eight test subjects showed better signal to noise ratio (SNR) and amplitude (mV) ratios for the compression sleeve (22 dB), compared to standard Ag/AgCl electrodes (16.959 dB). A detailed method for sensor fabrication, EMG test measurements, and signal processing are discussed. Results from the study indicate the use of graphene-based smart fabrics as a viable alternative to non-reusable Ag/AgCl electrodes for high-quality EMG monitoring.

ENCODING BLOCKS FOR DIGITAL VIDEO OF DVB-S2 STANDARD WITH DRONE-BASED COMMUNICATIONS

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Abstract: Digital video information has continuously become a dominant portion of data types in the Industrial Revolution 4.0., whose general objectives are securing the information, transmitting with high efficiency, and building real-time system. Among different types of broadcasting standard, the video broadcasting DVB-S2 is considered a single, very flexible standard, covering a variety of applications for satellite-based communications. Being compatible with multiple input protocols makes it possible to handle many kinds of data such as voice and video. In this article, a design of the encoding blocks for the DVB-S2 system is implemented using the hardware language Verilog. Nonetheless, due to complexity of performing the whole video broadcasting system, only the channel encoding blocks are conducted as being one of the cores of the model. Specifically, three blocks: CRC8, Scrambling and BCH is conducted. In order to verify the results generated by Verilog, we also use online generator tool as well as C-written code to compare. The time for generating CRC8 and BCH code are 149ns and 388814ns for input of 72 bits and 38688 bits, respectively. In addition, our team also build a drone model to mount board onto it. The results demonstrates that DVB-S2 is suitable for broadcasting in real-time.

LOW-COST, HIGH-EFFICIENCY HARDWARE IMPLEMENTATION OF SMART TRAFFIC LIGHT SYSTEM

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Abstract: In this paper, we propose a low-cost, high-efficiency hardware architecture for a smart traffic light system. Our design especially achieves high efficiency for traffic systems where motorbikes are used as the main means of transportation. The main contributions of the paper consist of: (1) proposing a simple approach for automatically adjusting the green light time based on the state of the optical transmitter-receiver sensor pairs, (2) proposing a new traffic light signal generation, i.e., all traffic signals including the light signals and countdown timer module will be integrated inside only one block by using addressable WS2812B LEDs, (3) proposing the hardware architecture for a smart traffic light system which saves energy, maintenance costs, and is installed and operated easily.

MANUFACTURING PACS, ONLINE MEDICAL CONSULTATION SYSTEM AND DESIGNING SECURITY DICOM WEB VIEWER SOFTWARE

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Abstract: Nowadays, DICOM (Digital Imaging and Communications in Medicine), an international standard used worldwide to access and handle various medical images through PACS (Picture Archiving and Communication System). This helps eliminate completely the use of harmful and costly traditional films. Besides, the existing infrastructures of the Internet have allowed us to develop the telemedicine services. However, the usage of foreign PACS is not suitable to diagnosis and medical consultation over the distance in Vietnam. This paper researches to implement PACS, online medical video consultation system and security DICOM Web Viewer serving diagnosis in Vietnam. First, several scientific and technological challenges and our methods of implementation are mentioned. Then we discuss the results of completing image compression technology, connection technology, load balance technology for manufacturing PACS and online medical video consultation system. Next, the result of designing DICOM Web Viewer is introduced and updated. In order to solving security issue over Internet, modern security techniques are integrated into software system. Specially, an efficient solution to enhance information security in DICOM images over the Internet is also proposed by exploiting different techniques of data encoding, cryptography and watermarking. The system has been implemented, evaluated and in hospitals.

OPTIMIZED HARDWARE DESIGN OF LOW POWER AND LOW COST SELF DRIVING MULTI-PURPOSES ROBOTISED PLATFORM

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Abstract: Mobile ground robots have become commonly used systems due to the advancements in sensing technologies, image recognition algorithms and wireless communication solutions. Commonly robots are bulky and have low reliability, while having high cost. Most of the technologies have requirements for the human operator presence, which reduces the potential of the fully automated systems. The main technical challenges in the mobile robot operation are the battery life and the processing speed from the sensors. The paper present signal fusion and the hardware circuitry of microcontroller based autonomous rover. The rover's embedded system has opted out from using state of the art sensor, for more power efficient techniques with lower data generation. This in turn reduces the demand for processing power, which enables for less power consumable and cheaper processors. The differential drive system traditionally followed on mobile robots has been modified towards an all-wheel steering all-wheel drive model. This design improves the maneuverability of the rover. The reverse kinematic equations used balanced wheels velocities and turning angles combined with the feedback from the wheel encoders to prevent slippage and improve accuracy.

HARDWARE ARCHITECTURE DESIGN FOR VEHICLE DETECTION

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Abstract: In this paper, the research goal is to realize and implement the algorithm Delta-Sigma Background subtraction on FPGA. The application of vision-based method is the real-time information of road traffic congestion detection. A stationary camera is used to capture vehicles that are moving through on the road and background subtraction is applied in order to detect the moving objects. First of all, the moving vehicles are obtained by Delta-sigma method. Secondly, the density of vehicles on the lane is calculated by number of pixels extracted. Finally, the current condition of the traffic flow is determined based on the density of vehicles.

TEMPERATURE DEPENDENT OF ER-DOPED YTTRIUM ALUMINUM GARNET

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Abstract: There is a need for the constant development and improvement of emitting materials to enable the realization of future technologies (eg laser and LED) and as markers for biological applications. The emitting materials in these technologies are known as fluorescent materials which luminescence when excited either optically by the absorption of a photon or electrically by the injection of opposite charge carriers. The focus for this paper will be on optically excited materials that exhibit photoluminescence. Normally, the most important optical property is high luminescence intensity when the material is excited which implies high quantum efficiency including good colour tunability and purity, particularly when the desired application is display technologies. Furthermore, the luminescent lifetime of the material is important with a long lifetime desirable for population inversion to occur (for example of the Er3+ 4I11/2 energy level) which is a prerequisite for lasing applications, whilst a short lifetime is desirable for fast switching devices such as metal oxide semiconductor field effect transistor (MOSFET). Based on these desired properties there has been a long-established interest in the development of new rare-earth phosphor materials with the aim of developing an improved understanding of their optical properties to guide future development.

FACIAL EXPRESSION RECOGNITION SYSTEM ON SOC FPGA

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Abstract: In this paper, we present a facial expression recognition (FER) system implemented on a SoC FPGA device. Our system can operate independently and automatically classify 7 different types of basic emotions. We designed a processing engine on FPGA that is able to calculate convolutional layers of convolutional neural networks and designed a CNN optimal with a designed hardware for the task of emotions recognition and achieving 66% of accuracy in FER2013 dataset. The whole hardware system is designed on SoC FPGA which can process up to 15 image frames per second at an operating frequency of 130 MHz.

PHÂN BAN: KỸ THUẬT VÀ HỆ THỐNG VIỄN THÔNG

SESSION: COMMUNICATION ENGINEERING AND SYSTEMS

A K-BAND NONINVASIVE VITAL SIGNS MONITORING SYSTEM IN AUTOMOTIVE APPLICATIONS

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Abstract: In this paper, a K-band noninvasive vital signs monitoring system for measuring respiration rate and heart rate is presented. The system consists of a 24 GHz Doppler Radar motion sensor and an ARM-based digital signal processing unit. To demonstrate an automotive application, the system is designed to be installed on the vehicle, monitor the vital signs of the drivers, and activate a warning system automatically in which the vital signs of driver is abnormal. The errors of respiration rate and heart rate measurements are 2.3% and 8.6% respectively when there is a driver in front of the sensor. The error increases to 12.5% of respiration rate and no signal detected of heart rate in case the sensor measures on the side of the driver. The measurement results are stored on an open-source data server for remote monitoring and future investigation.

A TOPOLOGY CONTROL ALGORITHM IN WIRELESS SENSOR NETWORKS FOR IOT-BASED APPLICATIONS

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Abstract: Wireless sensor networks (WSN) is a part of an Internet of Things (IoT) in which the sensors connect to an IoT platform via wireless or fixed line networks for specific applications such as e-health environmental monitoring applications or underwater applications. Sensor nodes can perform different tasks such as environmental monitoring and control the WSN configuration which is one of many WSN-based-IoT applications. The sensor nodes connect to the gateway which transmits data to the Internet. It is necessary to maintain the network topology which requires low energy consumption at the sink node and long network lifetime. In order to satisfy the quality of services of WSN-based-IoT, the topology control algorithm allows the sensors to be configured to maintain the communication links as well as reduce interference and packet loss. To this end, we introduce the modified LEACH to discover neighbors and, then, to form into the cluster. The maximum number of cluster members is set to a desired value which is equal to the node degree of cluster head. The modified LEACH algorithm can adapt the changing of the dynamic network; therefore, the node can adaptively change its transmission range to ensure the network connectivity.

ACOUSTIC SCENE CLASSIFICATION USING A DEEPER TRAINING METHOD FOR CONVOLUTION NEURAL NETWORK

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Abstract: In this paper, we present a deep learning framework applied for acoustic scene classification (ASC) recognizing the environmental sounds. Since an audio scene related to a given location potentially contains numerous sound events, only few of these events supply helpful information on the scene, which makes the acoustic scene classification task become a very complex problem. To confront this challenge, we suggest a novel architecture consisting of two basic processes. The front-end process approaches a spectrogram feature, using Gammatone filters. Regarding the back-end classification, we propose a novel convolutional neural network (CNN) architecture that enforces the network deeply learning middle convolutional layers. Our experiments conducted over DCASE2016 task 1A dataset offer the highest classification accuracy of 84.4% as compared to 72.5% of DCASE2016 baseline.

DATASET MODEL TO PREDICT BOUND ERROR VIA SUPERVISED MACHINE LEARNING FOR WIRELESS SENSOR NETWORK SYSTEMS

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Abstract: We consider the problem how to build the dataset model which supports to track the target in wireless sensor network (WSN) systems for online phase. Our current works introduced particle filter (PF) based on Kullback-Leibler Distance (KLD) with adjusted bound error method to ameliorate the effect of the Received Signal Strength (RSS) variations by generating a sample set near the high-likelihood region. The bound error of this method is one of three parameters that decides to enhance the estimation accuracy and convergence rate of declining number of particle used. Therefore, in this paper, we propose the dataset model and applied a typical supervised machine learning to predict bound error. The first iteration, using the observation information via KLD resampling optimal bound error to conduct a resampling on the basis of the initial bound error. From the second to the end iteration, we propose a supervised machine learning technique to search the predicted bound error value that fulfills the minimum of mean number of particle used between at the current and the next iteration. Our experiments show that our dataset model by predicted bound error via supervised machine learning does not only enhance the estimation accuracy but also improve the efficient number of particles used when compared to the traditional methods.

DESIGN OF A DUAL-BAND RECTENNA FOR SMALL IOT TERMINAL

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Abstract: This article presents the design of a dual-band rectenna with a 40×30×2mm3 dimension. The proposed circuit operates at the 925 MHz and 2450 MHz bands in order to harvest the RF power from cellular and ISM communication system. This rectenna consists in 2 main parts such as the rectifier circuit and the metal rimmed antenna. By combining two resonance structures, the dimension of the rectifier part can be minimized while the efficiency always keeps up to 60% for all bands. Moreover, the metal rimmed antenna that is connected to the rectifier part provides a reflection coefficient of−10 dB for 925 MHz and 2450 MHz frequency bands. In addition, with the antenna, a total efficiency of 47% at 925 MHz and more than 80% at 2450 MHz is achieved, which confirm that the proposed rectenna is perfectly suitable for small IoT terminal.

ENERGY EFFICIENCY MAXIMIZATION WITH PER-ANTENNA POWER CONSTRAINTS FOR HETEROGENEOUS NETWORKS

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Abstract: This paper considers energy efficiency (EE) optimization in downlink multiple-input multiple-output (MIMO) heterogeneous networks (HetNets) in which one macro base station (MBS) and multiple small cell base stations (SBSs) communicate with multiple MIMO users. The primary objective is to design the precoders to maximize the network EE under the constraints on per-antenna and per-base-station transmit power and acceptable interference levels at each user in the macro cell. The design problem results in nonconvex fractional program whose optimal solutions cannot be found directly. In this paper, the relationship between the achievable data rates and the minimum mean square error (MMSE) is adopted to reformulate the design problem into amenable one. Then, an iterative algorithm based the Dinklebach and the block coordinate ascent (BCA) methods is employed for finding optimal precoders. We conduct the numerical simulations to examine the achievable EE performance of the considered HetNets.

BEHAVIOR ANALYSIS FROM RESPIRATION DETECTION USING INERTIAL MEASUREMENT UNIT

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Abstract: We propose a method to detect respiration using an inertial sensor. The inertial sensor attached to the chest or abdomen takes out the vector of the acceleration, angular velocity, and derives the quaternion from the Digital Measurements Processor function in the inertial sensor module, and detects respiration from time-series changes. We try to detect respiration of representative postures in daily life.

ENERGY HARVESTING COOPERATIVE COGNITIVE NETWORKS: RELAY SELECTION FOR INFORMATION SECURITY

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Abstract: Relay selection is proposed in this paper as an efficient solution to secure information transmission of unlicensed users against wire-tappers in energy harvesting cooperative cognitive networks. The proposed relay selection method selects the unlicensed relay (among available unlicensed relays which correctly restore the information of the unlicensed source) with the minimum signal-to-noise ratio (SNR) at the wire-tapper. All relays are capable of harvesting energy in radio frequency (RF) signals of the unlicensed source. To collect more information from unlicensed users, wire-tappers combine signals from both direct and relaying channels with the selection combining technique. For the security performance evaluation of the proposed relay selection method, an exact intercept outage probability (IOP) formula accounting for Rayleigh fading, interference power constraint, and maximum transmit power constraint is suggested. Computer simulations are created to corroborate the proposed formula. Numerous results expose that positions of relays, the number of relays, and parameters of the energy harvesting method significantly influence the security performance while the power constraints on unlicensed transmitters cause the performance saturation. Moreover, the proposed relay selection method is more secured than the referenced one and more especially, the security performance superiority of the proposed relay selection method to the referenced one increases with rising the number of relays.

EVALUATION OF FULL-MESH NETWORKS FOR SMART HOME APPLICATIONS

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Abstract: Wireless mesh networks (WMNs) is a promising technology for the next generation of wireless network. Because of the strong points, it is considered to dominate over other wireless networks while human had entered the era of the Internet of Things, WMNs are being developed rapidly and inspiring large number of applications. This article intends to study and expand low-cost networking for smart home applications using 6LowPAN/IPv6 (new and modern technology of WMN), and this development is able to be future platform for advanced smart home systems. Therefore, it concentrates on contributing to a solution which allows to expand and exploit thoroughly 6LowPAN technology by combining 6LowPAN/IPv6 with mesh-wifi. In addition, Batman-adv routing protocol and OpenWRT platform are chosen for mesh-wifi nodes. Particularly the performance evaluations are investigated in the term of throughput, latency, packet loss rate, switching time of mesh-wifi nodes and possibility of interconnecting two wireless mesh networks.

JOINT OPTIMIZATION OF EXECUTION LATENCY AND ENERGY CONSUMPTION FOR MOBILE EDGE COMPUTING WITH DATA COMPRESSION AND TASK ALLOCATION

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Abstract: In this paper, we consider the mobile edge offloading scenario consisting of one mobile device (MD) with multiple independent tasks and various remote edge devices. In order to save energy, the user's device can offload the tasks to available access points for edge computing. Data compression is applied to reduce offloaded data size prior to wireless transmission to minimize the execution latency. The problem of jointly optimizing the task allocation decision and the data compression ratio to minimize the total tasks' execution latency and the MD's energy consumption concurrently is proposed. We show that the design problem is a non-convex optimization one but it can be transformed into a convex one through a semidefinite relaxation (SDR) based approach. Numerical simulations demonstrate the outperformance of the proposed scheme compared to the benchmark one.

LANDSLIDE DETECTION METHOD USING LASER BEAM

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Abstract: Events of landslides in the tropics often occur, and the main causes of these events are often caused by the high intensity of rainfall. Before an avalanche occurs, it will usually be preceded by land movements that can occur slowly (creeping) or fast, depending on the condition of the type of soil that exists in that location. Some ground motion detectors include sliding stakes and inclinometers. This tool is useful as a measure of the amount of movement, especially on sloping land. The purpose of this study is to make a movement detection device that can be an alarm or early warning for residents who live in locations that are prone to movement. The benefit for science is the development of monitoring methods using laser light that have not been done so far. The results of this study will be useful for the development of methods for measuring land shifts. The signal is sent using an internet network, so that it can be monitored continuously. The significance of this research for science is the development of a method of applying sensors using laser light which has not been done so far. Recording is done by using a web-based data logger by sending visual measurement data to the data center. The accuracy of the laser beam that spreads when it is received on the target board, is done using the center cluster method.

MULTICLASS BREAST CANCER CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK

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Abstract: Nowadays, the performance of classification systems relies on appropriate dataset representation, a time-consuming process that uses expert knowledge to create useful features. Meanwhile, deep learning can extract and organize features from the dataset, not requiring the design of feature extractors. Convolutional Neural Network (CNN) is a type of deep learning, a special type of Neural Network that achieves successes in tasks such as speech recognition, signal processing, object recognition and classification. In this paper, we use CNN to classify breast cancer histopathology images from a public BreakHis dataset. This dataset includes 7,909 breast cancer (BC) histopathology images of two classes: benign and malignant that they contain eight different subclasses. Developing automated BC recognition system applied on patient's medical images can help reducing death rates and saving people's lives in the world. The task associated with this dataset is the automated classification of these breast cancer images in eight classes. Our method based on the resizing original images for building CNN model and classifying breast cancer classes.

MULTICLASS IMAGE CLASSIFICATION USING ENSEMBLE OF PRE-TRAINED DEEP NEURAL NETWORKS WITH DATA AUGMENTATION FOR THE DIAGNOSIS OF ESOPHAGEAL CANCER

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Abstract: This paper presents the development of image classifiers to support physicians in the screening and diagnosis of esophageal cancer using the Cellvizio® system. The final image classifier is constructed based on the ensemble of three state-of-the-art deep convolutional neural networks including DenseNet, InceptionResNet and Xception, which have been fine-tuned from the separate pre-trained networks, using averaging strategy. For training each individual network of the ensemble, we adopt fine-tuning strategy of all layers in the corresponding pre-trained network with appropriate data augmentation in order to handle overfitting problem caused by relative small dataset. In addition, since images from different patients show high variability and low correlation, each individual network is trained in two steps. The first step involving fine-tuning the pre-trained network using the training and validation data sets to obtain a trained network that is then used to evaluate the testing set. Subsequently, the images that provide high output classification probabilities (i.e., greater than 0.9999) in the testing set are added to the existing training set to obtain a new training set, which is used to fine-tune the trained network to obtain the final individual classifier. The final ensemble performs very well on the testing data with the classification accuracy of 0.969.

ESP-NOW BASED DECENTRALIZED LOW COST VOICE COMMUNICATION SYSTEMS FOR BUILDINGS

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Abstract: This paper presents an indoor voice communication system based on ESP-NOW, a peer to peer network protocol powered by Espressif. The system is implemented on a System on Chip (SoC) ESP32 along with the modified firmware built with Espressif development platform (ESP-IDF). With such hardware and firmware, the targeted application of the network is to support a quick response communication in short range areas including factories, hospitals or offices. In order to minimize the cost and power consumption the final product must conduct a trade off in range but still satisfy a low latency communication.

ROBUST LINE HAUSDORFF DISTANCE FOR FACE RECOGNITION

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Abstract: Human face recognition has a lot of applications in recent life. For last 20 years, face recognition has been an attractive problem for pattern recognition researcher which a lot of method has been introduced. However, non-ideal conditions (lighiting conditions, face expressions) for face recognition have been still a significant challenge to researchers. Line Hausdorff distance (LHD), which used distance between edge map of face images for calculating the different between facial images, was a fast and high accuracy method for face recognition. In this paper, a modification of LHD was proposed, Robust Line Hausdorff distance. The experimental results showed that the proposed method had a half of time of the LHD method while the accuracy of face recognition was higher than LHD method. Moreover, the accuracy of the proposed method robusted which the non-ideal condition of face images.

SECURITY ANALYSIS FOR COGNITIVE RADIO NETWORK WITH ENERGY SCAVENGING CAPABLE RELAY OVER NAKAGAMI-M FADING CHANNELS

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Abstract: An unlicensed energy scavenging capable relay is proposed to not only keep an unlicensed source communicate an unlicensed destination in cognitive radio networks (CRNs) but also secure this communications against eavesdropping of malicious users. This paper evaluates information security capability for such a network configuration through secrecy outage probability (SOP). Towards this end, a precise closed-form expression of the SOP accounting for maximum transmit power constraint, Nakagami-m fading, and interference power constraint is first proposed. Then, the proposed expression is justified by computer simulations. Finally, various results are provided to demonstrate that optimizing the relay position, the time percentage, and the power percentage of the energy scavenging technique brings the best security performance. Moreover, the SOP is constant in the range of high maximum interference power or high maximum transmit power and decreases with lower severity fading level.

SUM RATE MAXIMIZATION FOR FULL DUPLEX MULTIUSER MIMO SYSTEMS BY GRADIENT PROJECTION APPROACH

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Abstract: In this paper, we study the achievable sum-rate of a multi-user (MU) multiple-input-multiple-output (MIMO) wireless communication system in which one full-duplex (FD) base station (BS) serves a number of half-duplex (HD) mobile stations (MSs). The problem of interest is to design the precoding matrices of the uplinks and the downlinks to maximize the system sum rate under transmit power constraints at the BS and the MSs. An iterative algorithm based on the gradient projection (GP) and the Armijo rule is developed to maximize the sum-rate. The convergence of the algorithm and the achievable sum-rate performance of the FD MU-MIMO model as compared to those of the HD MU-MIMO one will be investigated through numerical simulation results.

USER'S AREA (ZONE) ESTIMATION METHOD USING BLE BEACONS FOR IOT SERVICE IN SUBWAY STATION ENVIRONMENT

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Abstract: A novel location estimation method using IoT (Internet of Things) sensors to detect classified service areas in subway station is presented in this paper. By using RSSI (Received Signal Strength Indicator) values of BLE (Bluetooth Low Energy) Beacons, virtual areas are divided electromagnetically according to specific service facilities for IoT service. The virtual service area is called Zone. MLP (Multi-Layer Perceptron) algorithm applies to recognize the assigned Zone with the received RSSIs from multiple IoT sensors constructed in a real subway station. For verification of the proposed method, an experimental test is carried out in a real subway station environment. For recognition of 2 divided Zones, 10 sensors are used with their different transmitting power levels. From the test results, it is noticed that zone recognition accuracy obtains 78.1% experimentally for a real subway station environment.

MAP MATCHING USING LINE SEGMENT FEATURES FOR SELF-VEHICLE LOCALIZATION IN ROAD ENVIRONMENTS

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Abstract: Autonomous vehicle technology offers the possibility of significant benefits to social welfare such as reducing crashes, congestion, fuel consumption, and so on. Among them, collision prediction and avoidance system are especially important topics in real road scenes. To complete the collision prediction and avoidance system, we need to estimate the exact position. Here, we introduce map matching system between the detailed digital map and the features of the line segments in the image using a monocular camera. We uniformly represent curbs and white lines on the road surface as line segment features. Furthermore, digital map and surrounding environment created by line segment are matched by performing a bird's-eye view conversion of line segment features. Finally, we verify the usefulness of this system by matching experiment between surrounding environment created by line segment and digital map.

CRACK DETECTION BASED ON GAUSSIAN MIXTURE MODEL USING IMAGE FILTERING

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Abstract: Pavement cracks are caused by various factors such as aged deterioration, load and weather conditions, and so on. As these reduce the safety of road traffic, regular inspections are necessary. In recent years, various crack detection methods using pavement images have been proposed. However, they often have problems with accuracy and processing time. Therefore, we considered the crack detection from the viewpoint of image segmentation. In this paper, we propose a new crack detection method combining GMM and image processing which is filtering. The experimental results show that our proposed method is superior to the state-of-the-art crack detection methods in both accuracy and processing time.

PHÂN BAN: KỸ THUẬT ĐIỀU KHIỂN VÀ TỰ ĐỘNG HÓA

SESSION: CONTROL ENGINEERING AND AUTOMATION

DESIGN AND IMPLEMENTATION OF LIVESTOCK ROBOT FOR EGG PICKING AND CLASSIFICATION IN THE FARM

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Abstract: The proposes of this study is to build a livestock robot that can pick and also classified the eggs in chicken farms. The robot was equipped with an embedded controller, ultrasonic sensors, image sensors, motors, drivers, and virtual instrument devices that can perform obstacle detection and color recognition of eggs. Meanwhile, the speed difference control method is used to adjust the direction of the robot. The eggs on the ground will be picked, classified, and collected by the robot with a special turntable and sliding mechanism. The experiment results illustrate that the efficiency and feasibility of the proposed robot can assist farmers to reduce the labor load.

FAILURE DETECTION SYSTEM DESIGN FOR ASYMMETRIC ELEVATOR FAILURES IN THE F-16 AIRCRAFT

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Abstract: In today's aerospace industry, fault tolerant control approach is widely used. In this control approach, it is very important to determine the occurrence of a failure accurately. In this study, a failure detection system is proposed to detect asymmetric control surface failures that may occur in the elevator of the F-16 aircraft. The proposed detection system is verified by nonlinear flight simulations involving common failure scenarios, namely freezing, floating and loss of effectiveness.

HYBRID SINE-SPIRAL DYNAMIC ALGORITHM FOR DYNAMIC MODELLING OF A FLEXIBLE MANIPULATOR

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Abstract: This paper presents a newly developed algorithm formulated based on a synergy between a mathematical sine equation and a spiral equation. The sine formula is taken from Sine-Cosine Algorithm (SCA) while the spiral equation is adopted from Spiral Dynamic Algorithm (SDA). The synergy combines a deterministic approach from SDA and a random approach from SCA. In the hybrid strategy, all agents update their position either via sine based or spiral based position update equation. The proposed hybrid algorithm is tested in comparison to SDA and SCA on various benchmark functions. A convergence plot and accuracy achievement are recorded and compared. In term of a real world application, the algorithm is applied to optimize a parametric model of an end point acceleration of a flexible manipulator robot. Result of the benchmark functions test shows that the proposed algorithm significantly improves the accuracy of both SCA and SDA. Result of the modelling shows that the SCA, SDA and the proposed algorithm have successfully modelled the end point acceleration.

HYSTERESIS IDENTIFICATION OF PIEZOELECTRIC ACTUATOR USING NEURAL NETWORK TRAINED BY JAYA ALGORITHM

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Abstract: The hysteresis nonlinearity widely existing in smart materials yields undesirable responses, which cause the hysteresis control problem even more challenging. Therefore, many studies based on the neural network have been introduced to cope with the hysteresis nonlinearity. However, the popular back-propagation algorithm used in training neural network model often performs local optima with stagnation and slow convergence speed. To overcome these drawbacks, this paper proposes a new training algorithm based on Jaya algorithm to optimize the weights of the neural network model. Proposed approach is applied to identify the nonlinear hysteresis loop of the piezoelectric actuator. The identification results demonstrate that the proposed algorithm successfully identifies the highly nonlinear hysteresis with perfect precision.

ROBUST CONTROL OF TWO-AXIS GIMBAL SYSTEM

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Abstract: This paper presents a two-degree-of-freedom robust controller for stabilization loop of a two-axis gimbal system. This control structure is shown to guarantee disturbance rejection and reference tracking simultaneously. Additionally, numerical and experimental results show that full-order robust H∞ controller designed with LMI method has better performance compared to PI controller based on fixed-order H∞ optimization method.

SINE BASED BACTERIAL FORAGING ALGORITHM FOR A DYNAMIC MODELLING OF A TWIN ROTOR SYSTEM

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Abstract: This paper introduces a sine-based position update strategy into Bacterial Foraging Algorithm (BFA). In solving many optimization problems, BFA produces an acceptable accurate solution but it presents a slow convergence speed towards the global solution. On the other hand, a sine-based position update strategy from the Sine Cosine Algorithm (SCA) utilizes an elitism in its position update equation. The elitism strategy contains a promising solution that guiding search agents toward global optima with relatively a faster speed. In this proposed technique, the sine-based position update strategy is incorporated prior to the reproduction phase of the BFA. With the consideration of the advantages of the elitism, it helps the BFA to converge faster and hence acquires better accuracy of the final solution. The proposed algorithm is tested on several CEC2014 benchmark functions that have various fitness landscapes and features. For solving a real world problem, it is applied to optimize a dynamic model of a Twin Rotor System. Result of the test shows that the proposed algorithm significantly outperforms the original BFA for both convergence speed and accuracy performances. On the other hand, result of the modelling shows that the proposed algorithm acquires the dynamic model for the Twin Rotor System with a significant smaller error.

USING PIECEWISE AFFINE PID CONTROL SCHEME FOR DOUBLE PENDULUM OVERHEAD CRANE

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Abstract: This paper proposes a new Piecewise Affine Proportional-Integral-Derivative (PA-PID) controller for cart position tracking and hook and load sway angle suppression of a double pendulum overhead crane (DPOC) system. A Safe Experimentation Dynamics (SED) algorithm is utilized as a model-free optimization tool to find the optimal PA-PID controller parameters such that the integral square of error and input are reduced. The essential feature of the PA-PID controller is that the parameters of proportional, integral and derivative gains are adaptive to the error variations according to the Piecewise Affine (PA) function. Moreover, the proposed PA function is expected to produce better control accuracy than the conventional PID controller. In order to justify the efficacy of the PA-PID controller, a widely known nonlinear model of DPOC plant is considered. The performances of the proposed controller are observed based on the integral square of error and input, and the responses of the cart position, the hook and load sway angle and the control input. The numerical results verify that the proposed PA-PID controller yields higher control accuracy than the conventional PID controller of DPOC system.

PHÂN BAN: HỆ THỐNG NĂNG LƯỢNG

SESSION: POWER AND ENERGY SYSTEMS

A NEW DESIGN METHOD OF LCL FILTER FOR SINGLE PHASE GRID CONNECTED POWER CONVERTER

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Abstract: This paper proposes a new design method of LCL filter for a grid connected single phase inverter to improve reduction of switching ripple current. LCL filter is designed from the viewpoint of Total Harmonic Distortion (THD), reactive power and minimization of magnetic materials. The converter side filter inductor L1 depends on a ripple ratio of the switching frequency component of the converter side current to the rated current, which varies by the modulation index of the inverter. Filter capacitor limits the amount of reactive power absorbed from the grid. The grid side filter inductor L2 depends on an attenuation ratio of the switching frequency component of the converter side current and the grid side current. The validity of filter design is verified by simulation of current control stability and current ripple characteristics by applying designed LCL filter to the single phase inverter.

A NOVEL ASYMMETRIC HALF-BRIDGE INVERTER FOR CAPACITIVE WIRELESS POWER TRANSFER

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Abstract: Capacitive wireless power transfer (CPT) is becoming a promising alternative to the inductive power transfer (IPT) due to the low cost and simplicity of the coupler link. However, if the configuration of the conventional IPT system is directly applied to the CPT, it increases the cost of the system. The paper proposes a topology to make CPT system more simple with the high voltage gain and the wide zero voltage switching (ZVS) feature. The target system is a low power system with the universal input voltage and wide load range applications. The design and analysis procedures are presented, and the circuit is simulated in PSIM to verify the performance of the proposed topology.

A SIMPLE RIPPLE VOLTAGE COMPENSATION METHOD IN HYBRID AC-DC MICROGRIDS

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Abstract: In hybrid AC-DC microgrids (HMGs), AC and DC microgrids (MGs) are linked by interlinking converter (IC). In HMGs, the operated single-phase inverter with variable frequencies (SPI-VF) makes DC bus voltage ripple. This paper proposes an IC control strategy that can mitigate ripple voltage at different frequencies. In the proposed IC control scheme, to save system cost, only DC bus voltage is measured instead of SPI-VF current/voltage. Moreover, DC bus voltage is constantly kept despite of the wide load power variation. Simulation and experimental results are carried out to verify the control scheme performance.

AN EFFICIENT CIRCUIT TOPOLOGY FOR WIRELESS CHARGING APPLICATIONS

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Abstract: Series-Series (SS) compensation has been proven as the most efficient compensation circuit topology in wireless charging systems. However, the most critical issue of the SS compensation circuit is that its input current is extremely high in the absence of the secondary winding, i.e., at no load condition. In order to overcome this drawback, this paper propose an impedance-source circuit configuration to feed this SS topology instead of the conventional full-bridge converter. The proposed circuit configuration is not only able to operate in no load condition without causing damage power switches due to inrush current, but also provides voltage boost capability to satisfy full battery charging process which requires a wide range of load voltage regulation. In comparison to the conventional approaches, the proposed concept provides numerous advantages such as using the least number of add-on electronic components to achieve a wide range of output voltage regulation while maintaining zero phase angle of the input resonant network and overcoming no-load issue of the conventional SS compensation configuration. Theoretical analysis and computer simulation results are provided to demonstrate the feasibility of the proposed concept.

AN OVERVIEW INTRODUCTION TO LOW-HEAD HYDROPOWER IN VIETNAM: VISIONS TOWARDS A GREENER VIETNAM 2030 AND BEYOND

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Abstract: To date, hydropower is the least expensive among all types of natural renewable energy sources. The possibilities for developing low-head hydropower in Vietnam are immense, and maybe unequivocally the longer-term solution to sustainable energy production in Vietnam. With the enormous amount of low-head energy in the Mekong and more than 3500 miles of coastline, a combination of hydropower and wave-energy technologies will pave the path towards zero-Carbon emissions in the future. Extending the possibilities, which low-head and wave energy collectively provide, it is reasonable to conclude that low-head hydropower and wave energy must be included in the National renewable energy portfolio and perceived as a contributor to the long-term socio-economic development in Vietnam. As educators and researchers, we must contribute towards the collection of knowledge gained through exploring low-head hydropower and wave energy, and the resulting innovation, which in a multitude of ways, can transform the society. In this context, we propose to establish a Center at the Ho Chi Minh University of Technology (HCMUT) that will advance water power technologies with innovative ideas and aid the long-term integration of natural renewable sources in Vietnam. Through academia, industry, and government partnerships, the Center will focus on research, scalable prototype development and testing, and full-scale pilot plant demonstrations, to enable the transformation of the Mekong Delta in meeting all its energy needs through effective use of water resources.

ANALYSIS AND DESIGN OF BLDC MOTOR CONTROL IN REGENERATIVE BRAKING

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Abstract: Brushless DC motor is suitable to be implemented in electric vehicles for it can develop high torque and is capable to do regenerative braking. During the motor is running, back electromotive force is generated with its magnitudes lower than the DC-link. To make the motor current can flow into the battery in regenerative braking mode, a bidirectional converter with boosting function capability is required. Standard three-phase converter can be controlled to provide such requirements. In this paper, a simple control strategy for a BLDC converter to operate under regenerative braking is proposed. it is capable to be operated in lower speed due to its boosting chopping concept. To verify the analysis, simulations and experimental works were done. They show the effectiveness of the proposed control strategy.

ANALYSIS OF RESONANT FREQUENCY OF TRANSMISSION LINE BASED ON LARGE SCALE OFFSHORE WIND FARM

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Abstract: Most offshore wind farms use a large capacity offshore collector substation om order to stably transfer generated power. Many bundles of wind turbines are connected to offshore platforms by using submarine cables that contain bigger capacitance than the overhead one. This means that the line impedance has a resonant frequency, and it will be changed depending on the connection of offshore wind turbines. When the additional offshore wind turbines are linked to an existing offshore substation, the resonant phenomenon may be caused by submarine cables due to the fact that the inverter system of a wind turbine can make harmonics through the switching operation. From this perspective, this paper analyses the resonant frequency of a transmission line based on a large-scale offshore wind farm. In order to verify this analysis, the models of a 75 MW wind farm will be simulated by using the PSCAD/EMTDC program. The simulation results presented the response of a wind farm injecting resonant frequency in accordance with the composition of offshore submarine cables.

AUXILIARY POWER UNIT FOR RAILWAY VECHICLES USING THREE-LEVEL LLC CONVERTER WITH PULSE WIDTH MODULATION CONTROL

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Abstract: This paper presents the structure of an auxiliary power unit for railway vehicles to reduce the amount of electrical energy conversion and increase efficiency. An auxiliary power unit is a key device for supplying the various control power for railway vehicles. Isolation is required as this provides the necessary power for the passenger car. Therefore, high-efficiency isolated LLC converter has been mainly applied. However, the LLC converter has poor control performance in response to voltage variation. To overcome this problem, the existing system has been implemented in two stages by installing a non-isolated DC / DC converter, such as buck or boost, at the LLC converter input. The heart of this white paper is the analysis of an LLC converter that accepts a wide range of input voltages by applying PWM control. This can achieve volume reduction. The proposed control strategy is verified by PSIM and MATLAB, which are power conversion simulation analysis programs.

DECOUPLING CONTROL OF INPUT-PARALLELED SYSTEM WITH DUAL ACTIVE BRIDGE CONVERTERS

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Abstract: This paper proposes a new control strategy for DC-DC converter systems consisting of multiple dual active bridge (DAB) modules. At first, the relations between input current sharing control and output voltage regulation (OVR) in input-paralleled systems are investigated, which is based on small signal model. Then, an input current sharing (ICS) control loop is designed, which is decoupled with the OVR control loop. In the proposed method, the model of the modular converter is simplified, in which a decoupling control scheme is easily derived. In addition, the modeling technique is applied not only to the input-parallel output-parallel (IPOP) system but also to the input-series output-series (IPOS) system. The effectiveness of the proposed control strategy has been verified by simulation results for a 30-kW system.

DECENTRALIZED INTERLEAVING AND CURRENT CONTROL FOR MULTICELL SERIAL-PARALLEL CONVERTERS

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Abstract: This paper presents the study of interleaving PWM and current control method which is based on the decentralized principle for multicell serial-parallel converters. Firstly, the decentralized principle will be applied to interleave the Phase-Shifted PWM control signals of a multicell serial-parallel converter. Secondly, the decentralized principle will be used for the balancing of the currents in the parallel arms of the converter cells. The simulation results demonstrate the feasibility and effectiveness of the proposed current control algorithm applied to a multicell serial-parallel converter presenting a large number of cells, especially when a dynamic reconfiguration of the system is required.

DESIGN CONSIDERATIONS FOR LOW STRAY IMPEDANCE PRINTED-CIRCUIT-BOARDS FOR SWITCHING CONVERTERS

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Abstract: A structure and layout of printed-circuit-board (PCB) have a considerable impact on the overall system efficiency and switching performance for high-frequency applications. The current distribution can be significantly distorted as the operating frequency increases and reach the skin depth frequency of the copper traces due to eddy and proximity effects. Also, stray inductances are the main source of destructive switching ringing and electromagnetic interference (EMI). They both are often designed to be minimized, however, it is difficult to expect and quantify the effects in the complex geometry of PCB layout. Hence, PCBs for power transfer has been often designed by a rule of thumb. The practical case of the printed circuit board for a resonant-type grid-tied switching converter is studied to reduce the stray inductances and effective resistances at switching frequency of several hundreds of kHz in this paper. Quantitative studies with the exact geometry of PCB from Gerber files are conducted using finite element analysis (FEA) tools. The overall process is integrated and linked by scripting glue language, Python. The suggested structure and layout show considerable improvement by rearranging patterns of copper traces and properly handling high-frequency effects.

DEVELOPMENT AND IMPLEMENTATION OF SMART STREET LIGHTING SYSTEM BASED ON LORA TECHNOLOGY

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Abstract: This paper concerned with the development and implementation of smart street lighting control system based using Led lamp and Lora Wireless communication. Currently, a traditional street lights are automatically turn on or off based on timer or day/night sensor. Recently, the conventional light sources are replaced by Led, which have so many advantages such as: energy savings, long lifetime, high reliability, pure light color, fast response, and friendliness to the environment. Furthermore, the intensity of the LED can be controlled easily. In this paper, the smart lighting system is designed to control and monitor devices via wireless transmission frequencies below 1 GHz. The smart lighting system has been built at Hochiminh City University of Technology to meet the standards for data transmission.

DEVELOPMENT OF LOW VOLTAGE DC/DC CONVERTER FOR ELECTRIC VEHICLE USING SIC MOSFET

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Abstract: This paper deals with development of low voltage dc-dc converter (LDC) for electric vehicle. The developed LDC is integrated with inverter for driving the traction motor, and all of power semiconductors are designed using silicon carbide (SiC) MOSFET for increasing the power density and efficiency. In this paper, a design procedure of phase-shifted full bridge converter and are introduced. For verifying of the designed parameters of LDC, the simulation and the experiment are performed using PSIM tools and 5.6kW laboratory prototype, respectively. In the experiments, the maximum efficiency is measured as 94.3% at 70% load condition.

DEVELOPMENT OF PMSM DRIVE FOR WATER SUPPLY SYSTEM

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Abstract: In order to increase the energy efficiency for wide operating range and minimize the system size, permanent magnet motor (PMSM) is used for water supply system in this paper. For operating the PMSM, sensor-less algorithm using extended electromotive force (EMF) is applied to the PMSM. And the heat sink design was optimized through CFD analysis for reduction of inverter size. Experimental results from a laboratory prototype are presented to validate the feasibility of the proposed using 11kW class PMSM for water supply system.

DIRECT POWER CONTROL FOR BALANCING CAPACITOR VOLTAGES IN GRID-CONNECTED THREE-LEVEL NPC CONVERTER

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Abstract: This paper presents a new Direct Power Control (DPC) strategy for balancing capacitor voltages in grid connected three-level Neutral-Point Clamp (3L-NPC) converter. In order to maintain balancing voltage between two input capacitors, the current flow through the neutral point will be controlled by selected the vector states. Theoretical analysis, computer simulation and experimental results demonstrated the feasibility of the proposed concept.

FAILURE-RATE ANALYSIS CONSIDERING OPERATIONAL CONDITION OF HALF-BRIDGE SUBMODULE IN HVDC SYSTEM

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Abstract: The half-bridge submodule is a unit system of MMC and consists of three main circuit components: IGBT, diode, and capacitor. Failure of the part causes the submodule failure, and this failure extends to the failure of the upper system of the MMC, which eventually leads to failure of the HVDC. Therefore, the lifetime prediction of the submodule is used as an important index to predict the failure of HVDC system. However, the conventional part failure analysis considering only the type and number of parts cannot reflect the operational characteristics of the system. To overcome this problem, we design a fault-tree that reflects the operational characteristics of the half-bridge submodule and estimate the lifetime of the sub-module by applying the failure-rate of MIL-HDBK-217F to the basic event. The validity of the proposed fault-tree analysis is verified by comparing with the conventional part failure analysis method.

FAULT-TOLERANT CONTROL FOR 7-PHASE NON-SINUSOIDAL PERMANENT MAGNET MACHINES WITH ONE OPENED PHASE

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Abstract: This paper presents new fault-tolerant control strategies for field-oriented control of 7-phase non-sinusoidal permanent magnet (PM) machines supplied by voltage source inverters (VSI). Single phase open-circuit fault is considered. The proposed strategies aim at finding waveforms of current references in natural frame in the way that post-fault currents create the same rotational magnetomotive force (MMF) as in healthy mode. Therefore, in the faulty mode, average torque can be maintained if no current limits are set. The proposed strategies are validated and compared to a previous strategy by numerical results in terms of joule losses, maximum RMS and peak phase currents, maximum phase voltage as well as their controllability with PI controllers.

FS-PTC WITH SWITCHING TABLE FOR MATRIX CONVERTER IN INDUCTION MOTORS DRIVE SYSTEM

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Abstract: An application of Finite State Predictive Torque Control (FS-PTC) for induction motors fed by matrix converter pays attention to researchers because it has more advantages such as small torque and stator flux, simple and flexible structure, easy implimentation. Besides, it also has two main disadvantages. The matrix converter has 27 voltage vectors, which are used in every predictive step. This leads to a relatively large computational burden. The weighting factors selection in the cost function isquite complicated. If weighting factors are not selected correctly, the system will not work well or even become unstable. This paper proposes FS-PTC with switching table structure for induction motors fed by matrix converter. It is a combination of FS-PTC structure and Direct Torque Control (DTC) structure. This structure not only reduces computational burden and eliminate weighting factors selection in the cost function but also it ensures unity power factor and sinusoidal input current.

HIGH-RELIABILITY SINGLE-PHASE SIX-SWITCH DUAL OUTPUT CURRENT SOURCE INVERTER WITH SWITCHING-CELL

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Abstract: This paper proposes a novel single-phase six-switch dual-output current source inverter. The switching-cell structure is implemented into two of three phase legs of the proposed inverter to improve the reliability due to the absence of open-circuit problems. In addition, the overlap-time between switching transition can be minimized or eliminated to enhance output performance, efficiency, and dc-source utilization. Both the numbers of semiconductor devices and conduction loss of the proposed inverter are reduced in comparison with the conventional dual-output current source inverters. The proposed topology can be applied in dual-output inverters, universal power filter, and uninterruptible power supply, for instance. A 300 W prototype with 35 V dc input was built and tested to verify the performance of the proposed inverter.

IMPACT ANALYSIS OF JEJU ISLAND POWER SYSTEM CONSIDERING PREDICTED POWER DEMAND OF EV

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Abstract: Nowadays, the local government of Jeju Island has proceeded with an energy policy, named 'Carbon Free Island Jeju by 2030' to change fossil fuel to electric driven cars. However, the Jeju Island power system is an isolated power system which is connected to the main land by line-commutated converter (LCC) high voltage direct current transmission systems (HVDCs). Thus, the impact of the charging demand of EV must be considered in order to operate Jeju Island power system stably. From this perspective, this paper analyzed the future model of Jeju Island's power system which included an EV charging load, a new thermal power plant and a modular multi-level converter (MMC) HVDC. The EV charging load was adopted by the results of advanced research which estimated EV charging loads in northern Europe. The simulation results of the Jeju Island power system were carried out by the PSCAD/EMTDC program.

IMPROVED DVR CONTROL BASED ON FEEDBACK LINEARIZATION FOR DFIG WIND POWER GENERATION SYSTEMS

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Abstract: The paper proposes a nonlinear control scheme of dynamic voltage restorer (DVR) for the low voltage ride-through capability in wind power generation systems under the grid voltage faults. First, a nonlinear model of the system including the output LC filters is derived in the dq synchronous reference frame, not by small signal analysis. Then, the system is linearized by the multi-input multi-output feedback linearization (FL). The effectiveness of the proposed methods is verified by the simulation results for the 2 [MW]-doubly-fed induction generator (DFIG) wind turbine system under grid voltage fault.

IMPROVED MODEL PREDICTIVE CONTROL TO ELIMINATE COMMON-MODE VOLTAGE AND BALANCE THE NEUTRAL-POINT POTENTIAL FOR 3L-NPC RECTIFIER

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Abstract: In this paper, an improved model predictive control (MPC) algorithm with fast computation is proposed to eliminate the common-mode voltage (CMV) and balance the neutral-point potential for three-level three-phase neutral-point diode clamped (NPC) rectifier. First, the switching states that generate high CMV and NP unbalance are eliminated when designing MPC schemes. Then, four voltage vectors are preselected as candidate voltage vectors depending on the location of the reference voltage vector. Compared with the conventional MPC, the number of voltage vectors involved in the MPC algorithm can be reduced from 7 to 4, which effectively improves the computation time. The validity of the proposed method has been verified by simulation results using Matlab/Simulink.

INDUCTANCE IDENTIFICATION OF SYNCHRONOUS RELUCTANCE MOTORS USING CAPACITOR DISCHARGE METHOD

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Abstract: Motor characterization has an important role in control of Synchronous Reluctance Motor (SynRM) which achieving the optimal efficiency and torque accuracy. This paper presents a new method by using the capacitor discharge to determine inductance characteristics of the SynRM, the magnetic saturation is taken into consideration. Apparent and incremental inductances will be analyzed and discussed. This presented identification method is general and to be able to use for many motor types, not only for SynRM. Finally, experimental results on the SynRM 1.1kW manufactured by ABB are presented to confirm the validity of the proposed method.

INTEGRATION OF OBC AND LDC USING ADAPTIVE DC LINK VOLTAGE

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Abstract: The OBC employs a high frequency transformer for the galvanic isolation between the grid and the propulsion battery. And LDC also adopts a high frequency transformer for step-down about 10 times from 240 [V] to 24 [V] and electrical insulation. However, in the case of a magnetic component, it is desirable to minimize the use because of the reduction of the traveling distance due to the increase in weight and volume and the insulation breakdown between the transformer windings due to vibration. Therefore, this paper proposes a dc-link voltage-variable integrated system that uses OBC and LDC transformers in common. The proposed circuit is divided into four operation modes. We also present the transformer design conditions that satisfy the voltage conversion of all conditions. Finally, PSIM simulation is performed to verify the validity of the proposed integrated system.

NOVEL CONFIGURATION OF AN INVERTER-BASED THREE-PHASE INDUCTION GENERATOR FOR SINGLE-PHASE LOAD: COMPARISON TO TSCAOI SETUP

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Abstract: This paper presents the study of a novel configuration of an off-grid single-phase generator using a three-phase Squirrel Cage Induction Machine (SCIM) by providing the comparison to the existing Two-Series-Connected-And-One-Isolated (TSCAOI) configuration. In TSCAOI configuration, a single winding is used to provide excitation while the other two windings are connected to load. In the new structure, two of the generator stator windings are excited by two independent sources and the remaining winding provides power to load. This setup allows better control freedom and flexibility. The performance comparison of the proposed configuration and the TSCAOI configuration in open loop is presented in simulation and experimentation. This work contributes to frugal innovation for rural electrification in developing countries.

NOVEL SCADA- INTEGRATED FACTS DEVICES FOR VIETNAM GRID

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Abstract: Integration of the distributed local generation units with non-linear behavior, such as photovoltaic systems and wind generation units together with increasing number of the non-linear loads has increase awareness of the power quality of the grid. There are two main parameters to assess the power quality: harmonics distortion and power factor. To maintain controllability of the overall grid, the communication systems have been integrated in the grids, so they become smart grids. The overarching control systems to monitor the status of the grid was developed and it is known as Supervisory Control and Data Acquisition (SCADA) systems. This paper presents a system to improve the harmonic distortion and power factor parameters with the use of flexible alternative current transmission system (FACTS) devices such as Static synchronous compensator (STATCOM) and Static Var Compensator (SVC) along with integrating them in the SCADA-based grid.

ONE LEG CONTROL STRATEGY IN SINGLE-PHASE FIVE-LEVEL INVERTER

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Abstract: The use of power inverter technology with low harmonics content is rapidly growing. For decades, researchers have conducted investigations to minimize its harmonics content, leading to the creation of a five-level inverter. This new topology often deals with many power semiconductor switches, thereby making it difficult to control. Therefore, this paper studies a further simulation and hardware implementation of the one leg control strategy of the single-phase five-level inverter design with efficient control of switches operated in a line frequency to achieve a higher-level demand. The verification of this research is a simulation and prototype implementation carried out in the laboratory.

OPERATION OF FOUR-LEVEL ANPC INVERTER BASED ON SPACE-VECTOR MODULATION FOR COMMON-MODE VOLTAGE REDUCTION

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Abstract: In this paper, the problem of common-mode voltage (CMV) in four-level active neutral-point clamped (ANPC) inverters is alleviated with a modified space-vector modulation. With the proposed technique, the CMV peak value is reduced by 40% compared to the in-phase disposition (IPD) carrier-based modulation, while the total harmonic distortions (THDs) are similar at high modulation indices. The effectiveness of the proposed method and the power losses across the switching devices have been verified by simulation results.

OPTIMAL BIPED WALKING PATTERN GENERATOR WITH PRESET HIP-SHIFT USING JAYA OPTIMIZATION ALGORITHM

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Abstract: This paper presents the comparative evolutionary optimization techniques to optimize the design and implementation of the walking pattern generator (WPG) permitting the biped robot able to stably walking with pre-set hip-shift magnitude. The novel JAYA optimization algorithm is initiatively applied and comparatively investigated with four different efficient evolutionary optimization techniques including Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Modified Differential Evolution (MDE), and Central Force Optimization (CFO). The comparative performance of five optimization techniques applied on the generic small-sized nonlinear uncertain biped robot (HUBOT-5) comprehensively considered by executing each technique 10 times with the same initial parameters. Using obtained results, it gives the best evolutionary optimization approach for optimize the walking gait generator applied for allowing a stable walking with pre-set hip-shift value. Simulation and experimental results on biped robot HUBOT-5 prove that the JAYA optimization algorithm is most feasible.

RESEARCH FOR FABRICATION OF LITHIUM-ION CAPACITOR BY VERTICAL DOPING METHOD

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Abstract: A lithium-ion capacitor is called a "hybrid capacitor." It is a new energy storage device that combines the advantages of lithium-ion batteries that have been widely used and electric double-layer capacitors used for energy regeneration and electric power storage of automobiles. As it has not been long since the development of lithium-ion capacitors was started, it is generally difficult to procure them from the market except some overseas and Japanese manufacturers. However, many different varieties of lithium-ion capacitors will likely be put on the market and are expected to be commonly used with the future development of the market.

SOLAR BUCK CONVERTER VOLTAGE CONTROLLER DESIGN

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Abstract: This paper proposes a technique to design a voltage controller for increasing stability and tracking speed of MPPT. First, Describe the controller configuration of the photovoltaic power generation system, and the solar buck converter model using state-space modeling approach is presented. Based on the model, the design of the voltage controller is proposed. the performance of the controller is verified using simulation.

TORQUE ERROR COMPENSATION ALGORITHM FOR IPMSM DRIVES USING A GOPINATH STYLE STATOR FLUX LINKAGE OBSERVER

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Abstract: A compensation algorithm targeting torque development from an interior permanent magnet synchronous machine (IPMSM) is presented in this paper. Maximum Torque per Ampere (MTPA) lookup table (LUT) used for the minimization of copper loss uses the calculated permanent magnet (PM) flux linkage, and torque error occurs due to change of PM flux linkage. In this paper, proposed an algorithm to compensate torque error using a stator flux linkage observer. PM flux linkage estimated through the stator flux linkage observer is used to the MTPA LUT to compensate for the torque error.

KHOA KHOA HỌC ỨNG DỤNG

FACULTY OF APPLIED SCIENCE

PHÂN BAN: TOÁN ỨNG DỤNG

SESSION: APPLIED MATHEMATICS

SOME ESTIMATES ON THE L^2 BOUNDARY NORM OF THE BERGMAN KERNEL

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Abstract: The Bergman projection is one of the most important tools in complex analysis. This tool has been used in the study of quantum mechanics and geometry. The Bergman kernel associated to the Bergman projection admits many nice properties, even though it may be a challenging task to calculate the Bergman kernel explicitly. Some new estimates on the L^2 boundary norm of the Bergman kernel are given. The techniques come from the L^2 theory of the $\overline{\partial}$ equation and the relation between the Bergman kernel and the pluricomplex Green function.

Keywords: *Bergman kernel, Pluricomplex Green function, Weighted Bergman projections*

LYAPUNOV EXPONENTS OF A CLASS OF STOCHASTIC HYBRID DYNAMICAL SYSTEMS

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Abstract: This paper is devoted to a study of stability of a class of stochastic hybrid partial differential equations with non-constant coefficients. Using explicit formulae of solutions, we can explore and confirm the p-th moment Lyapunov exponents. In addition, some numerical examples are carried out to demonstrate the theoretical results.

Keywords: *Stochastic partial differential equations, Markov chain, Lyapunov exponent, Stabilization*

CLASS OF APPROXIMATION OF ALGEBRAIC STRUCTURES

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Abstract: Given a certain class K_1 of algebraic structures. We study a problem of finding a class K_2 of algebraic structures such that the class K_1 is approximable into K_2 with respect to various predicates by mappings from K_1 to K_2 This problem is more difficult and actual than the problem of approximation we have been studying for a long time. We have found positive results for the class of commutative idempotent semigroups with respect to the predicate of equality of two elements and for the class of commutative, regular and periodic semigroups with respect to the predicate of belonging of an element to a subsemigroup. The problem of minimization of approximation is also considered.

Keywords*: stochastic partial differential equations, nonlinear, stability, Lyapunov exponent*

STABILITY OF A CLASS OF NONLINEAR HYBRID STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS

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Abstract: In this paper, we study a class of nonlinear stochastic partial differential equations driven by a Markovian switching. Using a fixed point theorem, we can verify the existence and uniqueness of the mild solution of the equations. Moreover, we also obtain the p-*th* moment exponential stability of the solution as well as the p-*th* moment Lyapunov exponents. Numerical simulations are accomplished for illustrative purpose.

Keywords: *stochastic partial differential equations, nonlinear, stability, Lyapunov exponent*

MATHEMATICAL MODEL FOR CONTROL RELAY AND ITS APPLICATION

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Abstract: Relay with delay is a phenomenon that occurs quite often in electromechanical systems. Researching or designing these systems requires a suitable analytical model to be able to use computers to simulate the system with high accuracy. In this paper, we present the properties of the relay with a delay and a general method of building a mathematical model for the relay with delay called a smooth model. In particular, the smooth relay model is a highly practical and applicable model that will be presented clearly.

Keywords: *Relay with delay, electromechanical systems, smooth relay model*

EXISTENCE CONDITIONS FOR SYMMETRIC STRONG VECTOR QUASI-EQUILIBRIUM PROBLEMS

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Abstract: In this paper, we study the symmetric strong vector quasi-equilibrium problems. Afterward, we establish the existence conditions of solution sets for these problems. The results presented in this paper improve and extend the main results in the literature. Some examples are given to illustrate our results.

Keywords: *symmetric strong vector quasi-equilibrium problems, existence conditions, solution sets*

STABILITY FOR STRONG PARAMETRIC VECTOR QUASI-EQUILIBRIUM PROBLEMS WITH AN APPLICATION

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Abstract: In this talk, we consider the strong parametric vector quasi-equilibrium problems with variable cones. First, we introduce concepts of upper and lower semicontinuity of vector-valued mappings with respect to variable cones. Next, under suitable assumptions, sufficient conditions for semicontinuity of the solution mapping to such problems are established. Some examples are provided to illustrate the essentialness of the imposed assumptions. As an application, we discuss the stability of traffic network equilibrium problems. Our results improve the corresponding ones in the literature.

Keywords: *Stability, parametric vector quasi-equilibrium problems variable cones, semicontinuity*

SECOND-ORDER COMPOSED CONTINGENT DERIVATIVES OF PERTURBATION MAPS IN SET-VALUED OPTIMIZATION

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Abstract: In the talk, we study calculus rules of second-order composed contingent derivatives. More precisely, chain rule and sum rule are established and their applications to some particular mathematical models are obtained. Then, sensitivity analysis in set-valued optimization using second-order composed contingent derivatives are proposed. Our results are new and many examples are given to illustrate them.

Keywords: *Second-order composed contingent derivative, Chain rule, Sum rule, Perturbation map, Weak perturbation map*

GODUNOV-TYPE NUMERICAL SCHEME FOR THE SHALLOW WATER EQUATIONS WITH HORIZONTAL TEMPERATURE GRADIENT

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Abstract: We present a Godunov-type scheme for the shallow water equations with horizontal temperature gradient and variable topography. First, the exact solutions of the Riemann problem in a computational form are given, where algorithms for computing these solutions are described. Second, a Godunov-type scheme is constructed relying on exact solutions of the local Riemann problems. Computing algorithms for the scheme are given. The scheme is shown to be well-balanced and preserve the positivity of the water height. Numerical tests show that the scheme is convergent with a good accuracy, even for the resonant phenomenon, where the exact solutions contain several distinct waves propagating with the same shock speed.

Keywords: *Shallow water equations with temperature, topography, nonconservative, Godunov scheme, accuracy, resonant*

PHÂN BAN: KỸ THUẬT Y SINH

SESSION: BIOMEDICAL ENGINEERING

IMMUNOSENSOR SYSTEM FOR PANCREATIC CANCER

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Abstract: Pancreatic cancer (PC) is a global health problem and UL16 binding protein 2 (ULBP2) is a new biomarker for PC. Therefore, this study aims to develop a simple, reliable and inexpensive PC screening system, consisted of an immunosensor and impedance readout circuit. A screen-printed immunosensor was successfully fabricated with good sensitivity, selectivity, and storability. The readout circuit is accurate (less than 5% error) as compared with a precision impedance analyzer. It is therefore concluded that the designed immunosensor can determine the concentration of ULBP2 antigen accurately and the readout circuit has good accuracy. The system can be applied to the detection of early pancreatic cancer and achieves the purpose of early detection of early treatment.

Keywords: *Pancreatic cancer, ULBP2, Screen-printed, Immunosensor, Readout circuit*

THE APPLICATION OF PENH SIMULATION ON PROTON IMAGING

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Abstract: Proton therapy is one of the most accurate forms of cancer therapies, which requires accurate knowledge of the dose delivered to the patient and verification of the correct patient position with respect to the proton beam to avoid damage to critical normal tissues and geographical tumor misses. In existing proton treatment centers dose calculations are performed based on x-ray computed tomography (CT) and the patient is positioned with x-ray radiographs. The use of x-ray CT images for proton treatment planning ignores fundamental differences in physical interaction processes between photons and protons and is therefore inherently inaccurate. Further, x-ray radiographs depict only skeletal structures; they do not show the tumor itself. Ideally, one would image the patient directly with proton CT by measuring the energy loss of high-energy protons that traverse the patient. The main content of this report is the application of simulation programs PenH proton transmission via phantom associated with the PENEASY creation in proton imaging can be applied in proton therapy.

Keywords: *proton therapy, proton imaging, PenH simulation*

THE EFFECTS OF LETTER MATRIX AND INTER STIMULUS INTERVAL ON P300 EVENT - RELATED POTENTIALS

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Abstract: The P300 wave is an event related potential (ERP) component elicited in the process of decision making. It is usually elicited using the oddball paradigm, in which low-probability target items are mixed with high-probability non-target items. The Emotiv Epoc + contains 14 Electroencephalogram (EEG) channels and the sampling rate is at 128 Hz was used to collect P300 wave of five healthy volunteers in our Brain Computer Interface (BCI)'s experiments. The communication interface is the letter matrix showing in three forms: 2x2, 3x3 and 6x6 matrix. The subject was asked to pay his attention to the letter serves target in oddball paradigm and it elictes P300 response. The duration of the inter stimulus interval (ISI) between targets is set at 187,5 ms and 300 ms. For the letter matrix 2*2 and 187,5 ms ISI condition, the online accuracy was 100%. For the letter matrix 3x3 and 6x6, after trainning section, the classification is performed and its accuracy was about 85%. P300 waves with largest amplitude occurs remarkably at the occipital and frontal channels and in 6x6 letter matrix. These good results promised real assistance application for disabled man.

Keywords: *P300, EEG, EMOTIV EPOC+*

A DUAL ANTICANCER MOLECULE CAN BE A THERANOSTIC PHOTO-INDUCED NUCLEAR TRANSPORT MECHANISM

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Abstract: We synthesized a dual anticancer theranostic fluorophore, EO, which emerged the dark cytotoxicity and photodynamic therapy characters to cancer cells. Following the bioassays evaluations, chemotherapy EO can specifically localize in mitochondria to cause mitochondrial dysfunction and then induce apoptosis in cancer cells but not normal cells. Simultaneously, phototherapy EO is able to generate particular reactive oxygen species (ROS) to undergo type I photodynamic therapy (PDT) programme under irradiation. It is interesting that slight irradiation may alternatively accelerate intracellular EO delivered to nuclear, instead of performing phototherapy, to triggered chemotherapy and synchronously cause fluorescence color switch. That is, the photo-induced nuclear transport of this chemo-phototherapy molecule can be a dual anticancer theranostic drug candidate, especially for cell death marker, with the intracellular fluorescence colors switching between cytoplasm and nucleus.

Keywords: *theranostic, chemotherapy, mitochondrial dysfunction, chemo-phototherapy, nuclear transport*

SHAPE DEPENDENT BREAST LESION DIAGNOSIS WITH SPHERICAL AND STAR-SHAPED GOLD NANOPARTICLES

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Abstract: The study investigated the potentials of spherical and star-shaped 15 nm hydrophilic nano-particles as computed tomography contrast agents for breast lesion malignancy screening. Breast cancer is one of the most serious diseases affecting women's health. Presently, it is initially evaluated by palpation or image detection, and further confirmed by biopsy (needle biopsy). However those methods have their disadvantages. Although the image detection with conventional iodinate contrasted multiple detector computed tomography has a non-invasive advantage, the accuracy of the interpretation is not sufficiently accurate no matter it is based on the morphological indices or the dynamic time-density patterns. Nano-gold particles have high X-ray absorption coefficient and well documented biocompatibility, and the preferential accumulation of nano-particles in cancer tissue due to enhanced permeability and retention effect (EPR) can improve the malignancy screening efficiency. In this study, the lesion morphological indices or the dynamic time-density patterns of breast cancer xenografts on nude mice contrasted by the two different shapes nano-gold particles in nude mice was investigated for their beneficial characteristics in diagnosis.

Keywords: *breast lesion diagnosis, computed tomography, gold nanoparticle, star-shape nanoparticle*

IMAGING OF TOOTH STRUCTURE BY NEAR-INFRARED TECHNIQUE

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Abstract: In dentistry, near-infrared (NIR) technology has been studied for decades that is being applied for the detection of dental damages without using of ionizing radiation. Based on the interaction between dental tissue and NIR light such as transmission, absorption and scattering, the teeth structure and dental lesions can be observed by NIR camera. The aim of this study was to build the dental diagnostic device using NIR light at 940-nm wavelength for detecting the early and hidden dental damages. According to the various types of tooth samples, the transillumination and the scattering methods were designed and applied for capturing the tooth structures. The transillumination technique was used for thin teeth such as incisor and canine while the scattering system for observing occlusal surface. The results show that the areas suspected to be the demineralized enamel are distinctly distinguished from the surrounding sound tissues as well as the stain and pigmentation due to their different colors in NIR image. The designed device fulfills some requirements such as simple setup, safety and affordable price for the purpose of replacement of imported equipment.

Keywords: *tooth structure, near infrared, transillumination technique*

IMAGE PROCESSING OF NEAR-INFRARED IMAGES OF TOOTH STRUCTURE

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Abstract: In the recent years, oral problems are receiving more attentions from not only experts but also almost people. If tooth lesions in the early stages, such as white spots, hidden dental caries and tooth decay, etc., are not detected and treated promptly, they will lead to a risk of tooth loss. There are several common methods to detect tooth lesions such as clinical method, x-ray and particularly near infrared method, which is being developed significantly during the past decades. This method is substantially efficient for detecting early lesions by observing infrared images of tooth structures. However, it will be difficult to diagnose early lesions because infrared images have noisy and poor contrast. The diagnosis of these diseases depends on the experience of the dentist, environment brightness, or observation conditions, which can lead to many subjective errors of diagnosis results. This study designed and built a simple program interface to analyze and enhance image quality, to detect borders and reduce noise. In addition, the program interface, that is based on Guide, also identified types of lesions and marked regions to detect early lesions of the teeth. The images used to process were captured by a dedicated infrared dental camera in dentistry.

Keywords: *tooth structure, near infrared, image quality*

LIVER CT IMAGE PROCESSING AND DIAGNOSING USING ARTIFICIAL NEURAL NETWORKS AND MATLAB

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Abstract: Processing liver image and predict the healthy degrees of patient is a challenge. There are ways to approach this challenge in the world. With the aim of making an automatic and more accuracy program to process and dianose human liver, without the need of doctors and easy-to-use for people, in this research, we use many classical as well as modern image processing algorithms. Claasical algorithms, such as SHAKE or spacial filters help to improve the pre-processing and denoising stages, while state-of-the-art methods such as CNN neural networks, big data... improve the making-decision and prediction with new cases.

Keywords: *Biomedical segmentation, CT human liver image, active contour, neural network, deep learning*

IMPROVING DIAGNOSIS IN UTERINE CERVIX USING CROSS POLARIZED IMAGE

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Abstract: Early detection of cervical pathology as well as changes in cervical cancer is the most effective method to improve the patients' quality of life and reduce the death rate due to cancer. One of the most common methods to detect abnormal indication in cervix is to scan through it using the colposcopy. In this study, we are looking to the research and development of a colposcopy model using polarized Led light source with considerable enhancement in image quality as well as a reasonable price, serving to meet the huge demand of modern medical equipments of the society. In addition, we also develop an application for storing and analysing the images directly, in order to highly visualise the disease area, providing doctors with clearer and better perspective about the symtoms. Preliminary results then help analyse and evaluate some typical characteristics of cervix-related diseases.

Keywords: *colposcopy, cross polarized image, uterine cervix*

PRELIMINARY DEVELOPMENT OF COMPUTED TOMOGRAPHY (CT) SCANNER USING TRANSILLUMINATION IMAGING

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Abstract: Near-infrared transillumination imaging is useful in many biomedical applications such as human biometrics and animal experiments. Using near-infrared (NIR) light, we can able to obtain a two dimensional (2D) transillumination image of the internal absorption structure such as blood vessel structure, liver ... in a small animal body. If we can obtain projection images from many orientations, we can reconstruct a three dimensional (3D) image using various computed tomography techniques. In previous studies of our group, even with simple system (light-emitting diode (LED)'s array and low-cost charge-coupled device (CCD) camera), we can obtain the blood vessel transillumination image of human arm. In this paper, we propose a preliminary research on development a computed tomography (CT) scanner of human body parts using transillumination imaging.

Keywords: *diagnostic, transillumination imaging, near infrared, computed tomography, Optical CT, scattering*

CHARACTERISTICS OF MOUSE BLOOD-OXYGEN-LEVEL DEPENDENT FUNCTIONAL MAGNETIC RESONANCE IMAGING RESPONDING TO VISUAL STIMULATION

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Abstract: The use of mice in fMRI is rapidly increasing to investigate the relationship between genes and brain functions in health and diseases. In this study, we aimed to characterize visual stimulation parameter-dependence of mouse BOLD fMRI under ketamine/xylazine anesthesia. Mice were performed BOLD-fMRI on 9.4T/30cm Bruker scanner with LED stimulus. The bilateral BOLD activation was mainly localized in the primary visual cortex (VC), superior colliculus (SC) and dorsal lateral geniculate nucleus (LGd). The frequency-dependence of BOLD response in 3 regions was increased gradually from 1 to 5Hz, but at higher frequencies stimulation (8 and 10Hz), the response was decreased rapidly in VC, while it was still maintained at subcortical SC and LGd. And pulse-width-dependence result showed a similar trend as the frequency dependency, the normalized BOLD response linearly increased up to the pulse width of 30ms and decreased for a longer pulse (50ms). Our mouse fMRI data under ketamine/xylazine is in agreement with previous studies in rats and cats, suggesting that ketamine/xylazine is a good anesthetic for mouse fMRI. And it provides optimal parameters of light stimulation, which is helpful for obtaining maximal BOLD responses evoked by visual stimulation in future transgenic mouse fMRI studies.

Keywords: *mouse fMRI, visual stimulation, ketamine/xylazine*

SYNTHESIS FLUORESCENT GLYCO-NANOPARTICLES FOR SPECIFICALLY TARGETING TO CANCER CELL

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Abstract: We focus on the daevelopment of carbohydrate-functionalized nanoparticles (NPs) and their biomedicine applications such as cell-specific targeting, bio-imaging, and cancer therapy. Since the number of breast cancer patients are growing in recent years, we study anti-cancer drug carriers for targeting breast cancer. Mannose receptors overexpress on the surface of MDA-MB-231, a kind of human breast cancer cell line. Therefore, we decorated a Cy3 fluorescent dye and mannosides on the surface of silica NPs for imaging and targeting. To investigate the size of NPs effect on cellular uptake rate, various sizes of silica NPs were designed and synthesized by using different amount of ammonium. The physical properties of these NPs were characterized by scanning electron microscope (SEM), dynamic light scattering (DLS) and their zeta-potential, respectively. Cellular experiments demonstrated that mannose-modified NPs can be selectively uptake by MDA-MB-231. The mannoside glycol-NPs in size of 250 nm had the best uptake ability. All ManCy3@SiO2NPs are not cytotoxic, indicating they may potential for biomedical applications.

Keywords: *carbohydrate-functionalized nanoparticles, MDA-MB-231, Mannose receptors, cell-specific targeting*

STUDYING DOZE OFF IN STUDENT BY USING ELECTROENCEPHALOGRAPHY SYSTEM

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Abstract: Sleep deprivation of high school and university students is currently an actual concerning issue. Sleep deprivation is one of the leading causes of dozing-off during daytime. Dozing-off is not only an undesirable state and disrupts daily activities, but also provides information on personal health status. In that case, early alertness for dozing-off event is very helpful in preventing unwanted consequences. The study has designed a process to record dozing-off event, then constructed and implemented the hypnogram processing program that evaluated quantitative changes in polysomnography signals at sleep onset, the transition time from wake stage to sleep stage. By analyzing the energy spectrum of the signal and using wavelet transform in combine with the support vector machine algorithm, the research allows a comprehensive evaluation of the state of dozing-off. Eight recordings from volunteered students were processed from a 45-minute vigilance test. The result presented a successful method to distinguish dozing-off event with other stages.

Keywords: *dozing-off, sleep onset, polysomnography, support vector machine*

RESEARCH INTO CONCENTRATION IMPROVEMENT OF THE BRAIN USING MUSICAL STIMULATION

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Abstract: The speedier our pace of life is, the more things we have on our shoulders. Distraction becomes an obsession to many of us. Therefore, finding resolutions to improve focus and concentration is a must. This study aims to demonstrate the utilization of music as a method of strengthening mental attention. There are two types of music in the study: classical music and background music without vocals. With the help of electroencephalogram (EEG) in examining responses of the brain to musical stimulation in the state of concentration, conclusions are then drawn regarding how certain types of music can improve brain concentration. The main signal processing technique of the study is the Fourier – Wavelet transform, which serves the purpose of calculating and circumscribing the areas where Beta brainwave (relating to consciousness, cognition and concentration) appears dominantly. This approach allows us to observe the changes of Beta power spectra in focus state and compare their differences under the effect of music. These changes are later displayed in brain maps - 2D reconstructions of functional areas in the brain - on which changes are presented more apparently and the location of electrical sources can be estimated.

Keywords: *concentration, focus, music, EEG, Beta, Fourier - Wavelet transform, Brain Mapping*

RESEARCH INSOMNIA DISORDERS THROUGH NEUROLOGICAL PROBLEMS

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Abstract: Sleep is one of the most important factors in balancing work and life. It's generally agreed that people are coping with an increase of stress and anxiety, resulting in popularizing of sleep disorders, while sleep is one of the most important factors in balancing work and life. The importance of sleep is represented by many functions such as eliminating toxins, regulating the body's physiology. Sleepless causes severe problems with the most serious one is a heart attack. Based on the characteristics and feature of Electroencephalography - EEG, this research was carried out the application of algorithms to investigate typical differences between sleep disorders specificity and normal people's polysomnogram. The main method of this study is to calculate the relative power of alpha and delta waves and to find the experimenter's confusion if any. The experimental procedure was performed in the Biomedical Engineering laboratory of the Ho Chi Minh City University of Technology.

Keywords: *Insomnia disorders, EEG, neurological*

EEG-BASED STUDY ON SLEEP QUALITY IMPROVEMENT BY USING MUSIC

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Abstract: Napping is essential for human to help the body relax, thereby reduce drowsiness and alertness, contribute to improving cognitive function, reflexes, short-term memory, and mood. Researchers believe that a certain amount of time for a nap can boost the body's immunity and reduce the danger of cardiovascular disease. However, not every person can easily take a nap especially in a short period of time to shift work among morning and afternoon. Using music to help people relax and feel asleep is an effective solution that earlier studies have shown. The aim of the study was to confirm the positive effect of music on sleep quality. The research calculates the correlation coefficient between alpha and theta wave to determine sleep onset – the moment of transition from wake to sleep - with and without the auditive stimulus.

Keywords: *sleep quality, Electroencephalography (EEG), music, napping*

EXERCISE PHYSIOLOGY: IMPROVING STATIONARY BIKE TRAINING PERFORMANCE USING HEART RATE VARIABILITY

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Abstract: Exercising is said to bring benefits to people taking part in, not only physical but also physiological gain. Heart Rate Variability (HRV) is an important marker reflecting the function of autonomic nervous system (ANS), which has shown potentials in some exercise therapy and sport physiology studies. HRV analysis is said to be used for getting better understanding of our body's response to exercise and the reaction to different stressors from workout. Thus, it is essential to monitor and optimize the recovery to avoid overtraining. This study aims to investigate the influence of HRV reflecting the physical stress level on participants when exercising, therefore, building a concept of self-training guide to improve the adaptation and performance. Electrocardiogram (ECG) is acquired by BIOPAC system over 10 healthy college students during a proposed training protocol on stationary bike, and post-exercising. HRV data from ECG is analyzed in time, frequency and nonlinear domains to extract various features to evaluate physiological recovery status, manage physical fatigue, intensity adjustment. From the evaluation of these indexes, participants are able to keep track of their physiological condition as well as to have more effective training exercises.

Keywords: *Heart Rate Variability, stationary bike training, stress, recovery status, exercise physiology*

HEALING THE THIRD DEGREE THERMAL BURN IN MICE BY DIELECTRIC BARRIER DISCHARGE PLASMA (DBD PLASMA): COMPARISON AND EVALUATION OF AREA, BURN WOUND HEALING TIME, BURN SKIN TEMPERATURE

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Abstract: Burns are one of the most devastating conditions encountered in medicine. This injury is in skin or other tissues, caused by heat-cold, electricity or chemicals. There are lots of methods to treat burns and each method has its own advantages, such as medicine, dressing, low-level laser, plasma, skin graft surgery...This study experimented with the 3rd degree burn model in mice by heat, treating by DBD plasma, is a non-invasive treatment and using clinical diagnostic methods by (1) normal image, (2) thermal image, (3) HE staining. Aim of this research is evaluation and comparison the area, temperature and wound healing time of non-invasive treatment with DBD plasma and non treatment. After 3-week experiment, using diagnostic methods and analysis tools have demonstrated that the 3rd thermal burn wound healing of plasma treatment recovers faster than non treatment about: (1) Burn wound surface shrinkage rate is higher: ~ 5%; (2) Healing time is faster: 2-3 days; (3) The average temperature of the burn wound is lower: 1-2^{o}C. Therefore, DBD plasma is a potential treatment in burns wound and wound healing in the future.

Keywords: *DBD plasma, burn wound, healing wound*

ADIPOSE-DERIVED STEM CELLS ENHANCE BURN WOUND HEALING AND NEUROPATHIC PAIN TREATMENT

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Abstract: Stem cells are found in multi-cellular organisms, and are biological undifferentiated cells which can differentiate into specialized cells to divide and produce more stem cells through mitosis. In adult organisms, stem cells and progenitor cells act as a repair system for the body replenish adult tissues. We select to carry on the experiments with adipose-derived stromal/stem cells (ADSCs), because the obtaining on clinic is easy; the chance of surgery complication is low; the patient acceptance is high; the cultured cell number is in a large quantity; and the proliferative generation is stable. Burn injury has been shown to bring out the neuropathic pain in general cases, and it is hard to cure. The present clinical medicine is with low efficacy, and is often accompanied obvious side effects. The management of neuropathic pain after burn injury is a critical issue. We found that the over-inflammation and the neuron apoptosis in spinal cord ventral horn in burn damaged rat. ADSCs can be applied to diminish inflammation, decrease neuropathic pain and reduce neuron apoptosis. Following, we will move to treat the difficult wound (high glucose conditions). During normal wound healing, various kinds of cells are recruited to the wound by cytokines released from the injury area. The prolong inflammation and the poor circulating/resident cell migration impaired the diabetic wound healing. The elevated TNF-α expression decreases fibroblast proliferation and increases apoptosis of fibroblast. The local injection around the wound with keratinocyte-secreted cutaneous T-cell attracting chemokine (CTACK) is shown to improve wound healing by recruiting circulating cells. In our clinical preliminary data, the increased TNF-α expression with the decreased CTACK expression was noted in diabetic wound fluids compared with the normal wound fluids. This will be a worth topic to discuss the relationships between ADSCs and the wound repair.

Keywords: *wound injury, adipose-derived stromal/stem cells, TNF-cutaneous T-cell attracting chemokine*

EFFECTIVE BONE REGENERATION TREATMENT OF LOW-LEVEL LASER

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Abstract: The aim of this experimental study was to evaluate if the effect simultaneously wavelengths of 780 nm and 940 nm enhances bone regeneration of the broken bone. Experiments on pets: 14 dogs, they were randomly divided into 2 groups: group I (low-level laser therapy) and group II (control). The results showed that dogs in group I had better bone regeneration and bone marrow formation than the control group. Then, we treated 25 patients with different fracture levels. They agreed to enjoy our method. After treatment, the fracture is no longer visible on X-ray film. The majority of patients after treatment only feel no pain or mild pain. This suggests that osteoblasts are positively affected when projected by low-level laser. It is very practical for the treatment of older patients because osteoblasts grow slowly than osteoclast.

Keywords: *bone regeneration, osteoblast, low-level laser*

SIMULATE THE INTERACTION OF BENIGN PROSTATIC HYPERTROPHY TO THE URETHRA, BLADDER BOTTOM AND VAS DEFERENS

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Abstract: Benign prostatic hypertrophy in men when they are older has been a very common problem not only in Vietnam but also a worldwide problem. Benign prostatic hypertrophy causes difficulties in patients' daily activities such as urinary obstruction and irritation. The aim of this study is to investigate benign prostatic hypertrophy that interacts with the urethra, bladder bottom and vas deferens by finite element method, with ANSYS program. The simulation results show the displacement and distortion of the urethra when being blocked by the leaves of the prostate in the five calculated cases. In addition, the results of studies on the interaction process between the prostate gland and the bladder can help scientists build a theoretical basis for inflammation of the bottom or neck of the bladder. Furthermore, the problem of flow in the urinary tract segment experiencing the deformation caused by benign prostatic hypertrophy is also studied in this paper, to explain symptoms of weak urine and several time urination.

Keywords: *benign prostatic hyperplasia (BPH), urethra, bladder bottom, vas deferens, finite element method (FEM)*

IN SILICO ASSESSMENT OF THE IMPEDANCE PARAMETERS OF TISSUE USING A 3-D FINITE ELEMENT MODEL TO DETECT BREAST CANCER

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Abstract: The early diagnosis benefits the greater efficiency of the curing of breast cancer. One of the modalities for detection of abnormal tissue in present days is electrical impedance myography (EIM). EIM is a non-invasive electrophysiological technique, using high frequency, low-intensity electrical current to derive voltage at the positions of sense electrodes. A Comsol Multiphysics-based finite element model was carried out in order to build 3D model of breast tissue for computational simulation of mentioned technique. EIM parameters of breast tissue involving resistance, reactance, phase angle in case of malignant tissue were calculated and compared with parameters of normal tissue. The results of the study showed some remarkable effects of tumor sizes, tumor positions and electrode positions on the EIM parameters, which can be considered for potential early detection.

Keywords: *finite element model, electrical impedance myography, breast cancer*

QUANTITATIVE OCT ANGIOGRAPHY OF RETINA VESSEL DENSITY FOR EARLY GLAUCOMA DIAGNOSIS

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Abstract: Glaucoma is one of the leading causes for irreversible blindness worldwide. Most of the glaucoma patients experience open-angle glaucoma (OAG), whose progression of the disease over a longer period and clear signs are opportunities for early diagnosis and treatment. OCTA is a promising non-invasive eye imaging diagnostic tool developed recently. The ability to identify microvascular in the retina and the choroid, shape and size of the optic disc area, especially the FAZ area (Fovea Avascular Zone), …provides information about structures to help ophthalmology doctor for diagnosing glaucoma, vascular obstruction, macular degeneration, … In particular, OCTA's ability to early diagnose open-angle glaucoma is highly appreciated in some recent studies. Through quantification of vascular density in the regions around the macula, inside the optic disc or especially the area around the optic disc called peripapillary area shows a significant decline in vascular density depends on the severity of the disease. Moreover, the division and calculation of the vascular density of areas in the peripapillary area, it is better to assess the condition of the disease. These studies have demonstrated the effectiveness of this method compared to previous methods such as visual field measurements and evaluation of retina nerve fiber thickness on OCT scans. Here, we design a GUI by MATLAB programming language and use OCTA images scanned peripapillary area as input. Through image processing algorithms to obtain a color-density map, we calculate the density of areas of interest. This result will greatly support the early diagnosis of this leading blind disease.

Keywords: *OCT, Angiography, Retina Vessel Density Glaucoma*

PHÂN BAN: VẬT LÝ TÍNH TOÁN

SESSION: COMPUTATIONAL PHYSICS

CONTROLLING ELECTRONIC TRANSPORT PROPERTIES OF SAWTOOTH PENTA-GRAPHENE NANORIBBONS BY DOPING POSITION

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Abstract: Electronic and transport properties of the doping sawtooth penta-graphene nanoribbons (P-SPGNRs) at eleven distinct positions are systematically investigated by using the density-functional theory in combination with the non-equilibrium Green's function formalism. All samples are optimized using DFT calculations within the generalized gradient approximation (GGA) of Perdew Burke Ernzerhof (PBE). The electronic and transport properties such as band structure, density of states, transmission spectrum and Volt-Ampere characteristics are computed. Our result shows that electronic structures and currents of the studied samples will be strongly effected by doping position. Specifically, current intensity of P-SPGNRs is more eight orders comparing to SS-PGRP pristine and I-V characteristic shows four changing trends. This study helps guide the selection of I-V rules in atom-doped penta-graphene nanoribbons.

Keywords: *transport properties, penta-graphene nanoribbons, density-functional theory, non-equilibrium Green's function*

QUANTUM DESIGN FOR PROBING MOLECULAR CHIRALITY THROUGH ENANTIOMER-SPECIFIC COHERENT PI-ELECTRON ANGULAR MOMENTUM

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Abstract: Molecular chirality, right-handed or left-handed chiral molecules, is the fundamental concept in stereochemistry and biochemistry. Biomolecules in nature have specific molecular chirality, e.x., amino acids have L-enantiomers, and sugars have D-enantiomers, while synthesized chiral molecules have both L-, D-enantiomers equally, called racemic mixture. Thus, investigation of probing molecular chirality is very important. The conventional theory of optical activity measurements, circular dichroism (CD) and optical rotatory dispersion (ORD) spectroscopy are derived in the second-order processes involving electric and magnetic dipole moments and the signals are very weak. In this talk we present an efficient laser control scheme for probing the enantiomers of chiral aromatic ring molecules by using two linearly polarized (LP) intense UV lasers. We utilized dynamic Stark effect (DSE). Two electronic excited states are subject to the dynamic Stark shift, and the degeneracy induced by two LP intense stationary lasers generates unidirectional π-electron angular momentum pulse trains, which are specific to molecular chirality. A pair of enantiomers of phenylalanine, one of the essential amino acids, is considered to demonstrate numerical simulations of enantiomer-specific coherent angular momentum. Enantiomer-specific coherent magnetic fluxes of a few tesla order can be generated in several tens femtoseconds.

Keywords: *Molecular chirality, pi-electron rotation, dynamic Stark effect, coherent magnetic flux*

VIBRATIONAL EFFECTS TO UNIDIRECTIONAL PI-ELECTRON ROTATION IN AN AROMATIC RING MOLECULE WITH LOW-SYMMETRY

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Abstract: Recently we proposed a new lasers-control scheme for unidirectional pi-electron rotation in an aromatic ring molecule with low-symmetry having no degenerate electronic states. In this control scheme we assumed a fixed nuclei condition, and two relevant excited states subject to dynamic Stark shift using two linearly polarized UV lasers. Each laser is set to selectively interact with one of the two electronic states, the lower and higher excited states are shifted up and down with the same detuning, respectively, and two excited states become degenerate at their midpoint. In this presentation for more realistic numerical simulation of unidirectional pi-electron rotation, we take into account the nuclear vibrational effect in a molecular system. The total wave function is separated into electronic and nuclear parts under the B.O. approximation. The vibrational states in each excited state follow the Franck-Condon principle. It is also interesting to investigate the interactions between the relevant two electronic states through the vibronic (non-adiabatic) couplings, and the vibronic couplings through the breakdown of the B.O. approximation can be estimated at the equilibrium nuclear distance. We demonstrate a result of numerical simulation and discuss how the nuclear vibrations affect the unidirectional pi-electron rotation.

Keywords: *pi-electron rotation, dynamic Stark effect, nuclear vibration, UV laser*

FRICTION AND FRICTION HEAT STUDY OF MICRONSCALE MATERIALS BY PARTICLE COARSE-GRAINING AND SMOOOTHED PARTICLE HYDRODYNAMICS SIMULATION

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Abstract: In this work, friction and friction heat of micronscale materials such as iron, alumina, hematite, silica are investigated by particle coarse-graining and (adaptive) smooothed particle hydrodynamics. Friction of alumina coatings on relatively sliding iron contacts is also investigated via percentage of covered area and roughness of covered layer. Properties monitored in the study are friction force, normal force, friction coefficient, heat generated by friction, and influences of sliding velocity, external applied normal load and coating on friction.

Keywords: *Friction, Heat friction, micronscale materials, particle coarse-graining, SPH simulation*

THEORETICAL EVALUATION OF SINGLE WATER CATALYSIS IN GAS PHASE REACTIONS

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Abstract: In atmospheric chemistry, studies have mentioned that possibility of clustering with water molecules to help enhance the reactivity. In this study, we will theoretically evaluate gas phase reactions where one can and cannot see enhancement by the addition of single water to the reaction. We will first look at the H-abstraction reaction of OH radical and alcohols, which was erroneously claimed to show water enhancement. Here we will show that just using electronic energies can give the wrong information and that the proper evaluation of the free energy is required. Then we will look at reactions involving Criegee intermediates, which are important oxidizing agents in the atmosphere. For these species, we saw a large enhancement in the reaction rate by the participation of a single water molecule. The water molecule acts as a bridge to connect the two active sites of the reactants.

Keywords: *quantum chemistry, free energy, hydrogen bond*

BAND GAP ENGINEERING OF SILICENE NANORIBBONS: A STUDY OF DENSITY FUNCTIONAL TIGHT-BINDING THEORY

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Abstract: We investigate the electronic properties of the silicene nanoribbons (SiNRs) with either zigzag edge (ZSiNRs) or armchair edge (ASiNRs) by using density functional tight-binding theory. We predict that, ZsiNRs and 3p+2 AsiNRs and have flatband, independent of dimer line. However, the band gap of 3p and 3p+1 AsiNRs increases from 0.25 eV to the maximum value of 0.80 eV when decreasing the number of dimer lines. Futhermore, pDOS calculation shows that the contribution of only p-orbitals of edge-Si.

Keywords: *ZSiNRs, ASiNRs, band gap*

DFT STUDY ON ADSORPTION OF VOLATILE ORGANIC COMPOUNDS ON SILICENE

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Abstract: Cancer can be regarded as a rising threat towards modern societies. Detecting cancer at an early stage significantly improves the curability of the disease; unfortunately, currently available methods for early diagnosis of cancer are scarce and inefficient. In fact, the concentration of Volatile Organic Compounds (VOCs) in cancer patients in the breath is different from that in normal people. Therefore, the development of new sensors that can detect VOCs at the early stage of cancer with low concentrations, is desirable. 2D materials are expected as attractive materials for these sensors due to their large surface area to volume ratio. In this work, we investigated the adsorption mechanism of some small-to-medium VOCs on the surface of silicene by the quantum simulation method. The images of the potential energy surfaces for different positions of the adsorbate on the silicene surface were explored by Computational DFT-based Nanoscope for determination of the most stable configurations and diffusion possibilities. The adsorption energy profiles were calculated by three approximations of van der Waals interation: revPBE-vdW, optPBE-vdW, and vdW-DF2. It is found that the adsorption energies of the VOCs in question vary in the range of 0.6-1.0 eV, which indicates that silicene is considerably sensitive with these VOCs. The charge transfer between the substrate and VOCs was also addressed.

Keywords: *Cancer Detection, Volatile Organic Compound, Adsorption, Silicene, Computational Physics*

FIRST PRINCIPLES PHONON INVESTIGATION OF H ON PT SURFACES

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Abstract: Phonon investigation provides useful information for investigating variety of properties of materials, such as phase transition, thermal and mechanical characters. The phonon frequency and zero point energy were studied for the adsorption of hydrogen on the different platinum surfaces using the first principle calculation. Via the DFT calculated information of phonon, the most stable sites of H interaction on Pt surface have been showed.

Keywords: *Computational physics, DFT calculation, phonon frequency, H adsorption*

OXYGEN REDUCTION REACTION ON FEIII-PORPHYRIN

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Abstract: Proton exchange membrane fuel cells are considered to be promising clean energy converters, due to their high efficiency and low emissions. However, improving the slow kinetics of the oxygen reduction reaction (ORR) on the cathode to achieve the performance at a practical level is an important task. The ORR on nitrogen and Fe–based macrocycles have attracted much attention due to their excellent activity and selectivity. By using density functional theory and Norskov's thermodynamic model, we study the ORR activity and mechanism on FeIII-porphyrin.

Keywords: *Computational Physics, oxygen reduction reaction, FeIII-porphyrin*

EXTRACTING THE IONIZATION RATE FROM PHOTOELECTRON MOMENTUM DISTRIBUTION INDUCED BY CIRCULARLY POLARIZED LASER PULSE

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Abstract: Extracting target structure and dynamics information from high-order harmonic spectra and photoelectron momentum distributions (PEMDs) generated in the ionization of atoms and molecules by intense low-frequency laser pulses is one of the fundamental goals of strong-field physics. A powerful technique of tomographic imaging of molecular orbitals is established in high-order harmonic spectroscopy [1]. Photoelectron spectroscopy suggests several complementing approaches of two kinds, depending on whether rescattered or direct photoelectrons perform imaging. Rescattered photoelectrons recollide with the parent ion before arriving at a detector [2], so their contribution to strong-field PEMDs bears information on the target collisional properties. One widely used approach in rescattering photoelectron spectroscopy focuses on the high-energy part of PEMDs dominated by nearly backward rescattered photoelectrons [3]. The contribution of direct photoelectrons to PEMDs contains information on the tunneling ionization process and, through this, on the ionizing orbital. While in rescattering photoelectron spectroscopy linearly polarized laser pulses are usually used, to force a photoelectron to return to the parent ion for recollision, for the observation of direct photoelectrons it is preferable to use circularly polarized pulses to eliminate rescattering [4] which contaminates tunneling observables. Thus, circular polarization is essential for accurate measurements of tunneling ionization rates of molecules [5]. In this report, we introduce the possibility to extract the ionization rates from the PEMDs induced by circularly polarized laser pulse based on the adiabatic theory [7,8]. The molecular hydrogen ion in different states is used for illustration.

Keywords: *Adiabatic theory, ionization rate, photoelectron momentum distribution, circularly polarized laser*

ERYTHROMYCIN, CETHROMYCIN AND SOLITHROMYCIN DISPLAY SIMILAR BINDING AFFINITIES TO THE E. COLI'S RIBOSOME: A MOLECULAR SIMULATION STUDY

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Abstract: Macrolide antibiotics bind to the exit tunnel of the ribosome and inhibit protein synthesis blocking its translocation. Thus, antibiotics including the known macrolide Erythromycin (ERY) are active against bacteria. However, at present, some bacteria show resistance to drugs, which requires the development of new powerful antibacterial agents. One possible way is to use the ERY structure, but change its side chains, while the size of the lactone ring can remain unchanged or change. In this work we consider Cethromycin (CET) and Solithromycin (SOL), which are ketolides with quinolylallyl group at C6 and aminophenyl at C11, respectively (both of them have the same lactone ring as ERY). Experiments have shown that these ketolides have improved efficacy against pathogens, but their binding affinity to the E. coli's ribosome is almost identical. To clarify this issue, we have studied in detail the binding mechanisms of ERY, CET and SOL using the docking and molecular dynamic simulations. In agreement with the experiments, we showed that these compounds have similar binding affinities. Desosamine and lactone ring groups play a critical role in the binding of ERY to the ribosome. In CET and SOL, the contribution of keto and alkylaryl groups is balanced by cyclic carbamate. We have demonstrated that increased fluctuations in the ribosomal residues at the binding site led to an increase in the entropic term in the free binding energy of ERY compared to SOL and CET. The alkyl-aryl arm of both ketolides strongly interacts with A-752 and U-2609. In addition, the presence of macrolides in the exit tunnel can alter the conformation of U-2585, which is located in the peptidyl transferase center, through non-bonded interaction. Therefore, the side chain of ketolides affects not only the binding site but also other residues possibly leading to a strong effect on the protein synthesis process. We predict that to combat bacterial mutations, it is necessary either to design a bulk and charged group as a cladinose, or to use several groups with different signs of charges. This prediction can be used for the development of new efficient antibiotics.

Keywords: *computational physics, antibiotics, molecular simulation*

MECHANISM OF OXYGEN REDUCTION REACTION ON DEFECT TRANSITION METAL DICHALCOGENIDE WTE2

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Abstract: Proton-exchange membrane fuel cells are potential technologies that can replace fossil fuel combustion engines, but their performance needs to be improved due to the slow rate of oxygen reduction reaction on the cathode. In this paper, we investigate the mechanism and the reaction rate of the oxygen reduction reaction on the monolayer of transition metal dichalcogenide WTe2 with a vacancy (WTe2d) as the cathode catalyst of the fuel cells. By using the density functional theory calculations, we study the reaction intermediates on the surface of WTe2d. The Gibbs free energy calculations are used to clarify the thermodynamic properties of the reaction.

Keywords: *Computational Physics, Oxygen Reduction Reaction, WTe2, Density Functional Theory*

INFLUENCES OF PHENOL SUBSTITUTION IN LINEAR FE III - PORPHYRIN MONOMER ON MECHANISM AND ACTIVITY OF OXYGEN REDUCTION REACTION

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Abstract: The low rate of the oxygen reduction reaction (ORR) on the cathode is one of the most critical issues for an effective proton exchange membrane fuel cell. The knowledge of the ORR mechanism and activity on the cathode' surface is important to improve the rate of the ORR. In this research, we investigate the mechanism and activity on the catalyst of phenol-substituted linear FeIII-porphyrin monomer (FeMOH) by using the density functional theory in combination with thermodynamics model. The obtained results are then compared with those of the linear FeIII-porphyrin.

Keywords: *Computational Physics, Oxygen reduction reaction, Phenol substitution in linear Fe III - porphyrin monomer*

STUDYING ON FAILURE MECHANISM OF 2D GRANULAR COLUMNS: NUMERICAL EXPERIMENT

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Abstract: The failure mechanism of granular columns and the characteristics of this failure flows have been intersted in researching in recent years. In particular, the experiments in failure mechanism and failure flow of 2D granular column are not often 2D standard. Therefore, Cuong T. Nguyen et al. (2015) conducted research this problem based on 2D standard in the laboratory and developed a numerical computation model using SPH (Smooth Particles Hydrodynamics) method (Cuong T. Nguyen et al., 2017). This model has proven the reliability by verification of calculation and experimental results. In this paper, the developed numerical model is used to perform a series of numerical experiments that some are difficult or impossible to obtain accurate results by physical experiment model to re-examine the previously identified characteristics and find out the rules more general of this failure flow.

Keywords: *Granular Flow, 2D Granular Column, Failure Mechanism, Numerical Experiment, Characteristics of Flow*

MELTING OF TWO-DIMENSIONAL SIC

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Abstract: Spontaneous melting of a perfect monolayer honeycomb structure of Silicon Carbide model in 2D space is studied via molecular dynamics simulation. The model containing 11040 atoms interacted via Vashishta potential is heated up from 50 K to 4500 K in order to see the evolution of various thermodynamic quantities, structural characteristics and occurrence of various structural defects. We find that spontaneous melting of our silicon carbide model in 2D space exhibits a first-order behaviour of the transition from solid 2D silicon carbide sheet into a ring-like and chain-like structure 2D liquid. The occurrence of breaking of bonds are the first step of the melting process followed by occurrence/growth of various types of multimembered rings and chains. These defects occur homogeneously throughout the system. The occurrence of small ratio of Stone–Wales defects during the melting process indicates that the melting scenario is inconsistent with the classical nucleation theory and the Berezinsky–Kosterlitz–Thouless–Nelson–Halperin–Young (BKTNHY) one. Spontaneous melting point of our silicon carbide model occurs at Tm = 4050 K.

Keywords: *Melting, Monolayer honeycomb structure, Two-Dimensional SiC*

USING RETICULAR CHEMISTRY TO DESIGN NEW ZEOLITIC IMIDAZOLATE FRAMEWORKS FOR CO_2 SELECTIVITY

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Abstract: Using the reticular chemistry designing method, we develop new zeolitic imidazolate framework (ZIF) structures with new topological categories: pth, pts, and ast. Different metalation is considered with Ni^{2+}, Cu^{2+}, Mn^{2+}, Co^{2+}, Zn^{2+}. Subsequently, density functional theory (DFT) calculations are employed to verify structural and mechanical stability of each structure. More specifically, ast and pts networks are unstable because of negative phonon modes. Then, the mechanical stability is examined by analyzing the elastic tensors (Cij), and we obtain four stable structures: pth-1 (NiMn), pth-2 (NiCo), pth-3 (NiZn), and pth-6 (CuZn). From electronic structure analysis, the first two structures are shown to exhibit strong magnetism, whereas the latter are weakly or non-magnetic. Finally, the uptake of CO_2 versus N_2 within pth-1 and pth-3 are estimated by conducting grand canonical Monte Carlo simulations. For both cases, the uptake of CO_2 dominantly outreaches that of N_2 at the pressure < 1 bar, which shows a good potential in CO_2 capture and selectivity.

Keywords: *DFT, ZIF, GCMC*

FIRST-PRINCIPLES THEORETICAL STUDY ON ELECTRONIC PROPERTIES AND CHEMICAL REACTIONS AT SURFACES AND INTERFACES

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Abstract: First-principles electronic structure method is a quite powerful tool to elucidate electronic properties and chemical reactions at surfaces, interfaces and in solutions at the atomic level. In this talk, I will discuss topics recently investigated in our group. The first one is on the activation and hydrogenation of CO_2 over Cu catalyst. Adsorption and reaction of CO_2 on solid surfaces are attracting growing interest because of their importance in industrial, energy and environmental management. We investigated CO_2 adsorption, dissociation, and hydrogenation on Cu surfaces using van der Waals density functionals as implemented in our home made STATE (Simulation tool for Atom TEchnology) program code. As the second topic, we will discuss the enhancement of NO dissociation by hydrogen bonding on Cu surfaces, which is very important in the application for automobile emission control. We will discuss origin for the weakening of N-O bond by hydrogen bonding. Finally, we will discuss the electronic and chemical properties of graphene-related materials. Graphene is attracting enormous attention due to its outstanding electrical, mechanical, thermal and chemical properties. Understanding of the interactions of graphene with other atoms, nano-particles, or molecules is indispensable in order to find novel or improved usage of graphene in wide range of applications.

Keywords: *Nitric Oxide, CO_2 hydrogenation, Graphene, Density Functional Theory, Computational Physics*

INFLUENCE OF THE DYNAMIC CORE-ELECTRON POLARIZATION ON THE ODD-EVEN HIGH-ORDER HARMONIC GENERATION FROM POLAR MOLECULES IN LINEARLY POLARIZED LASER FIELDS

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Abstract: High-order harmonic generation (HHG) is a nonlinear effect, which occurs when an intense ultrashort laser interacts with atoms or molecules [1]. HHG reveals many applications in probing the structure of matter [2], molecular tomography [3], and generating attosecond pulses [4]. Most of works have been centered on investigation of HHG from atoms or symmetric molecules, which its spectra contain only odd harmonics [5]. For polar molecule in linearly polarized laser, the HHG spectra contain both odd and even harmonics as a consequence of symmetry-breaking of the molecule-field system [6]. In this report, we study the influence of the dynamic core-electron polarization (DCeP) on the odd-even high-order harmonics from the polar molecules by directly solving the time-dependent Schrödinger equation in the framework of single-active-electron model. The results show that the DCeP effect affects noticeably for the odd harmonics only, but does not change the behavior of even ones. The correlation between the even-to-odd ratio and the permanent dipole of the polar molecules will be discussed in detail.

Keywords: *Computational Physics, ultrashort laser, dynamic core-electron polarization, even harmonics, even-to-odd ratio*

STRUCTURAL PROPERTIES OF AMORPHOUS GERMANENE-A VIEW FROM MOLECULAR DYNAMICS SIMULATION

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Abstract: Germanene, a two- dimensional (2D) honeycomb structure material, has been under an intensive investigation by both experiments and computer simulations due to its potential applications in nanotechnology. We have successfully simulated a 2D structure of amorphous germanene using molecular dynamics simulation. The model contains 6400 atoms and has a fixed length in the z-direction which equals to the buckling length of 0.7Å with the elastic reflection behavior boundary. Our simulations suggest that 2D amorphous germanene can be synthesized from the liquid state using Stillinger-Weber (SW) potential. Here, the structural properties of the model are investigated by a combination of radial distribution functions (RDFs), coordination numbers, ring statistics, interatomic distances, and bond-angle distributions. We also show the 2D visualization of the atomic configurations.

Keywords: *amorphous germanene, molecular dynamics simulation, honeycomb structure*

EFFECTS OF ORGANIC MOLECULE ADSORPTION ON ELECTRONIC PROPERTIES OF MoS2 MONOLAYER

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Abstract: The molybdenum disulfide (MoS2) monolayer is a two-dimensional semiconductor of the transition metal dichalcogenides, which is of great interest in electronic applications. The understanding of the electronic properties of monolayer MoS2 under the adsorption of organic molecules is important for the successful applications of MoS2. In this work, by using the density functional theory calculations, we demonstrate that the electronic properties such as the band gap of the monolayer MoS2 are modified when the system physically interacts with different organic molecules.

Keywords: *Computational Physics, Monolayer MoS2, Density Functional Theory, Electronic Properties, Organic Molecules*

DENSITY FUNCTIONAL THEORY STUDY ON FORMATIONS OF NO DIMER AND NO TRIMER ON CU(111)

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Abstract: Recently, Shiotari et al experimentally suggested that NO unexpectedly adsorbs in an trimer configuration on Cu(111) by the scanning tunneling microscopy observations.1 Their finding is then verified by electron energy loss spectroscopy (EELS) which proposed that NO molecules in NO trimer are inclined from the surface normal owing to intermolecular interactions of the adsorbates.2 To provide mechanistic insights into the unusual formation of NO trimer on Cu(111), we herein study the formations of NO dimer and NO trimer on Cu(111) by mean of a plane-wave pseudopotential density functional theory within vdW-DF method. We find that the NO monomer preferably adsorbs in an upright configuration at the fcc-hollow site, whereas all NO molecules of the NO dimer and trimer are in inclined configurations at the neighboring fcc-hollow sites due to short-range attractions between molecules. The NO trimer is always the most stable among (NO)n (n = 1 – 3) on Cu(111), which is consistent with the experiment.1,2 Vibrational analysis also reveals that the N-O stretching mode shifts up from 179 meV of NO monomer to 190 meV of NO trimer, and the latter mode agrees much better with the EELS data (~190 meV). The origin of the unique behavior of NO on Cu(111) is attributed to enhancements of $2\pi^*$ orbitals couplings when the trimeric adsorption on Cu(111) takes place.

Keywords: *Nitric Oxide Adsorption, Density Functional Theory, Computational Physics.*

MOLECULAR-DYNAMICS STUDY ON PRESSURE-INDUCED STRUCTURAL CHANGES IN AMORPHOUS SILICON

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Abstract: Amorphous Si possesses the tetrahedrally-coordinated amorphous network at ambient pressure and exhibits a semiconducting property. On the other hand, the coordination number (CN) increases with pressure and finally high-density amorphous Si with a metallic property is formed. This structural changes are known as polyamorphism and examined experimentally and theoretically by radial distribution function analysis [1,2]. However, there are no detailed structure analysis, such as partial pair-distribution functions and partial bond-angle distribution functions, and the details of phase transformation have not been clarified yet. In this study, we examined the structural change of amorphous Si using molecular dynamics study (MD). Amorphous Si was prepared by melt-quench methods, and then the as-quenched atomic configurations were pressurized. It was found that the first peak in the pair-distribution function shifts to the longer distance side with increasing pressure. On the other hands, the second peak split to the peaks of 3.0 and 3.8 Å, and eventually the former peak becomes dominant. The change in the first peak is due to the decrease in bonding strength per atom with increasing CN, and the change in the second peak is due to the change in bonding angle to 80° from 109° tetrahedral angle.

Keywords: *amorphous Si, phase transformation, molecular dynamics study (MD)*

THE PERTURBATION OF MATERIAL DENSITY IN F(R) MODIFIED GRAVITY OF POLYNOMIAL EXPONENTIAL FORM

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Abstract: In this paper, we investigate the linear perturbation of material density of universe in f(R) modified gravity of polynomial exponential form on the scale of distance below the cosmic horizon (sub-horizon). The results show that the model for the evolutionary universe is slightly different from that in the ΛCDM standard cosmological model. They can be used to show the difference of this modified gravitational model with the ΛCMD standard cosmological model and other cosmological models. We also investigate the rations Ψ/ Φ and Geff / GN in the model and show that they are within allowable limits of experiments.

Keywords: *Computational Physics, The growth index of universe, Polynomial exponential form*

ON-SURFACE SYNTHESIS OF ORGANIC MOLECULES ADSORBED SINGLE ATOMS USING SCANNING TUNNELING MICROSCOPY

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Abstract: Organic molecules have been attracted to provide a variety of properties by inserting desired species inside a molecule cage. For example, metal-free phthalocyanine (H2Pc) can be magnetized by inserting magnetic atoms inside, e.g., FePc or MnPc. Such metallization has been done by chemical liquid methods, while the inserted atom locates always at the center of the Pc.

However, recently, new metallization has been eamined in ultra-high vacuum (UHV) condition. In this study, we demonstrated on-surface synthesis of Fe-H2Pc complexes using scanning tunneling microscopy (STM) in UHV at 5 K. An atomically-flat clean Cu(111) substrate was used. Single Pc molecules and Fe atoms are co-evaporated on the Cu(111) at cryogenic temperature. Using the STM tip, we succeeded to adsorb the atom at desired atom position inside the Pc molecule. We show unique properties, such as Kondo peaks, of the UHV-synthesized molecules.

Keywords: *Scanning tunneling microscopy, phthalocyanine, atom, organic molecule, manipulation*

VOCs ADSORPTION ON 2D MATERIALS: TOWARDS THE DETECTION OF LUNG CANCER AT EARLY STAGE

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Abstract: Screening tests to detect lung cancer at an early stage is very important for localizing the cancer cells and significantly improving the possibility of the curability of the disease. Human breath contains violate organic compounds (VOCs) as clinically useful markers which can be detected by electronic sensors. The monolayer materials such as MS2 (M=Mo,W, etc) and the two- dimensional (2D) materials such as graphene, silicene, germanene, etc. are strongly expected to be promising materials for the electronic sensors in detecting the VOCs because these materials exhibit a very high sensitivity in adsorption of gases.

In this talk, the adsorption mechanism of various VOCs on 2D materials such as MoS2, silicene, graphene, borophene, germanene by using the quantum simulation method based on Density Functional Theory (DFT) will be presented. Scanning images of the adsorption possibility are shown for the several types of VOCs in breath of lung cancer patients on these materials by using Computational DFT-base Nanoscope to determine the potential energy surfaces, potential adsorption areas and the diffusion path of VOCs on 2D materials. The adsorption energy is calculated with employing five functionals of van der Waals interaction: vdw-revPBE, vdw-optPBE, vdw-optB88, vdw-optB86b and DFT-DF2. Charge transfer between 2D materials and VOC molecules is explored by calculating the Bader charge. The trend of adsorption is evaluated in respect of the chemical functional group of VOCs.

Keywords: *Computational Physics, 2D materials, gas sensors, adsorption, VOCs*

CO_2 CAPTURE IN METAL ORGANIC FRAMEWORK MIL-88S BY COMPUTATIONAL METHODS

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Abstract: Carbon dioxide (CO_2) is a main gas causing the greenhouse effect and global warming. Therefore, the minimization of CO_2 emissions is an important task. Many studies of CO_2 capture by using metal organic frameworks have been performed. MIL-88s has a high flexibility and stability. However, there are no available works for the study of the CO_2 capture in MIL-88s. In this work, density functional theory and grand canonical Monte Carlo simulations were applied to elucidate the CO_2 adsorption in MIL-88s and assess the CO_2 capture ability of MIL88s. More detailed results will be presented at the conference.

Keywords: *Computational physics, Density functional theory, Metal organic framework*

MICROSTRUCTURAL PROPERTIES OF LIQUID LEAD SILICATE UNDER TEMPERATURE

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Abstract: The structural properties of liquid lead silicate PbSiO3 are investigated by means of molecular dynamics simulation using the Born-Mayer pairwise potentials. The simulations were performed on the systems with up to 5000 particles (1000 Pb, 1000 Si, and 3000 O atoms) prepared at different temperatures from 750K to 1000K at ambient pressure. The short and intermediate range order in liquid PbSiO3 are analyzed via pair radial distribution functions (PRDFs), coordination distribution, angular distribution. The evolution of structure of liquid PbSiO3 was observed and discussed. Calculations show that the size and shape of SiOx (x=4,5) and PbOy (y = 3, 4,5) units are almost not dependent on temperature. However, the fraction of PbOy units are slightly dependent on temperature. The intermediate range order is also discussed in this work.

Keywords: *Computational Physics, microstructure, silicate materials, under temperature, molecular dynamics*

MICROSTRUCTURE OF LIQUID LITHIUM SILICATE UNDER PRESSURE

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Abstract: The microstructural characteristics of liquid lithium silicate (Li_2SiO_3) are investigated by means of molecular dynamics simulation using the Born-Mayer pairwise potentials. The simulations were performed on the systems with up to 2025 atoms (consist of 750 Li, 375 Si, and 1125 O atoms) at 3200K in the 0-30 GPa pressure range. The microstructure of liquid Li_2SiO_3 are analyzed via pair radial distribution functions (PRDFs), coordination distribution, angular distribution. The results shown, the structure of the liquid lithium silicate consist the basic structural units TO4 (T= Li, Si) at ambiet pressure and this units decrease as the pressure increases. Besides, the shape and size of the basic structural units are slightly dependent on pressure. Calculations also show that calculated data agree well with the experimental ones.

Keywords: *Computational Physics, microstructure, silicate materials, under temperature, molecular dynamics*

SAMPLING THE FOLDING TRANSITION STATE ENSEMBLE IN A TUBE-LIKE MODEL OF PROTEIN

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Abstract: We used the tube model with Go-like potential for native contacts to study the folding transition of a designed three-helix bundle and a designed protein G-like structure. It is shown that both proteins in this model are two-state folders with a cooperative folding transition coincided with the collapse transition. We defined the transition states as protein conformations in a small region around the saddle point on a free energy surface with the energy and the conformational root mean square deviation (rmsd) from the native state as the coordinates. The transition state region on the free energy surface then was sampled by using umbrella sampling technique. We show that the transition state ensemble is broad consisting of different conformations that have different folded and unfolded elements.

Keywords: *Computational Physics, Go-like potential, tube model*

VIBRATION EFFECT ON THE EXTRACTED MOLECULAR STRUCTURE FROM LASER-INDUCED ELECTRON DIFFRACTION

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Abstract: It is well-known that the laser-induced electron diffraction (LIED) contains molecular structural information which can be extracted with a spatial resolution of angström and time resolution of few femtoseconds [1, 2]. The retrieval is based on the quantitative rescattering method (QRS) allowing the LIED signal to be split into two components [3], one of which is a laser-free differential cross section (DCS) containing molecular structure. The method based on fitting the experimental DCS extracted from the LIED spectra to the theoretical DCS calculated with assumed initial structure parameters then allows one to reveal the real molecular structures. The theoretical DCS of molecules is treated within the independent atoms model (IAM) [1, 4] or the more advanced model based on the multiple scattering theory (MS) [2, 5].

In this report, we talk about how to consider the molecular vibration effect to the MS model and examine this effect of molecular vibrations on the DCS by comparing the oscillation component with the component of the MS second order describing the interference of the scattering waves. We perform an application of the developed theory for some diatomic molecules.

Keywords: *electron induced diffraction spectra, molecular vibration effect, laser-induced electron diffraction*

THE INTERACTION OF DERIVATIVES OF BEXAROTENE WITH MULTI-TARGET FOR ALZHEIMER'S DISEASE

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Abstract: In 2012, Cramer et al. reported that bexarotene shows a great efficacy in reducing amyloid beta plaques in mice models of Alzheimer's disease (AD) but many later studies have shown that bexarotene cannot clear amyloid aggregates due to their weak interaction using in silico and in vitro experiments. For improving mentioned feature of bexarotene, we screened to obtain fifteen compounds in Binding BD having similarity at least 81% of chemical and structural with bexarotene and calculated using the steered molecular dynamics (SMD) either the rupture force Fmax in the force-extension/time profile or the non-equilibrium work, Wpull, of derivatives of bexarotene for three targets (amyloid beta fibril, peroxisome proliferator-activated receptor gamma (PPARγ), retinoic X receptor alpha (RXRα). The results showed that Wpull of derivatives of bexarotene for PPARγ, RXRα targets is larger than Aβ target in comparison with bexarotene; meanwhile for Aβ target, Wpull of derivatives of bexarotene is not significantly larger than Wpull of bexarotene. With further investigations mentioned derivatives of bexarotene could be considered as potential candidates for clearing amyloid aggregates.

PHÂN BAN: CƠ KỸ THUẬT

SESSION: ENGINEERING MECHANICS

EVALUATING ON FLOODING AREA AND TIDAL BEACH CHANGE IN QUANG NINH COASTAL ZONE DUE TO SEA LEVEL RISE

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Abstract: The sea level rise (one of main consequences of the Climate change) can cause many negative effects, such as flooding, saline intrusion, beach erosion …, on coastal zones. In order to have reasonable measures and policies to utilize efficiently and exploit sustainably coastal zones, it is necessary to predict well changes in hydrodynamics and environment there.

Quang Ninh, located in the east – north part of Vietnam, is one of the vulnerable coastal provinces under the heavy affects due to the sea level rise. In this study, the changes of flooded areas and tidal beaches due to the sea level rise are evaluated on the basis of the climate change scenarios (CP4.5, RCP8.5) in the period from 2020 to 2100, by using the numerical modelling. The changes of flooded area and tidal beach in Quang Ninh coastal zone are considered not only statically by changing of water sea levels but also due to changing of the tidal range in this area. The calculated results point out that districts under the most affect of the sea level rise are Mong Cai, Hai Ha ...

Keywords: *Sea level rise, tidal beach, numerical model*

SOME STATISTICAL TECHNIQUES APPLIED TO ENGINEERING MECHANICS PROBLEMS

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Abstract: This article deals with numerical techniques popularly used in Engineering. Variables or parameters in Problems of Engineering Mechanics always face set of data: a) of materials (with technical specification); b) of analysing model using specific software; c) of measurement using variety of devices and approaches; and d) of the technology process of manufacture (outcome). An engineering object to be studied has k variables and each variable has m values or level of status, it will need m^k cases to be solved. This results in a too large number of test cases to be solved for the problem and target objective(s). A Taguchi Method will be applied for finding solution in which much less effort of computation is paid and other different conditions of noise could be taken into account. Besides, other statistical tools have also proved to be useful in quantifying uncertainties in engineering problems, both in aleatory (nature) and epistemic (knowledge and measurement) categories. A typical example of engineering problem is chosen to study using above-mentioned Taguchi method and statistical tools. This method is very useful for design of experiments, both in traditional laboratory and computer modeling laboratory and it can used to optimize the set of input data for obtaining the best results of outcome product.

Keywords: *Taguchi method, orthogonal matrices, noise, degree of freedom, ANOVA*

ASYMPTOTIC SINGULAR BEHAVIOR OF PLANE STRAIN SOLUTIONS FOR THE DOUBLE SHEARING MODEL IN THE VICINITY OF FRICTIONAL INTERFACES

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Abstract: Frictional interfaces are a souse of singular solutions in quasi-static flow of rigid plastic solids. In the case of hyperbolic systems of equations comprising the yield criterion, flow rule and equilibrium equations, singular solutions appear if an envelope of characteristics coincides with the friction surface. The singularity in solution behavior can be used for developing a new method of predicting the evolution of material properties in a narrow layer of intensive plastic deformation. Such layers are often generated in experiments and industrial processes. Application of the method is restricted by the lack of numerical solutions that are capable of describing the singular nature of the exact solutions. Presumably, an efficient numerical method to deal with singular solutions should be based on the theory of characteristics. In order to develop such a method, it is necessary to derive the exact asymptotic representation of solutions in the vicinity of singular surfaces in characteristic coordinates. The present paper provides such a representation for planar flow of materials obeying the double shearing model.

Keywords: *friction, singularity, double-shearing model, planar flow*

LARGE DEFLECTION OF CANTILEVER FUNCTIONALLY GRADED SANDWICH BEAMS UNDER END FORCES BASED ON A TOTAL LAGRANGE FORMULATION

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Abstract: A two-node beam element for studying large deflection of cantilever functionally graded sandwich (FGSW) beams under end forces is formulated in the context of total Lagrange formulation. The beams consist of three layers, a homogeneous core and two functionally graded layers with material properties varying in the thickness direction by a power gradation law. Linear functions are adopted to interpolate the displacement field and reduced integral technique is applied to evaluate the element tangent stiffness matrix to avoid the shear locking. Newton-Raphson based iterative algorithm is employed in combination with arc-length control method to compute equilibrium paths of the beams. Numerical investigations are carried out for two cases of external load, a transverse point load and a moment, to show the accuracy of the element and to illustrate the effects of material inhomogeneity and the layer thickness ratio on the large deflection behavior of the beams.

Keywords: *Cantilever FGSW beam, large deflection, total Lagrange formulation, nonlinear beam element*

DEVELOPMENT OF WIRE SUSPENDED ROBOT SYSTEM (ARANEUS 2.0) FOR BRIDGE INSPECTION

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Abstract: This study addresses the development of a robot for inspection of old bridges. By suspending the robot with a wire and controlling the wire length, the movement of the robot is realized. An inspection method using an unmanned aerial vehicle (UAV) has been proposed. Compared to the method using an unmanned aerial vehicle, the wire-suspended robot system has the advantage of insensitivity to wind and ability to carry heavy equipments.The robot mounts a high-definition camera and aims to detect cracks on the concrete surface of the bridge using this camera. This makes it possible to install a high-definition camera and a cleaning function to find cracks that are difficult to detect due to dirt. Construction of developed robot system is introduced in this article.

Keywords: *Wire-driven robot, Bridge inspection system, Robotics*

THE MESHFREE RADIAL POINT INTERPOLATION METHOD FOR BUCKLING ANALYSIS OF STIFFENED PLATES BASED ON REFINED PLATE THEORY

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Abstract: The buckling analysis of stiffened plates by the meshfree radial point interpolation method is investigated. Most of the meshfree methods require background cells during numerical integration that is not suitable for the principle of the meshfree method. In this work, the Cartesian Transformation Method-CTM integration scheme was combined with the existing meshfree method to develop a new approach in which the background cell is removed during numerical integration, which results in the applicability of the method is improved. In present work, the approach is applied to the buckling analysis of composite stiffened plates using the refined plate theory. Various numerical examples were considered to demonstrate the applicability and accuracy of the proposed method.

Keywords: *meshfree, improved Radial Point Interpolation Method, Cartesian Transformation method, refined plate theory, aminated composite plates, buckling*

ANALYSIS OF CONCRETE BEAM UNDER BENDING BY QUASI-STATIC LOADING AND DYNAMIC LOADING

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Abstract: Structural design in practice is usually conducted with the assumption of quasi-static load, in which the inertial effect is omitted. The dynamic loading capacity is predicted by the static loading capacity and a safety factor. The assumption of quasi-static load is only valid if the loading process is slow, which is not appropriate in some practical cases, for example impact. In order to provide better view on this issue, the present work investigates the behavior of a simply supported beam under bending in two cases: a) quasi-static load and b) dynamic load. Differences between the two cases are demonstrated and analyzed by the loading capacity and the damage of the beam.

Keywords: *plain concrete beam, impact, loading rates, damage modeling, finite element analysis*

STRUCTURAL ANALYSIS FOR TUBULAR TOWERS OF HORIZONTAL AXIS WIND TURBINE

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Abstract: Nowadays, green energy is undergoing a revolution and wind power plays an important role in in this field because of it numerous benefits. To convert wind energy into electrical power, horizontal axis wind turbine (HAWT) is widely used. Wind tower has vertical structure, and mounts all components of the wind turbine on top such as rotor, nacelle and drive train components which can have significant effect on the efficient operation of a HAWT. In this study, the finite element analysis (FEA) is applied to analyze the behavior of tubular tower structure of the 5MW HAWT tower from National Renew Energy Laboratory (NREL). Several structural problems are performed including static, dynamic and buckling analyses. The numerical results are validated with FEA report from NREL. Finally, as a result, a general procedure for this typical structure is applied for tower structure of DeVie HAWT 100kW project at our laboratory.

Keywords: *Wind turbine tower, finite element analysis, static analysis, buckling analysis, modal analysis*

OPTIMIZATION OF LONG RANGE TRAJECTORY FOR A UNPOWERED FLIGHT VEHICLE

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Abstract: The report presents an optimization problem for long-range trajectory for unpowered controlled flight vehicle. The set problem is solved by gradient method using numerical simulation tools. The optimal long-range trajectory is selected from the trajectories created by the different sets of predetermined normal g-load factors as variables.

Keywords: *long-range trajectory, maximum range, normal load factor, simulation*

ON THE AERODYNAMIC INTERACTIONS ANALYSIS BETWEEN THE MAIN ROTOR AND THE HELICOPTER FUSELAGE

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Abstract: This paper develops a numerical method that is capable of analyzing the aerodynamic characteristic of the helicopter main rotor in considering the influence of fuselage. The method is based on an unsteady nonlinear vortex-lattice method that can be used to simulate the interactions among the helicopter components efficiently. To clarify the effect of the main rotor-fuselage interaction, the aerodynamic characteristics of the main rotor in consider the influence of fuselage is determined along with those of the combined main rotor-fuselage system. The paper also shows the velocity field and free wake model in several flight regimes. The fuselage is modeled as a streamlined object, which is discretized into the system of quadrilateral vortex panels. The no-penetration boundary condition is satisfied on the fuselage surface, and no vorticity is shed from the fuselage. The results obtained in this paper are validated against experimental data and some from previous numerical methods.

Keywords: *Helicopter rotor, rotor-fuselage aerodynamic interaction, vortex-lattice method*

DYNAMIC INVESTIGATIONS OF TWO-BODY MECHANICAL SYSTEM “A CONTROLLED AIRSHIP TOWED BY A VESSEL”

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Abstract: The air transportation system using lighter-than-air vehicle (airship) towed by a vessel allows a significant increase in the rate of payload on the airship. The airship is equipped with four or more control rotors (quadrotor/multirotor) to improve the stability of the airship when affected by the wind, at the same time the rotors ensures vertical take-off and landing. This transportation system promises to create a highly efficient, safe and environmental friendly flight vehicle, especially when it is used to carry sightseeing tourists from high altitudes. This article presents a computerized dynamics model and research results of two-body mechanical system "an airship towed by a vessel" with consideration of influence of wind from different directions. This is the basis for giving a lot of unknown warnings and useful recommendations for designers to ensure airships to fly in the desired trajectories.

Keywords: *dynamics and control, an airship towed by a vessels, airship with sightseeing tourists*

FREE VIBRATION OF A TENSEGRITY STRUCTURE BY USING SEM

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Abstract: Tensegrity structure is a structure which consists both of compressive and tensile elements without being restrained at the boundaries. The self-equilibrium state inside the tensegrity structure is the condition that builds the structure without any boundary condition necessity. The conventional Eigensystem solver cannot deal with this kind of structure since there are rigid body motions in the governing equations. The exact dynamic solution of tensegrity structure problems can only be obtained by using the frequency-dependent dynamic method. In this study, the free vibrational characteristics of a tensegrity structure which is modeled by a combination of the compressive strut and tensile cables elements is solved by using the Spectral Element Method (SEM). Natural frequencies of the tensegrity are tracked by using the Wittrick-Williams algorithm. Numerical calculations are given to show the effectiveness, efficiency, and accuracy of the SEM in solving the axially vibrating members of the tensegrity structures.

Keywords: *Free vibration, Tensegrity Structure, Self-Equilibrium, Frequency domain, Spectral Element Method*

A STUDY OF FRACTURE PROPAGATION BY PHASE FIELD METHOD IN DEAL.II WITH LOCAL REFINEMENT TECHNIQUE

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Abstract: Fracture propagation in elastic and porous media is still challenge topics in mechanical, energy, and environmental engineering. Many approaches for brittle fracture have gained increased interest from studies such as and phase field method and extended finite element method (XFEM). Distinguishing to model the discontinuities explicitly (like in the XFEM), the lower-dimensional crack surface approximated by a phase field function which introduces a diffusive transition zone (brittle or mushy-zone are also common expressions depending on the discipline) between the broken and the unbroken material is attractive trend in now and so on. In this paper, the phase field method will be used to model the fracture propagation at the small scale for elastic media. This method is doing well in DEAL.II with the help of local refinement technique which allows to study the fractured rock mass behaviour without prior knowledge of cracking propagation path and reduction of computational consumption. This implementation is applied to model a fractured rock mass in which a plenty of explicit fractures are distributed though total energy released by Griffith's criterion. Through this application, we demonstrate and highlight the performance of the phase field method with local refinement technique in model fracture propagation

Keywords: *fracture propagation, fractured rock mass, explicit modelling of fractures, phase field method, DEAL.II*

FATIGUE CRACK GROWTH UNDER COMPRESSIVE LOADING CONDITION

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Abstract: The applications of fracture mechanics have traditionally concentrated on crack growth problems under an opening or mode I mechanism with positive stress ratio ($R > 0$). However, there are some case of failures occur from growth of cracks subjected to compressive loading with negative stress ratio ($R < 0$). To reveal the mechanism of this failure, a detailed elastic-plastic analysis was performed. This paper will focus on reviewing effect of compressive stress on the fatigue crack propagation.

Keywords: *Fatigue crack growth, compressive stress, crack closure, elastic-plastic analysis*

EFFECT OF SLIDING AND HAMMERING CONTACT FOR CRACK GENERATION AND FRACTURE TOUGHNESS IN SCRATCH TEST

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Abstract: Scratch test is one of widely used, fast, and effective methods to obtain the critical loads that are related to adhesion properties of coating. The contact situation in a scratch tester is the combination of the hammering and sliding contact. Due to the increasing load of the stylus over an elastic-plastic zone, the surface defect will occur and lead to the creation of some first visible angular cracks in the coating. As a result, this phenomenon will affect to the crack generation and failure mechanism. A three-dimensional finite element model (FEM) for describing the stress-strain behavior under stylus loading was built to get the explain the effect of contact forces for the fracture mechanism

Keywords: *Scratch test, Coating, Fracture mechanism, Elastic-Plastic behavior, Abaqus*

OPTIMAL VERTICALLY ASCENDING FLIGHT OF AN INSECT-LIKE FLAPPING-WING MICRO AIR VEHICLE

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Abstract: Insect-like flapping-wing micro air vehicles (FWMAVs) mimic the flight behaviors of actual insects in nature to enhance their flight capability. For FWMAVs, vertically-ascending flight is important, especially when vehicles take off; however, this type of flight has not been thoroughly studied. This paper explores the optimal flight condition of an insect-like FWMAV while ascending vertically at constant speeds. The FWMAV is assumed to have the same mass properties and wing geometry as those of the hawkmoth Manduca sexta. The optimization is conducted through the combination of an artificial neural network and the genetic algorithm. The training data for the artificial neural network are provided by the unsteady panel method written in the programming language FORTRAN using parallel computation techniques. The results show that the FWMAV has to alter its wing kinematics and flapping frequency to sustain vertically ascending flight. Moreover, while ascending, the FWMAV requires more energy than that in hover. The findings from this work are useful for the design of control strategies used for insect-like FWMAVs.

Keywords: *insect-like flapping-wing micro air vehicle, vertically ascending flapping flight, genetic algorithm, artificial neural network*

COMPUTATION FOR THE DEBONING IN THE LAMINA COMPOSITE MATERIAL USING A COHESIVE ZONE MODEL BY ABAQUS

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Abstract: In this paper, a generalized potential-based constitutive model for mixed-mode cohesive fracture is presented in conjunction with physical parameters such as fracture energy, cohesive strength and shape of cohesive interactions. The unified potential leads to both intrinsic (with initial slope indicators to control elastic behavior) and extrinsic cohesive zone models (CZM). The PPR, potential-based traction-separation relation is chosen to describe the element's constitutive model. The intrinsic cohesive formulation is outlined due to its compatibility with the standard, implicit finite element framework present in ABAQUS. The implementation of the cohesive elements is described, along with instructions on how to incorporate the elements into a finite element mesh. Numerical examples are provided which display the capabilities of the elements in both small deformation and finite deformation regimes.

Keywords: *Cohesive strength, Cohesive element, Debonding, Abaqus*

PREDICTION FORMING LIMIT OF ALUMINUM ALLOY BASED ON SOME YIELD CRITERIA

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Abstract: The main objective is to numerically determine the Forming limit for Aluminium alloy is developed theoretically and experimentally. Earing defect is mainly attributed to the plastic anisotropy of sheet metal. The classical Marciniak–Kuczynski (M–K) model, Nakajima model and some new yield criteria are utilized to simulate the necking phenomenon and calculate the limit strains theoretically. The mechanical behavior of the matrix material is used Hill'48, BBC 2003 yield criterion and isotropic hardening rule. For this purpose, using ABAQUS finite element software to simulate deep drawing processes. The stress and strain are obtained at the last loading step before crack. FLD of Aluminum alloy are plotted. The quality of the numerical results is evaluated by comparison with experiment

Keywords: *Forming limit, M-K Model, Nakajima, BBC2003 yield criterion, Hill'48 yield criterion*

FINITE ELEMENT MODELLING FOR FREE VIBRATION RESPONSE OF CRACKED STIFFENED FGM PLATES

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Abstract: This paper presents the new numerical results of vibration response analysis of cracked FGM plate based on phase-field theory and finite element method. The stiffener is added into one surface of the structure, and it is parallel to the edges of the plate. The displacement compatibility between the stiffener and the plate is clearly indicated, so the working process of the structure is described obviously. The proposed theory and program are verified by comparing with other published papers. Effects of geometrical and material properties on the vibration behaviours of the plate are investigated in this work. The computed results show that the crack and stiffener have a strong influence on both the vibration responses and vibration mode shapes of the structure. The computed results can be used as a good reference to study some related mechanical problems.

Keywords: *finite element, phase-field theory, FGM, crack, stiffened plates, vibration*

IMPROVING QUALITY CONTROL OF OPERATING ROOM ENVIRONMENT BY COMPUTATIONAL FLUID DYNAMICS

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Abstract: In Vietnam, operating room (OR) is used with max productivity. So that, how to maintain comfort environment level, which is one of the assignments in designing and installing operating room. In this study, OR model is designed based on ASHRAE 170 – 2013 standard and dimensions are referred to “Comparison of Operating Room Ventilation System in the Protection of the Surgical Site”. ANSYS CFX is used for calculating and simulating velocity and temperature of surveyed air points inside the room by many cases. A face temperature between 20,3 and 20,6 ℃ and velocity of around 0,15 to 0,18 m/s is provided from the same laminar diffuser array. From the results, the OR comfort level is reviewed through ADPI index.

Keywords: *operating room, ventilation, ANSYS CFX, diffuser, ADPI*

BUCKLING ANALYSIS OF THE INDUSTRIAL FACTORY MODEL BY FINITE ELEMENT METHOD

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Abstract: Buckling is a subject that has been discussed long ago, however it still be studied and developed due to its practicality. The following article introduce two methods which are used to solve the problems involving buckling of the beam, shell and solid with an I shape cross section having different cases of boundary load. The theory which is used in this article is Euler's formula and Eurocode 3 standard. The analytical results by ANSYS commercial software are compared with the theoretical results and results from Eurocode 3 standard. The authors base on the reliability of the calculating results to simulate buckling of the industrial factory model with different cases of load conditions. The simulating results show a general view about buckling cases.

Keywords: *finite element method, buckling, Euler's critical load, Eurocode 3, industrial factory*

CRACKING ANALYSIS OF CONCRETE ENCASED STEEL BEAM BY FINITE ELEMENT METHOD

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Abstract: Concrete encased steel beam is a new type reinforced concrete structure. Investigations showed that such composite beams lead to a reduction of both structure weight and the resulted deformations. In the present paper, an accurate modeling for concrete encased steel beams is achieved by using the nonlinear three-dimensional finite element method through ANSYS. The analysis takes into consideration the interaction between the steel and concrete to simulate the cracking behavior of the encased beams well. The analysis has been performed for nonlinear stages. The results obtained from the present work are compared with the corresponding ones of previous available experimental works.

Keywords: *Concrete encased steel beam, Finite element method, cracking, nonlinear analysis*

ANALYZE THERMAL CRACKING RESPOND OF CONCRETE ENCASED STEEL BEAM BY FINITE ELEMENT METHOD

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Abstract: Concrete encased steel beams with many advantages, such as high resistance to high temperature and high resistance to thermal shock. Therefore, it is widely used in buildings construction recently. Concrete encased steel beams are directly under the exposure of the time-dependent variations of the temperature of air and solar radiation. Such thermal loads can vary the temperature of the different parts of the structure causing undesired structural effects, such as cracks formation. In this research, a numerical model – based on finite element method - of a transient thermal analysis is presented for the evaluation of thermo-mechanical response of concrete encased steel beam to the high daily air temperature and a solar radiation.

Keywords: *thermal cracking, Concrete encased steel beam, Finite element method, , thermo - mechanical analysis, transient thermal analysis*

AN EXTENDED TWICE - INTERPOLATION FINITE ELEMENT METHOD APPLIED TO SIMULATE CRACK PROPAGATION IN MATRIX INCLUSION MATERIAL WITH RANDOM HOLES

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Abstract: The buckling analysis of stiffened plates by the meshfree radial point interpolation method is investigated. Most of the meshfree methods require background cells during numerical integration that is not suitable for the principle of the meshfree method. In this work, the Cartesian Transformation Method-CTM integration scheme was combined with the existing meshfree method to develop a new approach in which the background cell is removed during numerical integration, which results in the applicability of the method is improved. In present work, the approach is applied to the buckling analysis of composite stiffened plates using the refined plate theory. Various numerical examples were considered to demonstrate the applicability and accuracy of the proposed method.

THE ANALYSIS OF FLUID DYNAMICS OF WAVE POWER STATION WITH WELLS TURBINE BY CFD

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Abstract: Natural energy such as wind, wave and other natural vibrations is one of the high potential renewable energy sources. The Wells turbine is based on the use of bidirectional turbines, which act as axial-flow self-rectifying turbines that employs a symmetrical blade profile and rotating unidirectionally in reciprocating airflows generated by the air chamber to extract energy from vibrations. These topics have been extensively studied both numerically and experimentally such as research on the parameters of the effects of structure, angle of attack, blade shape, etc. In this paper, numerical simulation is carried out using commercially available tool Fluent for fluid dynamics analysis and focus on oscillating predictions, with particular attention to the behavior of the flow. Axial-flow turbines system and future development as well as the proposed limitations will be discussed in detail.

Keywords: *Oscillating Water Column (OWC), Volumn of Fluid (VOF), dynamic flow, wave energy, Computational fluid dynamics (CFD)*

VIBRATION OF FGSW BEAMS UNDER NONUNIFORM MOTION OF MOVING LOAD USING AN EFFICIENT THIRD-ORDER SHEAR DEFORMATION FINITE ELEMENT FORMULATION

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Abstract: Vibration of functionally graded sandwich (FGSW) beams under nonuniform motion of a moving load is studied by a third-order shear deformation finite element formulation. The beams are considered to be formed from a homogeneous core and two functionally graded faces. Instead of the cross-sectional rotation, the formulation is derived by using the transverse shear rotation as a unknown. Newmark method is adopted to compute the dynamic response of the beams. Numerical result reveals that the proposed formulation is efficient, and it is capable to give accurate vibration characteristics by a small number of elements. A parametric study is carried out to illustrate the effects of the material distribution, layer thickness ratio and moving load speed on the dynamic behaviour of the beams. The influence of acceleration and deceleration of the moving load on the vibration of the beam is also examined and highlighted.

Keywords: *FGSW beam, moving load, nonuniform motion, third-order theory, transverse shear rotation, vibration*

BENDING ANALYSIS OF SANDWICH BEAM WITH FUNCTIONALLY GRADED FACE SHEETS USING VARIOUS BEAM THEORIES BY MESHFREE METHOD

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Astract: An interpolation techniques-based meshfree method using polynomial functions is employed to analyze static behaviors of sandwich beams with functionally graded face sheets and homogenous core. Various beam theories are expressed in general form and taken into account both shear deformation and normal deformation effects. Governing equation is derived from the principle of virtual work. The model has been verified with the previously published works and found a good agreement with them. Effects of skin-core-skin thickness ratios, volume material's parameters, span-to-height ratios, and various beam theories on deflection, stresses are investigated and discussed.

Keywords: *bending analysis, various beam theories, meshfree method, FG sandwich beams*

STATIC BENDING OF TWO-DIRECTIONAL FUNCTIONALLY GRADED SANDWICH PLATES USING A THIRD-ORDER SHEAR DEFORMATION FINITE ELEMENT MODEL

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Abstract: In this paper, static bending of a two-direction functionally graded sandwich (2D-FGSW) plates is studied by using a finite element model. The plates consist of a homogeneous core and two functionally graded skin layers with material properties being graded in both the thickness and length directions by power gradation laws. Based on a third-order shear deformation theory, in which the transverse displacement is split into bending and shear parts, is adopted to derive. Bending characteristics, including deflections and stresses are evaluated for the plates with classical boundary conditions under various types of distributed load. The effects of material distribution and the layer thickness ratio on the static bending behavior of the plates are examined and highlighted.

Keywords: *2D-FGSW plate, static bending, third-order shear deformation theory, finite element model*

BUCKLING ANALYSIS OF TWO-DIRECTIONAL FUNCTIONALLY GRADED SANDWICH PLATES BASED ON A QUASI-3D SHEAR DEFORMATION Q4 ELEMENT

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Abstract: The quasi-3D shear deformation theory, which includes the thickness stretching effect into consideration, is employed to develop a Q4 plate element for buckling analysis of two-directional functionally graded sandwich (2D-FGSW) plates. The plates are considered to be formed from three layers, a homogeneous core and two functionally graded face layers with material properties varying in both the thickness and length directions by power gradation laws. The plate element with nine degrees of freedom per node is derived using Lagrange interpolation functions and employed in computing the buckling loads. The accuracy of the element is confirmed by comparing the result obtained in the present work with published data. A parametric study is carried out to illustrate the effect of the material gradation and the layer thickness ratio on the buckling loads. The influence of the length to thickness ratio on the buckling loads of the plates is also examined and discussed.

Keywords: *2D-FGSW plate, Power gradation law, Quasi-3D theory, Q4 element, Buckling analysis*

NONLINEAR HEAT TRANSFER ANALYSIS IN FUNCTIONALLY GRADED MATERIALS USING A TRULY MESHLESS METHOD

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Abstract: Functionally graded materials (FGMs) are special types of composite structures, they have been developed on the concept of continuous variation of the material properties in one or more directions with predefined profiles and mainly used in structure parts that subjected to non-uniform working requirements. Studying on the non-linear thermal behavior of FGM models is so important in structure analysis and mechanical engineering. In this study, a truly meshless method based on the moving Kriging (MK) interpolation and the Cartesian Transfer Method (CTM) is presented and applied for non-linear heat transfer analysis in Functionally graded material model. The main important advantage of MK method is that it satisfies the Kronecker's delta property and has the high-order continuity. Moreover, CTM technique helps the meshless method become a completely free of mesh by removing integration cells. Various numerical test results will be compared with articles and commercial software to show the good performance of the MK truly meshless method.

VIBROACOUTIC BEHAVIOR OF A FINITE SIMPLY SUPPORTED ORTHOTROPIC DOUBLE-COMPOSITE PLATE WITH AN AIR CAVITY

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Abstract: Based on the classical laminated plate theory, the vibroacoustic behavior of a simply supported finite orthotropic double-composite plate with a closed air cavity is investigated analytically. Using the method of modal decomposition, a double Fourier series solution is obtained to characterize the vibroacoustic performance of the structure. The sound transmission loss (STL) is calculated from the ratio of incident to transmitted acoustic powers. The accuracy of the solution is shown with comparing the STL values obtained from this presented model with the previous published results in literature. The insulation ability of finite double-composite plate is shown. The effects of thickness of face sheets, thickness of air cavity and the angles of the incident sound, as well as the effect of composite materials and the laminate configuration of face sheets are systematically examined.

IMPACT ANALYSIS OF 2D COMPRESSIBLE HYPER-ELASTIC MATERIAL USING THE BSMPM AND NEO-HOOKEAN MODEL

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Abstract: The original Material Point Method (MPM) is developed based on an explicit procedure, so it deals with the problems of impact easily. However, the MPM is facing a computational error called grid-crossing error when the particles move through the computational grid. An improvement by using high order B-Spline basis functions can reduce the grid-crossing errors significantly. This is called the B-Spline MPM or BSMPM. In this paper, the Neo-Hookean model is applied for the relationship between stress and strain in hyperelastic material and the BSMPM is utilized to analyze the behavior of compressible hyperelastic material in impact problems. The obtained results are validated with reference solutions from existing numerical method and some advantages of BSMPM are discussed in this report.

ANALYZING THE NATURAL VENTILATION OF CAR PARKING BASEMENT BY USING CFD

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Abstract: The car parking basement is a popular solution to effectively use urban land, especially in commercial centers and apartments. However, explosion situation of apartment buildings is a topical issues, partly due to the basement ventilation has not met the requirements of fire safety. Therefore, the design of car parking basement ensures fire safety as well as bring comfort to people. In this study, the problem of basement temperature and wind velocity by natural ventilation method will be analyzed and evaluated in accordance with ADPI standards to identify areas of unsatisfactory temperature and velocity to reasonably adjust and propose other suitable ventilation options.

PHÂN BAN: VẬT LÝ KỸ THUẬT

SESSION: ENGINEERING PHYSICS

STUDY THE SYMMETRIC FORMS OF ENERGY GAP IN HIGH-TEMPERATURE SUPERCONDUCTORS CONTAIN COPPER OXIDE

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Abstract: Bardeen - Cooper - Schriefer (BCS) theory, introduced in 1957, satisfactorily explained almost all experimental results that previous theoriesa could not do about superconducting materials at low temperatures. The current major challenge for theoretical physicists is to explain the superconducting nature of high-temperature superconductors, not only in superconductivity but also in the normal state. Through the study of symmetric forms of energy gap in high-temperature superconductors, the author wishes to contribute a small part to finding that solution. In this study, the author builds a theoretical model and finds the solution of the Self-consistency equation, while representing the symmetric forms with drawings. The results of the study explain the symmetric forms of energy slots in high-temperature superconductors contain copper oxide (cuprates) that many experiments have previously published. The article also shows that the competition of pairing mechanisms of electrons in cuprates affects the symmetry of the energy gap.

Keywords: *Superconduct, cuprates, the energy gap, pairing mechanisms*

INVESTIGATE NONSEQUENTIAL DOUBLE IONIZATION PROCESS OF ARGON ATOM BY TWO-COLOR LASER PULSES

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Abstract: By using the classical three-dimensional ensemble model, we investigate nonsequential double ionization process (NSDI) of argon atom under influence of the parallel two-color laser pulses, in which the wavelengths of the controlling and driving fields are and respectively. The results indicate that not only the correlated momentum distribution of two ionizied electrons but aslo recollision time and energy depend strongly on relative phase of the two pulses. Moreover, the double ionization mechanisms and their dynamics are comprehensively presented in this study. This displays that the parallel polarized two-color laser pulses is powerful tool to control the correlated electron dynamics in NSDI.

Keywords: *Nonsequential double ionization, argon atom, parallel two-color laser pulses*

INWARDLY RECTIFYING POTASSIUM CHANNELS IN MOUSE FUNGIFORM TASTE BUD CELLS

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Abstract: Each taste bud comprises approximately 50 taste bud cells (TBCs), which are classified into four types (I–IV) and express a variety of ion channels that generate action potentials and conduct taste information. Among these ion channels, inwardly rectifying potassium channels play key roles in maintaining the resting membrane potential and regulating the action potential duration in neurons. However, the expression of these channels on TBCs remains unclear. In the present study, we found that inwardly rectifying potassium currents occurred in a cell-type-independent manner and that several types of mRNAs were expressed in peeled lingual epithelia containing fungiform papillae. These findings suggest that TBCs functionally express several types of inwardly rectifying potassium channels, which may contribute to taste signal transduction.

Keywords: *taste receptor cells, signal transduction, in-situ whole-cell recordings, RT-PCR*

COMPOSITION DEPENDENCE OF AMORPHOUS STRUCTURE AND RADIATION TOLERANCE IN SILICON OXYCARBIDE GLASS

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Abstract: Silicon oxycarbide (SiOC) glasses are anticipated to be utilized as a component material for nuclear reactors, because of their high thermal stability, irradiation tolerance, and corrosion resistance. Recent research demonstrated that the formation of He bubbles in SiOC was highly suppressed after even 90 at% He implantation [1,2].To clarify the origin of superior radiation tolerance of SiOC, knowledge of amorphous structures is required. In the present study, we prepared SiOC with different composition by sputtering (SiC: SiO_2= 1:2, 1:1, and 2:1) and examined their structures as well as radiation tolerance using transmission electron microscopy. Electron diffraction experiments revealed that amorphous structures were maintained after irradiation. No He bubble formation was detected in SiO_2-rich and equiatomic specimens, while remarkable He bubbles were formed in SiC-rich one. From a quantitative analysis of electron diffraction intensities, it was found that a first sharp diffraction peak (FSDP) appears at ~1.5 Å-1 in SiO_2-rich and equiatomic specimens. The FSDP revealed that the size of voids formed by connecting the SiOxC4-x tetrahedra in both the specimens is much larger than the diameter of He atom, suggesting that He atoms can easily migrate in the amorphous SiOC networks [3]. On the other hand, SiC-rich specimens possessed the smaller network voids than SiO_2-rich and equiatomic ones. It is considered that the He diffusion in SiC-rich specimens becomes slow which is attributed to the formation of He bubbles.

Keywords: *Amorphous materials, Radiation effect, Transmission electron microscopy*

FEMTOMOLAR DETECTION OF DOPAMINE USING SILICON NANOWIRES FIELD-EFFECT TRANSISTORS WITH AN ULTRA-LOW POWER CMOS READOUT IC

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Abstract: Silicon nanowires field-effect transistors (SiNWs FETs) show a good electrical property and are sensitive to the slight changes of the electrical field after appropriate surface modifications. Here, we applied 4-carboxyphenylboronic acid (BA) to modify p-type channel SiNWs FETs for the detection of different concentrations of diol-containing molecules, i.e. glucose, galactose, and dopamine. The IDS-VGS curves were recorded to observe the changes of threshold voltage and transconductance of the devices after each modification process. After BA modification, the threshold voltage shifted -8.01±4.87% and the transconductance changed 47.17±8.04%. These results of showed that our modification successfully implemented the immobilization of the BA on the surface of SiNWs. Interestingly, the results of IDS-time (IDS-T) in the detection of either glucose or galactose in the range of 10 fM and 10 mM showed that the higher concentrations of glucose and galactose caused an increase of the current. The changes of galactose sensing were larger than glucose and indicated the BA modified SiNWs FETs were more sensitive to galactose owing to the better binding affinity of BA and galactose. On the other hand, the varied concentrations of dopamine from 10 fM to 100 pM were examined using BA modified SiNWs FETs. No matter where dopamine molecules were in pH7.4 or pH11, the results of IDS-T showed upward signals and indicated the sensing mechanism of dopamine was through diol functional groups instead of their charges. The interference experiments during dopamine detection were also demonstrated in 5-mM glucose and 5-mM galactose solutions. The results displayed that dopamine sensing was successfully detected in the complicated environment using our BA modified SiNWs FETs. In order to facilitate future diagnostic use, the SiNW FETs were integrated onto an ultra-low power CMOS readout IC, which allows the signal to be converted to frequency response for display on portable devices later.

Keywords: *silicon nanowire field-effect transistors, boronic acid, dopamine, ultra-low power CMOS readout IC*

THE EFFECTS OF LETTER MATRIX AND INTER STIMULUS INTERVAL ON P300 EVENT RELATED POTENTIALS

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Abstract: The P300 wave is an event related potential (ERP) component elicited in the process of decision making. It is usually elicited using the oddball paradigm, in which low-probability target items are mixed with high-probability non-target items. The Emotiv Epoc + contains 14 Electroencephalogram (EEG) channels and the sampling rate is at 128 Hz was used to collect P300 wave of five healthy volunteers in our Brain Computer Interface (BCI)'s experiments. The communication interface is the letter matrix showing in three forms: 2x2, 3x3 and 6x6 matrix. The subject was asked to pay his attention to the letter serves target in oddball paradigm and it elicits P300 response. The duration of the inter stimulus interval (ISI) between targets is set at 187,5 ms and 300 ms. For the letter matrix 2*2 and 187,5 ms ISI condition, the online accuracy was 100%. For the letter matrix 3x3 and 6x6, after training section, the classification is performed and its accuracy was about 85%. P300 waves with largest amplitude occurs remarkably at the occipital and frontal channels and in 6x6 letter matrix. These good results promised real assistance application for disabled man.

CHARACTERIZATION OF GRAPHENE NANORIBBONS BY USING TIP-ENHANCED RAMAN SCATTERING

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Abstract: Graphene nanoribbon (GNR) has exceptional properties and being expected for various applications. Unzipping carbon nanotube by sonochemical method to obtain GNR is scalable, however, still many problems exist; edge structure of obtained GNR is unclear, the cost of dispersant polymer PmPV (poly[(m-phenylenevinylene)-co-2,5-dioctoxy-p-phenylenevinylene]) is too high. Especially, the edge structure of GNR is important for control the electric or magnetic property of GNR. Here, we focused on unravel the edge structure of GNR by using tip-enhanced Raman scattering (TERS). Firstly, DWNT was annealed at 500 ℃ for 3 h, then sonicated in 1,2-dichloroethane solution of PmPV and GNR was obtained. Then, obtained GNR was casted on Au substrate and TERS was measured. As a result, G-band and 2D-band was observed anywhere in GNR, but could not observed D-band at the edge, which indicates zigzag edge was obtained. In addition, CH3-band and C=O-band was observed, which are originated from moieties of PmPV which functionalized edge or inside GNR. So, simple chemical modification of the GNR is available by unzipping method.

Keywords: *Graphene nanoribbon, Tip-enhanced raman scattering, Carbon nanotube, Unzipping*

THE ELECTRIC AND MAGNETIC PROPERTY OF FREE-STANDING STRONTIUM TITANATE NANOPARTICLES

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Abstract: Electric and magnetic properties of metal oxide is still attracted because of increasing demands for wide-gap semiconducting materials. Strontium titanate (STO) is mainly perovskite oxide and was reported changing of the crystal structure and the electric properties at low temperature. However, these properties previously reported were only for bulk state. No reports were reported in nanoscale because of no technique was available to fabricate free-standing nanoparticles (NPs). Here, we report that the free-standing NPs synthesized by sol-gel method at different temperature were measured to know the electric and the magnetic properties. UV-vis spectra showed that STO NPs had bigger band-gap (4.24 eV) than that of bulk state (3.2 eV). STO NPs were bridged between aluminum electrodes for electric measurement by dielectrophoresis technique. I-V curves showed that conductance increased as temperature increased. It can be assumed by Arrhenius plots that hopping conduction occurred at high temperature and mixture of tunneling and hopping conduction occurred at low temperature. Because M-H curves at room temperature had hysteresis, STO NPs possibly have ferromagnetism.

Keywords: *Strontium titanate nanoparticles, Electric property, Ferromagnetism*

PULSE GENERATION BEHAVIOR OF SINGLE-WALLED CARBON NANOTUBE/ POLYOXOMETALATE COMPLEX RANDOM NETWORK

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Abstract: Carbon nanotubes (CNT) having high surface sensitivity when functionalized with redox active polyoxometalate (POM) molecules can be a good candidate for generating large electrical noise with rich dynamics, which holds the potential for brain like computing. Here, we fabricated a random network of SWNT/POM (SV2W10O40[H4TPP]) complex in which POM molecule have four porphyrin moieties binding with CNT. The time dependent current (I-t) measurement showed negative pulse at a lower POM concentration while both positive and negative pulses at higher concentration, which can be due to the multiple redox of the POM molecules inducing hole carriers to CNTs. The spike time interval was analyzed with the Poincare plot. The spikes appeared at random intervals with shifts to large time intervals for higher POM at higher voltages, which affects the capacitance at the junction and results in an increased impulse generation. These results show that the discrete noise generation can act as a source of information, which can be utilized for brain-mimicking computing by controlling the time interval.

Keywords: *Single walled carbon nanotubes, Polyoxometalate, Brain inspired computing*

TACTILE SENSOR USING CARBON NANOTUBE/SPONGE COMPOSITE MATERIAL

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Abstract: Tactile sensor is used for variable purposes presently. For the harvesting robots, soft sensor is required to avoid the damage to fruits or vegetables. However, flexibility and sensitivity of present sensors were not sufficient. In the present work, sponge/CNT was utilized for the sensor to make much more flexible. Solution of tetrahydrofuran (THF) with CNT (0.5 mg/mL) were prepared. PDMS (25mg) was put into each solution to promote immersing CNTs into sponges well with 1 h sonication. Then, the sponge and 9 mL of the curing agent were mixed to each solution and sonicated for 1 h. The sponge/CNT was picked up from each solution and dried to evaporate the solvent. Comb shape electrodes with 1 mm gap were printed on Si substrate by silver paste. Sponge/CNT used as a detection part of the sensor was placed on the electrodes. Varying of resistance was measured against pressure applied to the detection part by 4.8 g weights each and was saturated at 19.2 g. Detail will be talked at the session.

Keywords: *Carbon nanotube, Composite material, Tactile sensor*

STUDY ON TRAPPING CONDITION BY DIELECTROPHORESIS TO FABRICATE GNR DEVICE

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Abstract: Graphene has attracted attention due to high carrier mobility and high conduction even in low cross section. Various reports suggested to form graphene with sub-10 nm width, called graphene nanoribbons (GNR), to make the finite band gap. Sub-10 nm GNR can be obtained by longitudinal unzipping of single-walled carbon nanotubes (SWNTs). Although it can produce sub-10 nm width GNR by synthesis process and suitable for mass production, the application of unzipped GNR is still limited because of the difficulty in assembly of the GNR to make electric devices. In the present study, we tried to trap and align the unzipped GNRs using dielectrophoresis (DEP) method by varying the frequency from 100 kHz to 15 MHz and voltage from 5 to 10 Vpp. The GNR was synthesized by unzipping of HiPco SWNTs using poly [(m-phenylenevinylene)-co-(2,5-dioctoxy-p-pheny lenevinylene)] (PmPV) in dicloroethane solvent. The solution was casted to electrodes and followed by DEP process. AFM result showed GNR was successfully trapped and align with 500 kHz of frequency and 5 Vpp of amplitude of applied AC voltage by DEP method.

Keywords: *DEP, Graphene Nanoribbons, Longitudinal Unzipping*

SYNTHESIS OF AG-AG2S CORE-SHELL NANOPARTICLES FOR NON-LINEAR CONDUCTION

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Abstract: Von Neumann computers have downsized with higher performance. However, it reaches to the limit. To overcome such limitations, neuromorphic devices are proposed. Purpose of the present work is to fabricate the nanoparticles for non-linear conduction behavior for neuromorphic device. Ag-Ag2S core-shell nanoparticles were fabricated by following modified Brust-Schiffrin procedure 370 mg of allylmercaptane in 40 mL of toluene was mixed with 0.2 g of silver nitrate in 20 mL of deionized water. Then, 0.37 g of tetraoctylammonium bromide in 40 mL of toluene was added to the solution. The mixture was allowed to react for 30 mins at room temperature with magnetic stirring. The water phase was then removed from obtained solution. Sodium borohydride with 0.27 g in 15 g of deionized water was added to the solution and reacted at room temperature for 2 h with magnetic stirring. Then, the water phase was removed to obtain the nanoparticles. Molar ratio of Ag/S were varied with 0.25/1, 0.5/1, and 1/1 to control the size distribution of the particles. From TEM images, most homogeneous particle size contribution was observed on 0.25/1 condition. XPS results showed particles became bigger according to an increase in the silver composition.

Keywords: *Synthesis, Ag-Ag2S, neuromorphic devices*

PHÂN BAN: SÁNG CHẾ
TRONG KỸ NGHỆ

SESSION: INNOVATION TECHNOLOGY

EXAMINING THE RELATIONSHIP BETWEEN INFORMATION EVALUATION AND SECURITY STOCK LEVEL

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Abstract: In this research I intend to present a novel mathematical approach to logistics which allows (financial) value to be associated with information as a central corporate resource. The inherent logistics processes (transport, production, sales) uncertainty requires continuous inventory monitoring and maintenance of safety stock levels. Literature and practice show that logistics responds to poor quality or incomplete information by increasing inventory. In my research, I am looking for a minimum of safety stock levels based on the processing of information available in space and time and I intend to give a formal description of the mathematical model and present an example of its application.

Keywords: *logistics, information, value, safety stock*

OPTIMIZATION OF PROCESS LABILITY IN LOGISTICS SYSTEMS

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Abstract: The management and effective operation of enterprise systems – depending on ever-changing environmental impacts – can only be achieved by an appropriate information management practice. Today, in the corporate environment, an astonishing amount of data (often unstructured) is generated. The efficient processing of these data is by no means straightforward and unambiguous, and thus presents significant challenges for user systems. In our paper, we propose a methodology, which – together with the related mathematical model – can offer an opportunity to reduce entropy in logistics processes. We give the formal description of the mathematical model and present an example of its application.

Keywords: *process liability, logistics systems, entropy*

SOME POLYMERS USED IN BINH DUONG PROVINCE AND SOME METHODS TO BREAK DOWN POLYMER STRUCTURES BASED ON ELECTROMAGNETIC RADIATION

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Abstract: Polymers are popular used materials in the world because they are very convenient and cheap. But the use of too many polymer materials leads to environmental pollution. Because polymers are so difficult to decompose in nature, polymer waste is a big problem in the world today. This article is about breaking down the polymer structure based on electromagnetic radiation to reduce decomposition time in nature.

Keywords: *polymers, polymer waste, electromagnetic radiation, environmental pollution*

EVALUATION OF FORESTRY WASTE (PINE CONES) IN KOREA AS A PROMISING ADSORBENT FOR REMOVAL OF HEAVY METALS IN WATER

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Abstract: This study investigated the potential application of forestry waste (pine cones) as adsorbents for the removal of heavy metals in water. The basic chemical and physical properties of materials were characterized by scanning electron microscopy (SEM), Elemental analysis (EA) and Fourier transform infrared (FTIR) spectrometry. The adsorption process was analyzed as a function of pH, adsorbent dose and initial concentration of heavy metals ions. The adsorption data for heavy metals ions were successfully described using the Freundlich and Langmuir isotherms. The proposed mechanisms for the removal of heavy metals ions include ion exchange and adsorption by hydroxyl and carboxyl groups contained in the adsorbent. Based on these findings, forestry waste (pine cone) can be used as an effective adsorbent for the removal of heavy metals in wastewater.

Keywords: *Adsorption, Forestry waste, Pine cone, Heavy metals*

ENVIRONMENT MAP GENERATION IN FOREST USING FIELD ROBOT

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Abstract: We are developing an autonomous field robot to save labor in forest operation. About half of Japan's artificial forest area is already available as wood. However, trees are not harvested and forest resources are not effectively used, because the labor and costs are not sufficient. The employment rate of young people in forestry tends to decline, and the unmanaged forest area is expected to increase in the future. Therefore, in our laboratory we propose an autonomous field robot with all-terrain vehicles (ATV) that focuses on the automation of work. The robot we are developing automates weeding and observation for all trees in the forest.

In this research, we introduced Robot Operating System (ROS) developed in recent years to this robot. In addition, we observed trees by generating an environmental map in the forest using Simultaneous Localization and Mapping (SLAM).

Keywords: *Field Robot, ROS, SLAM, Mapping, Forestry*

COVERAGE MOTION PLANNING USING GRAPH IN FOREST ENVIRONMENT IN FIELD ROBOT

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Abstract: This paper presents the new numerical results of vibration response analysis of cracked FGM plate based on phase-field theory and finite element method. The stiffener is added into one surface of the structure, and it is parallel to the edges of the plate. The displacement compatibility between the stiffener and the plate is clearly indicated, so the working process of the structure is described obviously. The proposed theory and program are verified by comparing with other published papers. Effects of geometrical and material properties on the vibration behaviors of the plate are investigated in this work. The computed results show that the crack and stiffener have a strong influence on both the vibration responses and vibration mode shapes of the structure. The computed results can be used as a good reference to study some related mechanical problems.

Keywords: *Field robot, Motion planning, Graph, Forest industry*

LOW COST ACTIVATED CARBON PREPARED FROM DIPTEROCARPUS ALATUS FRUIT

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Abstract: Dipterocarpus alatus tree can grow throughout Thailand and can be tapped to yield significant quantities of oil, used as natural diesel. However, such practices lead to waste dried fruit dropping from the tree. This feasibility study investigates the use of Dipterocarpus alatu fruit as raw material to produce low cost activated carbon adsorbents. Activated carbons were prepared from Dipterocarpus alatu fruit: endocarp, mesocarp and wing by chemical activation with $ZnCl_2$, $FeCl_3$ and KOH. Each part of fruit was activated with 30 wt% activating agent at ratio of 1:2 for 1 h and carbonized at 500 ^oC for a further 1 h. The surface area, pore volume and average pore size of the resulting carbons were characterised by nitrogen gas adsorption. Activation of mesocarp with $ZnCl_2$, KOH and $FeCl_3$ gave activated carbons with surface area of 447, 256 and 199 m^2/g, respectively. In the same way, $ZnCl_2$ activation gave maximum surface area of 312 and 278 m^2/g for wing and endocarp, respectively. All of the aforementioned samples have average pore size of around 2 nm. On the other hand, KOH and $FeCl_3$ activation of wing and endocarp can produce activated carbon with very low surface area (below 25 m^2/g), but the average pore size is in the range of about 5~14 nm. The maximum surface area of activated carbon prepared from Dipterocarpus alatu fruit was higher than some biomasses used to prepare activated carbon such as palm flower (9.57 m^2/g), branches of walnut wood (32 m^2/g), oak wood (68 m^2/g), peanut shell (89 m^2/g), kenaf core fiber (299 m^2/g), macauba seed endocarp (371 m^2/g) and carnauba palm leave (431 m^2/g). Consequently, Dipterocarpus alatu fruit demonstrated the practical value for producing activated carbon as low cost adsorbents.

Keywords: *Dipterocarpus alatus fruit, activated carbon, chemical activation, surface area*

RESEARCH ON THE PRODUCTION OF OPTICAL NEEDLES USED IN INTRA-VENOUS LASER

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Abstract: Nowadays, Fiber optical are used in many areas such as information transmission, Medical;optical transmission with the advantage is rapid and avoid loss of efficiency. In the Medical,laser is increasingly used in rehabilitation treatment, especially low power laser with the biological response that the world literature has proven. Applying materials to bring low power laser into the body to 7 biological responses interact with red blood cells in blood vessels. Optic needles are one of the optimum options for bringing low power lasers into the body through the intravenous route. We propose the application of fiber, the first step is the single-mode fiber in the low-power semiconductor red laser beam with wavelength 632,8 ~ 680nm into the vascular domain to provide effective low-power laser treatment in medicine. Production of intravenous optical needle is our report.

Keywords: *Intravenous, Low level Laser Therapy, LLLT, Near infrared*

COLOUR REDUCTION OF BIODIESEL FROM CRUDE PALM OIL BY USING ACTIVATED CARBON PREPARED FROM CHILLI STEM

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Abstract: Biodiesel from crude palm oil is one of the main products of Lao Argotech Public Company. However, the colour of this biodiesel is red dark, therefore limiting its use. This present work aims to reduce the colour of biodiesel through application of activated carbon prepared from chilli stem waste. Chilli stem was prepared into activated carbon using 30 wt% KOH at ratio of 1:2 for 1 h, followed by carbonization at 500 ^oC under N_2 atmosphere for a further hour. Physico-chemical characteristics of the raw material and activated carbon were analysed including thermogravimetric analysis, proximate analysis and porosities. The results showed that the prepared activated carbon was porous material with mesoporous structure of about 84.5% and a surface area of 10.6 m^2/g, with an average pore size of 27.25 nm. This pore size range is suitable for the removal of large highly coloured molecules. Batch adsorption experiments were performed to investigate the reduction in colour of the biodiesel. Ratios of activated carbon to biodiesel of 0.002 and 0.1w/v were used in the study. For comparison, the adsorption was also tested against commercial activated carbon, which exhibited significantly highly surface area (1,129 m^2/g), but lower average pore size of 3.72 nm. The chilli stem activated carbon can reduce colour by approximately 15% within 24 h and the maximum colour reduction was 95% after 96 h for both activated carbon to biodiesel ratios. The colour of biodiesel changes from dark red to yellow and eventually resulted in a pale yellow with longer adsorption times. The yellow colour was deemed more attractive for use. Moreover, commercial activated carbon with its small pore size could not reduce the colour, with a maximum reduction of only 3%.

Keywords: *Colour reduction, Biodiesel, Activated carbon, Chilli stem*

DETECTION OF FORMALIN CONTAMINATION IN VEGETABLE BY LASER SPECKLE TECHNIQUE

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Abstract: Contamination of formalin in foods has been a major problem, since formalin is toxic and harmful to health. Therefore, detection of formalin contamination in food has become important. This work proposes a fast and simple method for evaluating formalin in food using dynamic laser speckle technique. The system will be developed for measuring the temporal variation of speckle pattern to detect changes in formalin contaminated cell. In the experiment with Chinese kale (Brassica alboglabra), 4 groups of samples were prepared for 15 minutes immersion in water and 3 different concentrations of formalin solutions (1%W/V, 2.5%W/V, and 5%W/V). The temporal variation of speckle pattern was recorded by a CCD camera, which was used for determining the autocorrelation function of each sample. It was observed that the decay rates of correlation coefficient of formalin contaminated samples are slower than that of controlled sample. The results show the feasibility to quantify formalin contaminated in food by the laser speckle analysis.

Keywords: *Laser speckle, Formalin, Contamination, Chinese kale, Correlation coefficient*

TOMATO-HARVESTING ROBOT COMPETITION TOWARD SMART AGRICULTURE

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Abstract: In Japanese agriculture, the aging and depopulation of farmers are big social problems, as the results the shortages of future farmers and manpower make their working environment more sever. Ministry of Agriculture, Forestry and Fisheries of Japan reported that Japanese self-sufficiency ratio for food is about 40%, which is lowest level among developed countries. Robot technology is expected as one of solutions and key for smart agriculture.

Most of commercialized robots work for industry and robots for agriculture, forestry and fisheries are under developing and not yet commercialized. The reasons for the delay are cost-efficiency of the robotization, safety, security, difficulty of outdoor environment. Also the knowledge transfer from talanted farmers is big issue how to evaluate the condition of plants, which parameters are suitable for evolution.

Robot has the possibility to contribute to the laborsaving, improvement of production, production line automation and also the management of agricultural products such as quality, quantity, and condition of environment become possible toward the smart-agriculture.

Tomato is one of important fruit vegetables and most tomatoes are produced in the greenhouses, or large-scale farms, where the high temperature and humidity, and long harvest age force the farmers heavy works.

With an aim to promote the automation of tomato harvesting, we have organized the tomato harvesting robot competition. In this paper, we report on the results of tomato harvesting robot competition.

Keywords: *Tomato harvesting, Smart agriculture, Robot Competition*

SENSING AND MODELING METHODS FOR AN INTELLIGENT TOMATO HARVESTING PLATFORM

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Abstract: Population of workers in agricultural field in Japan has been drastically decreasing each year. We investigated autonomous robotic fruit harvesting and growth estimation methods for tomato plants using multiple sensors to reduce the high labor load. As basic issues required for these mission in the field of computer vision, there are a fruit count, fruit color and shape measurements, image mosaicing of cultivation environments, and 3D modeling for plants. Because the change of luminance in the greenhouse environment is high, the vision system need to have a function of adaptation to the ambient light. In addition to vision system, we are developing the IoT (Internet of Things) system for measuring distribution of temperature and humidity in the air, and moisture in the soil to observe the condition of the cultivation environment. We propose an intelligent tomato harvesting platform that combines the above technologies.

Keywords: *growth estimation, 3D modeling, tomato harvesting robot, light Adaptation*

KHOA KHOA HỌC VÀ KỸ THUẬT MÁY TÍNH

FACULTY OF COMPUTER SCIENCE AND ENGINEERING

SYMPOSIUM ON COMPUTER SCIENCE & ENGINEERING

GENERIC FRAMEWORK FOR SMART MONITORING APPLICATIONS BASED ON THINGS

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Abstract: The Internet of Things (IoTs) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data. Based on the concept of IoTs, applications are increasingly proposed in various domains, ranging from smart home, smart office to smart agriculture. In this paper, a generic framework for smart monitoring applications based on the IoTs network is proposed. In this framework, low-powered sensor nodes are based on the micro: bit platform, providing a multiple footprints for different sensor connections. The data is wirelessly gathered by a base-station node that is powered by Android Things operating system provided by Google. Our approach provides a low cost implementation with minimum setup and especially amenable for monitoring applications. In this paper, our platform is validated for an automatic water monitoring in aquaculture based on the temperature, pH and dissolved oxygen sensory data.

Keywords: *Internet of Things, Wireless sensor networks, Smart Monitoring Devices, Android Things.*

TOWARDS A BLOCKCHAIN-BASED FRAMEWORK FOR TRACEABILITY IN COMPLIANCE WITH GS1

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Abstract: Traceability not only meets the social needs of product information transparency and reinforces the trust of consumers, but also meets the needs of enterprises for brand protection and enhances the competition in markets. Since a traceability system collects every necessary information at every stage in a supply chain, it is also an efficient tool for monitoring and optimizing the production procedure. In this paper, we will propose a framework that utilizes Blockchain to robustize traceability systems. Additionally, our proposed framework is compliant with GS1 traceability standard to achieve high reliability and compatibility as well as to adapt to traceability on a global scale.

Keywords: *Traceability system, Blockchain, Trust, Transparency.*

ONTOLOGY-BASED SENTIMENT ANALYSIS FOR BRAND CRISIS DETECTION ON ONLINE SOCIAL MEDIA

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Abstract: This paper discusses detection of brand crisis on online social media, i.e. when a brand is being suffered from unexpectedly high frequency of negative comments on online channels such as social networks, electronic news, blog and forum. In order to do so, we combined the usage of probabilistic model for burst detection with ontology-based aspect-level sentiment analysis technique to detect negative mention. The burst on online environment is a trendy topic that is rapidly growing recently. Thus, a burst with high frequencies of negative mentions to a brand implies a potential online crisis occurring with that brand. Our experimental results show that the aspect-level sentiment analysis technique is extremely useful for detecting of negative mentions that related with the products and brands.

Keywords: *Online crisis detection, burst detection, aspect-oriented sentiment ontology, sentiment analysis, Aspect-Oriented Sentiment Ontology.*

AUTHENTICATION IN E-LEARNING SYSTEMS: CHALLENGES AND SOLUTIONS

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Abstract: Digitization is gradually penetrating all aspects of modern society. One of the important factors determining the security of this process is user authentication. In most cases, this role is done with a password, but the evidence shows that this method is easily compromised. While there are many alternatives available such as biometric methods, user-challenging methods, smart card methods, etc. The strong development of technology that requires confidentiality and authentication must be tightly coupled. A qualitative survey of user authentication systems is being used in today's E-learning systems and a comparative study of various different authentication mechanisms presented in this paper.

Keywords: *Decentralized Authentication, Privacy, Merkle Tree, Blockchain.*

PRIVACY PRESERVING SPATIO-TEMPORAL DATABASES BASED ON K-ANONYMITY

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Abstract: The development of location-based services and mobile devices has lead to an increase in the location data. Through the data mining process, some valuable information can be discovered from location data. In the other words, an attacker may also extract some private (sensitive) information of the user and this may make threats against the user privacy. Therefore, location privacy protection becomes an important requirement to the success in the development of location-based services. In this paper, we propose a grid-based approach as well as an algorithm to guarantee k-anonymity, a well-known privacy protection approach, in a location database. The proposed approach considers only the information that has significance for the data mining process while ignoring the un-related information. The experiment results show the effectiveness of the proposed approach in comparison with the literature ones.

Keywords: *Location Privacy, Privacy Preserving, data mining, k-anonymity, spatio-temporal databases.*

A COMPARISON OF MACHINE LEARNING TECHNIQUES FOR FAULT DATA ANALYSIS

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Abstract: The increasing scalability, dynamicity and importance of today network and communication systems give rise to the challenges of fault management. These systems heavily depend on administrators and supporting tools frequently used to organize the workflow of the fault monitoring and detection processes. Recent fault monitoring and detection approaches focus on machine learning techniques for large fault data analysis that possibly meets the requirements of high efficiency and fast responsiveness as the systems become more complex and critical. This paper compares several machine learning techniques for fault data analysis and seeks the most suitable technique for detecting potential faults with high severity. These techniques use bug report datasets with extracted proper features to train the classification models that then apply for determining the severity of bug reports, thus detecting crucially potential bugs in specific bug datasets. The paper presents the performance of the techniques and highlights the optimal Decision Tree and K-Nearest Neighbors techniques with lessons learned.

Keywords: *Fault Management, Fault Detection, Fault Prediction, Machine Learning, Data Analytics.*

A MATHEMATICAL MODEL FOR TEAMWORK SCHEDULING PROBLEM IN AVAILABLE TIME WINDOWS

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sAbstract: This paper deals with teamwork scheduling problem in available time windows. This problem has been posed by combining the three constraints are the jobs can be splittable into some sub-jobs which can not be less than a threshold called splitmin, the jobs are not assigned into unavailable time windows and the jobs can be assigned to many people in the organization. The objective function aims to find a feasible schedule that minimizes the total completion time of all jobs. The mathematical model is given to achieve the optimal goal of this problem. Besides, we also proposed some heuristics to find good solution for the problem. The experimental results show the comparison of lower-bound, MILP model and some heuristics.

Keywords: *parallel machine, splitting-job, available time-window, MILP model, assignment approach, SPT/LPT rule.*

ENERGY-EFFICIENCY APPROACH FOR LONG RANGE WIRELESS COMMUNICATION

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Abstract: According to recent researches, the wireless sensor networks (WSN) which consume low levels of energy become more and more popular nowadays, so the research trend of optimizing energy for WSNs is rapidly increasing. LoRaTM technology is a modulation technique that provides long-range transfer of information and low power consumes. Besides, LoRaWANTM is a network protocol that optimized for batterypowered end devices. The LoRaTM and LoRaWANTM can be considered a suitable candidate for WSNs, which can reduce power consumption and extend the communication range. In this paper, we studied adaptive mechanisms in the transmission parameters of the LoRaTM network and proposed an energyoptimized solution for the adaptive algorithm. This research not only introduced the reference hardware of a sensor node in WSNs but also conducted experiments on typical LoRaTM network infrastructure.

Keywords: *IoT, LoRaTM, LoRaWANTM, Wireless Sensor Networks, Adaptive Data Rate, Energy Efficient.*

DESIGN, IMPLEMENTATION AND EVALUATION FOR A HIGH PRECISION PROSTHETIC HAND USING MYOBAND AND RANDOM FOREST ALGORITHM

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Abstract: A prosthesis is equipment provided to people who lost one or some parts of their limbs to help them having almost normal behaviors in daily or hard activities. Convenience and intelligence of devices should create easiness and flexibility for users. Artificial devices require interdisciplinary collaboration from neurosurgeons, surgical surgeons, physiotherapists and equipment development. Computer engineering plays a crucial role in the design step, supporting manufacturing, training and recognition to match the desirability of customers. Moreover, users need a wide range of different options such as an aesthetic functional material, a myoelectric mechanism, a body-powered appliance or an activity specified device. Thus, the flexible configuration, the proper features and the cost are some important factors that drive user's selection to the prosthesis. In this article, we describe an effective and powerful solution for analyzing, designing hardware and implementing software to train and recognize hand gestures for prosthetic arms. Moreover, we provide evaluation data of the method comparing with similar approaches to support our design and implementation. This is fairly a complete system, making it a convenient solution for hand-cutoff people to control prosthetic hands using their electromyography signals. Statistical results with evaluations show that the device can respond correspondingly and the method creates promisingly recognition data after correct training processes. The prosthetic hardware implementation has also been simulated using a Light-emitting diode (LED) hand model with a high accuracy result.

Keywords: *Prosthetic hand, MyoBand, Electromyography (EMG), Random Forest Algorithms.*

LONG SHORT-TERM MEMORY BASED MOVIE RECOMMENDATION

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Abstract: Recommender systems (RS) have become a fundamental tool for helping users make decisions around millions of different choices nowadays – the era of Big Data. It brings a huge benefit for many business models around the world due to their effectiveness on the target customers. A lot of recommendation models and techniques have been proposed and many accomplished incredible outcomes. Collaborative filtering and content-based filtering methods are common, but these both have some disadvantages. A critical one is that they only focus on a user's long-term static preference while ignoring his or her short-term transactional patterns, which results in missing the user's preference shift through the time. In this case, the user's intent at a certain time point may be easily submerged by his or her historical decision behaviors, which leads to unreliable recommendations. To deal with this issue, a session of user interactions with the items can be considered as a solution. In this study, Long Short-Term Memory (LSTM) networks will be analyzed to be applied to user sessions in a recommender system. The MovieLen dataset is considered as a case study of movie recommender systems. Several experiments have been carried out to evaluate the LSTM-based movie recommender system

Keywords: *Deep learning, Long Short-Term Memory, Recommender systems, Sequence mining.*

CHAOTIC TIME SERIES PREDICTION WITH DEEP BELIEF NETWORKS: AN EMPIRICAL EVALUATION

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Abstract: Chaotic time series are widespread in several real world areas. But forecasting in chaotic time series is still a challenging task since forecasting power on this kind of time series with some proposed methods is limited. In this paper, we investigate the use of a deep learning method, Deep Belief Network (DBN), to forecast chaotic time series. We compare the DBN method to RBF network, which is the state-of-the-art method for forecasting chaotic time series. Experimental results on several synthetic and real world chaotic datasets revealed that the DBN model is applicable to the prediction of chaotic time series since it achieves better performance than RBF network.

Keywords: *Deep Belief Network, Restricted Boltzmann Machine, chaotic time series, RBF network, forecasting.*

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XÁC ĐỊNH DUNG TRỌNG ĐẤT BÙN SÉT KHU VỰC THÀNH PHỐ HỒ CHÍ MINH BẰNG THÍ NGHIỆM XUYÊN TĨNH

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Tóm tắt: Thành phố Hồ Chí Minh, với diện tích trên 2000 km^2, là thành phố có tốc độ phát triển cơ sở hạ tầng nhanh nhất trong cả nước. Chi phí xây dựng cơ sở hạ tầng phụ thuộc rất nhiều vào đặc điểm địa chất công trình. Việc khảo sát địa chất công trình có vai trò rất quan trọng đối với các công trình xây dựng đặc biệt tại khu vực có lớp đất bùn sét dày phân bố trên diện rộng như Quận 2, 4, 6, 7, 8, huyện Nhà Bè và huyện Cần Giờ, dọc bờ sông Sài Gòn, sông Đồng Nai, khu vực giáp ranh giữa huyện Củ Chi và huyện Hóc Môn. Độ sâu phân bố lớp bùn sét tại khu vực thành phố có nơi lên đến 20-30m. Để xác bề dày và các đặc trưng cơ lý của tầng bùn sét này, ngoài phương pháp khoan truyền thống thì phương pháp xuyên tĩnh (CPT) là một lựa chọn phổ biến hiện nay. Số liệu thu được từ thí nghiệm xuyên tĩnh giúp minh giải được nhiều đặc trưng cơ lý như sức kháng cắt không thoát nước, phân loại đất, lực dính, mô đun biến dạng, dung trọng, … Các kết quả nghiên cứu minh giải thông số dung trọng từ thí nghiệm xuyên tĩnh cho các loại đất khác nhau trên thế giới đã được công bố bởi Robetson (1990), Mayne (2006), Robertson (2010), Robertson and Cabal (2010); Mayne and Peuchen (2013), Mayne (2016). Việc áp dụng các kết quả nghiên cứu vừa nêu vào minh giải dung trọng đất bùn sét từ thí nghiệm xuyên tĩnh khu vực thành phố Hồ Chí Mình là có ý nghĩa và hữu ích. Tuy nhiên, mức độ phù hợp giữa kết quả minh giải và kết quả đo trực tiếp vẫn chưa được đối chiếu, đánh giá. Dựa trên tài liệu 19 hố xuyên CPT với độ sâu từ 31-40m và 39 hố khoan với độ sâu trung bình 40m, các so sánh, phân tích giá trị dung trọng của đất bùn sét được tiến hành để đánh giá sự phù hợp giữa giữa kết quả minh giải dung trọng từ thí nghiệm xuyên tĩnh và giá trị đo trực tiếp, từ đó đề xuất hệ số hiệu chỉnh phù hợp. Kết quả nghiên cứu cho thấy, ở độ sâu nhỏ hơn 5m, giá trị dung trọng minh giải từ thí nghiệm CPT rất phù hợp với giá trị đo trực tiếp; tuy nhiên, ở độ sâu lớn hơn thì giá trị dung trọng minh giải từ CPT có xu hướng lớn hơn giá trị thí nghiệm trực tiếp. Giá trị hệ số hiệu chỉnh được trình bày trong phần nội dung chi tiết. Với kết quả nghiên cứu này, kỳ vọng có thể sẽ là nguồn tham khảo hữu ích khi minh giải dung trọng đất bùn sét từ thí nghiệm xuyên tĩnh khu vực Tp. HCM.

Từ khóa: *Dung trọng, Bùn sét, Áp lực nước lỗ rỗng, Thí nghiệm xuyên tĩnh*

ỨNG DỤNG THIẾT BỊ BAY KHÔNG NGƯỜI LÁI (DRONE) THÀNH LẬP BẢN ĐỒ ĐỊA HÌNH TỶ LỆ LỚN

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Tóm tắt: Bài báo này trình bày giải pháp thành lập bản đồ địa hình tỷ lệ 1:500 bằng phương pháp bay chụp ảnh lập thể bằng các thiết bị không người lái rẻ tiền Phantom 4 Pro, Phantom 4 RTK của hãng DJI. Dữ liệu ảnh được xử lý bằng phần mềm Agisoft bao gồm đám mây điểm (point cloud), mô hình số bề mặt (DSM), ảnh trưc giao. Độ chính xác bản đồ được thành lập bằng phương pháp đề xuất đáp ứng các yêu cầu của qui phạm thành lập bản đồ địa hình theo Thông tư 68 của Bộ TN-MT.

Từ khóa: bản đồ địa hình, đo vẽ ảnh hàng không, Agisoft, Phantom 4, DJI, point cloud, ảnh trực giao, DSM

PREDICTING SETTLEMENT BY STRESS PATH METHOD

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Tóm tắt: In this study, the Stress Path Method was applied to predict settlement of a preloading embankment combined with Prefabricated Vertical Drain (PVD) in Binh Chanh District, HCMC. In the Stress Path Method, the immediate settlement was estimated from the undrained stress-strain contours interpolated from the consolidated undrained triaxial compression tests, and the consolidation settlement was predicted based on the oedometer consolidation tests and the ratio of axial strain and volume strain. The results from the Stress Path Method were then compared with those obtained from the conventional method, Asaoka method and field data. The conventional method gave a good settlement prediction when the loading rate was slow whereas it underestimated the settlement in case of fast loading rate. Asaoka method should be used for prediction of final settlement after the embankment had reached its final height. The Stress Path Method proved to be successful in predicting settlement which was in good agreement with field data and that obtained by Asaoka method. The most suitable ratio of axial strain and volume strain was found in range 0.95-1.

Keywords: *Stress Path Method, PVD, Asaoka method, soft clay, settlement prediction*

LỰA CHỌN MÔ HÌNH PHÂN LOẠI ĐẤT PHÙ HỢP CHO ĐẤT BÙN SÉT KHU VỰC TP.HCM DỰA VÀO KẾT QUẢ THÍ NGHIỆM XUYÊN CPTu

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Tóm tắt: Thí nghiệm xuyên tĩnh (CPT- Cone Penetration Test) là một trong những thí nghiệm hiện trường đang ngày càng được sử dụng rộng rãi trong nước. Trong khi khoan khảo sát địa chất không thể phân chia địa tầng một cách chính xác thì thí nghiệm CPT có thể giải quyết được vấn đề này. Nhờ ưu điểm là có thể cung cấp một chuỗi dữ liệu gần như liên tục trong quá trình xuyên, việc phân chia địa tầng chính xác từ kết quả thí nghiệm CPT được thực hiện bằng cách sử dụng mô hình phân loại đất. Tuy nhiên, hiện tại có rất nhiều mô hình phân loại đất khác nhau. Để ứng dụng kết quả thí nghiệm xuyên CPT có hiệu quả, cần lựa chọn mô hình phù hợp cho khu vực nghiên cứu. Nghiên cứu này sử dụng dữ liệu từ 7 hố xuyên CPTu và 5 hố khoan khảo sát địa chất cho đất bùn sét khu vực Tp.HCM để đánh giá mức độ phù hợp của 20 mô hình phân loại đất. Kết quả cho thấy 2 mô hình phân loại đất Robertson (1986b) và Eslami – Fellenius (1997) cho kết quả phù hợp nhất cho đất bùn sét khu vực Tp.HCM.

Từ khóa: *CPT, phân loại đất, đất bùn sét*

ĐÁNH GIÁ HIỆU QUẢ XỬ LÝ MỘT SỐ KIM LOẠI BẰNG PHƯƠNG PHÁP KẾT HỢP CÁC VẬT LIỆU TRONG XỬ LÝ Ô NHIỄM NƯỚC DƯỚI ĐẤT SỬ DỤNG CHO SINH HOẠT TẦNG PLIESTOCEN KHU VỰC HUYỆN CỦ CHI, TP.HCM

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Tóm tắt: Huyện Củ Chi là huyện vùng ven của Thành phố Hồ Chí Minh, có tốc độ phát triển kinh tế - xã hội khá cao trong những năm gần đây. Hiện nay, tuy hệ thống cấp nước sạch đã được xây dựng nhưng việc sản xuất chăn nuôi không có hệ thống thoát nước thải sinh hoạt và nước thải sản xuất cùng với đa phần dân cư sử dụng chủ yếu là nước dưới đất ở tầng nông, nhiều hộ dân dùng nước này để ăn, uống và sinh hoạt mà không qua bất kì hệ thống xử lý nào, từ đó nguy cơ người dân sử dụng nguồn nước bị ô nhiễm là rất cao. Trong bài báo này, nhóm nghiên cứu sử dụng 3 vật liệu ODM – 2F, cát Mangan – MS và than hoạt tính dạng hạt AC(G) để xử lý các kim loại Mn, Al, As, Pb, Cd trong nước dưới đất đang sử dụng chủ yếu phục vụ sinh hoạt trên địa bàn Huyện Củ Chi dựa trên kết quả khảo sát hiện trạng ô nhiễm nguồn nước dưới đất tầng Pleistocen trung-thượng tại các giếng khoan. Nghiên cứu được tiến hành trên 2 giai đoạn: Nghiên cứu khả năng xử lý kim loại của từng loại vật liệu và khi kết hợp 3 vật liệu trong cùng một cột. Kết quả cho thấy ở giai đoạn 1 hiệu quả xử lý các kim loại khá cao từ 77,48% - 100%; ở giai đoạn 2 nghiên cứu trên ba nghiệm thức nồng độ, tại nghiệm thức nồng độ cao có hiệu quả xử lý cao hơn khi chỉ sử dụng một loại vật liệu; hiệu quả xử lý ở hai nghiệm thức nồng độ dưới quy chuẩn cho phép thì Pb và Cd đạt hiệu quả tối đa 100%; còn ba kim loại Mn, Al, và As có hiệu quả xử lý thấp hơn 25,93 – 99,66%. Bài viết này góp phần nâng cao chất lượng nguồn nước, từ đó đề xuất biện pháp nhằm nâng cao chất lượng nguồn nước, đảm bảo an toàn cho sức khỏe, nâng cao chất lượng đời sống người dân.

Từ khoá: ô nhiễm, kim loại, nước dưới đất, ODM – 2F, cát Mangan – MS, than hoạt tính dạng hạt AC(G)

Ô NHIỄM DẦU TRÊN BIỂN VIỆT NAM VÀ GIẢI PHÁP

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Tóm tắt: Công tác thăm dò và khai thác dầu khí trên biển ở Việt nam đã và đang được thúc đẩy không chỉ ở vùng nước nông mà còn ngày càng mở rộng ở vùng nước sâu hơn. Hơn nữa, Biển Đông là nơi có mật độ cao của các tuyến giao thông thuỷ trên thế giới. Do tác động của các hoạt động này, ô nhiễm dầu trên biển là không thể tránh khỏi.

Bài báo đề cập một cách tổng thể về sự ảnh hưởng của ô nhiễm dầu đối với hệ sinh thái biển, và đưa ra một số giải pháp cơ bản bao gồm cả giải pháp cơ học và hóa học nhằm xử lý sự tràn dầu trên biển.

Từ khóa: *Ô nhiễm dầu, xử lý tràn dầu*

ẢNH HƯỞNG NƯỚC BIỂN DÂNG ĐẾN QUÁ TRÌNH BỒI XÓI LÒNG SÔNG HỆ THỐNG SÔNG SÀI GÒN – ĐỒNG NAI - KHU VỰC TP.HCM

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Tóm tắt: Nước biển dâng không những làm thay đổi mực nước trung bình mà còn làm thay đổi cả biên độ triều ngoài cửa sông. Hậu quả là chế độ thủy lực và quá trình diễn biến hình thái sông cũng thay đổi theo. Bài báo đã sử dụng phương pháp mô hình toán đánh giá sự thay đổi này ở sông Sài Gòn – Đồng Nai. Để có thể đánh giá được sự thay đổi một cách tổng thể trên quy mô mạng sông nhưng vẫn phải đủ chi tiết, mạng sông đã được mô hình hóa bằng mô hình tích hợp 1D và 2D trong đó các nhánh sông lớn được làm mô hình 2D. Trong mô hình, các phương trình thủy động lực và vận tải bùn cát được giải bằng phương pháp thể tích hữu hạn. Kết quả tính đã chỉ rõ các khu vực gia tăng nguy cơ xói và sạt lở.

Từ khoá: *xâm thực, bồi xói, hệ thống sông Sài Gòn-Đồng Nai, nước biển dâng.*

ĐẶC ĐIỂM THỦY ĐỊA HÓA NƯỚC DƯỚI ĐẤT VÙNG BẮC SÔNG TIỀN VÀ VAI TRÒ CỦA ĐIỀU KIỆN CỔ ĐỊA LÝ

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Tóm tắt: Điều kiện địa chất thủy văn vùng Bắc sông Tiền (Gồm các tỉnh Đồng Tháp, Bến Tre, Tiền Giang, Long An) rất phức tạp, nhất là về sự phân bố nước nhạt, nước mặn. Dựa vào các tài liệu khoan thăm dò, khai thác cũng như quan trắc của Liên đoàn Quy hoạch và Điều tra Tài nguyên nước miền Nam gồm hình trụ, chiều cao cột áp và kết quả phân tích mẫu nước hơn 200 giếng khoan rải khắp toàn vùng nghiên cứu, trong đó có 5 cụm quan trắc với hơn 14 giếng, các tác giả đã xác định được 04 kiểu mặt cắt thủy địa hóa thẳng đứng: Kiểu 1: TDS tăng đến độ sâu phân bố qp_1 (10,06g/l) sau đó giảm tới dưới 1g/l; Kiểu 2: TDS tăng liên tục theo chiều sâu và mặn hoàn toàn; Kiểu 3: Nước nhạt hoàn toàn và TDS có xu thế giảm theo chiều sâu và kiểu 4: nước lợ - mặn – nhạt xen kẽ trong toàn bộ mặt cắt. Sự phân bố nước mặn – nhạt theo phương ngang cũng rất phức tạp, đặc biệt trong các tầng chứa nước Holocen, Pleistocen… Chính sự phức tạp về đặc điểm thủy địa hóa đó làm cho việc mở rộng khai thác nước dưới đất tại khu vực nghiên cứu gặp nhiều trở ngại.

Về mặt cổ địa lý, khu vực nghiên cứu đã trải qua 7 giai đoạn biển tiến – thoái khác nhau, bởi vậy, khu vực nghiên cứu luôn chịu ảnh hưởng của biển với những quy mô khác nhau. Chính những đợt biển tiến đã có những ảnh hưởng nhất định tới các tầng chứa nước bên dưới làm nó trở nên mặn hóa ở nơi tầng chắn bên trên mỏng hoặc thấm tốt… Ngoài điều kiện cổ địa lý, các nhân tố thủy động lực, hóa lý và nhân tạo cũng góp phần làm bức tranh thủy địa hóa nước dưới đất vùng Bắc sông Tiền càng phức tạp hơn.

Từ khóa: *Quan trắc, mặt cắt, thủy địa hóa, TDS, biển tiến, biển thoái, tầng chứa nước*

ẢNH HƯỞNG CÁC KỊCH BẢN NƯỚC BIỂN DÂNG ĐẾN NGẬP LỤT TẠI THÀNH PHỐ HỒ CHÍ MINH

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Tóm tắt: Thành phố Hồ Chí Minh (Tp.HCM) nằm trên vùng hạ lưu của lưu vực sông Sài Gòn - Đồng Nai (SG-ĐN). Thành phố có 3 dạng địa hình với sự chuyển tiếp từ vùng gò đồi kiểu bát úp với cao độ biến đổi chủ yếu từ 2,0m đến 30m ở Đông Nam Bộ đến dạng địa hình đồng bằng thấp, với cao độ biến đổi từ 0.8m đến 1.5m phân bố ở quận 2, quận 9, quận 7, Bình Chánh, Tân Phú, Nhà Bè, ven sông Sài Gòn và dạng địa hình thấp trũng, với mặt đất lồi lõm, biến động (Cần Giờ, Nam Nhà Bè). Nếu xem các diện tích đất đai thấp hơn cao trình 2,0m đều có thể chịu ảnh hưởng triều, thì có đến 75,6% diện tích Thành phố có thể chịu ảnh hưởng thủy triều trong tiêu thoát nước và sẽ chịu tác động nặng nề dưới tác động của nước biển dâng (NBD).

Bài báo tiến hành dự báo diện tích đất bị ngập cho toàn vùng hạ lưu sông SG-ĐN. Các tác giả sử dụng mô hình toán (phần mềm F28 được phát triển bởi Lê Song Giang) để nghiên cứu theo các kịch bản NBD 15cm, 30cm, 50cm, 75cm và 100cm, nhằm góp thêm cơ sở để hoạch định chiến lược và biện pháp ứng phó, giảm thiểu thiệt hại, phục vụ phát triển bền vững.

Kết quả của nghiên cứu chỉ ra rằng:

1. Có sự tương đồng khá tốt giữa kết quả chạy mô hình và kết quả thực đo mực nước, tuy số liệu tính toán có biên độ hơi nhỏ hơn so với số liệu thực, nhưng luôn đồng pha. Với kịch bản NBD 1,0m, diện tích ngập trên vùng hạ lưu sông SG-ĐN tăng từ 10.451 km^2 lên hơn 23.095km^2, trong đó diện tích lớn đất đai khu vực Tp.HCM sẽ bị ngập khi NBD nếu không có đê biển. Ứng với kịch bản NBD 1,0m, diện tích bị ngập của Thành phố lên tới 17,84%.

2. Để đưa ra các giải pháp thích ứng và ứng phó với tác động của Biến đổi khí hậu và nước biển dâng, Tp.HCM cần xác định có hay không xây dựng hệ thống đê biển để ứng phó với Biến đổi khí hậu- Nước biển dâng, và quy hoạch hệ thống đê này. Ngoài ra, cần nghiên cứu mức độ hạn và lũ cực hạn có thể xảy ra và cần xây dựng quy hoạch thoát lũ cho vùng hạ lưu sông Sài Gòn.

Từ khoá: ngập lụt, các thành phần thủy triều, nước biển dâng, mô hình toán.

LÚN MẶT ĐẤT TẠI MIỀN TÂY NAM BỘ - DO KHAI THÁC NƯỚC DƯỚI ĐẤT?

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Tóm tắt: Hiện tượng lún bề mặt đất tại đồng bằng sông Cửu Long đã được nhiều tác giả nghiên cứu và công bố tại một số Hội nghị, hội thảo khoa học. Hầu hết đều cho rằng lún bề mặt đất tại đây là do khai thác nước dưới đất quá mức. Bài báo này đặt lại vấn đề: Phải chăng lún bề mặt đất chỉ là do khai thác nước dưới đất hay còn những nguyên nhân khác nữa? Bằng những kết quả tính toán theo công thức Lohman và những kết quả quan trắc lún nông của một nghiên cứu khác, nhóm tác giả có những nhận định hoàn toàn khác với những kết luận trước đây. Trên cơ sở đó, nhóm tác giả có những kiến nghị về công tác khai thác và phát triển bền vững nguồn tài nguyên nước dưới đất trong hoàn cảnh vùng này đang chịu tác động mạnh của biến đổi khí hậu.

CÔNG CỤ MÃ NGUỒN MỞ GMT VÀ ỨNG DỤNG TRONG XÂY DỰNG BẢN ĐỒ

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Tóm tắt: Mục tiêu của bài báo là cung cấp thông tin cơ bản về lịch sử phát triển và ứng dụng của một số công cụ mã nguồn mở hiện nay trong công tác xây dựng bản đồ, đồng thời giới thiệu ứng dụng mã nguồn mở GMT (*Generic Mapping Tool*) chạy trên trình biên dịch Cygwin bằng ngôn ngữ lập trình C để xây dựng các lớp bản đồ 2D, 3D theo dụng ý người dùng trong bước đầu đưa ra quyết định triển khai các kế hoạch hoặc dự án một cách nhanh chóng.

Nghiên cứu đã chỉ ra rằng, việc sử dụng công cụ mã nguồn mở và mã nguồn đóng đều mang lại những thuận lợi và khó khăn; trong khi công cụ mã nguồn đóng giúp cho người dùng tương tác một cách hiệu quả, trực tiếp theo ý người dùng thì mã nguồn mở đòi hỏi người dùng cần tích lũy một ít kiến thức về công nghệ và thủ thuật dòng lệnh để tương tác; tuy nhiên, trong khi công cụ mã nguồn đóng bị giới hạn về nguồn dữ liệu và cần phải cập nhật thông qua các phiên bản thì mã nguồn mở thuận lợi hơn khi dữ liệu liên tục được chỉnh sửa; ngoài ra, vấn đề chi phí

Từ khóa: *GMT, mã nguồn mở, trường ứng suất, đứt gãy*

EFFECT OF VESSEL WAVES ON RIVERBANK EROSION: A CASE STUDY OF MEKONG RIVERBANKS, SOUTHERN VIETNAM

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Abstract: The purpose of this paper is to investigate the effect of vessel waves on erosion process of Hau riverbanks, one branch of Mekong Rivers, Southern Vietnam. The authors have identified the potential impacts of vessel waves on the riverbank instability using the in-situ measurements and CCTV (closed-circuit television). It is shown that vessel wave height greater than 0.3m contributed 12.11% total of recorded waves lead to erosion. These waves attacked the bank with high applied shear stresses and caused surface erosion. The natural conditions such as bank materials, water content, weathering process, and bankslope also impacted on bank instablity triggered by vessel waves.

Keywords*: river bank erosion, vessel waves, riverbank instability, Hau riverbank, Mekong riverbanks*.

ỨNG DỤNG VẬT LIỆU ĐA NĂNG ODM – 2F, CÁT MANGAN – MS VÀ THAN HOẠT TÍNH DẠNG HẠT – AC(G) ĐỂ XỬ LÝ CÁC KIM LOẠI ASEN, CHÌ, CADIMI TRONG NƯỚC DƯỚI ĐẤT DÙNG CHO SINH HOẠT KHU VỰC HUYỆN CỦ CHI

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Tóm tắt: Nước dưới đất được quan tâm khai thác và có vai trò quan trọng sau nguồn nước mặt.Trong khai thác và sử dụng nguồn nước dưới đất thì chất lượng nước cũng được quan tâm hàng đầu. Tuy nhiên những nghiên cứu gần đây cho thấy nước dưới đất trên địa bàn huyện Củ Chi nói riêng và khu vực Tp.HCM nói chung đã phát hiện ô nhiễm một số kim loại sắt, Asen, Chì, Cadimi với hàm lượng kim loại tăng theo thời gian.

Nguồn nước được khảo sát và lấy mẫu phân tích ở một số xã trên địa bàn huyện củ chi, hầu hết các mẫu nước phân tích cho thấy đều bị ô nhiễm kim loại như Sắt, Asen, Chì, Cadimi. Từ đó đề xuất ra qui trình xử lý nước dưới đất cho hộ dân. Nghiên cứu thực hiện ở 3 nồng độ 1 mg/l; 0,5 mg/l; 0,05 mg/l khi cho các kim loại qua 3 lớp vật liệu lọc kết hợp như Cát Mangan – MS, ODM-2F, than hoạt tính dạng hạt - AC(g). Kết quả nghiên cứu cho thấy hiệu suất xử lý As, Pb, Cd lần lượt: NT1 đạt 91,32%; 98,08%; 99,78%; NT2 đạt 88,54%; 97,63%; 99,66% và NT3 đạt 71,25%; 89,25%; 93,80%. Nghiên cứu này cho ta thấy khả năng xử lý các kim loại nặng trong nước của các hạt vật liệu Cát Manga - MS, ODM-2F, Than hoạt tính dạng hạt - AC(g) góp phần vào việc nghiên cứu xử lý ô nhiễm theo mục tiêu "Bảo vệ môi trường và phát triển bền vững".

Từ khóa: *Nước dưới đất, ô nhiễm kim loại, Asen, Chì, Cadimi, vật liệu xử lý.*

PHÂN CẤP CHẤT LƯỢNG NEON COBALT BLUE SPINEL – LOẠI ĐÁ QUÝ HUYỀN THOẠI CỦA VIỆT NAM

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Tóm tắt: Spinel là một loại đá quý có giá trị cao, có màu sắc đa dạng. Trong các màu sắc của Spinel thì màu đỏ được xem là màu có giá trị nhất. Tuy nhiên, gần đây Việt Nam xuất hiện chủng loại Neon Cobalt Blue Spinel – dân gian gọi là xanh chân tông – một loại màu xanh lam tuyệt đẹp, và đặc biệt hơn nữa, nó chỉ được tìm thấy duy nhất tại một vùng mỏ của Việt Nam, không có ở bất kỳ nơi nào trên thế giới.

Kể từ khi xuất hiện Spinel "xanh chân tông", thì trong lĩnh vực đá quý, thế giới đã biết đến Việt Nam chúng ta, các tài liệu có uy tín nhất trong ngành Ngọc học quốc tế đều gọi nó là một loại ngọc "huyền thoại" của Việt Nam. Độ hiếm và giá trị của nó vượt cả ruby hay kim cương, trở thành loại đá quý hiếm và có giá trị nhất ở Việt Nam hiện tại.

Trong bài viết này, tác giả lần đầu tiên phân tích các đặc điểm ngọc học, phân cấp chất lượng loại đá quý đặc biệt này trên các cơ sở khoa học về màu sắc, về ngọc học, và đưa ra tiêu chuẩn xác định và phân cấp cho Neon Cobalt Blue Spinel.

Từ khóa: *tông, chân tông, xanh tông, xanh chân tông, Spinel xanh chân tông, neon cobalt blue spinel.*

PHÁT HIỆN KHOÁNG VẬT PYROXENE TRONG ĐÁ BASALT CÓ CHẤT LƯỢNG ĐÁ QUÝ TRANG SỨC TẠI GIA KIỆM

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Tóm tắt: Pyroxene khu vực Gia Kiệm được người dân địa phương phát hiện và khai thác cách đây không lâu. Nhưng bước đầu họ đã nhầm lẫn đây là đá quý tourmaline vì chúng có hình thái và chất lượng tương tự như một số loại tourmaline. Khi phát hiện mẫu trên thị trường có những đặc điểm có phần khác biệt so với tên gọi thương mại (tourmaline), tác giả nhìn nhận đây có khả năng không phải tourmaline mà một khoáng vật khác hoàn toàn, theo nhận xét của chủ nhiệm đề tài thì đây có khả năng là khoáng vật nhóm Pyroxene. Tìm hiểu về nguồn gốc xuất xứ nhóm tác giả biết được chúng được khai thác tại khu vực Gia Kiệm, huyện Thống Nhất, tỉnh Đồng Nai.

Sau khi khảo sát thực địa lấy mẫu gia công và tiến hành các phân tích ngọc học tiêu chuẩn, bước đầu khẳng định đây là loại đá quý thuộc nhóm pyroxene và là chủng loại hoàn toàn khác với các loại được sử dụng làm đá quý phổ biến. Và cũng khẳng đinh rằng đây là ghi nhận đầu tiên về khoáng vật pyroxene có chất lượng làm đá quý trang sức ở Việt Nam.

Với phát hiện trên, nhóm tác giả nhận thấy rằng cần có những nghiên cứu chi tiết, đầy đủ hơn để đánh giá toàn diện về loại đá quý mới này, làm cơ sở cho hoạt động quy hoạch, quản lý, bảo vệ, tiến tới khai thác sử dụng nguồn tài nguyên rất có giá trị này được hợp lý, hiệu quả mang lại lợi ích kinh tế cho địa phương và đất nước.

Từ khóa: *pyroxene, đá quý mới tại Gia Kiệm, đá quý nguồn gốc basalt khu vực Nam Trung bộ.*

XÁC ĐỊNH HIỆN TƯỢNG SỤT LÚN ĐẤT TẠI TỈNH TRÀ VINH BẰNG PHƯƠNG PHÁO GIAO THOA DỮ LIỆU LỚN CỦA VỆ TINH RADAR SENTINEL 1

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Tóm tắt: Bài báo trình bày kết quả phân tích hiện tượng sụt lún đất tại tỉnh Trà Vinh trong giai đoạn 2015-2019 bằng kỹ thuật giao thoa InSAR từ dữ liệu vệ tinh radar Sentinel-1 kết hợp với các dữ liệu đo dạc thực địa và ảnh hưởng của việc đô thị hóa và khai thác nước ngầm đến việc hiện tượng sụt lún đất tại khu vực nghiên cứu. Trong giai đoạn 2015-2019, tại thành phố Trà Vinh tốc độ sụt lún vào khoảng 1cm/năm trong khi tại xã Dân Thành, huyện Duyên Hải tốc độ sụt lún lên đến 3cm/năm. Một trong những nguyên nhân chính gây nên hiện tượng sụt lún nhanh là việc khai thác nước ngầm quá mức tại các khu vực này, đặc biệt là tại xã Dân Thành, huyện Duyên Hải.

Từ khóa: *sụt lún đất, InSAR, Sentinel-1 Natural Resources and Environment of Tra Vinh, Viet Nam*;

ĐÁNH GIÁ ĐỘ ẨM BỀ MẶT TẠI VƯỜN THANH LONG TỈNH BÌNH THUẬN BẰNG PHƯƠNG PHÁP SỬ DỤNG ẢNH VIỄN THÁM SENTINEL 1

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Tóm tắt: Tỉnh Bình Thuận là một trong những tỉnh khô hạn nhất Việt Nam. Tình trạng khan hiếm nước phục vụ nông nghiệp tại khu vực này vào mùa khô là rất nghiêm trọng. Độ ẩm bề mặt là một trong những thông số dùng để đánh giá độ khô hạn. Trong nghiên cứu này, nhóm tác giả đánh giá mối tương quan giữa giá trị phản xạ VH trích xuất từ ảnh Sentinel 1 và độ ẩm bề mặt tại khu vực nghiên cứu. 20 mẫu độ ẩm và 2 mẫu hiệu chỉnh sẽ được lấy ở độ sâu 5cm tính từ bề mặt, vào thời điểm bay chụp của ảnh Sentinel 1 qua khu vực nghiên cứu. Trong đó, 2 mẫu hiệu chỉnh được lấy tại vị trí có giá trị phản xạ VH cao nhất và thấp nhất. Kết quả phân tích mẫu độ ẩm ngoài hiện trường với giá trị độ ẩm dao động 16.0% đến 57.5% và có tương quan với giá trị độ ẩm từ ảnh Sentinel 1.

Từ khóa: *Độ ẩm đất, sentinel1, thanh long, khan hiếm nước, đa thời gian*

ĐÁNH GIÁ BIẾN ĐỘNG ĐỊA HÌNH SUỐI TIÊN, PHAN THIẾT BẰNG PHƯƠNG PHÁP LẬP BẢN ĐỒ 3D ĐỊA HÌNH

Chung Minh Quân, Phùng Ngọc Anh, Trần Anh Tú*, Nguyễn Thế Được, Võ Trần Thế Vĩ

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Tóm tắt: Hiện nay, các địa điểm có cảnh quan tự nhiên đang là những điểm đến thu hút rất nhiều khách tham quan. Tuy nhiên, các cảnh quan ấy rất dễ bị hủy hoại do chưa có biện pháp quản lý và giám sát phù hợp. Công nghệ thiết bị bay không người lái (UAV) sử dụng trong ngành Viễn thám rất phổ biến trên thế giới với nhiều nghiên cứu về các ứng dụng trong lĩnh vực Nông nghiệp, Mỏ, Xây dựng,... Nhờ sự phát triển của phương pháp "Structure from Motion" (SfM) để từ ảnh bằng UAV tạo ra mô hình số bề mặt (DSM) và ảnh trực giao, giúp đánh giá chính xác sự thay đổi địa hình của khu vực. Do đó tác giả tiến hình nghiên cứu sự thay đổi địa hình ở khu du lịch Suối Tiên, Bình Thuận bằng máy bay không người lái và mô hình 3D ở ba thời điểm khác nhau với chu kì 4 tháng/ lần. Độ phân giải ảnh trực giao thu được khoảng 3cm/pixel và mô hình số bề mặt là 5.5-6.5cm/pixel. Từ ảnh trực giao xây dựng hình thái sườn dốc dốc theo 3 thời điểm để từ đó xác định sự dịch chuyển của chân sườn nơi đây. Đồng thời, mô hình thay đổi DSM (DoD) được sử dụng để xác định các khu vực có sự biến động kết hợp với ảnh trực giao. Nghiên cứu đã cho thấy được khả năng ứng dụng UAV vào đánh giá biến động địa hình giúp việc quản lý trở nên hiệu quả hơn.

Từ khóa: *UAV, DSM, DoD, biến động địa hình, sạt lở, địa du lịch.*

GIÁM SÁT KHU VỰC XÂY DỰNG BẰNG DRONE

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Tóm tắt: Trong những năm gần đây, Drone đã được ứng dụng trong nhiều lĩnh vực khác nhau như lập bản đồ, khảo sát trên không, giám sát mỏ, giám sát xây dựng,… So với các phương pháp truyền thống, Drone có nhiều ưu điểm nổi bật như tính linh hoạt cao và chi phí thấp cho mỗi thông tin thu thập. Bài báo này nghiên cứu về dự án giám sát khu vực xây dựng sử dụng ảnh quang học được thu thập bằng Drone Phantom 4 Pro. Khu vực nghiên cứu là khu dân cư Việt Phú Garden ở xã Phong Phú, Huyện Bình Chánh, Thành phố Hồ Chí Minh. Tác giả theo dõi trong khoảng thời gian 6 tháng nhờ sử dụng Drone để thu thập dữ liệu ảnh và sử dụng phần mềm Agisoft Photoscan để xử lý tạo các sản phẩm gồm đám mây điểm, ảnh trực giao, mô hình số bề mặt. Độ phân giải của ảnh trực giao và DSM lần lượt là 5.5cm/ pixel và 11cm/pixel. Sản phẩm được sử dụng tạo các mô hình thay đổi DSM (DoD) đồng thời kết hợp ảnh trực giao để giám sát sự biến động không gian xây dựng của khu vực. Kết quả đánh giá được sự xuất hiện của các tòa nhà mới, các tòa nhà được sửa chữa, và các khu vực không có sự thay đổi. Nghiên cứu góp phần cải tiến việc quản lý sự phát triển không gian đô thị và giúp việc quy hoạch dễ dàng hơn. Tuy nhiên, phương pháp vẫn gặp một vài hạn chế về sai số, tác giả cũng đã đề xuất hướng cải thiện độ phân giải và độ chính xác ở các nghiên cứu tiếp theo.

Từ khóa: *UAV, giám sát, xây dựng, DSM, DoD.*

UNCERTAINTY OF METHOD USING RADIOACTIVITY CONCENTRATIONS OF ^{210}Pb, ^{137}Cs AND ^{241}Am TO ESTIMATE SEDIMENT AGES AND ACCUMULATION RATES IN CAN GIO MANGROVE FOREST, VIETNAM

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Abstract: Application of methods using natural and artificial radionuclides such as ^{210}Pb, ^{226}Ra, ^{137}Cs and ^{241}Am in sediments to estimate ages and accumulation rates of sediments, has been extensively developing for the recent past decades. Generally, their results had have been worldwide agreed in many certain areas, but other areas have not yet. Can Gio mangrove forest (CGM) located in the downstream of Dong Nai – Sai Gon River, Southwards of Ho Chi Minh City to the East Sea, where its sedimentation and erosion have complicatedly changed for decades. A number of 152 sediment samples of the core in the CGM was analyzed for ^{210}Pb, ^{226}Ra, ^{137}Cs and ^{241}Am. The results showed unsupported 210Pb very low concentrations and irregular decline with time, consequently, their sediment ages and accumulation rates could be extensively deviated. Otherwise, method using low peaks of ^{137C}s concentrations at few different depths of cores, could be counted for estimation of sediment ages and accumulation rates, but it's results are quite far to match with those using ^{210}Pb concentrations. Whereas, almost concentrations of ^{241}Am have not been detected any depth of cores. These could be suggesting that resulting from the CGM's geographic location and unique features. Therefore, other appropriate methods should be applied to substitute for estimating ages and accumulation rates of sediment in estuary of the CGM region

Keyword: *Sediment accumulation rate, radioactivity concentration, ^{210}Pb, ^{137}Cs, and Can Gio mangrove forest.*

LỊCH SỬ TIẾN HÓA KIẾN TẠO BỂ TRẦM TÍCH MESOZOI MUỘN PHÚ QUỐC KHU VỰC TÂY NAM VIỆT NAM

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Tóm tắt: Bể trầm tích Mesozoi muộn Phú Quốc khu vực Tây Nam Việt Nam phát triển trên khối Chanthaburi và đã trải qua hai chế độ kiến tạo: Bể giữa núi (giữa đới khâu Klaeng - Bentong Raub ở phía tây và đới khâu Sa Kaeo - Hòn Chuối ở phía đông) trong thời kỳ Jura sớm - giữa. Chồng lên bể giữa núi Jura ra sớm - giữa này là bể sau cung (sau cung núi lửa pluton Tri Tôn - Đà Lạt) trong thời kỳ Jura muộn - Creta. Bể trầm tích Phú Quốc trong giai đoạn Jura - Creta chính là bể tích chồng. Vào Paleocen, quá trình nén ép, uốn nếp, đứt gãy, nâng lên và bóc mòn xảy ra mạnh mẽ, tạo nên hệ thống các nếp uốn lớn phương TB-ĐN (nếp lồi Nam Thổ Chu) và phương kinh tuyến (nếp lõm Tây Thổ Chu, nếp lồi Thổ Chu và nếp lõm Tây Phú Quốc); hệ thống đứt gãy nghịch phương kinh tuyến và đứt gãy trượt bằng trái phương TB-ĐN; và bề mặt bóc mòn mang tính khu vực, có xu hướng nghiêng thoải từ ĐB đến TN. Trong thời kỳ Eocen?, Oligocen đến Miocen sớm - giữa, vùng rìa TN bể trầm tích Phú Quốc phát triển bể trầm tích Malay - Thổ Chu. Lớp phủ trầm tích Miocen muộn - Đệ Tứ của bể được hình thành và mở rộng dần từ vùng TN đến ĐB trong bối cảnh thềm rìa lục địa thụ động.

Từ khóa: *Mesozoi muộn Phú Quốc, bể giữa núi, bể sau cung, bể tích chồng, Tây Nam Việt Nam.*

ĐÁNH GIÁ MỨC ĐỘ ẢNH HƯỞNG CỦA ĐỘ ẨM ĐẾN SỨC KHÁNG CẮT CỦA ĐẤT ĐỒNG THỜI ỨNG DỤNG VÀO TÍNH TOÁN ĐỘ ỔN ĐỊNH CỦA MÁI DỐC

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Tóm tắt: Nội dung bài báo này tập trung vào việc nghiên cứu trình bày các đặc điểm về mái dốc, những đặc trưng cơ lý cùng với những nhân tố ảnh hưởng đến đọ ẩm của mái dốc. Cơ sở lý thuyết về sức kháng cắt của đất,những chỉ tiêu cơ lý của đất, mối quan hệ giữa độ ẩm đến sức kháng cắt của đất, phương pháp chế bị mẫu đồng thời xác định cường độ chống cắt của đất tại những độ ẩm khác nhau. Sử dụng phần mềm Geostudio modul Geoslope/W để tính toán hệ số an toàn (HSAT) cũng như đưa ra kết quả đánh giá mức độ an toàn của mái dốc. Đồng thời sử dụng phương pháp tường chắn có cốt để tiến hành gia cố nền đất yêu tại độ ẩm 20%.

MẤT ỔN ĐỊNH BỜ SÔNG HẬU ĐOẠN QUA TỈNH AN GIANG: NGUYÊN NHÂN VÀ GIẢI PHÁP

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Tóm tắt: Trong những năm gần đây, hiện tượng mất ổn định bờ sông Hậu qua tỉnh An Giang đã xảy ra với cường độ và quy mô ngày càng lớn. Một số đoạn bờ sông đã bị trượt lở nghiêm trọng như đoạn trượt lở sông Hậu trên quốc lộ 91 vào năm 2010, 2019, đoạn trượt lở sông Hậu qua phường Bình Đức, phường Bình Khánh vào năm 2012, đoạn trượt lở sông Hậu xã Mỹ Hội Đông vào năm 2017. Nguyên nhân quan trọng gây ra mất ổn định bờ sông là do cấu trúc địa chất bờ sông trên nền đất yếu với ba đặc điểm đặc trưng gồm: Thấu kính cát hạt mịn đến hạt thô bề dày 12,0 - 16,0m ở độ sâu từ 6,0m đến 34,3m; Thấu kính cát hạt mịn đến hạt trung bề dày 10 - 30 cm xen kẹp trong lớp bùn sét ở độ sâu từ 14,0m đến 29,5m; Lớp sét pha phân bố từ bề mặt đến độ sâu 3,4m ở các cù lao với thành phần hạt bụi nhiều, dễ co ngót, nứt nẻ và bị bóc mòn khi có ngoại lực tác động. Ngoài ra, các yếu tố hình thái và các yếu tố thủy động lực dòng chảy bất lợi, bên cạnh các hoạt động kinh tế - xây dựng ven sông cũng đã thúc đẩy gây mất ổn định bờ sông. Bài báo đã nghiên cứu, tổng hợp các yếu tố gây mất ổn định bờ sông dựa trên các đặc trưng về cấu trúc địa chất từ đó kiến nghị giải pháp công trình phù hợp giải quyết các yếu tố gây mất ổn định bờ sông Hậu qua tỉnh An Giang tại bốn khu vực nghiên cứu điển hình là: đoạn qua thị xã Châu Đốc, đoạn qua phường Bình Mỹ, đoạn qua cù lao Bình Thạnh và đoạn qua cù lao Mỹ Hòa Hưng.

Từ khóa: *trượt lở, mất ổn định bờ sông, cấu trúc địa chất, cấu trúc nền đất yếu.*

THE VULNERABILITY OF COASTAL AREA TO SEA TOURISM DEVELOPMENT IN PHU QUOC ISLAND

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Abstract: Revenue from tourism contributes a large amount in the overall gross product domestic of a regional economy. It provides the opportunities for many people in local and regional area. Located in the Gulf of Thailand, Phu Quoc island has numerous advantages in the sea tourism development. This paper overviews the current state of the local development in sea tourism, analyzes the possible negative impacts threatening the vulnerability of the coastal area. As results, there are four main concerns identified during the tourism development in Phu Quoc island including: water pollution, beach erosion, reducing the coral colonies and the sea level rise.

Keywords: *Phu Quoc, sea tourism, beach erosion, vulnerability, coastal area.*

PERMEABILITY COMPARISON IN DIFFERENT METHODS OF DIAGNOSTIC FRACTURE INITIAL TESTS

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Abstract (250-300 words): Mini-Fracture Tests which are also known as Diagnostic fracture injection tests (DFITs) are utilized as an efficient technique to ascertain formation effective permeability and closure pressure indirectly in unconventional reservoirs. The results taken from Mini-Frac Test are specifically advantageous owing to its obtainment beforehand available production of a given well. An initial fracture, in Mini-Fracture Tests, is formed by injection of fluid until formation breaks down and the fracture propagates a small remoteness into the reservoir. After shut-in of the injec-tion, the pressure decline is recorded. From the falloff data, by Nolte's G-function, log-log plot, or square root of time analysis, the effective permeability of the formation can be estimated. In this paper, case studies are considered using the Software MFrac Suite 12 (Baker Hughes) by consistently applying method of analysis of the G-function, its derivatives, and its relationship to other diagnostic techniques including square-root(time) and log(Δpwf)-log(Δt) plots and their appro-priate diagnostic derivatives. By the way of illustration, the commonly applied G-function study yielded approximations of per-meability over an order of magnitude higher than the simulated matrix permeability. Error of perme-ability which is taken from the G-function were higher for higher matrix permeability and in the existence of a fracture network. In contrast, Δp versus G-time straight-line analysis yielded much closer (in the same order of magnitude) evaluations of permeability.

Keywords: *Mini-Fracture Tests; DFITs, fracture, G-function, Log-log, MFrac*

STUDY OF CORROSION MODELS FOR OIL AND GAS PIPELINE

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Abstract: The objective of this paper is to study the deviation of different corrosion simulating models. This research is motivated by a practical problem: a significant difference in results obtained by common existing corrosions models using in the petroleum industry. The investigated matter of this research is the empirical CO_2 corrosion rate calculation model of the Norwegian standard M-506 and the common software used in many oil and gas companies, ECE 5.4 Electronic Corrosion Engineer by Wood Group Intetech. The case study of this research is a multiphase flow pipeline transporting gas and condensate with traces of H_2S and CO_2. The outcome of this study will help future corrosion studies in choosing the suitable model as well as in prudent analysis of the results.

Keywords: *Corrosion, Pipeline, Modeling.*

DETERMINATION OF HYDROCARBON POTENTIAL IN UNCONVENTIONAL RESERVOIR USING ANALYTICAL METHOD

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Abstract: Unconventional Reservoir, Tight Reservoir, refers to Hydrocarbon which is highly locked in impermeable zones that are typically trapped between limestone and sandstone, called non-porous rock. Tight Reservoir is generally defined the permeability less than 0.1 mD of matrix permeability and less than 10 percent of matrix porosity, meanwhile the tight oil, known as shale oil or light tight oil that hydrocarbon consists of light crude oil contained in oil bearing-zone in a formation of low permeability (tight sandstone). Tight reservoirs are mostly associated with conventional reservoir, which could be sandstone, siltstone, dolomite, and chalks with significant thickness. The unconventional formation requires more efforts due to the low-porosity and irregularly distributed or badly connected porosity as a matrix saturation model in tight sand is established based on the conductive water affected by low porosity. In the previous study, they were not considering the clay mineral, this paper will discuss determining Hydrocarbon in a tight sand reservoir and has an advanced interpretation that cannot be using the primary method due to lower permeability so it will be derived by using the analytical method in determination of bound-water to determine saturation water affected by the presence of clay content, the bound-water is extremely important for the calculation of clean water saturation. therefore the gamma ray shows high gamma API which misleads the reservoirs as non-reservoir and the resestivity will show high resestivity due to low porosity. the outstanding result will be derived by various logs to determine the hydrocarbon potential. in the end, the study case will be discussed by step to step clearly to find out the potential location in tight sandstone.

Keywords: *Tight Reservoir, Clean Water-Saturation, Low Permeability, Clay Content*

ỨNG DỤNG MẠNG NƠRON NHÂN TẠO DỰ BÁO GIÁ TRỊ ĐƯỜNG LOG KHÔNG GHI ĐƯỢC TỪ NHỮNG ĐƯỜNG LOG ĐÃ CÓ

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Tóm tắt: Mật độ, điện trở suất là hai thông số quan trọng để đánh giá thành hệ và nghiên cứu về địa vật lý. Tuy nhiên, các bản dữ liệu đo log ghi được bị thiếu do nhiều nguyên nhân như dụng cụ bị hỏng, điều kiện về hố khoan, dụng cụ đo log bị lỗi hoặc mất dữ liệu do không phù hợp với bộ nhớ lưu trữ. Điều này làm cho kết quả đường log bị khuyết mất một phần hoặc toàn bộ đường log nào đó. Chính vì vậy nên việc tìm ra một phương pháp mới để ước tính các thông số bị mất là cần thiết. Để giải quyết vấn đề nêu trên thì mạng nơron nhân tạo là một phương pháp với tính năng vượt trội trong việc xây dựng mối quan hệ phi tuyến giữa đầu vào và đầu ra. Trong nghiên cứu này, tập thể tác giả sử dụng phương pháp mạng nơron nhân tạo bằng thuật toán lan truyền ngược để xác định giá trị đường log giếng X từ những đường log hai giếng A và B đã có. Kết quả tính toán sẽ được đối sánh để đánh giá độ tin cậy của dự báo giá trị đường log.

Từ khoá: *địa vật lý giếng khoan, mật độ, điện trở suất, sóng âm, mạng nơron nhân tạo.*

MÔ HÌNH HÓA THUỘC TÍNH VỈA DẦU KHÍ VỚI CÁC THUỘC TÍNH ĐỊA CHẤN VÀ MẠNG NƠ-RON NHÂN TẠO

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Tóm tắt: Các phương pháp địa thống kê thường được sử dụng trong thời gian qua để mô hình hóa vỉa dầu khí trong đó dữ liệu đo đạc từ các giếng và thông tin địa chất được tích hợp trên nền tảng xác suất thống kê để xây dựng mô hình thuộc tính của vỉa như mô hình tướng đá, mô hình rỗng-thấm. Mặc dù đã có nhiều quy trình mô hình hóa chuyên sâu được thiết kế và đưa vào sử dụng theo hướng tiếp cận địa thống kê, bản chất thiếu dữ liệu cố hữu trong giai đoạn thăm dò dầu khí thường dẫn đến tình trạng là ứng với cùng một vỉa dầu khí có tính bất đồng nhất cao, phương pháp địa thống kê cho ra nhiều mô hình kết quả có cùng xác suất tồn tại trong thực tế. Tính "đa nghiệm" này đòi hỏi nhiều thời gian và công sức để có một phương án phát triển mỏ khả thi.

Trong những năm gần đây, một hướng tiếp cận khác đã được ứng dụng rộng rãi trong mô hình hóa vỉa bằng cách tích hợp dữ liệu địa chấn vào trong mô hình tính toán của mạng nơ-ron nhân tạo (ANN). Hướng tiếp cận này tận dụng được một lượng lớn dữ liệu "cứng" (có được từ công tác thu nổ địa chấn) và nhờ vậy tránh sử dụng các thông tin "mềm" (có được trên cơ sở xác suất có điều kiện). Mặt khác, với các giải thuật tính toán nâng cao trong quá trình luyện mạng ANN nhằm mô tả các mối quan hệ phi tuyến đa biến phức tạp, hướng tiếp cận này cho phép mô hình hóa các vỉa dầu khí có cấu trúc phức tạp và có tính bất đồng nhất cao.

Bài báo trình bày kết quả xây dựng mô hình thuộc tính vỉa dầu khí cho mỏ X bằng cách kết hợp phân tích các thuộc tính địa chấn với mạng ANN. Trong nghiên cứu này, các giải thuật luyện mạng có và không có giám sát được đi sâu khảo sát để phân tích các thuộc tính địa chấn theo mối quan hệ của chúng với các thuộc tính của vỉa dầu khí. Mô hình thuộc tính vỉa sau đó được xây dựng bằng cách tích hợp các thuộc tính địa chấn đã được chọn lọc với các dữ liệu giếng để luyện mạng ANN nhằm mô tả một cách toàn diện các thông số vỉa. Mô hình kết quả của nghiên cứu này cho thấy sự tương đồng khá tốt với kết quả từ phần mềm thương mại. Ngoài ra, khác với phương pháp địa thống kê với bản chất đa nghiệm, mô hình kết quả của nghiên cứu này là duy nhất và có độ tin cậy cao.

Từ khóa: *Mạng nơ-ron nhân tạo (ANN); Luyện mạng không giám sát; Luyện mạng có giám sát; Thuộc tính địa chấn; Mô hình hóa thuộc tính vỉa dầu khí.*

CƠ CHẾ HÌNH THÀNH THÂN DẦU MÓNG NỨT NẺ, HANG HỐC TRƯỚC KAINOZOI MỎ BẠCH HỔ

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Tóm tắt: Đá móng với đặc trưng độ rỗng và độ thấm nguyên sinh rất nhỏ nên đã từng không được xem là đối tượng có triển vọng dầu khí; tuy nhiên trong những điều kiện nhất định khi đá móng bị biến đổi mạnh có thể có độ rỗng thứ sinh và độ thấm rất tốt, móng granite mỏ Bạch Hổ độ rỗng biểu kiến có thể lên đến 10% và độ thấm hàng ngàn mD, trở thành đá chứa dầu khí chất lượng cao. Trên thế giới hiện trên 200 mỏ dầu được phát hiện trong móng nứt nẻ, hang hốc Thực tiễn thăm dò khai thác đã chứng tỏ thân dầu móng mỏ Bạch Hổ trong đá móng nứt nẻ là thân dầu đặc biệt và là đối tượng chứa dầu chính tại Việt Nam, trong những năm đầu thế kỷ 21 thân dầu này góp 80% sản lượng khai thác. Tuy nhiên cách đánh giá cơ chế hình thành thân dầu trong móng vẫn còn nhiều vấn đề cần giải quyết. Với việc áp dụng hệ phương pháp phản chiếu hệ thống, di chỉ bền vững phân tích đặc thù riêng và phương pháp tiếp cận hệ thống.đã xác định cơ chế hình thành nứt nẻ, hang hốc thân dầu móng mỏ Bạch Hổ trong đó hai tác nhân kiến tạo và nhiệt dịch đóng vài trò chính.

Từ khoá: *Thân dầu móng nứt nẻ, kiến tạo, độ rỗng, độ thấm, tiếp cận hệ thống*

ỨNG DỤNG HỆ THỐNG MẠNG NƠRON NHÂN TẠO XÁC ĐỊNH ĐỘ THẤM THÂN DẦU MÓNG NỨT NẺ MỎ BẠCH HỔ THEO TÀI LIỆU ĐỊA VẬT LÝ GIẾNG KHOAN KẾT HỢP ĐỘ THẤM KHOẢNG

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Tóm tắt: Trong thăm dò khai thác dầu khí mạng nơron nhân tạo (ANN) đã được áp dụng để xác định độ thấm của đá chứa trầm tích lục nguyên theo tài liệu địa vật lý giếng khoan kết hợp với độ thấm xác định từ mẫu lõi làm thông số mong muốn. Tuy nhiên với đá móng nứt nẻ, những hạn chế khi lấy mẫu cũng như độ tin cậy của độ thấm được xác định trên mẫu lõi trong phòng thí nghiệm đã làm kết quả không phản ánh độ thấm của đới sát thành giếng.

Kết quả nghiên cứu thân dầu móng nứt nẻ ở mỏ Bạch Hổ, cho thấy: độ thấm khoảng được xác định trên cơ sở phân tích tài liệu thử vỉa (Drill Sterm Test: DST) và tài liệu khảo sát dòng có độ tin cậy cao, phản ánh trực tiếp và sát thực độ thấm của đới sát thành giếng. Do đó, để xác định mặt cắt độ thấm của đới dọc thân giếng trong mô hình ANN, độ thấm khoảng được chọn làm thông số mong muốn.

Trên cơ sở tài liệu DST và Production Logging Tool của 16 giếng khoan phương pháp ANN đã được áp dụng xác định mặt cắt độ thấm từ tài liệu ĐVL-GK (với tỷ lệ 10cm/điểm) với điều kiên bảo toàn giá trị khoảng. Độ tin cậy của kết quả thấm khoảng theo ANN và theo DST&PLT được kiểm tra với hệ số tương quan cao, R=0,98. Từ đó hệ thống ANN bao gồm 44 ANN được thiết lập và ứng dụng để xác định mặt cắt độ thấm đối với các giếng chỉ có tài liệu địa vật lý giếng khoan.

Từ khoá: *Mạng nơron nhân tạo, tài liệu ĐVLGK, độ thấm khoảng, thân dầu móng nứt nẻ.*

OLIGOCENE TRAPS AND THEIR RESERVOIR QUALITY IN CUU LONG BASIN, OFFSHORE VIETNAM

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Abstract: Cuu Long Basin (CLB), a Cenozoic rift basin located in the southeastern shelf of S.R. Vietnam with high potential of oil and gas. Up to date, most production in CLB is contributed from structural traps, making them more and more depleted after years of exploitation. Exploration activities in CLB, therefore, are shifting towards nonstructural traps including stratigraphic and/or combination ones.

The results of exploration and appraisal activities in recent years have increasingly discovered more hydrocarbons in the Oligocene section of CLB, thus showing higher potential of Oligocene targets. Some of them were discovered in combination/stratigraphic traps, such as Ca Tam, Song Ngu, Kinh Ngu Trang Nam etc. These demand further attentions to explore the nonstructural traps. Many studies on Oligocene targets in CLB have been carried out but only few mention nonstructural traps. This leads to unclear forming mechanism and distribution as well as unevaluated hydrocarbon potential of these nontraditional traps. Therefore, additional studies and assessments of recently discovered nonstructural traps need to be carried out in order to support future exploration and appraisal program in CLB.

By applying the integration of exploration methods such as seismic sequence stratigraphy and seismic attribute interpretation, petrophysical and petrographical analysis, this article discusses the assessments of combination/stratigraphic trap types within Oligocene section in CLB including (i) identifications of several trapping mechanisms and (ii) some evaluations of the trap's reservoir quality utilizing the database of some 2D/3D seismic sections, several wells and unpublished reports. The research results shows that the key forming factor for primary stratigraphic traps of sand body is lithology change and the one for pinch-out stratigraphic traps is tapering off of sand layers landward or toward the horsts. The reservoir quality of these traps ranges from moderate to good. Further detailed studies on reservoir distribution and sealing capacity of these trap types, however, need to be carried out to fully evaluate hydrocarbon potential of these stratigraphic/ combination traps, and minimize risks in exploration drilling.

Key words: *stratigraphic trap, trapping mechanism, reservoir quality, Cuu Long Basin*

XÁC ĐỊNH QUY LUẬT PHÂN BỐ TƯỚNG ĐÁ CẬP NHẬT MÔ HÌNH ĐỊA CHẤT TẬP ILBH 5.2 MIOCEN HẠ MỎ RỒNG TRẮNG, LÔ 16-1 BỒN TRŨNG CỬU LONG

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Tóm tắt: Dòng dầu khí thương mại được phát hiện tại tập cát kết 5.2U, mỏ Rồng Trắng lô 16-1 bể Cửu Long trong đối tượng triển vọng trầm tích Miocen hạ. Tuy nhiên tầng chứa thường là tập hợp các vỉa mỏng xen kẹp, rất bất đồng nhất. Trên cơ sở xác định nguồn gốc của vật liệu, điều kiện của môi trường bị phá hủy, chế độ động lực học của quá trình vận chuyển, bối cảnh địa hóa môi trường lắng đọng và tạo đá, công trình làm sáng tỏ quy luật phân bố tướng đá tầng chứa. Việc áp dụng phương thức tiếp cận tổng hợp địa chấn địa tầng, thuộc tính địa chấn, tài liệu thạch học, mẫu lõi và địa vật lý giếng khoan kết hợp với ứng dụng mô hình địa chất độ phân giải cao (HRGM) cho phép chính xác hoá quy luật phân bố tướng đá của tập ILBH 5.2 Miocen hạ trong khu vực nghiên cứu. Kết quả nghiên cứu tập trầm tích ILBH 5.2 đã phân loại thành công loại tướng đá tương ứng với môi trường thành tạo: Môi trường sông gồm tướng tướng trầm tích lòng sông, trầm tích vỡ đê và trầm tích ven sông có xu thế phân bố theo phương từ Tây – Đông đến Bắc Tây Bắc – Nam Đông Nam, trong đó vùng Bắc – Tây Bắc đá chứa có chất lượng tốt nhất, trong khi đó theo phương Đông Nam là các tướng trầm tích lòng hồ, trầm tích cát ven bờ và trầm tích cát xa bờ được hình thành trong môi trường hồ và tại ranh giới giữa 2 môi trường đá chứa có chất lượng cao hơn cả.

Từ khoá: *Tướng đá, xu thế phân bố, mô hình cập nhật, tích hợp số liệu.*

MÔ HÌNH HÓA TỐC ĐỘ KHOAN VÀ ĐÁNH GIÁ ẢNH HƯỞNG CỦA CÁC THÔNG SỐ KHOAN ĐỐI VỚI GIẾNG KHOAN ĐỊA NHIỆT

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Tóm tắt: Tốc độ khoan ROP là một trong những yếu tố quan trọng nhất quyết định đến sự thành bại của một dự án khoan. Khác với giếng khoan dầu khí vốn có thành hệ tương đối đồng nhất, thành hệ của giếng khoan địa nhiệt có nhiều tầng đất đá khác nhau với độ nứt gãy cao, và dễ bị biến chất do nhiệt độ cao. Bởi thế, để khoan một giếng khoan địa nhiệt có hiệu quả, cần phải lưu ý đến mức độ ảnh hưởng của những thông số khoan đến tốc độ khoan. Trong bài báo này, mô hình tốc độ khoan đã được thay đổi để phù hợp với giếng khoan địa nhiệt từ mô hình của Bourgoyne và Young đã được trình bày và áp dụng nó để mô hình hóa tốc độ khoan từ dữ liệu của một giếng khoan địa nhiệt. Sau khi thiết lập được mô hình tiến hành phân tích độ nhạy của các thông số khoan có thể điều khiển được như là tải trọng lên choòng WOB, số vòng quay RPM nhằm đánh giá ảnh hưởng của chúng.

Từ khóa: *tốc độ khoan ROP, tải trọng lên choòng WOB, số vòng quay RPM, phân tích độ nhạy*

ĐÁNH GIÁ MỨC ĐỘ ẢNH HƯỞNG CỦA ĐỘ LINH ĐỘNG CHẤT LƯU LÊN SỰ SUY GIẢM SẢN LƯỢNG KHAI THÁC BẰNG PHƯƠNG PHÁP MÔ PHỎNG

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Tóm tắt: Nắm rõ về hiệu suất tầng chứa và ứng xử khai thác là rất quan trọng trong việc tối ưu hóa, phát triển mỏ và quản lý vỉa trong giai đoạn khai thác. Đặc biệt, sự dịch chuyển dầu-nước, sự suy giảm sản lượng là một hàm biến thiên của độ nhớt chất lưu, góc nghiêng của tầng chứa, độ thấm tương đối, cũng như hình dạng tầng chứa và cơ chế chính xác của năng lượng vỉa. Sự suy giảm theo cấp số nhân (exponential) thường được sử dụng để dự báo sản lượng. Tuy nhiên, việc lạm dụng sử dụng phương pháp này có thể dẫn đến đánh giá thấp hệ số thu hồi dầu. Mục tiêu chính của nghiên cứu là tìm hiểu sự suy giảm sản lượng bằng cách sử dụng mô phỏng tầng chứa, phân tích đường cong suy giảm (DCA) và mô hình dịch chuyển chất lưu. Kết quả của mô phỏng được sử dụng làm dữ liệu đầu vào cho DCA và các mô hình phân tích: Buckley-Leverett và Welge cho dòng chảy khuếch tán. Nghiên cứu này chỉ ra rằng không nên áp dụng sự suy giảm theo cấp số nhân cho sản lượng. Khi độ nhớt của dầu và độ thấm tương đối của nước tăng, góc nghiêng của tầng chứa và độ thấm tương đối của dầu giảm, sản lượng khai thác có xu hướng chuyển sang Harmonic. Mặt khác, việc thay đổi độ bão hòa nước và độ bão hòa dầu dư không ảnh hưởng đến đường cong suy giảm sản lượng. Hơn nữa, kết quả chỉ khác trong trường hợp ngập nước. Phương pháp Buckley-Leverett không xét đến áp lực mao dẫn, nên một số kết quả dự báo sai khác với kết quả mô phỏng thực tế.

Từ khóa: *Suy giảm sản lượng, độ linh động của chất lưu, đường cong suy giảm, độ nhớt, độ thấm tương đối.*

CÔNG NGHỆ NANO ĐỐI VỚI DUNG DỊCH KHOAN TRONG CÔNG NGHIỆP DẦU KHÍ

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Tóm tắt: Công nghệ nano ngày càng có vai trò quan trọng trong khoa học và kỹ thuật, đặc biệt đối với dung dịch khoan trong công nghiệp dầu khí. Mục đích chính của bài viết là nhằm trình bày một số ứng dụng công nghệ nano đối với dung dịch khoan trong nhiều lĩnh vực của ngành dầu khí như là: giảm thiểu thiệt hại thành hệ và mất dung dịch; điều chỉnh các tính chất lưu biến của dung dịch; trừ khử hydro sunfua; xử lý nước thải dầu khí; nâng cao sự ổn định giếng đối với các thành hệ đá phiến; cải thiện hiệu suất thu hồi dầu tăng cường, v.v…. Chúng thực sự là mối quan tâm lớn của cả các nhà nghiên cứu trong công nghiệp và học thuật. Kết quả thu được cho thấy các hạt nano có tiềm năng lớn được sử dụng làm các phụ gia cho dung dịch khoan để khắc phục các sự cố trong quá trình khoan và khai thác dầu khí. Tuy nhiên, vẫn còn những thách thức cần được giải quyết để tận dụng tối đa khả năng của các hạt như vậy. Do vậy, cùng với các khả năng và cơ hội phát triển thì một số vấn đề thách thức của công nghệ nano đối với dung dịch khoan trong tương lai của công nghiệp dầu khí cũng được nhìn nhận và thảo luận.

Từ khóa: *Công nghệ nano, Hạt nano, Dung dịch khoan, Công nghiệp dầu khí.*

PHÂN TÍCH QUÁ TRÌNH VẬN CHUYỂN MÙN KHOAN TRONG HOẠT ĐỘNG KHOAN GIẾNG THÂN NHỎ

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Tóm tắt: Trong giếng khoan thân nhỏ, loại bỏ mùn khoan hiệu quả từ giếng khoan được coi là một điều cần thiết cho sự thành công của hoạt động khoan. Nó phải được theo dõi và kiểm soát thích hợp trong toàn bộ hoạt động khoan của giếng. Tuy nhiên, vẫn còn một số lượng hạn chế công việc liên quan đến vận chuyển mùn khoan trong giếng thân nhỏ. Trong bài báo này, hai mô hình được phát triển từ phương pháp thực nghiệm, cụ thể là mô hình của Larsen và mô hình của Rubiandini, đã được sử dụng để xem xét trong việc vận chuyển mùn khoan trong giếng thân nhỏ. Các phân tích trường hợp nghiên cứu cũng trình bày tác động của thông số khoan khác nhau đến tốc độ dòng chảy và tốc độ dòng chảy để vận chuyển mùn khoan hiệu quả. Các tính toán từ hai mô hình thực nghiệm cho thấy cả hai mô hình có cùng xu hướng giống về tốc độ dòng chảy và tốc độ dòng cần thiết để vận chuyển mùn khoan với các thông số khoan, như trọng lượng mùn, tốc độ khoan (ROP), lưu biến của mùn, v.v. Cuối cùng, một số khuyến nghị về vận chuyển mùn khoan như thế nào là tốt hơn được đề xuất thu được từ kết quả mô phỏng khi sử dụng mô hình Larsen và Rubindini cho tính toán tốc độ dòng chảy mùn khoan trong giếng thân nhỏ.

Từ khóa: *Vận chuyển mùn khoan, giếng khoan thân nhỏ, tốc độ dòng chảy, mô hình thực nghiệm, thông số*

TESTING NEURAL NETWORKS ASSESSMENT BASED ON DATA-DRIVEN USING WELL LOG DATA IN CUU LONG BASIN, OFFSHORE VIETNAM

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Abstract: The objective of this study is to evaluate the effectiveness of neural networks testing on well log data in the study area. The Artificial Neural Networks (ANNs) and Convolutional neural networks (CNNs) models will be developed to predict the missing part of the data or verify the values due to errors in the measurement process. The reliability and accuracy of the methods are expressed through the loss function or the correlation coefficient R^2. In addition, neural networks are also used to create virtual logs at any location in the reservoir based on log data from existing wells to get a better view of the geological characteristics in subsurface without any new drilling wells. The accuracy of these logs was tested for newly drilled wells at the time the system was developed and trained. Results showed that predicting using CNNs was much more effective than ANNs. Therefore, the use of CNNs allows to increase the efficiency of decision making by avoiding time-consuming procedures and processes.

Keywords*: Artificial neural networks (ANNs), Convolutional neural networks (CNNs), well log, loss function.*

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ỨNG DỤNG MÔ HÌNH ĐỊA CƠ HỌC TRONG PHÂN TÍCH ỔN ĐỊNH THÀNH GIẾNG KHOAN

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Tóm tắt: Việc phân tích và thiết kế giếng khoan trước khi đưa ra thực địa là một việc rất quan trọng, nó giảm thiểu tối đa những rủi ro có thể gặp phải, từ đó giảm chi phí khoan và đảm bảo an toàn cho môi trường và con người. Mục đích của bài báo này là xây dựng mô hình địa cơ học dựa vào các tiêu chuẩn phá hủy từ đó áp dụng vào tính toán tỷ trọng dung dịch gây sập lở, số cấp ống chống, chiều sâu đặt chân đế ống chống và xác định quỹ đạo giếng khoan thích hợp. Số liệu trong bài báo được lấy từ giếng khoan thực tế trong bồn trũng Nam Côn Sơn thuộc thềm lục địa Việt Nam. Dữ liệu này được lấy từ việc tổng hợp dữ liệu từ các giếng lân cận và tài liệu đo log. Kết quả nghiên cứu cho thấy rằng các thông số về ứng suất tạo chố, độ bền đất đá, góc nghiêng và góc phương vị của giếng có ảnh hưởng rất lớn đến độ ổn định giếng trong suốt quá trình khoan.

MÔ HÌNH BỒN TRŨNG VÀ HỆ THỐNG DẦU KHÍ KHU VỰC NƯỚC SÂU BỂ PHÚ KHÁNH, THỀM LỤC ĐỊA VIỆT NAM

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Tóm tắt: Mục tiêu của nghiên cứu này là đánh giá tiềm năng dầu khí trong lưu vực nước sâu bể Phú Khánh thông qua việc dự đoán thời gian hình thành hydrocarbon, các tuyến di cư, chất lượng và loại vỉa chứa hiện có tồn tại bên dưới bề mặt. Việc tích hợp tài liệu địa chấn, địa vật lý giếng khoan, dữ liệu địa chất và địa hóa nhằm mục đích mô phỏng quá trình tiến hóa và phát triển bồn trầm tích. Các điều kiện biên được xác định là dữ liệu đầu vào cho mô hình bồn trũng, bao gồm dòng nhiệt cổ (Paleo Heat Flow), độ sâu mực nước biển cổ (Paleo Water Depth) và nhiệt độ nước bề mặt (Surface Water Interface Temperature - SWIT). Bồn trũng bao gồm hai loại đá mẹ: đá mẹ Oligocene và Miocene Hạ - Trung, chủ yếu là hỗn hợp của kerogen loại II-III, với mức độ trưởng thành và phân bố khác nhau. Quá trình di cư của dầu khí đến tích tụ ở những cấu trúc nâng trong đá cát kết và đá carbonate rỗng thấm tuổi Miocene Hạ. Ngoài ra, một số lượng lớn các vỉa chứa dầu mỏ phân bố ở vùng nước cực sâu, với các dạng đá chứa như rẻ quạt biển sâu, turbidites, dạng trượt sụp của thành hệ Oligocene. Những kết quả này sẽ hỗ trợ các nhà điều hành khai thác xác định được vị trí của các vỉa chứa tiềm năng để lập kế hoạch phát triển mỏ trong tương lai.

Từ khóa: *Bồn trũng Phú Khánh, sự hình thành hydrocarbon, dòng nhiệt cổ, đá mẹ.*

ĐÁNH GIÁ YẾU TỐ KHÔNG CHẮC CHẮN ẢNH HƯỞNG TỚI KHỚP HÓA LỊCH SỬ ĐỐI TƯỢNG OLIGOCENE DƯỚI – E70, MỎ TN, BỒN TRŨNG CỬU LONG

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Tóm tắt: Xây dựng mô hình 3 chiều của một đối tượng vỉa chứa là bước quan trọng để dự báo sản lượng cũng như đề ra các phương án. Một trong những bước quan trọng là giai đoạn khớp hóa lịch sử. Vì vậy để giảm thiểu các yếu tố không chắc chắn, các thông số đầu vào cần được đánh giá tính rủi ro và lựa chọn những thông số có độ tin cậy cao nhất. Tính đến thời điểm hiện tại, việc xây dựng mô hình khai thác đối tượng Oligocene dưới - E70, mỏ TN vẫn tồn tại những rủi ro liên quan đến các yếu tố không chắc chắn của dữ liệu đầu vào. Đối tượng E70 đã khoan 2 giếng thăm dò, mẫu lõi lấy được số lượng không nhiều và chưa đại diện hết cho các vỉa sản phẩm, vì thế một số thông số cần phải lấy tương tự với các mỏ lân cận. Mẫu chất lưu gồm mẫu sâu thu thập trong quá trình khoan (DST và RCI), một số mẫu lấy đồng thời cả tầng E70 và tầng móng. Trong quá trình mô phỏng, kết quả của mẫu chất lưu riêng cho tầng E70 và mẫu đồng thời E70 và móng cho kết quả tương tự nhau. Tầng E70, mỏ TN tiến hành thử vỉa DST tại giếng 2X và 3X, tuy nhiên thời gian thử vỉa ngắn nên tính liên thông thủy động lực của khu vực giữa 2 giếng chưa đủ cơ sở để xác định. Trong quá trình xây dựng mô hình, tác giả đã đánh giá, xử lý và lựa chọn các thông số đầu vào cho đối tượng, bao gồm: quan hệ rỗng – thấm được lấy tương tự với đối tượng Oligocene, mỏ Bạch Hổ, mối quan hệ rỗng – thấm được sử dụng là trường hợp lowcase; kết quả phân tích mẫu lõi đặc biệt, mẫu PVT từ DST#1 TN-2X; thay đổi độ thấm xét tính liên thông. Thực hiện khớp hóa và chạy dự báo khai thác cho đối tượng E70. Mỗi lần chạy dự báo sản lượng thu hồi khi thay đổi độ thấm, kết quả thu hồi trên giếng sẽ được so sánh với kết quả thu hồi mỏ Bạch Hổ. Sản lượng khai thác trên giếng của mỏ Bạch Hổ nằm trong khoảng từ 1.9-2.1 triệu thùng, do đó, kết quả khớp hóa là giảm độ thấm của nửa bên khu vực giếng TN-2X 40-50%, nửa khu vực giếng TN-3X 20-30%.

Từ khóa: *yếu tố không chắc chắn, khớp hóa lịch sử, dự báo sản lượng, độ tin cậy, tính liên thông.*

ỨNG DỤNG MÔ HÌNH ĐIỆN DUNG – ĐIỆN TRỞ MỞ RỘNG ĐỂ ƯỚC TÍNH NHANH TỔNG LƯỢNG DẦU KHAI THÁC TỪ VỈA BƠM ÉP NƯỚC

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Tóm tắt: Nghiên cứu phát triển mô hình điện dung - điện trở mở rộng, CRMe (Extended capacitance – resistance models) cho vỉa X ở bồn trũng Cửu Long. Nơi mà nguồn năng lượng tự nhiên vẫn còn tác động gây nhiễu đến cơ chế năng lượng bơm ép nước. Điều đó đã ảnh hưởng đáng kể đến độ tin cậy của kết quả dự báo. Để giải quyết khó khăn này, chúng tôi xây dựng và kết hợp mô hình CRMe và Gentil mở rộng, đưa ra ước tính tổng lượng dầu khai thác cộng dồn khá sát với số liệu thực tế. Từ đó dự báo nhanh tổng lượng dầu thu được từ vỉa X trong 805 ngày tiếp theo là gần 3.14 triệu thùng.

Từ khóa: *điện dung – điện trở mở rộng, bơm ép nước, bồn trũng Cửu Long, dầu khai thác cộng dồn, extended capacitance – resistance models, waterflooding, Cuu Long Basin, cumulative oil production.*

ẢNH HƯỞNG CỦA CÁC CƠ CHẾ KIẾN TẠO MUỐI LÊN SỰ PHÁT TRIỂN VÀ PHÂN BỐ CỦA TẦNG CHỨA TẠI MỎ VOLVE, NA-UY BIỂN BẮC

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Tóm tắt: Dựa trên Tổng hợp dữ liệu địa chấn và nhiều giếng khoan trong mỏ Volve, nghiên cứu đã đánh giá các cơ chế hoạt động của tầng muối và sự ảnh hưởng của nó lên sự phân bố của tầng chứa. Tầng muối Zechstein được hình thành trong gia đoạn Permian muộn. Trong giai đoạn từ Triassic đến Cretaceous, sự phát triển của cấu trúc và địa tầng của đới nâng Utsira đã tạo ra hàng loạt các minibasin. Tiếp theo các trầm tích của môi trường biển, đầm lầy sông hồ và lục địa lắng đọng vào vùng trũng được tạo ra bởi muối di chuyển. Sự di chuyển của muối cùng với hệ thống đứt gãy trong khu vực đã gây ra sự phức tạp của sự bố và hình thái vỉa chứa. Các minibasin hình thành trong giai đoạn Triassic nguyên nhân do sự linh động của tầng muối Zechstein. Kết quả là các minibasin hình thành trong Jurassic do sự sụp xuống của các rạn muối. Trong Cretaceous sớm, các hình dạng của vỉa chứa ảnh hưởng bởi muối di chuyển ra khỏi khu vực nguyên nhân do sự nén ép của lượng lớn trầm tích lắng đọng bên trên. Trong giai đoạn còn lại của Cretaceous, thể tích muối di chuyển là lớn nhất so với các thời kỳ khác nguyên nhân do bề dày lớn và lắng trọng trầm tích trải dài trên toàn bộ khu vực nghiên cứu. Có 3 cơ chế chính gây ra muối di chuyển, đó là (i) sự hòa tan muối do nước ngầm và sự thay đổi mực nước biển biểu kiến, (ii) sự bào mòn muối và trầm tích khi tiếp xúc với nước biển, (iii) muối di chuyển từ khu này sang khu vực khác do sự tách dãn cấu trúc và sự nén ép lớn lên lớp muối bởi trầm tích dày, dẫn đến hình thành các khoảng trong cho trầm tích lắng đọng và hình thành các minibasin. Nghiên cứu đã đưa ra kết luận chi tiết về sự phát triển của minibasin trong khu vực mỏ Volve và vùng lân cận. Kết quả cũng đã nêu lên sự ảnh hưởng của tầng muối Zechstein lên sự phân bố và hình thái của vỉa chứa trong khu vực có sự hoạt mạnh mẽ của kiến tạo. Đồng thời, tác giả cũng trình bày quá trình trầm tích của các tầng chứa trong giai đoạn từ Triassic đến Cretaceous của mỏ Volve.

Từ khóa: *Kiến tạo muối, tầng Zechstein, sự phân bố tầng chứa, cơ chế hoạt động của muối, mỏ Volve.*

KHOA KỸ THUẬT GIAO THÔNG

FACULTY OF TRANSPORTATION ENGINEERING

PHÂN BAN: PHƯƠNG PHÁP TÍNH TOÁN TIÊN TIẾN TRONG KỸ THUẬT PHƯƠNG TIỆN

SESSION: ADVANCED COMPUTATIONAL METHODS IN VEHICLE ENGINEERING

INVESTIGATION ON THE EFFECT OF INTAKE PORT OFFSET TOWARDS SWIRL PATTERN IN LONG STROKE FPLG

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Abstract: This study aims to create swirl flow within the combustion chamber of a long stroke Free Piston Linear Generator (FPLG) by configuring the intake ports with an offset. In the current design, there are a total of 16 equally spaced intake ports placed in a circular pattern along the edge of the cylinder. ANSYS (fluent) Simulation is conducted for 3 different port offset values namely 15.8mm, 17mm, and 18.5mm. Results showed that 17mm is the more preferable option as it provides a balance between adequate swirl velocity while maintaining uniformity throughout the cylinder. Validation of this finding is done by constructing a prototype using acrylic based of selected simulated designs and then conducting PIV (Particle Image Velocimetry) experiments. Experimental results are found to be in close agreement with the simulation results. Therefore, it is concluded that 17mm port offset is indeed the most suitable option. Further optimization is done by also offsetting exhaust port at the same offset values as the intake port. Results have shown that even better performance can be achieved when both intake and exhaust port are at 18.5mm offset.

Keywords: *Free piston engine, Intake port offset, Linear generator, Long stroke, Swirl flow.*

A STUDY ON STABILITY AND CONTROL OF SMALL, SINGLE JET-ENGINE, MILITARY AIRPLANE IN A NONUNIFORM ATMOSPHERE

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Abstract: The purpose of this paper is to examine the stability and response characteristics of airplanes in terms of small motion perturbations relative to a given steady flight condition. These characteristics are also referred to as the dynamic stability and response behavior of an airplane in a nonuniform Atmosphere. We used Software Ansys-Fluent, Digital Datcom (AAA) and from some references we get all stability and control derivatives for our small Single Jet-engine military Airplane used in Vietnam. We used Matlab for calculation, analyze and modeling when an airplane is perturbed in pitch from a steady state conditions and resulting motion is damping out after some time, while the new steady state is significantly different from original one, the airplane is called dynamically instable and if it is not significantly different from original one, so the airplane is dynamically stable or neutral stability. Influence of Atmospheric turbulence will be examined in this paper.

Keywords: *Aircraft dynamics, Control systems Longitudinal motion, Phugoid mode, Short-period, Aircraft dynamics.*

AERODYNAMIC PROPERTY INVESTIGATION OF AN UNMANNED AERIAL VEHICLE (UAV) IN CASE OF FORWARD FLIGHT BY NUMERICAL APPROACH

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Abstract: This paper describes the process and results of a numerical simulation approach using the software OpenFOAM, for an unmanned aerial vehicle (UAV) in case of forwarding flight with a quite low Reynold number. With regard to the numerical approach, the aerodynamic properties are investigated through the turbulence model k-ω-SST (Shear Stress Transport), which is a part of the turbulence-calculation approach Reynolds Average Navier-Stokes (RANS). Furthermore, the entire process of mesh generation and the numerical-calculation process by simpleFoam in OpenFOAM, which is the solver using SIMPLE (Semi-Implicit Method for Pressure-Linked Equations) algorithm for steady, incompressible flow, are also depicted in this paper. In addition, the characteristics of the flow field surrounding the model and the characteristically aerodynamic coefficients (drag coefficient, lift coefficient, lift-to-drag ratio versus angle of attack and pressure coefficients, skin-friction coefficients for special positions on the wing) of the model are also illustrated apparently. Last but not least, the process description and results contribute a clear picture of numerical-execution steps in OpenFOAM and aerodynamic knowledge for the Computational Fluid Dynamics field in Aeronautics industry.

Keywords*: Unmanned aerial vehicle, forward flight, low Reynolds number, RANS, k-ω-SST.*

MODELING AND SIMULATION OF PID CONTROLLER-BASED ACTIVE SUSPENSION SYSTEM FOR A QUARTER CAR MODEL

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Abstract: Current automobile suspension systems using passive components only by utilizing spring and damping coefficient with fixed rates. Active suspension system has many advantages to make the vehicle operate safer and quieter than passive suspension system. Active suspension poses the ability to reduce the traditional design as a compromise between handling and comfort by directly controlling the suspensions force actuators. The objectives of this study are to obtain a mathematical model of active suspensions systems for quarter car model subject to excitation from a road profile using PID controller. The results of the study are a collection of multiple PID controller sets and comparative graphs between simulations of active and passive suspension systems. The study has been able to find the parameter of PID controllers of active suspension in many different road surfaces and speeds, which can create an active suspension. With the results of the study, it is possible to apply the real suspension system.

Keywords: *active suspension, passive suspension, quarter car, PID controller.*

THE EXPERIMENTAL STUDY ON THE PERFORMANCES OF THE THERMOELECTRIC GENERATOR UNIT AFFECTED BY HEAT RATE OF EXHAUST SYSTEM

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Abstract: This study examines the effect of heat rate transferring from exhaust system to the environment on the performance of the Thermoelectric Generator Unit (TGU). This heat rate is changed by attaching thermal insulation material on the outside of system and changing the heat absorbing area of TGU. The TGU consists of 8 thermoelectric generator modules and collects heat energy from the exhaust to produce electricity. It is attached on the custom muffler of the Suzuki Sapphire 125 and tested in the speed range from 20km/h to 50km/h. The results show that this heat rate affects the temperature and output power generated by the TGU. The reduction of this heat rate reduce the cool side temperature and raise the hot side temperature of the TGU. These two effects lead to the increase of the temperature difference between both sides of the TGU and therefore the output power increases. The difference in output power between test cases can reach up to 54%. At high speed, the heat dissipated at the exhaust tube does not considerably affect the output power of the TGU. However, the excess of hot side temperature of TGU due to thermal insulation material may damage the thermoelectric generator modules and reduce the efficiency of the TGU.

Keywords: *Heat rate, temperature, output power, thermoelectric generator unit.*

STUDY OF THE EFFECT OF BAFFLES ON LONGITUDINAL STABILITY OF PARTLY FILLED TANK TRUCK USING CFD

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Abstract: Sloshing of liquid in partially filled tank vehicle has strong effect to the directional stability and safety performance. Under the maneuver of the truck, such as steering, braking or accelerating, the liquid cargo in the tank tends to oscillate. As a result, hydrodynamic forces and moments are raised, which reduce the stability limit and controllability of the vehicle. To minimize the effect of sloshing, the baffles are usually added to the tank. This paper presents the study of the effect of baffles on the longitudinal stability of the tank truck using the computational fluid dynamics (CFD) approach. Three dimensional of fluid dynamic model of typical tank with different baffle configuration are developed. Simulation is performed for the case of constant acceleration longitudinal maneuver with different cargo load. The post processing results show that the baffles could provide resistance again the fluid sloshing, resulting in an improvement of longitudinal stability of the vehicle. The result also proof that the benefit of baffle to the tank truck stability depends on the size of the baffle, as well as the number of baffles.

Keywords: *Baffle, longitudinal dynamic fluid slosh, sloshing simulation, tank truck.*

A STUDY ON OPTIMIZING THE CHARACTERISTICS OF LITHIUM-ION BATTERY POWER SOURCE AND OPERATING COST FOR HYBRID MOTORCYCLE

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Abstract: This study presents a research related to a Plug-in Hybrid Electric Motorcycle which renovated from a Honda Lead 110cc with rear wheel is driven by original internal combustion engine and continuously variable transmission, while front wheel is directly-driven by a 48V – 1000W BLDC Hub-Motor. The research focuses on optimal calculating, designing, manufacturing and testing an electric power supply using Lithium-ion battery pack to replace the Lead – Acid battery being installed. Simulation and testing results are used as a basis to evaluate the dynamical characteristics and calculate the cost of renovation and operation. The study has completed designing and manufacturing a 48V – 33Ah Li-ion battery pack with a full-feature protection BMS circuit for mounting on the vehicle. The battery pack is 10.84kg weight and 8.11 liters volume, reduced 30 kg and 12.89 liters compared to the lead-acid battery. Battery life is greater than 2000 cycles. In only electric motor mode, the longest distance of the HEM is 78.77km (half load – only driver) and 65.83km (full load – one driver and one passenger). Maximum speed is 52.67 km/h (half load) and 48.42 km/h (full load). In hybrid mode until SOC reduce to 50%, HEM can travel 64.366 km (half load) and 54.477 km (full load). The fuel consumption in the each case is 2.162 and 2.425 liters/100km, 0.5 liter lower than the original one and 0.3 liter lower than Lead – Acid battery one. The cost of investment in HEM is VNĐ56 million and the operating cost is VNĐ1106/km, while the original vehicles are VNĐ40 million and VND1352/km. For every 1km using hybrid vehicles, VNĐ246.88 will be saved, after about 3.1 years, it will recoup the spending on investment. At the end of the motorcycle life cycle is about 200,000 km, VNĐ43 million will be save.

Keywords: *Lithium-ion battery, hybrid electric motorcycle, hybrid vehicle, battery management system.*

HEAD INJURY OF VIETNAMESE PEDESTRIAN IN CRASH ACCIDENT WITH SUV USING NUMERICAL SIMULATION

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Abstract: Crash test simulation using finite-element method is more and more popular in the automobile industry because of its feasibility and cost saving. The majority of finite element dummy models used in crash simulation are built based on anthropometrical and biomechanical data of the USA and European bodies. Thus, it is necessary to develop a scaling algorithm to scale a reference dummy size into a desired one without rebuilding the entire model. In this paper, the Hybrid III dummy model provided by LS-DYNA software is scaled to suit Vietnamese biomechanical characteristics. Then a standard criterion for head injuries called HIC is introduced. In addition, the Hybrid III dummy model is validated by comparing experimental data with simulation results obtained from computer model.

Keywords: *Crashworthiness, pedestrian fatality, dummy, HIC, acceleration.*

WAVELET DECONVOLUTION TECHNIQUE FOR IMPACT FORCE RECONSTRUCTION: MUTUAL DECONVOLUTION APPROACH

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Abstract: In the field of impact engineering, one of the most concerned issues is how to exactly know the history of impact force which is often measured by means of indirect method. This indirect method or well known as deconvolution technique has often encountered difficulty due to the ill-posed nature of inversion. Consequently, deconvolution technique often results in unexpected reconstruction of impact force with the influences of unavoidable errors. Although there have been some regularization methods in order to improve this ill-posed problem so far, most of these regularizations are considered in the whole-time domain, and this may make the reconstruction inefficient and inaccurate because impact force is normally limited to some portions of impact duration. This work is concerned with the development of deconvolution technique using wavelets. Based on the advantages of wavelets (i.e., localized in time and the possibility to be analyzed at different scales and shifts), the mutual reconstruction process is proposed and formulated by considering different scales of wavelets. The experiment is conducted to verify the proposed technique. Results demonstrated the robustness of the present technique when reconstructing impact force with more stability and higher accuracy.

Keywords: *Deconvolution, impact force, inverse analysis, reconstruction, wavelet transform.*

DESIGN OF A DYNAMIC POSITIONING FOR UNMANNED SURFACE VEHICLES USING GPS/INS (VIAM-NAVI-M)

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Abstract: Today, Unmanned Surface Vehicles (USV) maintain the direction and fixed position necessary for many different applications such as information stations, water sampling ... With USV model with two hull, control and propulsion systems, both of which are specifically designed to allow the vehicel to perform this task flexibly and maneuverable. With environmental effects, such as wind, waves and currents ..., it has a large impact on ships, leading to large errors or fluctuations. Therefore, a controller designed to produce better performance for USV under changing noise conditions is essential. To improve the ability of navigation for vehicles, Viam-Navi-M GPS/INS Module: integration of Inertial Navigation System (INS) and Global Positioning System (GPS) is developed with low-cost, highly accurate and stable navigation system. At the same time, the article will present the process of system development and software architecture design. Finally, with the four engine and controller propulsion system built and tested, it shows that the boat is well controlled, its ability to maintain specific direction and position for long periods of time.

Keywords: *Unmanned Surface Vehicles, Dynamic Positioning, PID Controller, Catamara, GPS/INS.*

ASSESSEMENT TRADITIONAL SAILING BOATS USING ISO 12217-2 STANDARD

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Abstract: The paper presents preliminary research results about implementing an object detection program on a Single Board Computer (Raspberry Pi). These results are used later to develop applications for drones. The object identification program is developed in Python using the TensorFlow library. The authors have succeeded in implementing and testing this object identification module using the artificial neural network model SSDMobileNet V2 (COCO database) on the Raspberry Pi 3B+. The results in this paper demonstrates the potential of this module for the further development in the future. Based on the simulation and real-world results, the authors showed that good outcome is achievable with limited resources for the AI module. Along with a high-precision object detection feature, this module can also estimate the distance and velocity of the "human" object with good accuracy. Besides, the paper also proposes several solutions to increase the performance and most importantly, the real-time feature of the developed module.

Keywords: *Object detection, Raspberry Pi, SSDMobileNet, computer vision, artificial neural network, Convolutional Neural Network.*

OBJECT DETECTION FOR DRONES ON RASPBERRY PI POTENTIALS AND CHALLENGES

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Abstract: The paper presents preliminary research results about implementing an object detection program on a Single Board Computer (Raspberry Pi). These results are used later to develop applications for drones. The object identification program is developed in Python using the TensorFlow library. The authors have succeeded in implementing and testing this object identification module using the artificial neural network model SSDMobileNet V2 (COCO database) on the Raspberry Pi 3B+. The results in this paper demonstrates the potential of this module for the further development in the future. Based on the simulation and real-world results, the authors showed that good outcome is achievable with limited resources for the AI module. Along with a high-precision object detection feature, this module can also estimate the distance and velocity of the "human" object with good accuracy. Besides, the paper also proposes several solutions to increase the performance and most importantly, the real-time feature of the developed module.

Keywords: *Object detection, Raspberry Pi, SSDMobileNet, computer vision, artificial neural network, Convolutional Neural Network.*

PHÂN BAN: KỸ THUẬT HÀNG KHÔNG – KỸ THUẬT TÀU THỦY

SESSION: AEROSPACE ENGINEERING / NAVAL ARCHITECTURE & MARINE ENGINEERING

DYNAMICS MODELING AND PARAMETER IDENTIFICATION OF A NOVEL HYBRID UAV

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Abstract: To make controller design possible for a novel unmanned aerial vehicle (UAV) design, dynamics modeling is compulsory to yield a set of equations that govern the motion of aircraft in three-dimensional space. In this work, we present a thorough process that yields the parametrized dynamics equation from Newton's second law and aerodynamics effects on the UAV. We also present an identification method that bases on maximum likelihood or least square cost optimization to estimate the aircraft's dynamic parameters such as aerodynamic and control and stability derivatives through an example involving our new hybrid UAV developed from fixed wing aircraft and a Tricopter. Wind tunnel tests for a one-third scaled model are carried out to receive outputs of the model, such as Euler angles and rotation rates, from prescribed input signals, which are rotors' speeds, then parameters are identified. Estimated model would then be validated to another set of experiment to show the fitness, hence remarks regarding the accuracy of the dynamics model and the parameters themselves can be made. The method has strong implications about its generality that is applicable to other novel vehicle designs.

Keywords: *control and stability derivatives, hybrid UAV, Maximum Likelihood Estimator, Least Square Estimator, wind-tunnel tests.*

MECHANICAL CHARACTERISTICS OF NATURAL FIBER COMPOSITES: COIR FIBER SHEET AND PAPER FIBER REINFORCED EPOXY RESIN COMPOSITES

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Abstract: In recent years, the industrial demand for composite materials is increasing rapidly. However, most composite materials are produced from synthetic fibers and resins. As a result, the current production of composite materials still has many problems and the most worrying concern is the environment and human health. From those challenges, natural fiber composite is gradually becoming a worldwide research and development trend. Natural fibers are an abundant and renewable resource, so their cost is relatively low compared with other conventional fibers. They are eco-friendly, biodegradable and reduce the problem of solid waste production when used to replace nondegradable fillers. The objective of this study is to approach and learn about natural fiber composite. Material testing experiments were performed on the coir fiber sheet and paper fiber reinforced epoxy resin composites to determine their mechanical properties as well as to find the mechanical properties of the coir fiber and paper fiber using the rule of mixtures theory. The results show that both composites have the medium-strength and they can be applied in aeronautical engineering such as manufacturing small unmanned aerial vehicle.

Keywords: *natural fiber composite, coir fiber, paper fiber, epoxy matrix, rule of mixtures.*

NUMERICAL AND EXPERIMENTAL STUDY ON PERFORMANCE ANALYSIS OF TABLE FAN

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Abstract: Nowadays, the axial fans are used not only in domestic but also in industrial applications. A fan converts the kinetic energy of its impeller into the kinetic energy of the free-stream flow. So, the fan performance could be expressed as a performance curve by a set of conditions including: air flow, static pressure, fan speed... An efficient axial fan is the one that could transfer more power to airflow with a power used by it. Because, the axial fan manufacturers in Vietnam are still based on backward technology, it needs a study on performance of the Vietnamese axial fans in order to improve fan design, and fan manufacturing technology aiming to increase efficiency of the Vietnamese axial fans. Thanks to the numerical and experimental approaches, in this paper, the study on performance of Vietnamese table fans woud be presented. And the table fan performance obtained from our simulation with OpenFOAM, validated by our fan test system, could help the Vietnamese fan manufactureres improving the efficiency of their fans.

Keywords: *Table fan, fan performance, OpenFOAM, axial fan test system.*

THE WATER ROCKET CONTEST: AFTERTHOUGHTS ON HYDRODYNAMIC PROPULSION

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Abstract: Water Rocket Contests have long been organized as an extracurricular activity among Vietnamese high schools and attracted considerable amount of palpable interest and heightened anticipation. However, the design of water rockets worth contemplation from an engineering perspective, notably about hydrodynamics and stability. In this article, we attempt to derive a dynamics model employing the rocket as a 6 DoF object with aerodynamics force acting on. The water jet thrust created by rapid expansion of compressed air is modeled as adiabatic process. Repeated calculations are performed to determine the best design that yield highest maximum launch height and accuracy. Based on the rules of the contests, we aim to acclimate the engineering approach to a high school contest, paving the way for better understanding of hydrodynamics, materials science, control and most of all, taking advantage of insurmountable enthusiasm of all students participating to encourage further ventures into aerospace engineering.

Keywords: *water rocket, hydrodynamics, dynamics, stability, high school contest.*

INVESTIGATION OF TRICOPTER'S AERODYNAMIC PERFORMANCE IN FORWARD FLIGHT BY NUMERICAL SIMULATION

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Abstract: This paper presents the process of implementing numerical simulation for a tri-copter in forward flight using the open source code OpenFOAM with the library of Virtual Blade Model (VBM). The tri-copter has 0.75-meter radius and 15-Newton weight. Its propulsion system consists of three two-blade propellers typed XOAR PJP-T-L 1245 with 12-inch diameter and 4.5-inch pitch. At the relative angle of -2 degree between the rotor tip-path-plane and the frame, the simulation for the tri-copter in forward flight including three rotor disks rotating at 4732-RPM will be carried out through the *rotorDisksource* library of the open source code OpenFOAM. A steady, incompressible solver with *k-ω SST* turbulence model is applied in the *simpleFoam* algorithm. The aerodynamic forces and the dynamic fields surrounding the tri-copter will be discussed in detail. Moreover, the results of thrust from each propeller from simulation is compared to that of analytical BET method and that of propeller performance provided by the manufacturer. This comparation proves rational of using virtual disk to replace real propeller in the CFD simulation.

Keywords: *forward flight, OpenFOAM, rotorDisksource, tri-copter, VBM.*

ANALYSIS OF THE ROTOR BLADE OF A SMALL HORIZONTAL AXIS WIND TURBINE USING REVERSE ENGINEERING AND QBLADE/FAST

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Abstract: Rotor blade of a wind turbine is an important component in converting wind energy into mechanical energy of the rotor blade. Therefore, the design of rotor blade has largely affected the wind efficiency of turbine. This paper presents an approach for analysis of the rotor blade of a horizontal axis wind turbine based on the IEC 61400-1 standard using reverse engineering of a turbine blade and QBlade/FAST. So, the blade element theory and the momentum theory would be used to determine the operational conditions of rotor blade. And the QBlade/FAST would be used to analyze the performance of rotor blade according to design load case (DLC) of the IEC 61400-1 standard. The results from the rotor-blade's simulation with QBlade/FAST are the mechanical power of turbine, the static structural characteristics of turbine such as out-of-plane bending moment, blade tip deflection… according to different wind field requirements of the IEC 61400-1 standard.

Keywords: *Reverse engineering, horizontal axis wind turbine, QBlade/FAST, IEC 61400-1 standard.*

NUMERICAL STUDY ON DRAG CRISIS PHENOMENON OF FLOW OVER TEARDROP MODEL

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Abstract: This paper presents the numerical approach to study the mechanism and properties of the laminar separation bubble which occurs on a symmetrical model during drag crisis. The model implemented in this paper has the teardrop shape which is generated by 2 different-diameter circles for head and tail, and symmetrical NACA airfoil for the body part. The critical Reynolds regime is numerically defined from 2.5x104 to 6x104, compared to the experimental result from 4.3x104 to 6.3x104. In this regime, drag crisis occurs and the model suffers from a sudden drop in drag coefficient from ~0.41 to ~0.09 with a slight increase in Reynolds. The computation also successfully captures the image of the structure of flow in laminar separation bubble region; therefore, the physical data of each particle is analyzed. This paper applies Semi-Implicit Method for Pressure-Linked Equation (SIMPLE) algorithm to solve the incompressible Navier-Stokes equations in both scalar and vector variables, with the accuracy of Second Order Upwind scheme. A combination of Reynolds averaged Navier-Stokes (RANS) with k-ω SST turbulence model is employed in OpenFOAM platform based on its good behavior in adverse pressure gradient and separation flow. Flow turbulence intensity and surface roughness height effects on drag crisis phenomenon are computed and discussed comprehensively.

Keywords: *drag crisis phenomenon, laminar separation bubble, CFD, RANS, k-omega SST.*

DEVELOPPEMENT OF AIR TRAFFIC CONTROL SIMULATOR SYSTEM APPLIED IN EDUCATION AND TRAINING

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Abstract: Air traffic control simulation system has become familiar in developed countries. Moreover, in Vietnam, the demand for air traffic control systems is increasing due to the boom of the civil aviation industry. However, there is any research or developpement on this system. The Northern and Southern Flight Management Companies all import control simulation systems at a very high cost. Many other flight management companies also have a high demand for this system, including military units. This demand prompted the research team to find a solution to build an air traffic control simulation system in accordance with domestic training needs. Based on individual open source simulation software with some basic features, the team has successfully built an aerodrome control simulation system that recreates the visually appealing 3D visualization used in training of air traffic controllers.

Keywords: *3D graphic, air traffic control, aerodrome control, opensource, simulator.*

ON THE AIRPORT ENVIROMENTAL NOISE MONITORING AND CONTROL SYSTEM

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Abstract: Most major airports use noise and operations monitoring systems to reduce the noise of flight operations in the surrounding community. This paper aims at a technical proposal for a permanent environmental noise monitoring and control system to provide solutions to reduce the noise of flying activities for communities around the airport. Airport noise monitoring is often used to evaluate noise abatement programs and to improve the aircraft's take-off / landing procedures, to minimize the impact of aircraft noise based on altitude, flight path and time of day. Noise monitoring is usually linked to the tracking radar to determine which aircraft is in particular when the noise limit is exceeded and thus provides immediate operational requirements to meet. The noise enviromental monitoring and control system is often structured with fixed permanent noise monitoring stations, mobile noise monitoring stations, multi-parameter wheather stations, radar tracks and flights information to automatically evaluate the noise impact due to operation of aircrafts in the surrounds of airport, near and on residential areas. The entire system is operated by a software platform proposed as a cloud configuration available on the internet. The platform provides all the modules required to manage data such as noise and flight information monitoring and control, live data, reports, noise and flight information in public disclosure, complaints management, alarms and warnings, etc.

Keywords: *Airport noise monitoring, sound exposure, noise event, AEDT, Lden, LAeq.*

RELIABILITY EVALUATION OF RIVER FERRY ENGINE SYSTEM THROUGH SAFETY CRITERIA

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Abstract: To ensure operating time according to schedule, the process of ferry exploitation must take into account maintenance and repair periodically. Since then the program supports calculating the reasonable exploitation time of the main system based on the set of reliability criteria that have been set. These programs are created in Excel spreadsheet format. Data used to illustrate are surveyed at Cat Lai-Ho Chi Minh City Ferry Company.

Keywords: *Waterway vehicle maintenance and repair norms, marine diesel, safety criteria , river ferry reliability.*

RELIABILITY EVALUATION ACCORDING TO THE CRITERIA OF DURABILITY AND ABRASION OF DETAILS ON RIVER FERRY ENGINES

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Abstract: Reliability is also assessed according to the criteria of durability and abrasion of details. The article presents the calculation program, assessing some indicators of durability and abrasion of key details on marine diesel engines. The program is made in spreadsheet format and based on the basic theory of ship diesel reliability and statistics of maintenance and repair at Cat Lai Ferry Company - HCMC.

Keywords: *Norms of maintenance and repair of waterway vehicles, indicators of durability, abrasion of details, marine diesel, reliability of river ferry*

BUILDING THE CONTROLER FOR DIFFERENTIAL DIVING MODES OF VIAM-AUV2000

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Abstract: This paper presents a new form of the autonomous underwater vehicle (AUV) with a built-in subsystem of cylinder and counterbalance in aid of vertical movement. The interconnected modular structure including mechanical design, electronic system and control algorithm ensures continuous operation for the vehicle at a depth of 50 meters underwater. In this paper, the advantages of hybrid AUV design inspired from the traditional one with thruster and fins as well as the underactuated glider form using counterbalance and cylinder for diving and floating are discussed specifically in the upcoming sections. In addition, the design of the control system for robots is also mentioned and clarified through the selection of sensors, actuators and hardware implementation to ensure stable operation for AUV. After that, the paragraphs focus on building and simulating control algorithms in AUV mode and Glider mode seperately.

Keywords: *AUV, Glider, structure of diving/ floating, waterproof, thruster, tri-axis rotation angles estimator.*

DESIGN, SIMULATION OF AUV FOR RESEARCH AND RESCUE

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Abstract: Autonomous Underwater Vehicles have gained popularity for the last decades, especially a lot of AUVs were considered as the most suitable tool for the purpose of reducing risks of people in dangerous marine operations. This paper presents preliminary results of the research on hardware design, the controller of an autonomous underwater vehicle model for the task of survey, search and rescue ... This model integrated various range of sensors helping it carries on its missions. Thanks to a compact design, AUV can operate in limited spaces. Through a unique ducted propeller and rudder located at the aft, the AUV can perform horizontal motion. It can also control pitch angle and depth motion by an inside mass shifter mechanism (MSM) which changes the vehicle center of gravity. Besides, it was simulated by Matlab/Simulink to evaluate the effective controllers.

Keywords: *AUV, SMC, steering control, depth control.*

NURBS WATERLINES BASED ON SECTIONAL AREA CURVE VARIATION

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Abstract: The design of ship lines is the result of parameters variation based on the Lackenby method. In the preliminary design stage, the ship line is built based on the sectional area curve. In this study, the uniform B-spline algorithm is applied using the basis of NURBS, and constructs the waterline in the form of composite B-spline curve instead of B-spline segments, making sure of continuity and smooth condition. As a result, the geometric quality of the design waterline curve and its resistance components are shown by computational fluid simulation.

Keywords: *Sectional area curve, NURBS, B-spline, waterline, continuity and smooth.*

INTEGRATED NEURAL NETWORK APPROACH FOR ANALYSIS AND SELECTION OF B – WAGENINGEN PROPELLER

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Abstract: The design of ship propeller should show the interaction between the hull and the main engine, combined experimental data to figure out the optimum thrust performance. The method of designing B - Wageningen propellers is based on the experimental test to determine the appropriate diameter and geometry. This paper presents the design and selection method of integrated B - Wageningen propellers using neural network algorithm in the preliminary design stage. The propeller proposed from the algorithm is calculated and verified through commercial computational software.

Keywords: *B - Wageningen propeller, thrust performance, neural network algorithm, preliminary design stage.*

PHÂN BAN: CÔNG NGHỆ
Ô TÔ HIỆN ĐẠI

SESSION: ADVANCED AUTOMOTIVE
TECHNOLOGY

THE METHOD FOR DETERMINING THE OPTIMIZATION OF PAYLOAD OF THE 3-AXLE SEMI-TRAILER FOR IMPROVING EFFICIENT USE

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Abstract: The three-axle semi-trailer is analyzed to achieve the maximum cargo loading based on the combination of the analysis of the loading distribution on the axles and the regulation of the 42/2014-BGTVT. The wheelbase of the semi-trailer is determined by a mathematical program that makes this model more efficient. The program is checked by performing a calculation for a typical three-axle semi-trailer CHIENYOU CY3SCE 16. As a result, the cargo of this semi-trailer increases by 360 kilograms when the wheelbase adds to 120 mm.

Keywords: *The three-axle semi-trailer, loading distribution, loading capacity*

STUDY THE TECHNOLOGY OF INJECTION MOULD FOR AUTOMOBILE PARTS

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Abstract: The injection mould is increasingly being used in injection processing for automobiles today, in Vietnam, the automakers have not yet been used this technology for localization components because of difficulties in production and technology. This article introduces the technology of injection mould to produce calandre, one of the localizing automotive components, contributing to improving technology content and productivity, lowering product costs.

Injection mould manufacturing technology is an advanced technology that has been successfully applied by Truong Hai automobile joint stock company to manufacture a number of truck parts, thereby increasing the localization rate of the car, reducing product price.

On this basis, we are conducting applications to manufacture all of the following injection mould for the same types of trucks, bus and passenger cars in the future.

Keywords: *injection mould, truck, automobile part, localization.*

CFD SIMULATION OF AIR TEMPERATURE INSIDE 45-SEAT BUS PASSENGER COMPARTMENT

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Abstract: In this study, we present a numerical simulation method to investigate the air temperature distribution within a passenger compartment. The 45-seat bus model used in the simulation as an example was a Hyundai Aero Express LDX 2003. Computational Fluid Dynamics (CFD) simulation was performed by using ANSYS/CFX software. This study conducted measuring the surface temperature inside a bus in the field experiments, and these values were used as boundary conditions. The results show that air temperature is quite high in rear compartment due to the effect of internal combustion engines. The air temperature becomes higher around the seats, which is far from the vents, than other locations. PMV at the seats close to the vents is about -1 satisfaction which means slightly cool feeling, and PMV at the seats far from the vents may be reaches +1 which means slightly warm feeling. However, the passengers in the rear compartment will feel hot and uncomfortable.

Keywords: *Vehicle thermal environment, thermal comfort (predicted mean vote, PMV).*

MEASURING ENGINE SPEED BASED ON VIBRATION OF AIR INTAKE MANIFOLD

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Abstract: Engine speed is an extremely important parameter, containing a lot of information that identifies the condition of the engine while working. Based on the engine speed and some signals of the engine control system, it is possible to know the parts and components inside the engine whether or not it is working normally. Measuring engine speed based on vibration of intake air flow is one of the new methods of measuring engine speed. Here, the researcher is concerned: the PIM signal of the MAP airflow absolute pressure sensor. This result will be compared to the cam position sensor signal G and BATT battery voltage signal when the engine is working. Compare the accuracy and practical application of the measurement methods using the above signals. The solution to this problem is to use an electronic circuit to convert the original signal into a pulse voltage signal, to send it to the microcontroller. The microcontroller will perform calculations and display the results to the LCD screen. The researcher designed a measuring device based on PIM, G, BATT signals to calculate engine speed. As a result, the speed error is within the limit and besides it represents the response of each signal. Moreover, it is expected that this device will be further improved in shape and other functions to be able to serve the teaching and application in the inspection and diagnosis of engine failure in the future.

Keywords: *engine speed, intake air, microcontroller, signal, vibration.*

A MANUFACTURING TECHNOLOGY OF ALUMINUM-ALLOY TANKS FOR TRANSPORTATION OF LIQUID FUELS AND CHEMICAL SPECIES IN VIETNAM

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Abstract: Possessing light weight and high strength superior to steels, aluminum alloys have widely been used as ideal materials for commercial vehicles from 1950s. Nowadays, most of tank trucks and tank semi-trailers for carrying liquid fuels and chemical species in G7, European and Asian developing countries are made from aluminum alloys. In Vietnam, the International Industrial Machinary and Equipment Joint Stock Company (IMAE) is the successful pioneer in applying aluminum alloys to design and manufacture tanks for commercial vehicles matching the US DOT 406 specification.

Keywords: *Aluminum-alloy tank, tank truck, tank semi-trailer, DOT 406 specification.*

VIBRATION ANALYSIS OF A BUS'S AIR SPRING SUSPENSION SUBJECTED TO RANDOM ROAD PROFILE

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Abstract: Vehicle dynamics model in type of ¼ is used for vibration analysis under the effect of random road profile with different levels. Spring stiffness and damping ratio are calculated from the supplier data. The results serve as a basis to evaluate the comfort of vehicles. From there, design can be improved by adjusting the pressure of the air-spring according to the quality of the road profile.

Keywords: *vehicle vibration, random road profile, air-spring suspension.*

DYNAMIC ANALYSIS OF SMALL GASOLINE CAR MODEL POWERTRAIN USING MATLAB / SIMDRIVELINE

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Abstract: Powertrain of small gasoline car model are designed based on the results of Matlab / Simdriveline simulation model. In particular, parts of car model powertrain include: engines, clutches, gearboxes, differentials and wheels, body is modeled by Matlab / Simdriveline. Input parameters for simulation are determined based on actual model and test calculations. The analysis of simulation results is used as a basis for design improvements to improve dynamic features of car model.

Keywords: *Car models, powertrain, Matlab/Simdriveline.*

ASSESSING ECONOMIC FUEL AND EMISSION OF HYBRID VEHICLE BY USING AVL CRUISE SOFWARE WITH COMBINING ENERGY SOURCES

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Abstract: In this study presented the simulating research on using AVL Cruise software to compare the methods in combining energy sources of hybrid vehicle as electric engine and internal combustion engine. The obtained results in Urban Driving Cycle were indicated that, the specific fuel consumption of combined hybrid vehicle was lower than that of succeed and parrallel hybrid, however, the CO_2 emission of combined hybrid vehicle.

Keywords: *AVL Cruise, Combining energy sources, Hybrid Vehicle, Economic fuel and emission.*

USING ANSYS FLUENT SOFTWARE TO EXAMINING FLOW MOTION IN COMPRESSION PROCESS OF CNG CONVERTED ENGINE

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Abstract: This paper presented the research results on the effect of structuring combustion chamber on the variable turbulence kinetic into compression stroke of converted CNG engine with port injection. The obtained results from Ansys fluent simulation were clearly showed the influence of the structuring parameter of combustion chamber on the turbulence kinetic that was strong during the compression stroke. The operating efficiency of engine was significantly improved due to the kinetic energy of the compression stroke was corrected in accordance with the suitable parameter of combustion chamber.

Keywords: *Ansys fluent, Kinertic energy, Compression stroke, Converted CNG engine, Port injection.*

INVESTIGATE DYNAMIC RESPONSE OF A TWO-WHEELED VEHICLE SELF-BALANCING USING GYROSCOPE

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Abstract: In order to significantly enhance safety to riders, a two-wheeled vehicle moving on the ground can counteract impacts of disturbing lateral forces with aid of gyroscopes' momentum conservation. Using a dynamic model induced by Lagrange's method in conjunction with a linear control law, this research numerically investigated dynamic response of a gyro-stablized bicycle under different gyroscope positions. Effects of load on self-balance performance were also studied. The results leaded to applicable hints for designing robust gyro-stabilized two-wheeled vehicles with minimal control energy.

Keywords: *self-balanced two-wheeled vehicle, gyroscope, Lagrange's method, dynamic response.*

KHOA KỸ THUẬT HÓA HỌC

FACULTY OF CHEMICAL ENGINEERING

PHÂN BAN: SINH KHỐI VÀ NĂNG LƯỢNG TÁI TẠO

SESSION: BIOMASS & RENEWABLE ENERGY

COST-OPTIMUM DESIGN OF GRID-TIED HYDRID DIESEL-RENEWABLE ENERGY SYSTEMS USING POWER PINCH ANALYSIS

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Abstract: Diesel power systems have been widely applied for energy supply generation. This power scheme however requires periodical maintenance and contributes to the emissions of greenhouse gases. These challenges may be mitigated by integrating existing diesel station with renewable energy (RE) technologies into a hybrid system.

Integration of diesel plants with RE systems has been mostly implemented using software and mathematical modelling tools. Modelling and optimisation of a hybrid PV-wind-diesel system in MATLAB has been presented by Ferrari et al. (2018). Notable cost and pollution savings for the studied consumer were successfully achieved. The study focused mainly on grid-independent hybrid system. Grid-connected hybrid systems have the potential to supply electricity at a lower cost in comparison to the standalone hybrid power systems. Halabi et al. (2017) examined the technical, economical and environmental aspects affecting the performance of a hybrid system consisting of diesel generators, PV system and grid connection. The authors recommended grid connection over battery storage application as the excess energy in the system was totally consumed while providing additional income to the local network.

Application of insight-based method for the integration of diesel plants with RE systems has so far received less attention. The feasibility of expanding existing diesel power plants into off-grid hybrid renewable energy systems using an insight-based Power Pinch Analysis (PoPA) method has been assessed by Mohammad Rozali et al. (2016). The total generation and runtime of diesel generator was successfully reduced, which led to diesel fuel savings as well as environmental emission reduction. The potential of integrating diesel system with RE in a grid-connected HPS however has not been explored using PoPA. This work aims to design a cost-optimum system that integrates diesel plant with RE technologies into grid-tied hybrid system using PoPA. The interactions between diesel generator, RE sources and the grid are considered in the methodology development. Economic assessment is done to ensure the trade-off between the costs of generation sources and grid electricity cost can be maximized.

Keywords: *Renewable Energy, Hybrid Pv-Wind-Diesel System, Power Pinch Analysis.*

LACCASE IMMOBILIZATION ON POLY(ETHYLENE) TEREPHTHALATE GRAFTED WITH MALEIC ANHYDRIDE (PET-G-MAH) NANOFIBER MATS

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Abstract: A comparative study was carried out on three different enzyme immobilization methods which were physical adsorptions (PA), covalent bonding (CV) and covalent bonding of cross-linked enzyme aggregates (CL) for laccase immobilization on Poly(ethylene) Terephthalate (PET) grafted with Maleic Anhydride (MAH) nanofiber mats. The chemically inert PET was successfully grafted with MAH at temperature between 40 – 45 ^{o}C and used as the carrier to immobilized laccase in the form of electrospun nanofiber mats. The peaks from carbonyl (C=O) and alkene (C=C) groups appeared on the spectral subtraction between PET and PET-g-MAH nanofiber mats. These groups might be the potential group to form covalent bond between the amine groups of laccase enzyme. Laccase immobilized on the PET-g-MAH nanofiber mats using CL methods using glutaraldehyde as crosslinker gave the best performance with the highest enzyme loading and immobilization yield which were 40.88μg/mg and 48.37% respectively. On top of that, the immobilized laccase on PET-g-MAH nanofiber mats also managed to retain 69.01% of its initial activity after 10 repeated cycles of 2, 2-azino-bis 3-ethylbenzothiazoline-6-sulfonic acid (ABTS) oxidations. These results demonstrate that PET-g-MAH nanofiber is a good material to be considered as laccase carrier.

Keywords: *Enzyme Immobilization, Cross-Linked Enzyme Aggregates , Nanofiber Mats*

WATER PURIFYING BY GAS HYDRATE: POTENTIAL APPLICATIONS TO DESALINATION AND WASTEWATER TREATMENTS

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Abstract: Freshwater scarcity has been troubling the high-quality development of many countries and regions, and water purification process is a vital source of freshwater. The traditional water purification processes such as distillation (multi-stage flash) and membrane processes (reverse osmosis) have been evaluated to be reliable and established processes. The desalination or water treatment technologies are mature enough to be a reliable source for fresh water but there is still a need to develop innovative technologies that can reduce energy costs. The water purifying by gas hydrate (hydrate-based) process is based on a liquid to solid phase change coupled with a physical process to separate the solids from the remaining liquid. In this study, we investigated the water purification by hydrate process for seawater and wastewater samples. In a single stage of hydrate process without any pre-treatment, dissociated water from the extracted hydrate pellets show that the removal efficiency of each ionic compound in seawater was 89 % (average). In the case of wastewater test from leachate sample, 77-95 % of dissolved contaminants and nutrients were excluded. Therefore, the experimental proposal and results of this study are of great significance to the development of water purification technology.

Keywords: *Gas Hydrate, Water Purification, Desalination.*

UPGRADING BIOMASS PYROLYSIS OIL MODEL COMPOUND VIA ESTERIFICATION WITH ETHANOL OVER HETEROPOLY ACID

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Abstract: The objective of this work was to investigate the effect of reaction parameters on acid conversion as well as develop a kinetic model for esterification of bio-oil from pyrolysis of jatropha cake. Ethanol over a HPA catalyst was used. Oleic acid was chosen as the model compound for jatropha cake pyrolysis oil, while a HPA with Keggin structure (12-Tungstosilicic acid, $H_4[Si(W_3O_{10})_4]\cdot H_2O$) was used as the catalyst. The esterification reactions were performed in a three-necked flask assembled with a reflux condenser, heated in an oil bath with temperature controller whisk at atmospheric pressure. A thermometer was used for monitoring the reaction temperature. Influences of reaction temperature between 35-75 ^oC, ethanol to acid molar ratio between 2-10, catalyst loading between 10-20% w/w and reaction time between 2-10 h were explored. The conversion of oleic acid was calculated based on the titration method using KOH-standardized solution. Response surface methodology was used for optimizing the process parameters. The properties of the model bio-oil and upgraded product under optimum condition were analyzed and compared. The kinetic model of the reaction was studied under the optimum condition with varying reaction temperatures. Sampling was carried out from the flask every 15 min from start to 60 min and then every hour until 4 h. The acid conversion was evaluated. Fitting of the kinetic model with the experimental results was used to determine the reaction rate constant at different temperatures, the activation energy and the pre-exponential factor for esterification of jatropha cake pyrolysis oil model compound over the HPA catalyst.

Keywords: *Esterification, Bio-Oil, Jatropha Cake , Surface Methodology*

TRANSESTERIFICATION OF PALM OILS CATALYZED BY IONIC LIQUID IN A MICROWAVE HEATED REACTORS

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Abstract: Biodiesel is a renewable, carbon neutral fuel, produced from vegetable oils or animal fats with alcohol via catalytic transesterification reaction. Conventionally, alkaline-catalysed transesterification using convective heating takes long time to complete. Alkaline catalysts used are usually non-recyclable, environmentally unfriendly and could react with free fatty acids to form soap. Recently, ionic liquids (ILs) have been shown to be effective in catalyzing transesterification. Furthermore, microwave irradiation has been shown to boost heat transfer to the reactants, making the reaction time shorter than the conventional heating. In this work, biodiesel production from continuous microwave-irradiated transesterification of palm oil with methanol using a green ionic liquid was investigated. The ionic liquid (ChOH) was synthesized from choline chloride (ChCl) with potassium hydroxide (KOH) and characterized by FT-IR. The transesterification experiments were setup and carried out in an 800 W microwave oven with a magnetic stirrer in a polytetrafluoroethylene (Teflon) tubing connected to a Teflon valve, a pump and a thermocouple. Variables considered were oil to methanol ratio (1:9 - 1:15), power of microwave (400-800 W), flow rate (10-20 ml/min) and catalyst loading (2-6% w/w). Response surface methodology based on the Box-Behnken design of experiments was used to optimize the biodiesel yields. Methyl ester content was determined by gas chromatography with a mass spectrometer. Various physico-chemical properties of the biodiesel were analysed according to related ASTM standards. Reusability of the ChOH liquid was also investigated.

From the findings, it was shown that the ionic liquid was effective in catalysing transesterification of palm oil. Microwave heating proved to accelerate the reaction in short time. Oil to methanol ratio and catalyst loading were found to be the significant variables for high ester content. The quadratic response surface regression model was a good estimator for the methyl ester content. Maximum ester content of 92% was realised at the oil to methanol molar ratio of 1:13, the microwave power of 800 W, the flow rate of 20 ml/min and the catalyst loading of 6% w/w. The qualified properties of biodiesel were in compliance with the requirements of the ASTM D6751-02 standard and the Thai standard for community biodiesel. The ChOH could be reused several times but the methyl ester content was appreciably lower than the fresh catalyst.

Keywords: *Esterification, Palm Oils, Ionic Liquid , Microwave Heated*

UTILIZING TOBACCO RESIDUES TO GENERATE CARBON-NEGATIVE BIOFUEL VIA ABLATIVE PYROLYSIS

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Abstract: Tobacco is one of the most popular secondary crops grown after rice harvest in many countries. Tobacco industry uses tobacco leaves for cigarette production. For the Thai Tobacco Monopoly operation, all cured dry tobacco leaves in the northern region are usually transported to a central collectionplant in Denchaifor extraction and processing into cigarettes. About 10% of the processed leaves consisting of midribs and dust is generated as wastes. Theses residues may be utilized to generate carbon-negative biofuels. This research work focuses on characterization of tobacco industry residues and subsequent generation of bio-oil via pyrolysis. Analyses for chemical compositions, heating value, thermal decomposition characters and lignocellulosic components were performed. Standard test methods for heating value (ASTM D 5865), proximate and ultimate analyses for moisture, volatile matter, fixed carbon, ash and C, H, O, N, S (ASTM D 7582, 5373, 4239) were employed. Detergent method was use to analyze the plant structural elements. Pyrolysis experiments were carried out at 450-600ºC in an ablative vacuum reactor for rotation speed between 1-10 rpm, size of tobacco residues between 10-30, 5 and.

It was found that the tobacco residues contained high carbon and volatile matter. The detergent method showed that the amount of lignocellulose content was about 24%. Maximum yield of the pyrolysis liquid was about 54%, obtained at 600ºC, 10 mm size and speed of 10 rpm with the char yield of about 31%. The pyrolysis liquids product contained aqueous and organic phases. From FT-IR spectra, comparison of the tobacco residues, the organic phase and the char was made for a number of basic functional groups at the frequency 3400-2400, 1600 and 1475 cm^{-1} corresponding to O-H stretching and aromatic C=C. Aromatic C–H peaked at 900–750 cm^{-1} and approximately 1020 cm^{-1} showed aliphatic C–O of organic phases. New peaks were observed, indicating that the pyrolysis products had different chemical bonds from the original tobacco residues. This work showed that the tobacco residues have potential for generation of carbon-negative biofuel.

New peaks were observed, indicating that the pyrolysis products had different chemical bonds from the original tobacco residues. This work showed that the tobacco residues have potential for generation of carbon-negative biofuel.

Keywords: *Tobacco Residues, Lignocellulose, Carbon-Negative Biofuel, Ablative Pyrolysis*

ORGANIC LIQUID PRODUCT FROM CRACKING OF USED COOKING OILS WITH MIXED CATALYSTS

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Abstract: High carbon emissions from increasing consumption of non-renewable fossil fuels is posing risk to Thailand and the Globe. Low carbon energy is becoming more attractive. Used cooking oils from food processing are excessively available and usually disposed of as wastes. These waste oils may be upgraded to biofuels via thermal cracking, transesterification, hydro-treatment, and catalytic cracking. Among these upgrading processes, catalytic cracking is regarded as a popular method for producing light hydrocarbons (alkanes, alkenes, and carbonyl compounds) similar to petroleum derived fuels. There are many commercial catalysts available for biofuel production such as ZSM-5, SAPO-34, MCM-22, β, and Y-zeolite, where each catalyst is used for different purposes such as increasing organic liquid product, expanding the percent of aromatic, enhancing conversion of biofuel, or increasing the yield of biofuel. Rather than using just one, mixed catalysts may be used to generate high yields and quality of products from upgrading used cooking oils.

In this study, catalytic cracking experiments were setup and carried out in a flow reactor with mixed catalyst (ZSM-5 and Y-Re-16). The objective of this study was to evaluate influence of operating parameters on yields of organic liquid product from catalytic cracking of used cooking oil. Three operating parameters, temperature (300 to 500), catalyst to oil ratio (0 to 20 %w/w), and catalyst mixture ratio (0 to 100 %w/w), were considered and optimized using response surface methodology. The organic liquid products obtained at optimum condition were subsequently analyzed for their chemical composition using gas chromatography-mass spectrometry and FT-IR spectrometry, and their heating value, density, and viscosity based on ASTM 4809, ASTM D88, and ASTM D4052 standards. The organic liquid products were compared against the original used cooking oil and commercial biofuels. Catalytic cracking over mixed catalysts proved to be effective in upgrading used cooking oils. The organic liquid products from catalytic cracking of used cooking oil could directly replace the use of fossil fuel in energy production. This process may potentially be adopted to upgrade waste oils to produce alternative biofuels.

Keywords: *Organic Liquid, Catalytic Cracking, Cooking Oils, Response Surface Methodology.*

SYNTHESIS OF ZINC OXIDE/REDUCED GRAPHENE OXIDE COMPOSITES FOR FABRICATION OF ANODES IN DYE-SENSITIZED SOLAR CELLS

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ABSTRACT: In this study, graphene oxide (GO) was synthesized using the improved Hummers' method, and reduce graphene oxide (rGO) was synthesized from GO with hydrazine hydrate as reducing agent. Zinc oxide (ZnO) was synthesized from zinc acetate using the precipitation method. Zinc oxide/reduced graphene oxide (ZnO/rGO) composites were synthesized using the ex-situ method. The ZnO/rGO composites with different rGO weight percents (0.05, 0.1, 0.5, 1, and 5 wt.%) were used for fabrication of ZnO/rGO anodes. A control anode was fabricated from ZnO (ZnO anode). The band gaps of fabricated anodes were measured using the ultraviolet–visible spectroscopy (UV-vis). The dye-sensitized solar cells (DSSCs) were assembled and investigated by current density-voltage (J-V) curves and electrochemical impedance spectroscopy (EIS). The ZnO/rGO composite with appropriate rGO content was determined to be 1 wt.%, with the efficiency of 1.55 %. The Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, X-ray diffraction (XRD) results confirmed wurzite structure of ZnO and the reduction of functional groups of GO to create rGO and ZnO/rGO. The transmission electron microscopy (TEM) showed that the ZnO nanoparticles with size of 10 – 20 nm were evenly distributed on rGO sheets. These results indicated that ZnO/rGO could be the potential material to improve the efficiency of DSSCs.

Keywords: *Graphene Oxide Composites, Reducing Agent, DSSCS* .

INVESTIGATION ON THE SYNERGITIC EFFECT OF TETRA BUTYL PHOSPHONIUM BROMIDE WITH POLY(N-ISOACRYLAMIDE) BASED KINETIC HYDRATE INHIBITOR

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Abstract: The problem of clathrate hydrate plugging in flow pipes has been the most important issue in the off-shore exploitation since hydrates were found in transport facilities. In recent years, low dosage hydrate inhibitors have attracted much interest among researchers in place of thermodynamic hydrate inhibitors such as methanol and mono ethylene glycol (MEG). Poly-vinyl caprolactam and poly-isopropylacrylamide (PNIPAM) are among the hydrate inhibitors that are typically used for polymers containing amide groups. Furthermore, various kinds of polymer inhibitors containing amide group including tetrabutylphosphonium bromide(TBPB), which is a quaternary salt, were synthesized and studied in a methane gas hydrate environment. In this experiment, the injection of 0.1 wt% inhibitor at 276 K and 5 MPa was followed by stirring the water to induce nucleation. From the result, when PNIPAM alone was used as a single KHI, PNIPAM exhibited worst performance among the KHIs tested in this study. But the mixing of TBPB with PNIPAM further extended the induction time and reduced the CH4 hydrate growth rate. The real-time in situ Raman system used to understand the inhibition principle was recorded during CH4 hydrate formation, as a result, PNIPAM showed that the large hydrate cage affected, while TBPB prevented the CH4 molecule from occupying the small cage. TBPB was excellent synergist in blends with PNIPAM for kinetic hydrate inhibition of structure I forming CH4 hydrate.

Keywords: *Ynergitic, Clathrate Hydrate, Hydrate Inhibitors, Poly-Isopropylacrylamide.*

A STUDY ON THE PROCESS OF CARBON REDUCTION POLICY USING ACTIVITY-BASED MODEL

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Abstract: The need for new urban policies that can take actions against climate change is rising, with industrialized cities recently. Especially, in order to make eco-friendly and efficient transportation systems, carbon-reducing transportation policies should be implemented with transportation demand management.

In this study, the effect of carbon reduction policy in terms of transportation plan is predicted, assessed, and various policy responses of users are predicted to develop a traffic planning model for improving the effectiveness of carbon reduction policy. In other words, it is intended to provide reasonable support for the decision-making process of transport policy and to establish a process for taking carbon emissions into account during the development of transport policy.

Specifically, this study used an activity-based model to complement for the shortcomings of the traditional four-step model used in the existing transportation plan. Since the activity-based approach identifies the various daily activities of individuals as the decision unit of the transportation and considers the passage as one of the activities of a continuous daily life, it is possible to provide analysis results that are more suitable for the study to calculate and manage carbon emissions. The activity-based approach can also analysis the micro level carbon reduction policies by improvement the aggregated trip-based models. For development activity based simulation modelling, we generate synthetic population according to urban type using the simulated annealing algorithm based on Kim and Lee(2016) and develop the Korean activity based simulation model using big data such as smart card data, travel survey data and GIS. The suggested model validated with actual data and the results of macro modelling using MATSim(Multi agent Transport Simulation) which is open source platform of large scale transports simulation (Balmer, M(2007). Based on activity-based model, the effects including carbon reduction were analyzed due to the introduction of policies for traffic demand management, such as 'car-free street' and ‘flexible commuting time policy’ that were not analyzed in the traditional 4-step model.

The proposed process of carbon reduction policy effectiveness analysis can be expected to support decision making of carbon reduction policy. In other words, it is believed that a activity-based simulation of urban transport carbon reduction will help policy-makers to support rational decision-making based on prior experimentation of urban development or planning and policy impact on cities.

Keywords: *Carbon Reduction Policy, Activity-Based Model, MATSim.*

PHÂN BAN: TÍCH HỢP VÀ MÔ HÌNH HÓA QUÁ TRÌNH CÔNG NGHỆ

SESSION: PROCESS INTEGRATION & MODELLING

PROCESS MODELING AND SIMULATION OF FAST PYROLYSIS PLANT OF LIGNOCELLULOSIC BIOMASS USING IMPROVED CHEMICAL KINETICS IN ASPEN PLUS®

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Abstract: The successful operation of biomass pyrolysis plant on an industrial scale would showcase and promote the possibility of practical decarbonizing energy projects. This work presents a comprehensive Aspen Plus® modeling work of fast pyrolysis processes for lignocellulosic biomass based on kinetic reaction mechanisms. The simulation uses mass and energy balance calculations to forecast the product yields and composition depending on different sets of operating conditions (temperature, residence time) and feedstock composition includes conventional components, nonconventional components, and solids component of lignocellulosic biomass. The reaction kinetic models are developed from the principle of biomass pyrolysis using data available from the literature. The product yield from a biomass pyrolysis pilot plant is used to demonstrate validation of the model. The results show a high correlation of the results for both slow and fast pyrolysis processes compared with those from the pilot plant and the previous works. The simulation model is found to be able to correctly predict fast pyrolysis products' yields within the typical range of operation considered (high reaction temperatures with low residence times). In conclusion, the model proved to be suitable for predicting fast pyrolysis reactions for lignocellulosic biomass feedstock and can be used for estimating the trend of pyrolysis products without the need for experimental data with t-test of differential of product yield's trend at 95 % confidence interval as 0.00327. This fast pyrolysis model offers rapid assessment for energy projects associated with the transition towards low-carbon development in Asia.

Keywords: *Process Modeling, Simulation, Fast Pyrolysis, Aspen Plus.*

OPTIMIZATION OF HYDROGEN SUPPLY CHAIN: A CASE STUDY IN MALAYSIA

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Abstract: Hydrogen is regarded as the fuel of future by having greater heating value than the conventional fuels and with zero carbon emission. However, most of the previous supply chain studies only consider the application of hydrogen as transportation fuel. Taking Johor as a case study, this paper aims to develop a holistic optimization model that exploits the use of hydrogen for vehicle fueling and electricity generation. Oil palm biomass and solar energy are used as the energy sources to produce hydrogen and electricity to satisfy the local energy demand. Through this study, the optimal configuration of hydrogen supply chain in Johor has been identified and the associated cost is found to be 305,932,301 USD/d.

Keywords: *Optimization, Hydrogen, Supply Chain , Fuel .*

CARBON GRAIN SUPPORTED NANO-SIZED AU FOR LOW TEMPERATURE REMOVAL OF VOCS IN HUMID CONDITION: EFFECT OF CATALYST'S SYNTHESIS CONDITIONS

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Abstract: This study reports the utilization of carbon grain as support for nano Au catalysts to treat VOC pollutants at low temperature. The catalysts were synthesized at various conditions including various pH of the sol solution and different PVA/Au mass ratios. The catalysts were characterized by specified techniques to evaluate crystallinity, surface properties, and morphology. The catalytic activity for VOCs removal has been conducted in the temperature range 100-200 °C and in the presence of water vapor. The relationship between catalyst's characterization and the low-temperature catalytic activity was evaluated, and the synergy effect in the dual functional adsorbent/catalyst was reported. Nano Au supported on granular carbon, which was synthesized with mass ratio PVA/Au = 4 at pH = 4, can removal toluene about 50.3 % at initial concentration of 314 ppmv after 60 min reaction at the reaction temperature 150 °C and high humidity (RH = 60 %). Furthermore, moisture reduces the activity only slightly due to the hydrophobicity of activated carbon, and the durability of the catalyst was also reported.

Keywords: *Carbon Grain Supported, catalysts, VOCS, Low Temperature. .*

OVERVIEW OF PELLET TECHNOLOGY AND CHARACTERISTIC FROM MAIZE RESIDUE

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Abstract: Maize is a popular field crop in Thailand for animal feed production. The country dedicates more than six million hectares to maize cultivation, and its total output amounts to about five million tons. The harvest of maize results in three primary residues: roots, stalks, and leaves. Over 80 % of these residues are disposed of in the cultivated area itself, usually by open burning. This practice releases large amounts of pollutants (such as the hazardous particulate matter known as PM2.5) into the atmosphere. Pelletisation represents one promising alternative to such strategies as open burning. The main objective of this study is to provide an overview of the pelletisation process in order to guide future attempts to increase efficiency and sustainability in maize pellet production. Thai standards for the production of pellets are compared with international standards, and the effects of differences in pellet composition on combustion efficiency are discussed. The results of this study can serve as a guideline for spearheading zero-waste agriculture initiatives and promoting the use of renewable resources like pellets for utilization in biomass power plants, per the recommendations in the Alternative Energy Development Plan (AEDP 2012-2021).

Keywords: *Pellet Technology, Maize Residue, Zero-Waste Agriculture.*

MATHEMATICAL OPTIMISATION MODEL FOR SUSTAINABLE MANAGEMENT OF SAGO PALM PLANTATIONS

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Abstract: Sago palm is an important indigenous crop grown in Southeast Asia. Its main product, sago starch, has the potential to be an alternative source of starch compared to traditional starch derived from cereals (maize, sorghum, etc), tubers (potato, sweet potato) and roots (cassava). Sago palms have very high yield and sago starch is a very versatile product. Sago starch has wide applications in both food and non-food industries. Sago palms are largely found in Papua New Guinea, Indonesia, and Malaysia as well as in small parts of Thailand and Philippines. Despite its potential, sago has remained as wild forest trees in swampy areas and unutilised for decades. Recently, Malaysia and Indonesia have shown interest in establishing estate plantations of sago palms. Although such development may be welcomed, it is advisable to exercise caution during expansion of sago plantations. It is highly likely that unplanned expansions may result in large scale clearing of the tropical and peatland forests that are densely concentrated. In this respect, the vulnerability of these sensitive ecosystems during sago plantation expansions must be carefully accounted for. Most notably, it is important that sago plantations do not suffer the same fate as the oil palm industry, which is plagued with controversies over sustainability issues. Therefore, in order to ensure sustainable sago plantation expansion, planning mechanisms that help to strategise land use changes (LUC) is crucial. Thus, this work presents a mixed integer linear programming (MILP) model to strategise for sustainable sago plantation expansions based on the predicted future demand of sago starch. The developed model is based on the concept which was used previously to strategise operation of utility systems. The proposed model determines the optimum lands for sustainable expansion (only if required) when there is an increased demand, accounting for the cost involved in expansion and environmental impact. Essentially, the proposed MILP model aids planning for sustainable expansion of sago palm plantations. A simple sago value chain with two different scenarios have been solved to illustrate the proposed model.

Keywords: *Sustainable Management, Mathematical Optimisation, Mixed Integer Linear Programming.*

PREPARATION OF POLYLACTIDE/MODIFIED CLAY BIO-COMPOSITES EMPLOYING QUATERNIZED CHITOSAN-MODIFIED MONTMORILLONITE CLAYS FOR USE AS PACKAGING FILMS

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Abstract: Composite materials of polylactide (PLA) have been a popular environmentally-friendly and low-cost bio-composite that is used for packaging applications. Clay has been used as fillers to improve the mechanical properties of PLA and enhance the gas permeation properties of the composites. However, adding unmodified clay to PLA leads to a reduction in its tensile strength and elongation at break, due to its incompatibility with PLA. In this study, Montmorillonite clay was modified with highly-positive charged quaternized chitosan (QC) by a solution mixing process. The modification efficiency was evaluated through the change in d-spacing values of the clays by X-ray diffraction spectroscopy. Fourier transform infrared (FTIR) spectroscopy was used to study the changes in the structures of the clays. QC with 50 % DQ at 10 % concentration, 2.5 % solid content,1,000 rpm of stirring speed, and by ultra-sonication (70 % amplitude in 15 minutes) were observed as the optimum conditions to modify Montmorillonite. The d-spacing value increased from 12.4 Å to 20.3 Å, after the modification, which is comparable to the 18.2 Å of commercial Cloisite 30B. The modified clays were then mixed with PLA to generate bio-composite materials. The results show that adding the modified clays (at up to 5 %) leads to a slight reduction in tensile strength and modulus, but a modest increase in the elongation at break of the material, compared to neat PLA. Tensile strength, strain, modulus, and elongation at break of the bio-composite are 41.60 ± 2.06 (MPa), 2.97 ± 0.15 (%), 1,740 ± 140 (MPa), and 3.00 ± 0.16 (%), in comparison with 46.20 ± 4.04 (MPa), 2.67 ± 0.26 (%), 2,015 ± 301 (MPa), and 2.79 ± 1.28 (%) for neat PLA, respectively. Moreover, the bio-composite shows an impact strength improvement of about 20 %, compared to neat PLA. Hence, QC can be applied as a promising agent to modify Montmorillonite clay for preparing bio-composites. These composites can maintain high mechanical properties and degradability with an improvement in impact strength are suitable for packaging applications.

Keywords: *Clay Bio-Composites, Packaging Films, Quaternized Chitosan.*

POLYETHYLENIMINE MODIFIED CORNCOB WASTE DERIVED ACTIVATED CARBON FOR THE REMOVAL OF HEXAVALENT CHROMIUM IN THE AQUEOUS SOLUTION

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Abstract: In this work, corncob waste was used to prepare a high performance adsorbent. Firstly, the corncob waste derived activated carbon (CWAC) was prepared using a chemical activation method with H3PO4 as an activator. Then, the CWAC was used to prepare the polyethyleneimine (PEI) modified CWAC (CWAC-PEI) through the wet-impregnation method. The structure of the CWAC and the CWAC-PEI was characterized by field emission scanning electron microscopy (FESEM) and Fourier transform infrared spectroscopy (FTIR). Furthermore, the CWAC and the CWAC-PEI were used as the adsorbents for the removal of Cr(VI) from aqueous solutions and their adsorption capacities were compared. The CWAC-PEI showed higher adsorption capacity than the CWAC, reaching 389 mg/g. Moreover, the reusability experiment showed that the CWAC-PEI maintains the high Cr(VI) adsorption capacity.

Keywords*: Polyethylenimine, corncob waste, activated carbon, hexavalent chromium.*

DETERMINATION OF THE ACTIVATION ENERGY AND KINETICS PROPERTIES OF ALGAE (SARGASSUM POLYCYSTUM) VIA THERMOGRAVIMETRIC ANALYSIS

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Abstract: Algae is a potential third-generation biofuel sources that can be used to produce high quality liquid fuel. The physio-chemical properties of algae depend on the species type, of which can also vary with climate, geography and environmental conditions. In this study, the pyrolysis behaviour of a brown macroalgae, Sargassum polycystum (SP), obtained along the coast of Desaru, Malaysia is characterised using a thermogravimeter. The thermal decomposition of the selected brown algae was carried out at the heating rate of 5, 10, 20 and 40 ˚C $min^{-1.}$ A model-fitting method, which includes the most common reaction mechanism in solid-state decomposition processes is being used to predict the kinetic parameters for Sargassum polycystum. The results showed that the Sargassum polycystum macroalgae decomposition process follows the third-order of reaction, F3 with a highest correlation value of 0.94, at 15-70 % of conversion level. The average activation energy from all heating rates is found to be 19.09 kJ/mol with a pre-exponential value of 0.537 s^{-1}. An increase in heating rate results in the increase of activation energy and pre-exponential values.

Keywords: *Activation Energy, Kinetics Properties, Algae, Thermogravimetric Analysis .*

PYROLYSING HORSE MANURE VIA MICROWAVE-INDUCED HEATING FOR BIOENERGY RECOVERY

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Abstract: Transforming waste to energy is essential in view of the need to search for greener and more sustainable energy sources. Such transformation of energy is also aligned with the aim of reducing excessive waste generation whilst creating potential biofuel pathways for power generation. In the present study, animal waste in the form of horse manure is being used as feedstock to undergo microwave-induced pyrolysis via a fixed-bed pyrolysis rig. The relationship of the pyrolysis parameters such as pyrolysis temperature of 350 and 550 ^{o}C, carrier gas flow rate of 0.5 and 1.5 L/min and ratio of horse manure to activated carbon blend of 1:2 and 1:1, with the yield of pyrolysed products was studied. The derived pyrolysis products in the form of solid, liquid and gaseous were characterised and quantified. Result shows that the highest yield of solid, liquid and gaseous products obtained are 78.8 wt%, 24.7 wt% and 34.2 wt%, respectively. Solid yield is observed to decrease with increasing pyrolysis temperature while gaseous yield shows a reverse trend. Higher carrier gas flow rate is observed to lower the generation of gaseous and liquid yield while increasing the solid yield. Higher amount of activated carbon within the feedstock is seen to lower the solid yield but increase the gaseous and liquid yields. The liquid yield is found to contain 55.78 wt% of phenolic compounds while gaseous product consists of up to 55 vol% of syngas. The control of the operating conditions in pyrolysis rig enables the production of pyrolysis end products in different phases, generating useful bioenergy and biofertilizer products in the context of circular economy.

Keywords: *pyrolysis, horse manure, Microwave, bioenergy.*

THE CHARACTERIZATION OF HYDROXYL TERMINATED EPOXIDIZED NATURAL RUBBER (HTENR) VIA OXIDATION DEGRADATION METHOD

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Abstract: The degradation of epoxidized natural rubber (ENR-50) and liquid epoxidized natural rubber (LENR) was done via oxidative degradation method for the production of hydroxyl terminated epoxidized natural rubber (HTENR) and hydroxyl terminated liquid epoxidized natural rubber (HTLENR) has been analysed. Cobalt (II) acetylacetonate (CAA) were used as an oxidizing agent for chain scission reaction at temperature 60 ºC in the presence of ethanol. The reaction temperature was fixed at 60 ºC meanwhile reaction time and the amount of CAA were varied according to the reaction formulation. The HTENR and HTLENR obtained have been characterized using Gel Permeation Chromatography (GPC), Fourier Transform Infrared (FTIR) and Nuclear Magnetic Resonance (NMR). GPC were used to determine the molecular weight before and after the oxidative degradation of respected HTENR and HTLENR were compared with ENR-50 and LENR. The lowest M_n and M_w of HTLENR that were obtained from the oxidative degradation method were found to be 5,163 g/mol and 58,087 g/mol. The appearances of OH end groups were verified by FTIR and NMR analyses to validate the position of each OH functional groups. FTIR analysis confirmed that HTENR and HTLENR contained OH group with the appearance of a broad peak around 3,400 cm^{-1} to 3,550 cm^{-1} after the reaction. The presence of OH end groups was verified by NMR analysis with the appearance at 3.39 ppm and 3.66 ppm, corresponding to methylene proton adjacent to hydroxyl group in $HOCH_2CH_2CH_2$ and methane proton adjacent to OH group in $CH_2CH_2CH(OH)CH_3$.

Keywords: *Degradation, Natural Rubber, Oxidation, Gel Permeation Chromatography* .

PHÂN BAN: VẬT LIỆU THÔNG MINH VÀ VẬT LIỆU XANH

SESSION: SMART & GREEN MATERIALS

WATER FOOTPRINT OF NATURAL COLOURED BATIK-MAKING PROCESS: STUDY ON A BATIK SMALL ENTERPRISE IN JARUM VILLAGE, KLATEN REGENCY, INDONESIA

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Abstract: Indonesian batik is usually produced by Small and Medium Enterprises (SMEs) which tend to induce environmental problems. Batik wastewater has caused pollution in some regions of Central Java, resulting in odour, allergic reactions among the local population, and the degradation of water quality. In addition to polluting the environment, batik production also requires a substantial volume of water. This study examines the water footprint of natural coloured hand drawn batik-making process by a small enterprise in the Jarum village, Klaten. Blue Water Footprint was determined by direct measurement, while Grey Water Footprint was estimated by calculating the water required to dilute COD. High concentration of TSS, BOD_5, and COD were found in natural dye extracts and wastewater. The Water Footprint (WF) analysis indicated that Grey Water Footprint was 37,343.15 L/d, which has a higher portion in the total WF than the Blue Water Footprint which was only 105.63 L/d. This result indicated the need to reduce pollution and to increase awareness among batik artisans. Promotions of behavioural change toward a more efficient use of water resources are advisable.

Keywords: *Water Footprint, Natural Coloured, Batik-Making Process.*

ANTIBACTERIAL ACTIVITY OF TRAM TRON SYZYGIUM GLOMERULATUM EXTRACT AGAINST METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

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Abstract: Methicillin-resistant Staphylococcus aureus (MRSA) has been spreading in hospitals. The use of medicinal herbs in the treatment of infections in traditional medicine has been around for a long time. Binh Duong province, Vietnam has a rich source of indigenous plants. However, there are almost no scientific studies on usage of the plant source in treatment of infectious diseases although the traditional remedies have been used. The purpose of this research is to determine antibacterial activity of the Tram Tron Syzygium glomerulatum extract collected in Binh Duong against MRSA. The activity of Tram Tron extract combined to vancomycin was also determined by using disc diffusion and micro-dilution methods. In addition, the cell toxicity of Tram Tron extract was determined by Sulforhodamine B (SRB) assay. The results showed that the minimum inhibitory concentration (MIC) of Tram Tron extract was 2.85714 µg/ml. Meanwhile, Tram Tron extract at 35-folds higher than MIC did not show toxicity on cancer cells hep G2 and fibroblast cells. The fractional inhibitory concentration (FIC) Index of 0.53544 indicated that the combination of Tram Tron extract and vancomycin was partial synergy.

Keywords: *Antibacterial Activity, Tram Tron Syzygium Glomerulatum, Methicillin-Resistant Staphylococcus Aureus*

ENHANCING WASTE MANAGEMENT PRACTICE – THE SUSTAINABLE STRATEGY FOR SOLID WASTE MANAGEMENT IN VIETNAM

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Abstract: This study aims to build the appropriate model of waste management practice (WMP) towards sustainable municipal solid waste (MSW) system in a city of developing country like Vietnam. A waste audit was performed and material flow analysis method was simulated to describe and analyse the current status of MSW system and its assumpted models. Four WMP models were built based on the feature of the region, the intention and optimisation of WMP, and the consensus of the government. This study shows that the improvement of the SWM system can reduce a significant amount of waste to landfill. Notably, the waste reduction performance is 5.0%, 7.8%, 11.11% and 29.3% in S1, S2, S3 and S4, respectively. Also, the recovery performance of recyclables changes in proportional to the level of SWM practice and reach at 3.78, 5.843, 4.593, and 7.120 t/d, respectively. This study reveals that the improvement of SWM practice at source from intentional to optimal rate is the sustainable strategy for developing an SWM system in Hoi An City.

Keywords: *waste management practice, sustainable municipal solid waste, Hoi An City .*

ACCEPTABILITY STUDIES ON THE UTILIZATION OF SACHA INCHI PRESS CAKE (PLUKENETIA VOLUBILIS) OF MYANMAR ORIGIN

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Abstract: Sacha inchi press cake (by-product from cold-pressed oil production), has notable protein content and could be a potential source of protein which was found 56.0% in proximate compositional analysis. Bioactive substances were investigated by phytochemical screening test. Antimicrobial activity was studied on six clinically important microorganisms, namely Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus pumilus, Candida albican and E. coli performed by Agar Plate Diffusion Method. For safety aspects, the tested samples was done with evaluation of acute toxicity , heavy metals (Pb, Cd, Zn and As) as well as microbial contaminants. Nine elements (Ca, K, P, S, Fe, Zn, Cu, Sr, Rb) were present in it. Acute oral toxicity was examined on Female Albino mice of DDY strain, tested with doses of 0.3, 2 and 5 g/kg body weight. It was found that LD_{50} of Press Cake is more than 5g/kg according to OECD guideline 423. The use of press cake powder in bakery products: biscuits and cup cakes were done with formulation design 10,15,20 percent. Sensory analysis was carried out to choose an optimal product and acceptable measurement was statistically analysed.

Keywords: *Acute oral toxicity, Agar Plate Diffusion Method, phytochemicals, press cake, sensory analysis*.

NUTRITIONAL COMPOSITION OF THE KERNEL OF *PLUKENETIA VOLUBILIS L.* SEEDS AND ITS BIOLOGICAL ACTIVITIES

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Abstract: This research is concerned with the investigation of nutritional and phyto-constituents of the kernel of locally cultivated *Plukenetia volubilis* L. (Star bean) seeds and some of its biological activities. In the present work, the seeds of *P. volubilis* were collected from Bago Township, Bago Region, Myanmar. The preliminary phytochemical screening indicated that the kernel of star bean seeds was very rich in bioactive secondary metabolites. In addition, the contents of phytoconstituents such as total phenol, total flavonoid, total steroid, total tannin, cardiac glycoside were estimated quantitatively. From the resulted data, the ethanol extract was found to contain higher amounts of the above phytoconstituents than watery extracts. Among the chemical constituents, phenolic compounds were observed in highest amount (652.2±2.14mg GAE/g) in ethanol extract. The second and third highest chemical constituents were found to be the steroid (260.0±10.0 mg CE/g) and tannin compounds (140.08±18.76mg TAE/g). Among the nutritional constituents of sample, the fat content (41.7 %) was observed in highest amount. Moreover, ethanol extracts showed the distinct higher activities such as antimicrobial, antioxidant, antidiabetic, cytotoxicity and antiproliferative activities than watery extract. Furthermore, the kernel of star bean seeds oil has a high content of unsaturated fatty acids: linoleic acid (ω-6) (43.151 %) and linolenic acid (ω-3) (37.953 %), determined by GC. Several studies have reported that ω-6 and ω-3 unsaturated fatty acids have beneficial effects on human health by preventing several diseases such as cancer, coronary heart disease and hypertension. Therefore, the present study contributed that the kernel of Star bean (*P. volubilis*) can be effectively used as traditional medicines to treat many diseases and food supplement.

Keywords: *Plukenetia volubilis L.; star bean; phytochemical constituents; antiproliferative.*

FERMENTATION OF MANGO (MANGIFERA INDICA) WINE AS FUNCTIONAL BEVERAGE BY USING RESPONSE SURFACE METHODOLOGY

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Abstract: Fermentation of mango wine was optimized by using Response Surface Methodology, Box-Behnken design. Variable factors were yeast concentration, sugar concentration and fermentation time. Based on ANOVA analysis, R2 > 0.98 and P < 0.05, the optimum conditions were yeast concentration 2.5 g/L, initial sugar concentration 22 % and fermentation time 14 days. The values of alcohol content and total soluble solids were 9 % and 6 (ºBx). Then phytochemical tests were screened and the antioxidant property was investigated with 2, 2-diphenyl-2-picrylhydrazyl (DPPH) scavenging assay. The above findings demonstrate that mango wine contains bioactive compounds and antioxidant property which gives medicinal value.

Keywords: *ANOVA, Box-Behnken design, Mango Wine, Phytochemical, Response Surface Methodology.*

FABRICATION OPTIMIZATION OF FORWARD OSMOSIS MEMBRANE FROM BACTERIAL CELLULOSE-ALGINATE COMPOSITE FOR WATER RECOVERY

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Abstract: Clean water availability is one of the sustainable development goals set by United Nations in order to sustain human life. However, water resources are very vulnerable to stress due to the accelerated changes in our lifetime. Rapid growth in the population, economy and industrialization tends to generate pollution and drive climate change which are the main cause in the stress on water resources. In order to address the needs in clean water, utilization of technologies capable of recovering water from wastewater, dirty water, floodwater and seawater is a sustainable alternative. One potential technology is forward osmosis, a membrane technology that utilized osmotic pressure gradients between solutions. This study determined the fabrication conditions (impregnation temperature, alginate concentration and cross-linking time) of a forward osmosis membrane from bacterial cellulose-alginate composite that provided the optimal water flux and salt rejection performance. The optimization process utilized the surface response methods using central composite design. The optimal condition obtained were at 2.44 wt% sodium alginate concentration, 30°C impregnation temperature and 2 hours crosslinking time. The predicted water flux and salt rejection performance were 3.414 L/m2-h and 98.48% rejection. A confirmatory run shows a 15% positive error for water flux and 0.06% positive error for salt rejection compared to there predicted value. This research is supported by AUNSEED Net (JICA, Japan) and PCIEERD DOST-GIA (PCIEERD Project No. 3983).

Keywords: *fabrication optimization , osmosis membrane, bacterial cellulose-alginate composite.*

DYNAMIC EXTRACTION OF D-PINITOL FROM THE LEAF OF BOUGAINVILLEA SPECTABILIS

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Abstract: D-Pinitol was extracted from the leaf of bougainvillea spectabilis under dynamic ethanol extractive method. The operating parameters investigated were extraction time, operating temperature and the particle size of bougainvillea spectabilis leaf. A Box-Behnken design was used to optimize the three operating parameters to produce high yields of D-pinitol and an empirical quadratic model was developed to correlate the three variables. Multiple regression analysis of experimental data indicated that particle size and extraction time posed significant linear effects on D-pinitol yield. The operating temperature and particle size, within the range considered in the present study, were also found to have significant quadratic effects on D-pinitol yield. An optimal extraction yield of 1.93% was obtained at a suggested operating condition of 43°C, 120 min and particle sizes in the range of 355 - 500 µm. Further increase in temperature and/or decrease in particle sizes beyond the optimal condition resulted in a decrease in the extraction of D-pinitol.

Keywords: *D-pinitol; bougainvillea spectabilis, Response Surface Method; dynamic ethanol extraction.*

THERMAL OXIDATION BEHAVIOUR OF SYNTHESIZED ZERO-VALENT IRON NANOPARTICLES (NZVI)

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Abstract: Zero-valent iron nanoparticle (nZVI) exists a nanoscale (1-100 nm) of the iron particle with zero oxidation number. It has received significant attention for its potential to capture the free electrons moieties such as heavy metal compounds in the wastewater. The nZVI, however, are relatively unstable lead to difficulty of synthesising and store. In this research, we aim to study on solvents effect on synthesising and characterisation of ZVI nanoparticles. The nano-scaled ZVI were synthesised by a facile chemical reduction method under atmospheric conditions. Iron (III) chloride hexahydrate ($FeCl_3 \cdot 6H_2O$) was used as a precursor, and sodium borohydride solution ($NaBH_4$) was employed as a reducing agent. Two parameters used in this study were: i) solvent types [ethanol (C_2H_5OH), diethyl ether ($(C_2H_5)_2O$), and acetone ($(CH_3)_2CO$)] ii) proportion of solvent and deionized water (4:0, 4:1, and 4:2 by volume). We analysed the physical and chemical characteristic of the synthesised samples such as morphology, particle size and distribution, and the chemical structure and composition using various techniques TEM, XRD, UV-vis spectrophotometer. We also studied the effect of particle size on thermal oxidation reaction using thermogravimetry analysis (TGA) and differential scanning calorimetry (DSC). The results show that solvent types were the critical parameters which influence the oxidation reaction during the synthesis process, allowing the formation of core and shell of the particle. This result yielded a distinct particle size of the nZVI sample, approximately 39 - 42 nm. According to the spherical shape of the synthesised nZVI, an approximated specific surface area was examined.

Regarding the core and shell formation, the core exited only zero valent iron while shell formed as the oxide of iron moieties. The XRD analysis shows an estimation of nZVI core about 79-81 wt.% and iron oxide (Fe_2O_3) about 20 wt.%. The relation between thermal oxidation enthalpy and the particle size of synthesised samples were revealed and predicted by the Boltzmann equation.

Keywords: *zero-valent nanoparticles, synthesis, characterisation, thermal oxidation.*

EVALUATION OF HYDROXYAPATITE FROM FISH BONE AS POTENTIAL PROTEIN ADSORBENT IN WASTEWATER

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Abstract: The objective of this research was to evaluate the potential of hydroxyapatite (HA) from fish bone as protein adsorbent in wastewater from food processing plant. HA was prepared by cooking, drying and calcinated fish bone at 900 ^{o}C in a furnace for 8 hours. The HA was subjected to oxidation process using TEMPO and electrostatic self-assembly technique by manipulation of iron oxide nanoparticles (IONPs) on HA surface to give magnetic functionality. Oxidation was performed to change primary alcohol in HA structure into ROO-carboxylate. It was expected that a stable conjugate amide bond is achieved through carbodiimide-coupling reaction when reacted with protein in wastewater. The function of magnetic HAs in this system serves as separation technique where the recovered protein using HAs in stick water was separated using magnet. The transformation of fishbone into HA were confirmed by FTIR, XRD and SEM. A broad adsorption band at 3272 cm^{-1} was identified as the stretching vibration of –OH groups on HA structure. XRD result showed that the calcination process changed the amorphous peak of fish bone to sharp peak, indicating crystalline structure of HA. HA showed uniform morphology after calcination however, agglomeration of particles was observed, probably due to milling process. The percentage of protein recovery was 62% which was confirmed by Bradford essay and FTIR characterization.

Keywords: *hydroxyapatite, fish bone, protein adsorbent, wastewater.*

PHÂN BAN: CÔNG NGHỆ BỀN VỮNG VÀ SẢN XUẤT SẠCH HƠN

SESSION: SUSTAINABLE TECHNOLOGY AND CLEANER PRODUCTION

GRAPHENE AS PROMISING SENSING MATERIAL FOR DETECTION OF VOCS AT LOW CONCENTRATION: A DFT STUDY

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Abstract: Detecting VOCs can allow for disease diagnosis before the other physical symptoms and the diagnosis at the early stage can greatly improve the clinical outlook. Therefore, in recent years, development of resistive gas sensors based on the different two-dimensional (2D) nanomaterials has attracted great interest in the field of breath diagnostics. The problem can only be solved if the mechanism of gas adsorption is explicitly explored, the suitable gas-sensitive materials are applied and the developing appropriate sensor structures as well as operation of the sensor are optimized. Our research aims to study systematically the adsorption of VOCs on the surface of the 2D gas-sensitive material - Graphene in sensing device using the quantum simulation at nanoscale. Quantum simulation performs the exploration of adsorption possibility and mechanism of Graphene with respect to certain VOC and evaluate the sensitivity and selectivity of Graphene. The adsorption mechanism of individual VOCs on the surface of graphene is investigated by using first principles calculations. The VOCs are chosen as selected examples of main VOCs in exhaled breath in lung cancer patients. To evaluate the adsorption sites of VOCs on graphene, we have performed simulation including physical adsorption under the different Van de Waals functionals of Ethanol, Toluene and Butanone on a graphene substrate. The global minimum energy configurations and binding energies for the considered VOCs molecules adsorbed on graphene are determined by using Computational DFT-based Nanoscope for imaging the binding possibility of the adsorbed molecules on the graphene surface. The adsorption energy profiles were calculated by three approximations of van der Waals interactions: revPBE-vdW, optPBE-vdW, and VDW-D2. It is shown that the adsorption energy is highly sensitive to the wDW potentials. The fundamental insights of the interactions between the considered VOCs molecules and graphene through molecular doping, i.e., charge transfer are discussed in detail. Selected VOCs adsorption on graphene produces a band gap of 4-12 meV.

Keywords: *Graphene, VOCs adsorption, ab-initio calculations, charge transfer.*

THEORETICAL STUDIES OF HYDROGEN STORAGE MATERIALS: HYDROGEN DIFFUSION IN MONOHYDRIDE VANADIUM AND ALLOYS

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Abstract: It is considered that hydrogen is going to fuel the next generation vehicles. Hydrogen is the most abundant element on Earth, is regenerative and environmentally friendly. Hydrogen fuel provided by green method is renewable. Hydrogen burns cleanly in air, the only product is water. The development of viable hydrogen storage system is becoming increasingly important for promoting the hydrogen economy. Various hydrogen storage materials, such as metal hydrides, carbon-based materials, and complex metal hydrides have been investigated. The highest volumetric densities of hydrogen are found in metal hydrides. Many metals and alloys are capable of reversibly absorbing large amounts of hydrogen. Metal hydrides compose of metal atoms that constitute a host lattice and hydrogen atoms. The elements of group V, such as vanadium, can combine with hydrogen in interstitials up to the hydrogen-to-metal atomic ratio H/M ≈ 2 to form a large variety of metal-hydrogen complexes. Vanadium based BCC alloys containing Mo, Cr and other transition metals have been known to improve hydrogen storage properties. Mo and Cr addition possibly affects not only diffusion but also site occupation of hydrogen in the metal lattice because it causes the lowered stability of the hydride phase. In our study, the effects of substitutional Mo and Cr in β-phase $VH_{0.5}$ and $V_{1-x}M_xH_{0.5625}$ (M = Mo, Cr; and x=0, 0.0625, 0.125) on the site occupation and diffusion paths of hydrogen are investigated by quantum mechanical calculations based on density functional theory (DFT). Fundamental processes of the interstitial-assisted mechanisms are systematically figured out and specific values of the site energies are obtained with zero-point energy (ZPE) corrections. The site occupation energy and activation energy for each hydrogen diffusion path are found to be strongly influenced by the substitution of Mo or Cr into vanadium hydride. The results presented in this work indicate that the additional H prefers to migrate directly from *T* site to the nearest neighboring *T* site without crossing *O* site. The energy barriers in the order of 0.253-0.276 eV of hydrogen migration in the $V_{1-x}M_xH_{0.5625}$ hydrides obtained from ab initio simulations are in good agreement with the experimental data by means of ^{1}H NMR measurement.

Keywords: *Hydrogen storage, Vanadium alloys, Hydrogen Diffusion, DFT simulation.*

EFFECT OF LIQUID SMOKE INCORPORATED INTO WHEY PROTEIN BASED EDIBLE COATING ON PRESERVATION OF SPANISH MACKEREL FISH (SCOMBEROMORUS COMMERSONI)

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Abstract: Fish is a highly perishable commodity. Fish can contain 60% of water, and it becomes spoilage more rapidly in tropical weather. Quality loss from fish meat takes place when fish is stored more than one day due to activity of spoilage bacteria and enzyme. Spanish mackerel fish (Scomberomorus commersoni) is pelagic fish mostly favored by fishermen for its high economical value. The fish meat can be processed into various fish products, and it has been exported to Asia, America and Europe. In this study, preservation of spanish mackerel fish is approached by applying coating method with whey protein incorporated by different concentration of liquid smoke (0%, 5%, 10% & 15%). Coated and non-coated samples were stored for 15 days in refrigerator temperature (7-10ºC), then also analyzed for each 5 days with some preservation tests including pH, water content, volatile base and total bacteria count. Scanning Electron Microscopy (SEM) is performed for morphology characterization of coated and non-coated fish meat. The result of this study shows that addition of liquid smoke was able to maintain fish quality and extend its shelf life longer than uncoated fish meat.

Keywords: *mackerel fish, perishable, preservation, edible coating, liquid smoke.*

CONTROLLING THE HYDRATION REACTION KINETICS OF CALCIUM SULFOALUMINATE (CSA) CEMENT WITH BIOPOLYMERS

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Abstract: In this research, how the effects of polysaccharides change the hydration reaction kinetics and mechanism of Calcium Sulfoaluminate (CSA) Cement was investigated. As the sources of polysaccharides, Cactaceae (*Opuntia ficus-indica*) and Rutaceae (*Aegle marmelos*) were chosen based on their availability and acceptable properties as cement admixture. For the extraction of polysaccharides, water based extraction technique and ethanol were used as precipitating agent. Extracted polysaccharides were characterized by Fourier transform Infrared (FTIR), Thermal Gravimetric Analysis (TGA) and Differential Thermal Analysis (DTA), Scanning Electron Microscope (SEM) and X-Ray Fluoroscence (XRF). Various parameters such as pH, density, viscosity, and loss on drying of extracted polysaccharides were also analyzed. For the calculation of hydration reaction kinetics, analysis data of Quantitative X-Ray Diffraction (XRD) was used. The mechanism of the hydration of polysaccharide cement mixture includes both physical and chemical modifications. The film of the polysaccharide covered the surface of cement particles in the hydration process and filled the pores of the concrete. According to the experimental investigations and analysis data, addition of polysaccharides influence for delaying the very fast hydration reaction rate of Calcium Sulfoaluminate (CSA) Cement.

Keywords: *CSA Cement, Cactaceae, Rutaceae, Polysaccharide.*

CHARACTERIZATION AND TESTING OF OIL-PALM DERIVED BIOCHAR AS POTENTIAL GREEN BIO-COAL CANDIDATE FOR POWER GENERATION

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Abstract: Urgent quest to reduce its dependency on fossil fuel involves biomass as a promising alternative. However, direct application of raw biomass faces problems such as high moisture content, low heating value, and poor grindability. Alternatively, biomass-derived biochar is promising candidate to become bio-coal in power plant. This study is aimed at investigating the characterization and combustion performance test of empty fruit bunch -derived biochar (EFBC) as green bio-coal candidates for power generation. The bio-coal which was produced using conventional method and microwaved techniques were compared and benchmarked with commercial coal used in power plant. For conventional method, biochar produced using a top-lit, updraft reactor with a peak temperature of 550 °C and fixed air flowrate of 4.63 L/min. While for microwave techniques, the bio-coal/biochar was produced using a 10 L microwave-assisted pyrolysis system. The produced bio-coal were physically-chemically characterised namely proximate and ultimate analyses using standard method. Proximate analysis was conducted on the EFBC by using a thermogravimetric analyser (TGA) (TGA/SDTA851, Mettler Toledo, USA) to determine the fixed carbon, volatile matter, moisture and ash contents. The ultimate analysis was conducted to determine elemental composition of studied bio-coal by using CHNS/O analyser (model LECO CHN628 and 628S, USA) according to ASTM D-5291 standard method. The higher heating value (HHV) was measured by using Parr 6100 oxygen bomb calorimeter according to BS EN 14918 and the ash compositional analysis was measured using energy dispersive X-ray fluorescence spectrometer (EDX, SHIMADZU EDX-720). The combustion tests on both EFBC (microwaved (MEFBC) and conventional (CEFBC)) and sub-bituminous coal (SBC) were conducted using a fixed bed reactor (370 mm high and 54 mm wide dimension) and the gaseous emissions were analysed using gas chromatography (GC). The results obtained showed that both MEFBC and CEFBC has acceptable limit of the coal properties, with a lower content of moisture, ash, and fixed carbon; a significant higher heating value, as comparatively similar to high grade of the coal. In combustion testing, the MEFBC showed higher avoided emission for CO_2, and CO gases that could significantly reduce Green House Gas (GHG) emissions compared to the CEFBC and SBC combustion process. However, a slightly high content of SiO_2, MgO and P_2O_5 in the EFBC ash might potentially result in slagging, fouling, corrosion, and agglomeration in the combustion reactor. This information is important to the power industry in upgrading the efficiency of coal power plants. In conclusion, EFB-derived biochar provides an attractive opportunity for these agricultural wastes to be utilized as an alternative coal fuel for power generation.

Keywords: *biochar, combustion tests, power generation.*

KINETICS OF ENZYMATIC CHOLESTEROL OXIDATION USING CHOLESTEROL OXIDASE FROM STREPTOMYCES SP. AS BIOCATALYST

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Abstract: Cholesterol oxydase can be used as enzyme-based cholesterol biosensor applications. However, the enzymatic oxidation behavior is still not clear and the enzyme is expensive. In this research, the kinetics of cholesterol oxidation using Cholesterol oxydase was studied. The enzyme was prepared from Streptomyces sp. by submerged fermentation method. The performance of the produced crude enzyme was also compared with the commercial enzyme. In order to find optimum conditions for enzymatic cholesterol oxidation, the effect of initial cholesterol and enzyme concentrations were investigated. The cholesterol concentration was measured by using HPLC. The kinetic model was also derived and fitted with the experimental data. The enzyme has been successfully produced by submerged fermentation of Streptomyces sp. having 1.69 U/mL of enzyme activity. The Enzyme was able to oxidize the cholesterol up to 84% within 250 minute. The cholesterol oxidation was increased by increasing enzyme concentration and became slower by increasing substrate concentration. Comparison between our prepared enzyme with the commercial enzyme showed that initially the enzyme activity almost the same until 60 minute. However, our enzyme activity become slower when we tested the oxidation behavior until 250 minute. The fitted result of the kinetic model showed that the irreversible oxidation model can described the oxidation behavior.

Keywords: *cholesterol, cholesterol oxidase, kinetics, Streptomyces sp.*

BIO-SUCCINIC ACID SYNTHESIS FROM OIL PALM EMPTY FRUIT BUNCH USING BACTERIA ISOLATED FROM GOAT RUMEN

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Abstract: Production of bio-succinic acid from oil palm empty fruit bunch (OPEFB) has been conducted in this study. Succinic acid producing bacteria has been isolated from goat rumen. Isolate of bacteria were employed to convert the substrate from OPEFB into bio-succinic acid through semi simultaneous saccharification and fermentation (SSSF). This study has been conducted by several steps. Initially, isolation of succinic acid producing bacteria has been conducted using goat rumen as the sources of bacteria. On the other hand, preparation of OPEFB was also carried out by conducting pretreatment and hydrolysis process in order to remove lignin content and obtain glucose as the fermentation substrate. Pretreatment of OPEFB was conducted by using peracetic acid solution for 9 hours at 35 ^{o}C and then followed by using alkaline peroxide solution for 12 hours at room temperature. Pretreated OPEFB were then hydrolyzed by cellulase enzyme at 50 ^{o}C. Hydrolyzed OPEFB were then added with isolate of bacteria and fermentation medium to conduct SSSF. SSSF were carried out in a shaker water bath for 48 hours at 37 ^{o}C. In this study, different concentration of glucose, yeast extract as nitrogen source, and $MgCO_3$ as pH regulating agent were carried out in order to study their effect to the yield of bio-succinic acid produced. Based on results, the highest yield of bio-succinic acid of 17.324 g/g glucose has been achieved at the concentration of glucose, yeast extract, and $MgCO_3$ at 0.0341 g/L, 25 g/L, and 30 g/L, respectively. The results suggest that OPEFB may be utilized as a source of substrate for bio-succinic production. Furthermore, the results also proved that bacteria isolated from goat rumen have been successfully converting OPEFB into bio-succinic acid.

Keywords: *Bio-succinic acid, Goat rumen, OPEFB, SSSF*

ANALYSIS OF PESTICIDE RESIDUES IN SURFACE WATER IN CHNOK TRU FLOATING COMMUNITY OF TONLE SAP LAKE DURING LOW WATER SEASON

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Abstract: Pesticides are substances or mixture of substances mainly used in agriculture to protect plants from pest, weeds or diseases. Most of these substances have been associated with health and environmental issues which the agricultural uses of certain pesticides have been banned. Residues and metabolites of many pesticides are very persistent with long half-lives in the environment. Many recent studies have indicated the presence of pesticides in surface water of many rivers and lakes, which are closely related to the agricultural practices of the nearby areas. Tonle Sap Lake (TSL) is one of the largest fresh water lakes in Southeast Asia and under the threat of pesticide residue contamination. In this study, water samples from 16 different sites in Chnok Tru floating community, which expand approximately 4.4 square kilometers on Tonle Sap Lake in Kampong Chhnang province, Cambodia, were collected on 14 march 2019 during low water season. Water samples were analyzed for the levels of 21 targeted pesticide residues as a case study to find out the extent of pesticide contamination and accumulation in the lake. Solid phase extraction (SPE) was selected as the method to treat the samples before GC-MS analysis. Chloroneb, mefenoxam and metalaxyl were the predominant fungicide residues detected in all samples analyzed with the maximum concentrations of 3.44 µg/L, 4.31 µg/L and 1.81 µg/L, respectively. In addition, herbicide residue, anilofos, was also detected in most study sites with an average concentration of 0.55 µg/L. Methamidophos is an insecticide presented in most samples with a concentration from 0.71 – 1.88 µg/L. Fungicides, insecticides and herbicide were detected in TSL water samples suggesting that the water at Chhnok Tru floating community was significantly contaminated by pesticide residues; thus, this community is directly exposed to the potential health risk due to their frequent contact and use of lake water for their daily life.

Keywords: *Pesticide Residues, Tonle Sap Lake, Solid phase extraction.*

BIOFUEL DISTILLATED FROM YANG TREE OIL (DIPTEROCARPUS ALATUS OIL) BY VACUUM DISTILLATION

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Abstract: Fossil fuels are the main energy consumption, which are not only weakening but also considered the main case of harmful emission and global warming. Therefore, biofuel has become more attractive, necessary for environmental and economic sustainability. Yang Tree Oil (Dipterocarpus Alatus Oil) has occurred as one of the most promising sources for biofuel production. The aim of this project is to produce distillated biofuel from Yang Tree Oil by using Vacuum distillation at -730 mmHg. In implementation, the distillated biofuel properties as Specific gravity, Cetane number, Viscosity, Sulphur content, Flash point were measured according to Standard of Lao State Fuel Company. Results showed the distillated time and temperature of crude Yang Tree Oil distillation as 1, 2 and 3 L were 11, 27 and 31 min, and 22, 42 and 58^{o}C, respectively. The distillated biofuel properties were followed the Standard of Lao State Fuel Company.

Keywords: *Yang Tree Oil (Dipterocarpus Alatus Oil), Vacuum distillation, Biofuel properties.*

DETECTION AND IDENTIFICATION OF ANTIBIOTIC-RESISTANT BACTERIA IN TONLE SAP LAKE, TONLE SAP RIVER, MEKONG RIVER, AND WASTEWATER

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Abstract: Antibiotics are medicines used to treat bacterial infections. Antibiotic resistance occurs when these medicines are not effective against the bacteria. This leads to higher medical costs, prolonged hospital stays and increased mortality. The current situation of antibiotic-resistant bacteria in the lake, rivers and wastewater in Cambodia has not yet been conducted so far. Therefore, the aim of this study was to detect and identify of antibiotic- resistant bacteria in Tole Sap Lake (TSL), Tonle Sap River (TSR), Mekong River (MR), and Wastewater (WW) in Phnom Penh (PP). For TSL, the floating villages around Tonle Sap Lake (TSL) such as Chhnok Trou, Phat Sornday, Prek Khscah, Kompong Loung, Kompong Plouk, Chong Khnas, Kbal Tor, and Kaoh Chiveang in Kampong Chhang, Kampong Thom, Pursat, Siem Reap, and Battambang provinces were investigated respectively. The concentrations of ARB in dry season (November to April) for both Phnom Penh sites and floating villages of TSL in March were detected by using R2A solid medium with the presence of antibiotics. Moreover, the colonies from antibiotic plates were isolated for multidrug-resistant (MDR) bacteria by disc diffusion method on Müeller-Hinton Agar. Furthermore, for some isolated strains of multidrug-resistant bacteria, DNA extraction, polymerase chain reaction amplifying, and gel electrophoresis were conducted in order to identify the bacterial strains by 16S gene rRNA sequencing in Japan. The results showed that for Phnom Penh site, the concentration of ARB in WW was the highest, followed by TSR and MR, respectively. Meanwhile, the ARB concentration in April was higher than other months. For floating villages in TSL, it is illustrated that the highest concentrations of ARB were in Kompong Loung and Kompong Phluk. Likewise, the concentrations of MDR bacteria were high for all sites, which range from 40% to 62%. The identification of MDR bacteria by 16S gene rRNA showed the presence of pathogenic bacteria, which are harmful and cause many serious infections, especially *Stenotrophomonas maltophilia*. Moreover, these bacteria were resistant to at least 4 types of antibiotics already.

Keywords: *Antibiotic-resistant bacteria, Tonle Sap Lake, Tonle Sap River, Mekong River, Wastewater*

KHOA KỸ THUẬT XÂY DỰNG

FACULTY OF CIVIL ENGINEERING

PHÂN BAN: CƠ HỌC TÍNH TOÁN

SESSION: COMPUTATIONAL MECHANICS

OPTIMIZATION OF STEEL PANEL DAMPER DESIGN FOR SEISMIC MOMENT FRAMES

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Abstract: The proposed 3-segment steel panel damper (SPD) consists of one middle inelastic core (IC) and two end elastic joint (EJ) wide-flange sections. During earthquakes, the two EJs of the same cross-sectional property, are designed to remain elastic while the IC could undergo large inelastic shear deformation thereby dissipating seismic energy. In order to sustain a large deformation and delay the shear buckling of the IC web, stiffeners must be properly devised. In this study, optimization algorithm is adopted to proportion the SPDs and the boundary beams, and achieve the minimum steel weight design. It is assumed that two identical SPDs, one above and one below, are attached to the boundary beam mid-span. The MATLAB optimization toolbox combined the simulated annealing algorithm with the gradient-descent method is adopted to find the minimum steel weight design. The objective function is the total weight of the SPD, the boundary beam and the panel zone. The design variables are the sectional properties of the SPD, the boundary beam and the doubler plate thickness. Constraints include the capacity design of the SPD, boundary beam and panel zone, the stiffeners of the IC web, compact section and lateral torsional buckling limit state design requirements. The ‘‘basic design’’ is the lightest sections meeting all the constraints. The lateral stiffness of the two SPDs- to-boundary beam subassembly can be enhanced by either increasing the stiffness of the SPDs or the boundary beam. As examples, the optimization designs of increasing 50% more stiffness of the subassemblies as the new constraint were conducted also. While complying with the aforementioned constraints, the steel weight is increased by about 9% to achieve a 50% more stiffened design. The stiffness of the subassemblies are found enhanced most effectively by increasing the beam depths and web thicknesses.

Keywords: *steel panel damper; shear yielding; seismic design; capacity design; steel moment frame.*

STUDY ON TWO-DIRECTIONAL SEISMIC DETERIORATION OF TESTED STEEL COLUMNS

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Abstract: A collapse experiment on a full-scale four-story steel building specimen was conducted in 2007 on the E-Defense – one of the largest shake-table facility in the world, located in Hyogo prefecture, Japan. In that experiment, various increasing scaled ground motions were applied in the building specimen until collapse. With a valuable numerous data resource, the test has attracted a number of exploration and analysis studies eversince, both in and outside Japan.

As a member of the test conductors, the author provides further up-to-date investigation on the building response in this paper. It addresses the deterioration of the column subjected to simultaneous biaxial moment and axial force, which caused local buckling, consequent decrease in base shear capacity, and eventual structural collapse.

Experimental results show totally different deteriorating patterns of biaxial bending moments among all six columns because their axial force magnitudes differ considerably due to the column locations. Shifting of the principal direction of the biaxial bending moments cycle by cycle also caused the initiating damage of column section in the X direction and consequently reducing the resistant capacity in the Y direction. The column deterioration evolution is clarified and detailed from these perspectives.

Keywords: *steel building collapse, shake-table experiment, column deterioration.*

ADVANCED ANALYSIS FOR STEEL FRAMED STRUCTURES SUBJECTED TO STATIC AND DYNAMIC LOADINGS

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Abstract: This paper presents an advanced analysis procedure for steel framed structures subjected to static and dynamic loadings. Nonlinear inelastic finite element formulations are established based on stability functions obtained from exact solutions of second-order differential equations of beam-column member subjected axial forces and bending moments at the two-ends. Stability functions help minimize modelling and computational time because only one element per member is used for beams or columns. Plasticity of steel can be modelled by two approaches: the refined plastic hinge approach and plastic fiber approach. Generalized displacement control method is developed to solve nonlinear static equilibrium equations, while the Newmark average acceleration method combined with Newton-Raphson iterative algorithm is adopted to solve nonlinear dynamic equilibrium equations. Several numerical examples are presented to verify the accuracy, computational efficiency and prove the convenience of the proposed program for engineering design.

Keywords: *Advanced Analysis; Nonlinear Analysis; Plasticity; Stability Functions; Steel Frames.*

THE RELATION BETWEEN COMPRESSIVE STRENGTH AND ELASTIC MODULUS IN THE DIFFERENT TIME

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Abstract: The elastic modulus of concrete according to Vietnamese standards (TCVN) is determined according to the table shown in the standard, or in the ACI 318 or ASTM standard, which shows the experimental formula showing that correlation. However, all of them show the correlation when the concrete strength has reached 100%, e.g. concrete reaches 28 days. The investigation to find these relationship with concrete at early ages that to be carried out with more than 336 cylindrical specimens with different strengths of concrete. Cylindrical concrete specimens were tested for strength and elastic modulus in 1.5 day, 3 day, 5 day, 7 day, 14 day, 21 day and 28 day age. Then, the correlation formula will be established based on the reliability of the experimental method using the statistical method.

Keywords: *analysis, elastic modulus, compressive strength, early age concrete.*

TOPOLOGY OPTIMIZATION OF TWO-DIMENSIONAL TRUSSES USING IMPROVED PARTICLE SWARM OPTIMIZATION

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Abstract: This paper presents an improved particle swarm optimization (PSO) algorithm for solving topology optimization problems of 2D trusses under kinematic stability, stress, and displacement constraints. Although PSO is generally considered as an effective search algorithm for truss topology optimization, it tends to be trapped in local optimal regions. In PSO, each particle moves, each time, in a direction that is a combination of three directions, namely its current direction, the direction to the best particle, and the direction to the best position it has ever experienced. In this study, each particle considers, in addition to the above three directions, a trajectory toward or away from another randomly selected particle. If the randomly selected particle is better than the particle being considered, the particle will move toward this randomly selected particle; otherwise, it will move away in the opposite direction. These added information exchanges between particles increase the degree of exploitation of good solutions from different regions, and, therefore, reduce the occurrence of premature convergences. The obtained results show that the proposed algorithm performs effectively and provides better results than those obtained from the conventional PSO.

Keywords: *Truss Design Algorithm, Truss Topology Optimization, Particle Swarm Optimization, Exploitation, Information Exchanges.*

TWO-DIMENSIONAL TRUSS TOPOLOGY DESIGN BY REINFORCEMENT LEARNING

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Abstract: In this study, a reinforcement learning algorithm for topology design of 2D trusses is proposed. When topology design of trusses is done by computers, optimization algorithms, especially metaheuristic optimization algorithms, are normally used. These optimization algorithms require large computational resources and time. In addition, each design problem has to be solved individually from scratch. This study takes a different approach to this type of problem. Instead of using optimization algorithms to search for optimal solutions of these problems, each of them from scratch, an intelligent agent is created and trained to solve them. To this end, topology design of 2D trusses is formulated as a game called "TrussGame." An intelligent agent is then created for the game and is trained to play the game via the reinforcement learning process. After the training, the agent becomes an expert that can instantaneously design the topologies of 2D trusses.

Keywords: *Machine Learning; Reinforcement Learning; Actor-Critic Algorithm; Truss Design; Model-Free Reinforcement Learning Algorithm.*

PHÂN BAN: ĐỘNG LỰC HỌC KẾT CẤU

SESSION: WIND LOAD AND DYNAMICS OF STRUCTURES

NUMERICAL MODELLING OF CONCRETE-FILLED STEEL BOX COLUMNS: BEHAVIOUR ANALYSIS

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Abstract: Concrete-filled-steel-tube (CFST) columns have been widely used in civil engineering because of high ductility and ultimate strength. Effects of initial imperfections and residual stresses significantly reduce ultimate strength of rectangular CFST columns under axial compression. This paper aims to determine the ultimate strength of CFST columns by improving its confinement effects provided by the steel tube. From the results in previous studies, a new empirical equation is proposed to determine confining pressure on the concrete (f_r) based on a database of experiments. Concrete Damaged Plasticity Model (CDPM) is employed in the finite element software package (ABAQUS) with defined parameters. The prediction of ultimate strength is compared with experimental results, the Eurocode EC4 specification to verify the accuracy and efficiency of the proposed model. The proposed analysis results are more accurate than those of previous studies in the case of normal-high strength material or thin-walled tubes.

Keywords: *CFST Column; ABAQUS; Concrete Damaged Plasticity Model; Confinement Effect; Imperfections; Residual Stress.*

VIBRATION-BASED DAMAGE IDENTIFICATION OF STEEL MOMENT-RESISTING FRAMES

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Abstract: In many industrial applications, steel moment-resisting frames with yield-link connection are used popularly for new and retrofitted structures to withstand tremendous shakes during an earthquake event. During the structural service life, the properties of connections (for example the stiffness of links) would be changed, leading to structural failures and collapses. Structural health monitoring (SHM), hence, is vitally important. The main objective of this study is to identify the frame's damages, including the damage status as well as failed links. In order to achieve the objective, the following vibration-based damage identification methods are performed: Frequency change–based damage detection method, Modal assurance criterion, Mode shape curvature–based damage detection method, and Modal strain energy–based damage detection method. In particular, OpenSEES software is employed in order to analyse the structural vibration characteristics when the properties of links change.

Keywords: *Moment-Resisting Frame; OpenSEES; Structural Health Monitoring; Vibration; Yield-Link Connection.*

APPLICATION OF MODIFIED D-VALUE METHOD CONSIDERING PLASTIC STRAIN HARDENING EFFECT TO PREDICTION OF STRUCTURAL MECHANICS OF STEEL MOMENT RESISTING FRAMES WITH NEW COLUMN SUPPORT SYSTEM

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Abstract: Kaneda et.al [1] has proposed the concept to realize beam yielding mechanism of a steel moment-resisting frame by applying a pin-support column base system. Controlling moment distribution, the system reliably prevents yielding of the first story columns. As design procedure to predict elasto-plastic behavior of steel moment-resisting frames with proposed pin-support column base system, modified D-value method has been proposed. Previous papers examined flexural strength of columns to keep them in elastic when frames were modeled as those having perfect elasto-plastic beams. In reality, however, bending moment keeps increasing due to strain hardening after beams yield. In this paper, the authors develop the modified D-value method to consider strain hardening effect. Using a proposed method, required flexural strength of columns is clarified to avoid them from yielding up to when the frame forms beam yielding mechanism.

The results of the modified D-value method sufficiently agree with those of static analysis of low-to-mid-rise steel moment resisting frame when strain hardening effect of beams is considered. It is clarified that the story drift is reduced for larger strain hardening gradient, and that the maximum bending moment of the column does not change significantly, compared with those of perfect elasto-plastic frame.

Keywords: D-value Method, Static Analysis, Steel Moment-Resisting Frames, Story Drift, Strain Hardening

OPTIMAL COMPENSATION OF AXIAL SHORTENING IN TALL BUILDINGS BY DIFFERENTIAL EVOLUTION

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Abstract: Differential axial shortening in a tall building can cause damages on structural and non-structural elements. In this paper, an optimization approach for reducing the differential axial shortening is presented. The differential shortenings among vertical members are controlled by means of a suitable compensation strategy. Differential evolution is applied to determine the optimal compensation solution in a sequence of small optimization problems. The efficiency of the proposed approach is demonstrated through an example of a 70-storey building and its performance is compared with those of existing methods.

Keywords: *differential shortening; tall building; optimal compensation; differential evolution.*

ELASTIC LATERAL BUCKLING LOAD OF CONTINUOUS BRACED H-SHAPED BEAMS WITH FORK RESTRAINT BY TORSIONAL RIGIDITY OF COLUMN

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Abstract: In Japan, most of H-shaped beams are rigidly connected to the box sectional columns which have high torsional rigidity, and the boundary condition is corresponding to warping fixed support. Our previous papers clarified that the lateral buckling load of beams with the warping restraint becomes higher than that with pinned support. Furthermore, it was shown that the continuous braces such as roof purlins or concrete slabs connected to the beams also prevent the lateral buckling deformation.This paper evaluates the restraint effect of continuous braces on the lateral buckling load for H-shaped beams with fork restraint under the uniform flexural moment. The lateral buckling load of beams with warping and fully fixed support is estimated by formulating energy conservation equations. Next, this paper derives the equations of elastic lateral buckling load of beams with fork restraint, which is corresponding to the rotational restraint between warping and fully fixed support by torsional resistance of column. By comparing the equations with the numerical analyses results, the restraint effect of the continuous braces and column on the lateral buckling is verified. It is shown that the lateral buckling stress becomes higher, as the rigidity of the continuous braces or fork restraint increases.

Keywords: *Lateral Bucking Load; Fork Restraint; Continuous Braces; Flexural Moment.*

A PROPOSED METHOD FOR INSPECTING AND PREDICTING THE SEISMIC VULNERABILITY OF DAM STRUCTURES IN KOREA

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Abstract: A new method for predicting and checking the operational condition of the dam is proposed in this study. This method is applied for the Bohyeonsan Dam as an example and the dam operators can follow this way to observe the dam safety regulations. Firstly, the Response Surface Methodology (RSM) is used to optimize the parameters of the dam to ensure that the numerical model is reliable. Then the potential range of Cumulative Absolute Velocity (CAV) at the site is compared with the capacity of the structure in order to assess the vulnerability of the dam. CAV range at a specific location is established based on the seismic source models of the Korean peninsula and the relationship between Magnitude (M) and Peak Ground Acceleration (PGA). In addition, Fragility analysis is an intermediate step to assess the probabilistic of structural failure. The proposed approach is combined by many methodologies, however, this study emphasizes the way to define the CAV limitation of the structure to predict and assess the potential issue under earthquakes effects.

Keywords: *Seismic risk assessment, Response surface methodology, Fragility analysis, Cumulative absolute velocity, Seismic source models.*

PHÂN BAN: TẢI TRỌNG GIÓ VÀ ĐỘNG ĐẤT

SESSION: WIND LOAD AND EARTHQUAKE

CYCLIC LOADING TESTS OF STEEL PILE FILLED WITH CONCRETE AT PILE TOP SUBJECTED TO TENSILE AXIAL FORCE

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Abstract: In Japan, for real structures with the steel pile foundation, the steel pile top is filled with concrete in order to connect it to the RC footing beam rigidly. At the pile top, internal rings are usually attached to the inside of the steel pile to help stress transmission between concrete infill and the steel pile. However, when tensile axial force by overturning moment of structures acts upon steel piles during earthquake, steel piles may have huge damage due to the pile's fracture or the infilled concrete's crack at the pile top. In previous papers, the structural capacity of steel piles filled with concrete at the pile top subjected to compressive axial force was clarified. In this paper, cyclic loading tests of steel piles filled with concrete at the pile top subjected to tensile axial force are carried out, and clarifies the ultimate flexural strength and stress transfer mechanism between steel pile with internal rings and the concrete infill.

From the result of the test, the ultimate flexural strength of steel piles filled with concrete at the pile top is higher than that of steel piles, and then the collapse mechanism is performed due to the fracture of the pile.
Keywords: *Steel Pile; Pile Top; Tensile Axial Force; Cyclic Loading; Ultimate Flexural Strength*

UPDATING THE RELIABILITY OF AGING MITER GATES IN THE PRESENCE OF CORROSION AND FATIGUE

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Abstract: Miter gate is a type of navigation lock gate which is used to allow the passage of inland navigation across different levels in a river system. Aging miter gates suffer from structural deterioration due to fatigue and corrosion resulting in a reduction of structural resistance, influencing the integrity and life cycle costs. Therefore, it is essential to re-assess our belief in the structural safety and perform maintenance accordingly to optimize the operation and maintenance costs. This research presents an approach to update the reliability of aging miter gates in the presence of corrosion and fatigue. The failure probability calculated in the present paper is based on a probabilistic crack propagation analysis which considers the uncertainty in material properties, weld geometry, and fatigue loading. The time-dependent capacity of a miter gate is assessed including the effect of both corrosion growth rate and corrosion fatigue. The method is then applied to an example where the failure probability of a miter gate welded joint is updated based on inspection outcomes. The reliability updating approach presented here can be used for risk-based maintenance optimization of lock gates.

Keywords: *Reliability; fatigue; corrosion; miter gate*

ENERGY SIMULATION AND LIFE CYCLE COST ANALYSIS FOR DESIGNING ENERGY EFFICIENT COMMERCIAL BUILDINGS IN PAKISTAN

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Abstract: In Pakistan, the commercial buildings consume up to 7.5% of total electricity produced. Being an energy deficient country, it is very important for Pakistan to promote the use of energy efficiency measures. This research is conducted to find out the best practices, which can be implemented in Pakistan to reduce the energy consumption of commercial buildings. Life Cycle Cost Analysis (LCCA) is also carried out to determine the payback period. Three commercial buildings ranging from 4 floors to 14 floors height in Lahore, Pakistan were chosen for this research. A Baseline model was developed using the Sefaira® energy analysis software. Energy efficiency measures (or products) were then selected which are available in the local market and individually applied to the Baseline model for comparison. Results of the energy simulation showed that the commercial buildings can save from 5% to 12% of electricity by using adequate wall and roof insulation, double glazed windows, LED lighting, and occupancy sensors. For LCCA, cost information of energy efficiency measures was gathered locally and Present Value method was employed to determine the payback period. The LCCA results showed that the initial cost of the energy efficiency measures can be recovered in 4 to 8 years. The paper provides recommendations for local designers, constructors, and policy makers to promote the use of energy efficient buildings in Pakistan.

Keywords: *Energy Efficiency; Commercial Buildings; Life Cycle Cost Analysis; Green Building; Pakistan*.

A MULTI-LAYER MOVING PLATE METHOD FOR DYNAMIC ANALYSIS OF MULTI-LAYER CONNECTED PLATE RESTING ON A PASTERNAK FOUNDATION SUBJECTED TO MOVING LOAD

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Abstract: This paper presents a new computational approach, namely Multi-layer Moving Plate Method (MMPM), for dynamic analysis of multi-layer connected plate resting on a Pasternak foundation under a moving load. The formulations of multi-layer moving plate element mass, damping and stiffness matrices are derived. To verify the accuracy of the proposed method, the static analysis of plates is investigated. Next, a parametric study is performed to examine the effects of various parameters on the dynamic responses of multi-layer connected plate structure.

Keywords: *Multi-layer Moving Plate Method*, *Dynamic analysis*, *Multi-layer connected plate.*

EXPERIMENTAL MODELLING OF SELF-EXCITED RESPONSES OF A SQUARE CYLINDER IN SMOOTH WIND FLOW

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Abstract: Conventional wind tunnel tests for modelling the self-excited responses of slender structures under wind actions considered the wind normal to a structural axis, allowing the testing model vibrating in a direction normal to the wind. This paper discusses the issue of how to model the self-excited responses of slender structures under wind actions in wind tunnel, where the structures can vibrate in both directions normal on inclined to the wind through a series of wind tunnel tests on a square cylinder. The self-excited responses, including vortex-induced vibration and galloping, are then estimated. This study provides a further insight of the aeroelastic phenomena of square-section prisms.

Keywords: Galloping, VIV, square section, wind tunnel test, cross-wind

INTEGRATION BETWEEN VERY LARGE FLOATING STRUCTURES AND WAVE ENERGY CONVERTERS

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Abstract: Wave energy converters (WECs) have recently been suggested to be integrated into very large floating structures (VLFSs). The integration between WECs and VLFSs brings many benefits for not only wave energy converters, but also for very large floating structures. For example, costs for WEC installation, operation and maintenance can be reduced via cost sharing with VLFSs. On the other hand, because the integrated WECs play a role as wave energy absorbers, the presence of the integrated WECs results in reducing hydroelastic response of VLFS. This paper first presents overviews of wave energy converters and very large floating structures. Then, typical techniques for integration between very large floating structures (VLFSs) and wave energy converters (WECs) are given. Finally, some recommendations for future studies are presented.

Keywords: Wave energy converters, very large floating structures, integration.

PHÂN BAN: KẾT CẤU THÉP VÀ NHÔM

SESSION: STEEL AND ALUMINUM STRUCTURES

SHEAR RESITANCE BEHAVIORS OF A NEWLY PUZZLE SHAPE OF CREST BOND RIB SHEAR CONNECTOR: A FEM MODELING STUDY TO COMPARE WITH THE PREVIOUS EXPERIMENTAL

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Abstract: A newly puzzle shape of crest bond rib shear connector is a type of ductile perfobond rib shear connector.
This shear connector has some advantages, including relatively easy rebar installation and cutting, as well as the
higher shear resistance strength. Thus, this study proposed a newly puzzle shape of crest bond rib with a "ʊ" shape, and its shear resistance behaviors and shear strengths were simulated by Ansys software then compare with the push-out test results that finished by other authors. Five main parameters were considered in the push-out specimens to evaluate the effects of shear resistance parameters such as the dimensions of the crest bond rib, transverse rebars in the crest bond dowel, concrete strength, rebar strength, and dowel action on the shear strength. After the initial bearing resistance behavior of the concrete dowel, a relative slip occurred in all the specimens. However, its rigid behavior to shear loading decreased the ductility of the shear connection. The cross-sectional area of the crest bond rib was also shown to have a minor effect on the shear resistance of the crest bond rib shear connector. The failure mechanism of the crest bond rib shear connector was complex, and included compression, shear, and tension. Based on the results of this study, we can analyze all the cases that cannot make by the practical experiments.

Keywords: *FEM, ANSYS software, crest bond rib; composite dowel; push-out test; shear connector; shear resistance; puzzle shape; equation of crest bond.*

DAMAGE DETECTION IN PLATES WITH DIFFERENT BOUNDARY CONDITIONS USING IMPROVED MODAL STRAIN ENERGY METHOD

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Abstract: This paper presents an improved modal strain energy (MSE) method for damage detection in plate-like structures. Firstly, the theory of MSE method established for plate-like structures with different boundary conditions is briefly outlined. Therein, two-step MSE-based procedure, which is global step and local step, is proposed to enhance the accuracy for detecting the location and severity of damages. An aluminum rectangular plate is investigated in order to verify the feasibility of the proposed method. The plate's finite element models are analyzed to obtain natural frequencies and mode shapes for before and after the occurrence of damage. A damage index is presented to assess the accuracy of the proposed method. The analytical results show that the global MSE step well identifies the damage zone in the plate; then, the local MSE step accurately detects the crack's length in the damage zone.

Keywords: *boundary condition, damage detection, modal strain energy, plate, vibration.*

MODELING OF REINFORCED CONCRETE BEAM RETROFITTED WITH FIBER REINFORCED POLYMER COMPOSITE BY USING ANSYS SOFTWARE

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Abstract: Strengthening and upgrade of old structures using advanced materials is a modern research in the field of Structural Engineering. It’s necessary to obtain an expected life span. The advantages of FRP materials had inspired the researchers and practicing engineers to use the polymer composites in the field of rehabilitation of structures. This paper deals with the finite element analysis of beam retrofitted with different fiber reinforced polymer (FRP) composite sheets carried out using ANSYS software. RC beams with different FRP composite sheet specimens were modeled using ANSYS software. First RC beam wrapped with carbon fiber reinforced polymer (CFRP) sheet, second with glass fiber reinforced polymer (GFRP) sheet and third with Aramid fiber reinforced polymer (AFRP) sheet. Warping along one, two and three sides were made. FRP sheets with different thickness and in layers were also checked. Also the combination of above three FRPs in layers was also wrapped around the beam. The performances of the above retrofitted beams are then compared with the controlled specimen and the results were presented in the paper.

Keywords: *Fiber Reinforced Polymers (FRP), CFRP, GFRP, AFRP, Retrofitting, ANSYS software*

EXPERIMENTAL AND NUMERICAL STUDIES ON THE SEISMIC PERFORMANCE OF ELECTRIC CABINET CONSIDERING THE NONLINEARITY OF CONNECTIONS

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Abstract: This paper presents the results from experimental study and finite element (FE) simulation of cabinet facility in nuclear power plant. The experimental results from the impact hammer test provide the dynamic characteristic of structure for validation purposes. The FE numerical models with differences of type (i.e. welding, and screw) and number of connections between plate and frame members have been developed to demonstrate adequately dynamic responses of cabinet structures. The screw connections with the bilinear relationship for the displacement force curve are proposed to represent the inelastic interaction of these members. The obtained results reveal that the natural frequencies of the structure are sensitive with the plate and frame connectors, and the screw connections reduce the free vibration compared to the weld one. The free vibration frequencies using the screw connections decrease 2.82% and 4.87% corresponding to front-to-back and side-to-side directions comparing with using the weld connections.

Keywords: *Cabinet Facility; Nonlinear Connection; Experimental Modal Analysis*

VIBRATION ANALYSIS IN DESIGNING POST-TENSIONED SLABS

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Abstract: Nowadays, the prestressed-concrete slabs are using more and more widely in Vietnam because they create the economic value for the whole project. But sometimes, people feel uncomfortable because of the floor's vibration caused by footfalls or running machines. Therefore, it is important to analysis vibration of floor to determine whether a floor meets the serviceability requirements for vibration using conservative values or whether a more detailed analysis is considered. This article shows the analysis vibration of author for some kinds of real and finished post-tension slabs in Vietnam then giving the proposal about which slab type should be determined vibrations guaranteeing the comfort of occupants.

The vibration analysis will be explained through the six-step process. They are: calculating natural frequency, exciting force of vibration, selecting floor type for damping ratio, calculating modal mass (weight of vibrating floor panel), determining peak acceleration ratio caused by footfall and comparing with the allowance values.

The allowance values are evaluated according to Applied Technology Council of America and Vietnamese Code. In conclusion, the author proposes to add the step of vibration analysis in post-tensioned slabs design.

Keywords: *PT slabs; bonded tendon; vibration; peak acceleration; post-tensioned; prestressed-concrete*

THE IMPACTS OF DIFFERENT STRUCTURAL DESIGN ALTERNATIVES ON THE EMBODIED CARBON EMISSIONS OF FLAT PLATE BUILDINGS

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Abstract: The building industry has been long criticised as the largest single contributor to climate change, due to extensive consumption of natural resources and discharge of Greenhouse Gas (GHG) emissions. It is therefore imperative for the entire industry to accommodate sustainable design and construction. Technically, the building's lifecycle carbon emissions are comprised of those at the use phase (operational carbon), and those occurring in the production and construction processes, Embodied Carbon (EC). Historically, great efforts have been put into mitigating the operational emissions, with embodied emissions being neglected. Recently, researchers have increasingly acknowledged the vital role of EC and the requirement for a thorough evaluation of EC in the environmental assessment. This research was undertaken to study the influence of structural design's alternatives on the overall EC. Specifically, a typical flat-plate building was investigated with respect to different column arrangements and concrete strengths. While previous research considered the horizontal and vertical load-resisting systems separately, this paper examined both slabs and columns to obtain their interrelated relationship in terms of sustainability. The outcomes revealed that reduction in the building's self-weight did not necessarily mean a decline in embodied environmental impacts, thereby highlighting the trade-offs between material saving and material carbon-intensiveness in the decisions towards sustainable designs and solutions.

Keywords: *Reinforced concrete; Sustainable Design; Embodied carbon; Flat plate system.*

PHÂN BAN: KẾT CẤU BÊ TÔNG VÀ COMPOSITE

SESSION: REINFORCED CONCRETE AND COMPOSITE STRUCTURES

TENSILE BEHAVIOR OF ULTRA-HIGH-DUCTILE FIBER-REINFORCED CEMENTLESS COMPOSITES

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Abstract: The paper presents an experimental study of the mechanical properties of ultra-high-ductile fiber-reinforced cementless alkali-activated slag (AAS)-based composites. Three mixtures, according to types of alkali-activators, were designed and prepared. Polyethylene (PE) fiber with high aspect ratio and high tensile strength was used as a reinforcing fiber for all mixtures. A series of experiments to measure the compressive strength and tensile behavior of AAS-based composites was performed at the ages of 7 and 28 days. The test results showed that AAS-based composites had superior tensile strain capacity, which was around 7%. The tensile performance of AAS-based composites was analyzed through the theoretical conditions for the pseudo-strain-hardening (PSH) behavior.

Keywords: *Activators; Composites; Ductility; Fiber; Slag.*

EXPERIMENTAL STUDY OF ULTRA - HIGH PERFORMANCE FIBRE REINFORCED CONCRETE SLABS UNDER CONTACT BLAST LOADING

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Abstract: This paper presents an experimental study of Ultra-High Performance Fiber Reinforced Concrete (UHPFRC) slabs under contact blast loading. The UHPFRC material is fabricated in laboratory using the material available in Vietnam. Two UHPFRC slabs with the volume fraction of micro steel fibers of 2%, two UHPFRC slabs with the volume fraction of micro steel fibers of 3% and two Normal Concrete slabs are tested. These slabs have the same dimensions (1000 mm of length, 800 mm of width and 120 mm of thickness). The Emulsion Explosive was used. Two cylindrical explosives blocks with a mass of 0.5 kg and 1.22 kg were placed on the top centre of the slabs. The concrete crater and spall damage of these slabs under contact blast loading are considered. These results allow to evaluate the blast resistance capacity of UHPFRC fabricated in lab. It's the basis for the future research and application of this concrete for special projects in Vietnam.

Keywords: *Ultra-High Performance Fiber Reinforced Concrete, Normal concrete, Blast loads, Fracture behavior, Experimental studies.*

INVESTIGATION ON MOISTURE TRANSFER IN MORTAR AFTER EXPOSURE TO HIGH TEMPERATURE

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Abstract: Concrete as one of main building materials can have a risk of an exposure to high temperature environment such as fire in its service life. Generally, concrete after exposed to high temperature of approximately 300°C do not need repairing and its compressive strength can recover after a while by re-hydration reaction. On the other hand, it is also reported that the high temperature can adversely affect the durability of concrete, which can be strongly related to moisture transfer. This study aims to investigate the moisture transfer in mortar after exposure to high temperature by using electrical resistance method. Two heating methods including plate-heating and radiation-heating were used in this study. The results showed that the temperature inside the specimen during heating was totally different depending on the heating methods even when the heating curve was almost the same. In addition, the different heating methods may affect the results of moisture transfer inside the specimen after heating. Furthermore, the electrical resistance method could be effective in assessing the moisture transfer in mortar after exposure to high temperature.

Keywords: *Moisture transfer; Heating; High temperature; Durability; Mortar.*

INFLUENCE OF CHLORIDE ION IN SEA SAND ON MECHANICAL PROPERTIES OF FLY ASH CONCRETE EXPOSED TO ACCELERATED CARBONATION

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Abstract: This study aims to investigate influence of chloride ion in sea sand on compressive strength and modulus of elasticity of fly ash (FA) concrete exposed to accelerated carbonation. Non-desalted sea sand (NSS) and desalted sea sand (DSS) were used as fine aggregates. Four mixtures were prepared with a constant water-to-cementitious materials ratio of 0.50. FA was used to replace ordinary Portland cement (OPC) with a ratio of 15% by mass. After cured under sealed condition at 20 °C for 28 days, a half of concrete specimens were continuously sealed, whereas the rest was exposed to carbonation with 5% CO_2 and 60% relative humidity until designated ages. Compressive strength and modulus of elasticity were measured at 28, 91 and 182 days. Results showed that the chloride ion in NSS improved the compressive strength and modulus of elasticity of concrete not only under sealed condition but also under carbonation condition regardless of FA replacement. Compressive strength and modulus of elasticity of FA concretes were higher than those of reference concrete (OPC-DSS) under sealed condition at 182 days. Under carbonation condition, compressive strength of FA concretes could be nearly the same while their modulus of elasticity was slightly lower in comparison with OPC-DSS.

Keywords: *Sea sand; Chloride ion; Fly ash; Compressive strength; Modulus of elasticity.*

LEAD ADSORPTION ON CEMENT PASTE AT VARIOUS pH VALUES CONTROLLED BY DIFFERENT METHODS

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Abstract: Recently, a recycling-oriented society has been required to solve environmental issues. In the concrete field, the use of industrial wastes for concrete materials is expected. However, these wastes may contain hazardous heavy metals. It is well known that heavy metal ions can be fixed in cement paste. However, it is also reported that lead adsorption on cement paste depends on pH value. This study aims to investigate lead absorption on cement paste at various pH values controlled by different methods. The adsorption test was carried out at various pH values controlled by three methods, including carbonation of cement paste, calcium hydroxide leaching from cement paste, and cement paste immersion in nitric acid solutions at different concentrations. The concentration of lead ions after adsorption test was measured by using an atomic absorption spectrophotometer. In addition, X-ray diffraction test was also employed to analyze chemical changes due to the pH value as well as lead fixation. The result showed that similar pH dependency of lead adsorption was found in every pH controlling method. Additionally, it was shown that lead adsorption amount increased with a decrease in the pH value.

Keywords: *pH dependency; lead; adsorption test; pH controlling method.*

EFFECT OF WATER-TO-BINDER RATIO ON CEMENTING EFFICIENCY FACTOR OF FLY ASH REGARDING COMPRESSIVE STRENGTH OF CONCRETE

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Abstract: This paper aims at investigating the effect of water-to-binder (W/B) ratio on cementing efficiency factor (*k*-value) of low-calcium fly ash with regards to strength development of concrete. All specimens were prepared with two W/B ratios of 0.30 and 0.50 and the fly ash was used to replace a part of cement at ratios of 0, 20, 30, and 40% by mass. At the ages of 3, 7, 28, 91, and 182 days, compressive strength of concrete was examined, whereas degree of fly ash reaction and portlandite content in paste specimens were measured by selective dissolution method and thermogravimetry and differential thermal analysis, respectively. The results showed that a lower W/B ratio yielded a higher *k*-value of fly ash at the ages of 3 and 7 days, while the *k*-value increased with an increase in the degree of fly ash reaction for a long period.

Keywords: *k-Value; Water-to-Binder Ratio; Fly Ash Reaction; Portlandite Content.*

INFLUENCE OF MOLAR CONCENTRATION OF SODIUM HYDROXIDE SOLUTION ON HIGH TEMPERATURE RESISTANCE OF GEOPOLYMER PASTE

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Abstract: This study aims to investigate the influence of the molar concentration of NaOH solution on the high temperature resistance of geopolymer paste. Specimens were prepared with 55% of fly ash, 45% of ground granulated blast-furnace slag and alkaline solutions. Alkaline solutions were prepared with sodium silicate solution and NaOH solutions at different concentrations; 10M, 12M, and 14M. Specimens were cured for 24 hours at 70 °C after casting. Then, they were cured at 20 °C, demolded at the age of 48 hours and stored at 20 °C and 60% RH. At the age of 28 days, specimens were exposed to high temperature of 500 °C and 950 °C. As a result, when the specimens were exposed to 500 °C, C-S-H gel was decomposed and their compressive strength decreased by approximately 50%. Furthermore, when the specimens were exposed to 950 °C, recrystallization to the secondary mineral phase was promoted and the specimens lost approximately 80% of their compressive strength. On the other hand, there was no significant difference in the results obtained from the different molar concentrations of NaOH solution. It implies that the molar concentration of NaOH solution cannot remarkably influence the high temperature resistance of geopolymer paste.

Keywords: *Geopolymer; High temperature resistance; Compressive strength.*

STRENGTH DEVELOPMENT PROPERTIES OF CORE SPECIMENS TAKEN FROM STRUCTURAL CONCRETE TEST SPECIMENS PREPARED ALL OVER JAPAN

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Abstract: This paper investigates the strength development properties of core samples (range: 40 to 100 N/mm^2) from concrete specimens prepared and tested at ready-mixed concrete plants all over Japan. Experimental data was obtained using cubic concrete blocks (1 m^3) made of three types of cement, which were classified according to the time of year they were prepared to account for the influence of seasonal/temperature conditions (spring/fall, summer, winter). The study considered the maximum internal temperature of concrete blocks, the relationship of cement-to-water ratio and compressive strength, and differences in compressive strength between underwater (standard)-cured specimens and core specimens attributable to season and cement type. In addition, design parameters were derived for cement-to-water ratio in order to achieve certain target strengths for structural concrete members.

Keywords: *Strength Development; Core Specimen; Maximum Temperature; Structural Member; Design Strength.*

AIR PERMEABILITY OF RECAST CONCRETE BOX CULVERT APPLYING STEAM CURING CONDITION

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Abstract: Air permeability plays as a vital durability index to evaluate the quality of the reinforced concrete structure including precast concrete box culvert. In the present study, the air permeability of a precast concrete box culvert applying a typical steam curing condition was monitored to evaluate the cover concrete quality. The Torrent air permeability test was employed to measure coefficient of air permeability kT for the box culvert specimen produced using steam curing, Portland cement, water-to-binder ratio of 0.485 over a period of one year. The obtained results showed the changes in kT on the tested surfaces up to the age of one year. Additionally, it also suggested the influence of segregation and sealing condition during applying steam curing on measured kT values.

Keywords: *Cover concrete; Air permeability; Steam curing; Transport properties.*

INVESTIGATION OF MECHANICAL PROPERTIES OF FLY ASH/ RFCC BASED GEOPOLYMER CONCRETE

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Abstract: Residue Fluid Catalytic Cracking (RFCC) is waste materials of petroleum industry, which contains Aluminium and Silicon ions. It could be used as source material for fabricating geopolymer materials. In this study, the properties of fly ash/RFCC based geopolymer concrete are investigated with the usage amount of RFCC in range from 20 to 100% by mass. The experimental results show that the higher usage amount of RFCC would provide higher content of alumino-silicate for geopolymerization. However, the ratios of SiO_2/Al_2O_3 and $Na_2O/(SiO_2 + Al_2O_3)$ are decreased. Also heat curing is required for fly ash/RFCC based geopolymer concrete. Thus, the slump of fresh geopolymer concrete is lower than 40% compared with fly ash mixing. Besides, fly ash/RFCC based geopolymer concrete is required higher content of alkaline liquid to maintain the properties of fly ash based geopolymer on mix proportion.

Keywords: *Geopolymer concrete; Fly ash; RFCC; Petroleum; Alkaline liquid.*

INVESTIGATION OF THE INFLUENCE OF RESIDUE FLUID CATALYTIC CRACKING (FCC) ON PROPERTIES OF AUTOCLAVED AERATED CONCRETE

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Abstract: The influence of residue fluid catalytic cracking (FCC) on properties of autoclaved aerated concrete (ACC) is investigated in this study. In petroleum refinery manufacturing, fluid catalytic cracking is a product of conversion process with major of zeolite which can be used as a composition in concrete. The experiment of geopolymer autoclaved aerated concrete was carried out with replacing 25, 50, 75 and 100% of crushing sand by fluid catalytic cracking. The workability, expansion properties, chemical properties as well as strength of geopolymer ACC are obtained and compared with cement ACC. The amount of activated aluminosilicate increased and the ratio of CaO per SiO_2 and Al_2O_3 decreased and effect to action in autoclaved environment. There is a decrease in workability, expansion properties of geopolymer ACC including expansion time, expansion level with an increase in percentage of FCC. The strength of autoclaved aerated concrete using fluid catalytic cracking is improved up to 20%, compared with ACC using cement.

Keywords: *fluid catalytic cracking; autoclaved aerated concrete; geopolymer; workability; chemical properties, strength properties.*

STUDY OF GEOPOLYMER SYNTHESIZED FROM FLY ASH TO IMPROVE SOFT GROUND

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Abstract: Geopolymer is a material that can replace Portland cement. This material is the product of the reaction process between silicon-rich materials and aluminum with alkaline activated solution. This is an environmentally friendly material due to the utilization of industrial waste, such as fly ash, while reducing the greenhouse effects because of replacing portland cement. This study summarizes the results of research on geopolymer application in the field of improvement soft ground in the world and Vietnam in recent years. This paper also proposes the research direction and ability to apply this technology in the field of improvement soft ground soil in Vietnam.

Keywords: *Geopolymer; Fly ash; Geopolymer concrete; Improvement soft ground; Sustainable development*

EFFECT OF FLY ASH AND ALKALINE SOLUTION ON RHEOLOGY OF CONCRETE FOAM

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Abstract: Characterisation of fly ash from coal-fired thermal plants is useful in developing a pollution method for many application such as cement and concrete manufacturing. The reaction of fly ash on alkaline environment can be produced low cost materials in construction to replace large amount of cementious materials. The major composition of fly ash is qualitatively similar to that of pozzolane materials such as meta-kaoline and slag. The physical properties of fly ash with sharping, moisture content, bulk density are various to depend on burning processing. In this research, cement is replaced by large amount of fly ash in concrete foam mix proportion. Moreover, alkaline solution is used to combine with fly ash to effect on workability and rheological parameters of fresh concrete. The experimental results show that the higher usage amount of fly ash would provide higher content of amorphous particle and reactivity in mixture. Fresh concrete environment can be effected on flow diameter, flow time by adding alkaline liquid. Besides, the workability of concrete foam is improved by suitable ratio of fly ash and alkaline liquid.

Keywords: *Fly ash; alkaline liquid; workability; rheology; concrete foam.*

INVESTIGATION OF COMPRESSIVE BEHAVIORS OF GEOFOAMS MADE IN VIETNAM

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Abstract: Geofoam or EPS is widely applied to construct highway embankments on soft ground in European countries and the United States of America, but has no practical applications in Vietnam. This study aims at better understanding of Geofoams made in Vietnam in terms of engineering properties. Compressive behavior of Geofoams is the most important properties and has limit research results in Vietnam. The study is also a fundamental step to propose applying Geofoams made in Vietnam to construct highway embankments on soft ground in Vietnam. Several Geofoams made in Vietnam were collected to conduct unconfined compressive strength tests to obtain compressive strength, compressive strain, modulus of elasticity, and poisson's ratio. The 5 cubic specimens of each geofoam type were made to perform unconfined compressive strength tests following the ASTM D1621. The 9 types of Vietnam geofoams were selected with mass density varying from 12-30 kg/m^3. The results indicate that the compressive strength increases linearly with increasing the mass density of geofoams and varying from 60 to 260 kPa. At compressive strain of 2% or less, compressive strength increases sharply and linearly with increasing the vertical loads, and the strength increases insignificantly with load's increments. The modulus of elasticity or initial modulus or young modulus also increases linearly with increasing the mass density of geofoams even though the results of this study is lower than the others. The poisson's ratio is appreciably smaller than data published in the literature.

Keywords: *EPS; Geofoam; Abutment; Bridge approaching embankment; Soft ground; Ground improvement.*

EFFECT OF SODIUM-SILICATE TREATMENT FOR RECYCLED CONCRETE AGGREGATE ON SLUMP AND COMPRESSIVE STRENGTH OF CONCRETE

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Abstract: The aim of the present study was to investigate effect of sodium-silicate treatment for recycled concrete aggregate (RCA) on slump and compressive strength of concretes. Replacements of crushed stone as coarse aggregate by RCA were 0, 25, and 50% by volume. RCA was treated by immersing in solution consisting of 50% sodium silicate and 50% tap water for 1 hour to improve its properties. After immersion, the surface of treated RCA was dried in air before making concrete. Concrete with untreated RCA was also prepared for comparison. Results showed that the higher the RCA replacement, the lower the slump and compressive strength at 3 and 7 days of concretes regardless of the sodium-silicate treatment. With the same water content, the concrete with treated RCA had the higher slump and lower compressive strength at 3 and 7 days when compared with the concrete with untreated RCA. Gain in 30-day compressive strength compared with 3-day compressive strength of the concretes with untreated and treated RCA was more significant than that of the concrete without RCA. Consequently, this treatment reduced water absorption of RCA, resulting in an increase in slump of fresh concrete and a decrease in compressive strength at early ages of hardened concrete.

Keywords: *Sodium-Silicate Treatment, Recycled Concrete Aggregate, Slump, Compressive Strength, Concrete.*

COMPARATIVE PERFORMANCES OF REINFORCED BEAMS USING CONCRETE MADE FROM ARTIFICIAL SAND AND FLY ASH

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Abstract: The study deals with comparative performance of reinforced concrete beams using developed concrete made from artificial sand and fly ash, which were evaluated to be environmentally friendly. There are two main groups of developed concrete: the first is originated from matrix M1-T00 (using fine aggregate, no fly ash) having design compressive strength of 20 MPa; the second is originated from matrix M1-T00 (using fine aggregate, no fly ash) having design compressive strength of 30 MPa. Eight beams using eight concrete matrice were prepared with same dimensions of 150×150×900 mm (depth x width x span length) and same reinforcing bars and stirrups. All beams were examined using 3-point bending test. The bending resistances of investigated beams would be comparatively evaluated and discussed.

Keywords: *Artificial sand, Fine aggregate, Fly ash, Environmental impact, Landslide.*

CHLORIDE PENETRATION TEST OF CONCRETE SIMULATING DEICING SALT ATTACK

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Abstract: Apparent chloride diffusion coefficient, Dc, plays as a vital index in evaluating resistance of structures against chloride attack. Our previous study reported that the coefficients obtained from existing concrete structures were ten times smaller than those obtained in chloride immersion tests. In the existing structures, chloride ions are supplied by deicing salt. There is a cycle in the supply of chloride ions, because deicing salt is sprayed only in winter season in a year. In the present study, the coefficient, Dc, was measured to investigate the chloride penetration under cyclic wetting and drying condition simulating deicing salt attack. The cyclic wetting and drying tests were conducted by changing total time of wetting and drying on cylindrical specimens. The concrete specimens were produced using Portland cement, and water-to-cement ratio of 0.55 and cured in the water for 28days. As a result, in the cyclic wetting and drying test, total test periods did not change on Dc when the ratio of immersion term and dry term is same. In addition, large variations of Dc were found in literatures. Possible reasons of the difference in Dc were discussed considering the ratio of immersion term to dry term in the literatures and this experiment.

Keywords: *Durability; Deicing salts; Wetting and drying; Chloride penetration.*

PHÂN BAN: CÔNG NGHỆ CHẨN ĐOÁN KẾT CẤU

SESSION: LATEST ADVANCES IN STRUCTURAL HEALTH MONITORING

CALIBRATING THE K&C MATERIAL MODEL FOR FIBER REINFORCED CONCRETE STRUCTURES

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Abstract: This paper presents a calibration of a material model implemented in LS-DYNA for simulating the fiber reinforced concrete (FRC) structures under dynamic loading. K&C material model, which is also known as MAT072r3 model, is employed for this purpose. Owing to the fact that K&C model was initially developed for conventional concrete, without any calibration it may not be appropriate for other concrete such as FRC. Using the axial and tri-axial tests on FRC specimens given in the literature, the calibrated parameters are determined. Numerical analysis of FRC columns under blast loading is then carried out to illustrate the performance of the calibrated model on describing the dynamic behaviour of FRC structures under high rate loading. Comparisons between FEA result and test data show that the calibrated model is capable of modelling of FRC structures under high-rate effect like blast and impact loading.

Keywords: *Blast loading; Material model; LS-DYNA; Fiber reinforced concrete; Numerical analysis.*

EXPERIMENTAL STUDY OF REINFORCED CONCRETE BEAMS STRENGTHENED BY HIGH-STRENGTH FIBER REINFORCEMENT CONCRETE

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Abstract: In this paper, the authors will investigate the effect of reinforced concrete beams strengthened with high-strength fiber reinforced concrete (SFRC) at the tensile zone. The experiments are tested at the University Structural Engineering Laboratory HCMC Technical Education. The experimental model gives the assessments with reinforced concrete beams corresponding to concrete grades of M20, M25, M30 in compressive zone and the high-strength fiber concrete in the tensile zone. Comparison results of the steel-reinforced concrete beams reinforced with high-strength fiber concrete and normal reinforced concrete beams shows the increasing the bearing capacity of beams, and the behavior of beams changed significantly compared to conventional concrete beams.

Keywords: *Steel fiber reinforced concrete, reinforced concrete beam, experiment of beam, concrete beam strengthened with fiber concrete.*

CASE STUDY ON FIELD APPLICATION OF STRUCTURAL STRENGTHENING TECHNIQUE WITH FIRE-PROTECTION TO A COMMERICAL BUILDING

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Abstract: The growth in the structural rehabilitation and retrofit industry in Asia has brought about the advent of a variety of new materials and techniques for strengthening purposes. The use of fibre reinforced polymers (FRP) or composite systems for structural strengthening and retrofitting of concrete and masonry structures is one such strengthening technique that has gained its acceptance and popularity over the past few decades. The ease in the use of FRP for strengthening such structures has brought about a spate of composite material suppliers in the Asian region. It is of prime importance to realize that the incorporation of FRP systems for structural purposes is not merely limited to supply and sale of constituent materials and site application but encompasses a wide range of issues pertaining to their development such as testing, environmental durability, usage, material quality control and post-installation quality assurance. As such, the implementation of FRP system for strengthening to a newly constructed 6-storey commercial building in Hanoi Vietnam went beyond the standard supply and installation, it incorporated an in-situ load testing and fire-protection to the FRP system used to ensure a long-term enhancement to the structures of the commercial building.

Keywords: *Strengthening; FRP; Systems; In-situ; Fire-protection; Load-Test*

THE REDUCTION OF VIBRATION OF MULTIPLE TUNED MASS DAMPERS IN CONTINUOUS BEAM TRAVERSED BY MOVING LOADS

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Abstract: This paper analyses the reduction of vibration of Multiple Tuned Mass Dampers (MTMD) in continuous beams traversed by moving loads. The continuous beam is discreted to the bar element by finite element method (FEM), the moving loads is modelled by body mass and wheel of the vehicle. The MTMD are applied to arbitrary position of the continuous beam. The equations of motion including the moving loads, beam and MTMD are established by the balance of dynamic forces and are solved by using the step-by-step Newmark's method in the time domain. A computer program written in the MATLAB language is used to dynamic analysis of the beam with and without MTMD. The results show that the research parameters of MTMD such as frequency and mass affected to the dynamic response of the beam.

Keywords: *Continuous beam; Multiple Tuned Mass Dampers; Moving loads; Reduction of vibration.*

THE DYNAMIC ANALYSIS OF BEAMS ON NONLINEAR FOUNDATION CONSIDERING THE MASS OF FOUNDATION TO MOVING OSCILLATOR

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Abstract: This article presents dynamic analysis of beam on nonlinear foundation to moving oscillator considering the mass of foundation. The beam is assumed as Euler-Bernoulli beam theory with finite length, one span, discretized by finite element method. The nonlinear foundation fully describes dynamic characteristic parameters including the Winkler linear and nonlinear elastic parameters, the Pasternak shear layer parameter, viscous damping and mass density of foundation. The governing equation of the system is solved by the Newmark method in the time domain. A computer program is written in the MATLAB programming language for analyzing the beam's dynamic behavior by finding the displacement and the dynamic factor of the beam. The effect of foundation mass on the behavior of the beams can be determined by examining the parameters of the beams, the foundation and of the moving oscillator.

Keywords: Dynamic analysis of beam, Nonlinear foundation, Moving oscillator, Mass of foundation.

STRUCTURAL DAMAGE DETECTION IN SPACE FRAMES USING MODAL STRAIN ENERGY METHOD AND GENETIC ALGORITHM

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Abstract: In this paper, a two-stage damage detection method combining modal strain energy (MSE) method and genetic algorithm (GA) is proposed to identify the location and the extent of multiple damages in space frame structures. The proposed method can detect the damages not only globally in whole structure but also locally in each structural member. In the first stage, a damage index based on modal strain energy, namely modal strain energy based index (MSEBI), is employed as the criterion to determine the occurrence of the damages among elements in the structure. The modal strain energy is calculated by using the modal analysis obtained from the frame's finite element model. In the second stage, the GA is utilized to minimize the objective function. The objective function is developed with design variables correspondingly represented the extent of the damages which are identified from the first stage. Finally, the feasibility of the proposed method is verified by numerical simulations for two space frame structures. Additionally, the effectiveness and the aspects needed to be improved of the proposed method are discussed.

Keywords: *damage detection; frame; genetic algorithm; modal strain energy; structural health monitoring.*

PHÂN BAN: CÔNG NGHỆ MỚI TRONG KẾT CẤU XÂY DỰNG

SESSION: RECENT ADVANCES IN TECHNOLOGIES FOR CIVIL ENGINEERING

ANALYSIS OF THE RELATIONSHIP BETWEEN THE DEFLECTION PATTERN OF A FLOATING PLATE INDUCED BY MOVING LOAD AND THE MATERIAL ANGLE BY USING THE BEM-MEM METHOD

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Abstract: Deflection patterns of a floating plate induced by a moving load have been mentioned in many studies. Generally, the structures have been assumed to be isotropic in those studies. In practical applications of floating structures, the directional-dependent bending stiffness should be considered. On the other hand, the direction of the moving load is not generally parallel to the strong material direction. Hence, the angle between the two directions should be also considered. Based on this issue, responses of a floating flexible plate subjected to a moving load in consideration of the material orientation are investigated. The plate is modeled as Kirchhoff's plate, while the linearized water wave theory is used for the hydrodynamic modeling. A mixed method of Boundary Element Method (BEM) and Moving Element Method (MEM) is introduced in this study in order to conduct the simulation. The dependence of deflection patterns on the material angle is considered according to numerical investigations.

Keywords: *MEM; BEM; VLFS; Material Angle; Hydroelastic.*

GALLOPING ANALYSIS OF A SCULPTURAL COLUMN

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Abstract: This paper provides a further insight of galloping analysis of slender structures through a development of 2DOF galloping analysis model. The role of mode shape, wind profile and coupling between modes will be discussed. An application on a famous art column which is the "Endless column" aims to illustrate the theory. Critical aspects in engineering applications will be also highlighted.

Keywords: *Galloping; Slender structures; Aeroelasticity; Aerodynamics; Endless Column*

STOCHASTIC MODELLING FOR SERVICE LIFE PREDICTION OF UNDERGROUND TUNNELS SUBJECTED TO WATER INGRESS

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Abstract: It is well known that water ingress is the main cause of deterioration in tunnel linings leading to potential direct or indirect damages. This paper presents a methodology in which both the temporal and spatial variation of water seepage in concrete lining can be considered. Temporal variation is modeled using the Gamma process, while copulas are used to model spatial correlation in the seepage process. Simulation based on the Monte Carlo technique is employed to find the extent of water seepage over the tunnel surface and to find the probability of failure based on a limit state defined for water seepage. An illustrative example is used to show applicability of the proposed method. The results showed that the effect of spatial variability of seepage process cannot be ignored in prediction of service life. This highlights the need for more research on statistical analysis of water seepage in concrete using experimental or field data.

Keywords: Service life, Reliability, Concrete, Tunnel, Seepage.

FREE VIBRATION ANALYSIS OF FG SANDWICH PLATES ON ELASTIC FOUNDATION USING A REFINED QUASI-3D INVERSE SINUSOIDAL SHEAR DEFORMATION THEORY

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Abstract: Free vibration analysis of functionally graded (FG) sandwich plates on elastic foundation is analyzed by using an efficient and simple refined quasi-3D shear deformation theory (R-QSDT) and the element-free Galerkin method based on the moving Kriging interpolation. The displacement field of the present theory is chosen to account for both shear deformation and thickness-stretching effect by using a inverse sinusoidal variation of all displacements across the thickness, and satisfy the stress-free boundary conditions on the top and bottom surfaces of the plate. The elastic foundation is modeled as Pasternak foundation. The pragmatic feature of the present theory is that it contains only four number of unknowns, which are less than the existing quasi-3D theories, but its solutions agree well with quasi-3D solutions. To show the accuracy and effectiveness of the developed method, numerical validations are performed for the FG sandwich plates on two-parameter elastic foundation.

Keywords: *Sandwich Plates; Elastic Foundation; Functionally Graded Materials; Refined Quasi-3D shear Deformation Theory; Moving Kriging Interpolation.*

USING DETERMINISTIC APPROACH TO PREDICT COMPRESSIVE STRENGTH OF HIGH-PERFORMANCE FIBER-REINFORCED CONCRETES UNDER DIFFERENT SIZES

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Abstract: This study work concentrates on building up mathematical equations for compressive strength of high-performance fiber-reinforced concretes (HPFRCs) with different sized specimens using deterministic approach. In previous study of the author, the compressive specimens, using two types of HPFRCs with three different cube sizes, were experimented under compressive test. The compressive strength of the investigated HPFRCs were observed to be decreased with increasing specimen sizes. Even though the testing results of large-sized specimens or structural members would be more precise and authentic, their sizes are very numerous and their tests requires huge space, equipments, high cost and much time. Thus, the mathematical equations were derived in this study work for the purpose of predicting compressive strength of large-sized specimens or structural members using HPFRCs.

Keywords: High-performance; Size effect; Deterministic approach; Energetic; Brittle failure.

PHÂN BAN: KIẾN TRÚC

SESSION: ARCHITECT

AN IMPACT OF PHYSICAL ENVIRONMENT ON USERS' BEHAVIORS IN OPEN SPACE: A CASE STUDY OF 29-3 PARK IN DANANG

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Abstract: Urban open space plays a pivotal role in improving the quality of life of city dwellers by accommodating various physical and social activities, concurrently further creating social coherence for the sustainable development. The purpose of this research is to explore different behaviors of residents in open spaces in Da Nang (Vietnam); which can support both later development and improvement of local open space. Users' behaviors were identified and categorized based on their activities in open space that were collected using place-centered behavior mapping method. Results of the statistical analysis revealed that this open space could be categorized into three types, each of which had four dimensions such as public facilities setting, openness, accessibility, and recreational facilities. The findings of the analysis showed some problems that need to be considered during the development process of open space as follows: 1) increasing the quantity and quality of public amenities; 2) separating accessible/ buffer space from already used space inside the park, particularly in entrance zone; the privacy in space; 3) providing space adjacent to the lake; 4) and removing obstacles (e.g. walls around the park) to give a clearer view from the inside park to streets outside and vice versa. Also, the calculation model of evidence-based designs provides input data for planners and authorities improve or design a better open space in the near future.

Keywords: *Behavior mapping; park environment; environmental behavior; 29-3 Park; Da Nang.*

ARCHITECTURAL DESIGN RXPLORATIONS USING INDUSTRIAL ROBOTIC ARM

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Abstract: The aim of this paper is twofold. First, it discusses the potential applications of industrial robots to lead innovative opportunities in architecture. Second, it investigates the basic procedures of controlling and operating a robotic arm. This research seeks to understand the operative methods of industrial robots. Accordingly, a simple hot wire cutter is installed in the robot and tested its features with a foam. Furthermore, a small-scale experimental design with the industrial robot is designed and fabricated. Wall designs with complex geometries are conceptualized. Then, the complex free-form designs with the robot are fabricated. In this experiment, a 6-axis ABB robotic arm with a payload of 10 kg is used for the exploration, and a hot wire is attached to the end effector of the robotic arm

Keywords: *Industrial Robot; Architectural Façade; Digital Design; End Effector; Wire Cutter*

URBAN APPERANCE IN THE INDUSTRY 4.0 IN CASE OF HO CHI MINH CITY

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Abstract: City provides resources for industrial activities and in return, industry promote urbanization and urban upgrading. In the era of Industry 1.0, with achievement in mechanic and steam engine, urban had formed from concentrating resources (manpower, capital,...) to workshops (i.e Manchester-UK 1750). Industry 2.0, with achievement of electricity; internal combustion engines and invention of automobile vehicle, city formed in 2 parts: manufacturing center and residential areas (i.e Detroit-USA 1900). Then, Industry 3.0, based on information technology and automation; city tend to sprawl out and formed in structure with core as CBD and outskirt belt as manufacturing space with zone concentrated of large-scale firms (i.e Asian countries' Industrial Park- XX century so far). In those eras, industry play the role of growth pole [1] that promote agglomeration lead to urbanization. In the trend of 4.0, with IoT and AI; the argument may be what relevant resource that Industry 4.0 require and can it shape the urban appearance as former industries.

HoChiMinh City is the key industry region in Vietnam. This city has resources enough to develop IoT/AI, and the trend moving to industry 4.0 is inevitable. In that trend, above arguments need to be discussed to contribute to policy maker, urban planner.

[1]: Perroux (1955); Boudeville (1966); Porter (1990)

CBD: centre business district

Keywords: urbanization, industrialization, IoT, IioT

ADAPTIVE BUILDING FACADES: DESIGN METHODS AND ROBOTIC FABRICATION

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Abstract: Climate-adaptive architecture is the key to achieving sustainability throughout history. Building façade, in particular, plays a significant role in providing a comfortable environment for its occupants. This structure aims to provide shade, reduce solar heat gain, and allow airflow for natural ventilation. In this study, we analyze a wooden window screen called Mashrabiya. Which was used in old times in Middle Eastern areas. Mashrabiya has been reinterpreted with changes in its design, mechanism, and materials. Two contemporary façade designs inspired by the traditional Mashrabiya are reviewed. On the basis of an analytical study, alternative design solutions are assessed through a geometric method. Moreover, their fabrication using contemporary technologies are briefly discussed.

Keywords: *Building façade, shading device, geometric method, Mashrabiya, fabrication*

IDENTIFYING AND ASSESSING THE ATTRACTIVENESS OF PUBLIC SPACES FOR THE YOUTH AS A KEY FACTOR TO HELP ESTABLISH SOCIAL SUSTAINABILITY - CASE STUDIES FROM HANOI

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Abstract: Social contact, communication and interaction often take place in public spaces. Thus, if well planned and designed, they will help connect people, establish social sustainability and make a city friendlier as well as more liveable. Hanoi is developing quickly and modernising vigorously its spatial structure. As a consequence, the city is becoming more densely constructed, public spaces are largely occupied and social relations have been immensely influenced. Over the past ten years, there have been numerous problems with public spaces for Hanoi city authority to deal with in terms of both quantity and quality. Therefore, the authors have chosen to explore (and evaluate) the attractiveness of urban spaces for the youth based on a number of properties, such as diversity, accessibility, flexibility, frequency and quality of activities organised) with 94 sites systematically surveyed in five wards: Phuc Tan, Truong Dinh, My Dinh 1, Thuy Phuong and Sai Dong, which are quite different, not only in levels of urbanisation but also in patterns of (and design concepts for) public places. The initial findings should then be discussed and targeted at a more socially sustainable city.

Keywords: *Public Space; Diversity; Accessibility; Flexibility; Frequency of Activities; Quality of Activities; Social Sustainability.*

ASSESSMENT ON ROOF ARCHITECTURE OF STREET HOUSE IN HO CHI MINH CITY

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Abstract: In Ho Chi Minh city (HCMC), there are 70% citizen are living in street house (SH). The facade of this type of housing has been concerned while the roof has not been taken care of so it is greatly affecting the environment and urban image. The objective of this study is to assess the current status of the roof of SHs in HCMC in order to offer solutions to improve the quality of living condition as well as increasing the aesthetics of the urban image. First, the SH roofs in different locations in HCMC are selected to take the survey. Then, collected data are synthesized, analysed and categorized to show the types of SH roofs according to functions, materials and structures. Next, 5 typical roofs among such houses are chosen to be measured the microclimatic parameters including roof surface temperature and glare. Finally, based on the quantitative results, practical solutions that are appropriate to the current situation are proposed to meet the future development capabilities. The results of this study will contribute to the completion of construction codes, standards, urban management and design regulations, which helps to upgrade the urban appearance and enhance the quality of life for residents in urban areas.

Keywords: *roof architecture; street house; living environment quality*

STUDIES ON HOUSEHOLD WATER CONSUMPTION AND WATER-SAVING SOLUTIONS FOR FOUR CITIES IN THE RED RIVER DELTA (HANOI, HAI PHONG, HAI DUONG AND NAM DINH)

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Abstract: Apart from energy efficiency, water saving has become a key standard for green buildings worldwide and will soon be a compulsory requirement for sustainable housing design in Vietnam, especially when the demand for clean water tends to rise whereas water supply under the impact of on-going climate change may be insufficient. In this context, household water consumption in cities, particularly in major cities, should be analysed to find out common issues and to highlight different points as well among several housing patterns and groups of users. In total, 198 households from four cities in the Red River Delta of North Vietnam (Hanoi, Hai Phong, Hai Duong and Nam Dinh) were surveyed in 2018. Before taking the potential of using grey water after treatment into account, rainwater - because of its abundance, simple technique, low cost and applicability - should be collected and used in place of tap water for certain purposes. Two villas and four row-houses in Hanoi have been selected for further investigations. In each case study, it is possible to calculate the level of water saving based on some input data and its significant contribution to a more sustainable city in Vietnam can be demonstrated.

Keywords: *Household Water Consumption; Water-saving Solutions, Rainwater Use; Sustainable Urban Development.*

AN ANALYSIS OF GREEN BUILDING CERTIFICATION SYSTEMS IN VIETNAM

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Abstract: As one of the worst affected countries in the world, Vietnam has established adaptation policies and measures to cope with climate change. Promoting the development of green buildings based on sustainable development is considered one of the useful measures. Green building is a construction, which is built environmentally friendly. Its operation does not adversely affect to community and nature, preserves natural resources. Although the number of green buildings in Vietnam has increased in recent years, the speed of green building development is slower than other countries in Asian. According to the statistics, there are 87 certified green buildings in Vietnam by the end of 2018. The objective of this study is to analysis on 10 green building rating systems existing in Vietnam today. First, 10 green building certification systems are reviewed and evaluated based on expert interview results. Then, the outstanding features of each certification system will be analyzed and compared with each other. Finally, some typical works will be briefly introduced to clarify the applied architectural solutions. In conclusion, a general picture of green building rating systems in Vietnam is drawn out and the ability to apply them to promote sustainable development effectively is discussed.

Keywords: *green building; climate change; sustainable development;*

RESILIENT SPATIAL PLANNING FOR DROUGHT-FLOOD COEXISTENCE ("DFC"): OUTLOOK TOWARDS SUSTAINABLE CITIES

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Abstract: The challenges of booming urbanisation are multi-faceted. There have been many different concepts being raised concerning the urban puzzle during the past few decades. The old fashion is *"Sustainable development"* and *"Sustainability"*, which is considered extremely expensive to be put in practice. More practically, *"Resilience"* arose in 2000s have attracted greater attentions and interests, in both academia and urban governance, then in planning practice. The most recent concern among them relates to *"Smart cities"*, in which cities embrace available technology to make them *"Smart"*. Many studies show that advanced technologies, such as remote sensing and GIS, have helped architects, urban planners and authorities planning and managing cities more resilient.

The paper explores how a city suffering "DFC" becomes resilient in three sections. The first examines the relationship between smart and resilient cities. The second focuses on how to turn smart cities into resilient by utilising remote sensing and GIS technology. In the third, the case of Ninh Thuan province will be presented with several key findings of its interrelated elements: natural conditions and built environment, resulting in the current "DFC". The study will be concluded with key urban planning and design principles, which make cities achieving smartness and resilience.

Keywords: *smart city, resilient city, resilient spatial planning, remote sensing and GIS technology, sustainable development, sustainability, extreme weather events, drought-flood coexistence.*

PHÂN BAN: ĐỊA KỸ THUẬT

SESSION: GEO-TECHNICAL ENGINEERING

PERFORMANCE ANALYSIS OF A COMBINATION BETWEEN D-WALL AND SECANT PILE WALL IN UPGRADING THE DEPTH OF BASEMENT: A CASE STUDY IN HO CHI MINH CITY

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Abstract: A combination between D-wall and Secant pile wall in upgrading the depth of basement of a high-rise building project in Ho Chi Minh was presented. In that, the secant pile wall was installed next to the available D-wall designed for original depths of basements. FEM analysis based on the Plaxis 2D was applied to perform the behavior of the combination. The results of the analysis were compared to currently standards and field observation. Based on the comparisons, the system between two kinds of wall showed the effects and satisficed technical requirements of deep excavation.

Keywords: *Deep excavation; D-wall; Secant piles wall; High-rise building; Geotech*

PERFORMANCE ANALYSIS OF AXIALLY LOADED PILES BY LOAD TRANSFER METHOD: A CASE STUDY IN HO CHI MINH CITY

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Abstract: The paper presented about an application of load transfer method in performance analysis of axially loaded pile in Ho Chi Minh City. The relationship between mobilized load and settlement at pile shaft and pile tip was described by hyperbolic model. The simple iterative algorithm was applied to determine the behavior of the piles. The analysis results were verified with a fulls cale static load test. A good agreement between predictions and measurements of load-settlement relationship at pile head and load distribution along depth was recorded.

Keywords: *Axially loaded pile; Load transfer method, Ho Chi Minh City*

ANALYZING SHEAR ELASTIC STRAIN OF SOIL CONSIDERING INTERACTION BETWEEN SFRC FOUNDATION AND INHOMOGENEOUS SOIL

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Abstract: This study shows that the influence of material models used in foundation structures will affect the shear elastic strain of the soil in the interaction problem between foundation and soil. The material modelling for the foundation structure mentioned in this paper is Steel Fiber Reinforced Concrete (SFRC) which is established based on the stress-strain relationship. The soil is considered to be an elastic half-space model and it is divided into multi-layers with the same thickness in depth. Both behaviours of SFRC foundation and inhomogeneous soil in the analysis are nonlinear using the Morh-Coulumb criteria for soil. The results achieved by the proposed model will be compared with those of the plain concrete foundation and linear elastic behaviour of soil.

Keywords: *ANSYS; Inhomogeneous Soil; Interaction Problem; SFRC; Plain Concrete.*

BACK ANALYSIS ON DEEP EXCAVATION IN THE THICK SAND LAYER BY HARDENING SOIL SMALL MODEL

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Abstract: This paper presented back analyses for 3 deep-basement projects in thickness layer of sand located in Ho Chi Minh City area, which were built by several different construction methods including bottom-up, semi-top-down and top-down. The FEM analysis by Plaxis 2D and the Hardening Soil Small Model were employed to describe the behaviour of structures. The parameters of HSS model for thick sand layer were chosen from the correlation between N(SPT) and depth, which was synthesized from 20 investigated boreholes of the projects. Besides, the parameter studies of $E_{50,}$ $P_{ref,,}$ $G_{0,}$ $\gamma_{0.7}$ were implemented to get the well agreement between the results of FEM models and observations. Based on the comparisons, using the values of E_{50} equal to 2500N(SPT) and P_{ref} values equal to σ_3 at the middle of those layers would give the acceptable outcome compared to observation results. Furthermore, the best fit between results of modelling and observation could be get by applying shear modulus at very small strains G_0 equal to $6000\rho N^{0.75}$ (unit in kPa) and shear strain $\gamma_{0.7}$ equal to 0.0002.

Keywords: *Deep excavation, back analysis, hardening soil small model*

FINITE ELEMENT ANALYSIS OF A DEEP EXCAVATION ADJACENT TO THE BEN THANH-SUOI TIEN METRO TUNNEL

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Abstract: Recently, in Ho Chi Minh City, due to rapid developments and limited urban area, more and more deep basements were constructed for high-rise buildings as car parks and shopping areas. In some cases these basements were carried out adjacent to existing metro tunnels, so it is important to check potential effects of constructing deep excavations on adjacent metro tunnels in service. The finite element analysis is usually used for analysis of this type of complex problem and in this study both 3D and 2D finite element analyses are carried out for the excavation. However, 2D models are the plane strain simulation so it does not accurately describe the actual excavations as 3D models. Especially, in 3D models, the “three-dimensional” effect or the “corner effect” is considered and it results in a reduction of ground movement near the corners of the excavation due to the stiffening effects of the corners. With comparisons between these two types of finite element analysis, this study proves the benefits of the 3D modeling for an economical engineering design. Furthermore, this research also focus on the displacement of the tunnels. By using the “T-panels” and cement deep mixing (CDM) method for the excavation, the total displacement of the tunnels were successfully controlled within 15.0 mm and the deferential movement in any plane was less than 1/1000.

Keywords: *deep excavation; metro tunnel; corner effect; economical design; displacement of the tunnel.*

APPLICATION OF VIBRO TECHNIQUES TO IMPROVE COMPLEX GROUND UNDER LARGE LOADING

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Abstract: Deep Vibro techniques is one of the reasonable solutions in case of multi-layer soil treatment because this technique can replace or compact respectively to different types of soil. This solution is selected to handle the case of geological condition with loose sand layer at the surface and soft clay layer underneath in the Hoa Phat Dung Quat Steel Complex Project. In this case, Stone columns is used to treat the soft clay and Vibro compaction to densify loose sand at the top layer. The simulation of Plaxis 3D and large-scale plate load test showed that the post treatment bearing capacity is increased and the ground settlement is significantly reduced. Simulation, experimental and monitoring results show that the physical and mechanical properties of the ground after treatment are consistent with the expected results according to Priebe method.

Keywords: *Vibro techniques, stone column, deep compaction, ground improvement, stockpile, large loading*

EFFECTS OF SPT NUMBERS DATA ON LIQUEFACTION POTENTIAL ASSESSMENT OF FINE SOIL

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Abstract: SPT data has increasingly been used in geotechnical engineering. Beside lab tests on undisturbed samples of soil, this kind of site test are not much reliable for fine soil, which is rather unfavorably susceptible to liquefaction. SPT data has still been used for assessing liquefaction potential via factor of safety, i.e ratio of cyclic resistance ratio CRR divided by cyclic stress ratio CSR. This paper aims at studying the reliability of liquefaction potential assessment using SPT numbers taken in layers of fine soil. By analysing data from many boreholes of projects in Ho Chi Minh City, correlation between SPT numbers and physical and mechanical properties of cohesive soil like fine sand and silty sand… was found. Probabilistic approach such as FORM (Taylor series), Monte Carlo Sampling of evaluation for liquefaction potential of fine soil stratum was carried out with modified correlation matrix. Results of significant correlations between corrected SPT numbers and others soil data was tentatively studied.

Keywords: *Standard Penetration Test*; *Cohesive and fine soil; Correlation Matrix; Safety Factor of Liquefaction Potential.*

UNCERTAINTIES IN PROBLEM OF GROUND IMPROVEMENT USING PREFABRICATED VERTICAL DRAINS (PVD) AND SEEKING A COST EFFECTIVE DESIGN APPLYING MONTE CARLO SAMPLING

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Abstract: This article studies a procedure of designing the PVD to attain a given overall degree of consolidation, considering investor's budget and a given time and constructor's capacity of construction; randomness of variables and factors involved in problem were also taken into account. Distribution law of variables and parameters was prescibed according to previously studied works. There were a lot of variables including height of preloads, length of installation or thicknness of compressible layer to be improved, time planned by investors, drainage capacity of drains, specification of the drains and compressibility of soil. Normal and Lognormal distribution of different variables and parameters were applied suitably. Probability of successful performance for attaining a total degree of consolidation U=85% or more, was found using Monte Carlo method with 10^5 runs. Some stochastic scenarios were considered to evaluate the overall cost. It was the cost in which all the possible variations of variables were intergrated to meet the investor's requirement of time and budget, including item cost of surcharge and length of PVD installation.

Keywords: *Prefabricated Vertical Drain (PVD), Uncertainties, Monte Carlo Sampling.*

DETERMINATION OF UNLOADING – RELOADING MODULUS AND EXPONENT PARAMETERS (m) FOR HARDENING SOIL OF SOFT SOIL IN HO CHI MINH CITY

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Abstract: This study analyzes and determines the modulus of deformation and the dependence of the modulus of deformation on the stress state of Ho Chi Minh City's soft soil. Parameters were determined as stiffness parameters: E_{50} and E_{ur} in Hardening Soil model. Triaxial compression testing was performed for very soft clay at depths of 4-6 m and 12-14 m, soft clay in the range of 18-20 m and 24-26 m according to drainage conditions with unloading and reloading.

Keywords: *Unloading-reloading Modulus, Hardening Soil, Soft Soil, Exponent Parameter;*

STUDIES ON THE EFFECTS OF RAFT AND PILES ON BEHAVIOR OF PILED RAFT FOUNDATIONS

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Abstract: In high-rise buildings, using piled-raft foundation has become a popular solution to meet economic and technical requirements. It is necessary to have a good combination between the raft and the piles in the piled-raft foundation design. In this paper, the effects of raft and piles on the behavior of piled raft foundations are analyzed by the finite element method, via Plaxis 3D software. There are several cases of piled-raft foundations to be analyzed: piles of equal length and piles of different length. For each case, the thickness of the raft varies from 2.0 m to 9.0 m. Results of the settlement, differential settlement of the raft, bending moment and axial load of the piles,... give the analysis and the evaluation of the effect of raft's thickness and pile design to the behavior of piled-raft foundation. Based on these results, this paper proposes a suitable design of piled raft foundation which mainly focuses on the relationship between pile group and raft' stiffness, the pile's density, and the load-bearing capacity of pile group.

Keywords: *piled raft foundation, differential settlement, raft, pile group, the load bearing capacity.*

APPLICATION OF EPS IN THE ROAD CONSTRUCTION ON SOFT GROUNDS

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Abstract: Expanded Polystyrene Fill (EPS) is one of solutions of road construction on soft soils. It is a lightweight fill used to reduce vertical stresses beneath embankments, or to reduce lateral stresses on retaining walls, abutments or foundations. EPS has been used in highway construction in Europe since the early 1970's, and after that was used in other countries. However, this solution is quite new and has not been widely used in Vietnam. In this paper, the physical and mechanical characteristics of EPS material are firstly introduced. The flammability, the durability, and the uniformity of EPS Block are also checked to ensure its quality. Then, several case studies of using EPS in road construction on soft soils are presented. Based on the field observations of deformation, settlement,… the analysis and the evaluation of the effectiveness of EPS solution are carried out with the recommendations of application of EPS solution in Vietnam condition.

Keywords: *EPS, road construction, soft soils, settlement, deformation.*

EXPERIMENTAL STUDIES ON THE IMPROVEMENT OF SOFT SOILS BY CEMENT IN VINH LONG CITY

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Abstract: The Mekong river delta is widely known as one of the soft soil areas in the world in which the uppermost layers of soft soil have to be improved for construction projects. Soft soil reinforcement methods by using soil cement columns are very popular by enhancing the strength and the deformation characteristics of soft soils. In this paper, a comprehensive laboratory testing programme was carried out to study the effect of cement content and the degree of saturation on the physical and the mechanical behaviour of soil-cement mixtures. Several unconfined compession tests, triaxial compession tests, direct shear tests, and the permeability tests have been carried out on the samples of cement-treated soft soils of Vinh Long city by varying the content of Portland cement. The results indicate the shear strength increases as the cement content increases, and the permeability coefficient decreases as the cement content increases. There are remarkable differences between the shear strength, and the Young's modulus of the unsaturated and saturated samples. In addition, in the saturated samples, as the confining pressure increase from 0 to 400 kPa, the peak strength and the Young's modulus fluctuate insignificantly.

Keywords: *Soft soil, cement, shear strength, Young's modulus, coefficient of permeability,Vinh Long city*

CONSOLIDATION BEHAVIORS OF SOIL SAMPLES OF DIFFERENT SIZES - A CASE STUDY OF PRELOADING WITHOUT PVD IN HO CHI MINH CITY

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Abstract: In the soil investigations, the consolidation test's results play an important role in the foundation design, especially in the soft soil improvement by preloading technic. Conventionally, small size samples are used for determination of consolidation properties. However, the test results may suffer from the limitations of the small sample size as small diameter sample may not truly represent the "fabric" and the "structure" of the soils in situ. Therefore, the consolidation tests on the large diameter samples are necessary. In this paper, in order to analyse the effect of sample size on soil's deformation characteristic, several tests on soil samples have been conducted in which the sample size varied within the range of 20cm^2, 30cm^2, 50cm^2 in the cross section area, and 2cm, 3cm, 4cm in the thickness. Then, these test results are used as input parameters for PLAXIS 2D analyses to estimate the consolidation settlement of soft ground due to the preloading. The field monitoring data are used to confirm the accuracy of settlement which are estimated by the mentioned above test results. Based on these results, this paper proposes a suitable determination of soil samples's sizes for the soil investigations.

Keywords: *Sample size, consolidation properties, preloading, settlement monitoring, PLAXIS 2D*

QUALITY ASSESSMENT OF FIELD SOILCRETE CREATED BY JET GROUTING IN THE MEKONG DELTA

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Abstract: Jet Grouting was initially applied to treat differential settlement of bridge abutments in Dong Thap province Vietnam. Key advantages of Jet Grouting are to preserve current highway pavement, to maintain traffic during construction, and to work in limit space. The two bridges were chosen in Dong Thap province for field experiments. The 40 soilcrete columns were created using Jet Grouting to reinforce the bridge abutments. The several bored core samples were taken at the field to evaluate quality of field soilcrete formed by the single Jet Grouting system at 28 days or more after construction. The core samples were used to make specimens for unconfined compressive strength (UCS) tests in laboratory. The UCS tests provided unconfined compressive strength, secant modulus of elasticity, and strain at failure. The results recommend that (1) average diameter of soilcrete columns was around 0.8 to 1.5 m meeting the designed diameter; (2) unconfined compressive strength varied from 0.6 to 2 MPa which is higher the designed strength of 0.5 MPa; (3) Secant modulus of elasticity was about 54-313 times of unconfined compressive strength; (4) Strain at failure was less than 2% agreeing well the published data and the typical failure strain of soilcrete material.

Keywords: *Jet Grouting; Soilcrete; Abutment; Bridge approaching embankment; Soft ground; Ground improvement.*

3D-MODELING OF SLOPE FAILURE BY USING UAV AND LASER SCANNER

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Abstract: Construction information modeling, CIM, is a keyword to improve the construction management. 3D-model of construction site can be speedily made by using UAV and 3D-laser scanner. The 3D-model consists of high-resolution images and point cloud data with position information. A large size slope failure due to heavy rain occurred in July 2019. For the early recovery from the disaster, the 3D-modeling of the slope failure site was made by using UAV and 3D-laser scanner. It takes a few hours to take pictures by UAV and measure the point data by 3D-laser scanner. The 3D-model of the slope was useful not only to grasp the features of the slope and calculate the scale and volume of the failure, but also to make a recover plan of the slope.

Keywords: *CIM, 3D-modeling, slope failure, UAV, laser scanner.*

PHÂN BAN: QUẢN LÝ XÂY DỰNG

SESSION: CONSTRUCTION MANAGEMENT

THE FACTOR INFLUENCE TO INTEGRATING KNOWLEDGE MANAGEMENT AND BIM IN CONSTRUCTION CONSULTING FIRM

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Abstract: The construction consulting firm is a knowledge-intensive and knowledge-generating company. However, challenges exist in terms of capturing and sharing knowledge of best practices and lessons learned within projects, and from one project to another. This is mainly due to the multi-disciplinary, multiorganizational and temporary nature of construction design projects, which causes valuable knowledge to remain with individuals and/or get lost with time. Therefore, it is critically important to effectively capture and share the experience-based knowledge that is generated in construction design projects in order to enable improvements in decision-making based on continuous learning. Building information modelling (BIM) has emerged as a solution that could possibly help in this endeavour through effective collaboration and learning processes. However, currently, BIM practices mainly focus on digitalising traditional information exchanges among project stakeholders. Hence, there is little consideration of how experience-based knowledge can be effectively captured in BIM-enabled projects and used for continuous improvement. This paper, used exploratory factor analysis (EFA), which defined 30 factors which influenced to integrating KM-BIM and categorised five critical factors group: individual psychosocial factors, organizational factors, economic factors, technological factors and clients/customers related factors

Keywords: *Knowledge Management; BIM; Influence factors.*

RESOLVING DISPUTE OF CONTRACT IMPLEMENT TIME USING SYSTEM DYNAMIC METHOD IN CONSTRUCTION PROJECT

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Abstract: Disputes often occur in the construction industry and one of its main issues is the delay in project completion. Prolonging the process of solving the delay disputes deprive parties of the time, reputation, the business relationship, and the other damages. This study proposes a dynamic framework to reveal the delaying process and assist parties to resolve delay disputes. A primary framework for resolving disputes using the highest-ranked causes of delay and the most affecting factors on choosing the method of dispute resolution that given by earlier analysis. Examining the model by three actual delay projects, the results show that the model has good quality to simulate the process of causing delays in construction projects and capable of advising the dispute resolution method in approximate to the particular situation. Applying system dynamics to the dispute resolution model will assist disputants to better understanding the process of causing delays, facilitating the parties to experience each other's problems, making the bargaining easier and more effective.

Keywords: *Delay, schedule, construction management, conflict, dispute, dispute resolution*.

Q QUANTITATIVE STRUCTURING FOR THE STRATEGY MAP OF COASTAL URBAN PROJECTS USING A HYBRID APPROACH OF FUZZY LOGIC AND DEMATEL

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Abstract: The urban development projects in coastal areas could help to connect the city to the coast that attracting to investors. Large-scale urban projects have been used as vehicles to promote a certain direction of urban transformation. However, the sea level rise will have intense impacts on coastal environments, ecosystems and human settlements. Therefore, while climate change strongly affects business decisions, strategic management is crucial for long-term organizational success. The strategy map is useful in enhancing the operational efficiency that employees' everyday operational activities will support in acquiring organizational strategic objectives. The main goal of this study is to propose a hybrid approach of Fuzzy logic and Decision making trial and evaluation laboratory (DEMATEL) in analyzing quantitatively the causal relationships in the strategy map constructed using the Balanced Score Card method for coastal urban projects. Fuzzy-DEMATEL technique is applied to reveal the ratings of the cause-and-effect relationships between strategic objectives/ success criteria of coastal urban projects. Therein, Fuzzy logic is exploited to overcome the limitations of grading the subjectivity within the values given. The case study of a coastal urban project in Vietnam is conducted to illustrate the study.

Keywords: *DEMATEL; fuzzy; strategy map; balanced scorecard; coastal urban project.*

REVIEW THE VIETNAMESE GENERAL CONTRACTOR'S ROLES IN IMPLEMENTING THE PREREQUISITES OF LEED V4 BD + C PROJECT

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Abstract: The Vietnamese economic growth has placed significant pressure on both infrastructure and environment, especially the pressure of increasing building demand, resource consumption, the pollution problems... In response to the development challenges and the green movement globally, the government has initiated actions to promote green building to promote more sustainable development. Recently, the Vietnamese electricity price has increased by 8.36% and it has placed significant pressure on the operation cost of the building. According to statistics of the Vietnam Green Building Council, by the end of 2018, there are 174 registered LEED projects and should be increasing in the near future. The LEED certificate adds the value to the project, but also cause several extra costs and working challenges to the contractors. Thus, the growth of LEED buildings has created a strong need for constructors to understand their roles of LEED requirements. This paper points the prerequisite roles of general contractors on a LEED v4 BD + C project, analyze the status of the contractor, and summarize LEED impact on their construction management practices. This research was conducted with the help of existing literature and the analyzing survey results from the constructor' staff.

Keywords: *LEED; Green Building; Vietnam; General Constructors.*

OPTIMIZING THE INSTALLATION AREA OF SOLAR PANELS ON THE BUILDING ENVELOPE BASED ON THE LIFE CYCLE ASSESSMENT AND LIFE CYCLE COSTING METHODOLOGIES

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Abstract: Designing envelope configurations of office building with the low construction cost and energy consumption is a discrete optimization problem. The configuration is currently determined merely on architects' experiences resulting in an inefficient expense or by building energy performance simulation which is time-intensive and involves complex processes. However, in order to reduce energy consumption in buildings, studies only focused on optimizing the facade design of the building or optimizing solar panels on the roofs of the building without focusing on combining the design solution, calculation and installation of energy panels on the facade (vertical surface) of the building. This study presents a method to optimize the installation area of solar panels on the building facades in order to reduce the amount of heat absorbed in the building and create a large amount of renewable energy used in the building. It is based on the Life Cycle Assessment and Life Cycle Costing methodologies to integrate both environmental and economic aspects, respectively

Keywords: *Optimization, Building envelope, Energy conservation, Life cycle assessment, Life cycle cost*

VARIATION ORDER MANAGEMENT IN VIETNAM CONSTRUCTION PROJECTS

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Abstract: Like other developing countries, Vietnam construction industry is very complicated. The inadequacies of design documentation, legal framework, as well as unexpected site conditions most likely happen. Moreover, numerous different parties involved in construction projects can result in a high risk of changes, which if not dealt with quickly, could develop into variation order, can affect the achievement of the project objectives. A clear understanding of VOs could potentially enhance existing management process of them. Therefore, objectives of this study are (a) to investigate the real cause of variation orders in order to take proactive measures, (b) to present some suggestions of practical ways to minimize them and improve overall project performance.

Keywords: *Claim; Change; Management strategy; Variation; Vietnam.*

INVESTIGATING PARTNERING PERFORMANCE IN THE VIETNAMESE CONSTRUCTION INDUSTRY

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Abstract: Partnering has been recommended as an innovative arrangement to avoid adversarial relations and to orient participants towards a win-win attitude on construction projects. Although, it has been widely applied in the construction industry in recent decades, the concept is pretty new to practitioners in the Vietnamese construction industry. The main goal of this paper is to develop a model that practitioners can easily employ to evaluate the level of their partnership success through the contribution of success factors. A questionnaire survey was employed to provide a data set of 79 responses for the analysis. Factor analysis has presented eight underlying dimensions of success factors in Vietnam, namely dedication; readiness; coordination; teamwork; sufficiency; leading; balance; and clarity, which were used as potential independent variables for the model. The model developed, using logistic regression technique, is of relevance to practitioners in developing, adjusting and improving their strategies to improve partnering performance.

Keywords: *Partnering performance, factor analysis, logistic regression, success factors, Vietnamese construction industry.*

PROGRESS REPORT ON THE PRESENT CONDITIONS AND TECHNICAL TRANSFER RELATED TO BRIDGE MAINTENANCE MANAGEMENT IN KINGDOM OF BHUTAN

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Abstract: The paper introduces a technical transfer project on bridge maintenance management in Bhutan. The project is performed under the "Technical Transfer" program funded by JICA. As there is no railway system in Bhutan, road is the essential transport system, and there are more than 300 road bridges in the country. However, as most of the bridges are "Bailey Type Bridge" which is commonly used as a temporal bridge, the load capacity and the road width is quite limited comparing to the permanent bridges. Therefore, detail management is necessary to use the bridges safely. The condition of some bridges, unfortunately, are in a critical condition due to exceeding durability period, and the management system of the bridge condition is not sufficient in Bhutan. This project aims to build an efficient and sustainable system on bridge management introducing "Bridge Database" and "Technical Manual on Inspection/Diagnose of Bridges" as well as to develop human resources in Bhutan for maintain the management system in the future.

Keywords: *Bhutan; Bridge Database; Inspection Manual; Technical Transfer;*

APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN CONSTRUCTION COMPANIES IN VIETNAM

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Abstract: Information and Communication Technology (ICT) plays a vital role in business operations of construction companies. This paper presents the current application of ICT in Vietnamese construction companies. Using a semi-structured questionnaire, 17 representatives from small-to-large construction companies in Vietnam are interviewed. In general, the interviewed practitioners have a positive attitude with the benefits of ICT in information management and feel satisfied with the current process of ICT; however, the level of applying the ICT in construction companies is not so high. Five main barriers for applying the ICT in information management are also explored, including leader-related factors, current company size unsuitable to the application of high ICT, current non-professional process of information management causing difficulties in restructuring the organization, cost burden under financial crisis, and unnecessary application of high ICT for information management in the current market. The results could provide practitioners with some useful information about a part of the whole picture of ICT applications in the Vietnamese architecture/engineering/ construction (EAC) industry.

Keywords: *Information and Communication Technology, information management, barriers, construction companies, Vietnam.*

MANAGEMENT OF BUILDINGS WITH SEMANTIC AND 3D SPATIAL PROPERTIES BY S-SUDM MODEL

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Abstract: Researching on urban management is important topic in information systems because urbanization has become the trend not only in the world but also Vietnam. Especially in big cities, the speed of urbanization is even faster.

The focus of the paper is to study the theory of three- dimensional (3D) spatial data models, compare models on many criteria to choose a suitable model to design an information system to manage buildings in urban areas. The paper proposes a new data model that integrates two properties of an object in geographic information system are: spatial and semantic. This new model is based on an existing 3D data model.

The proposed model called S-SUDM satisfies the need to store, select, inset, update, display buildings in both spatial and semantic attributes. Especially the new model can be displayed the levels of detail (LOD) of the buildings according to user requirements. The number of LOD are arbitrarily, it's user-defined.

This new data model was installed experimentally on a database management system Oracle 12i. The experiment uses of type of spatial data of supported Oracle to store spatial data structure. C# was used as data presentation language, and they realized the functions in the forms and reports in this paper.

Keywords: *Buildings, 3D, LOD, Management of buildings, Data model.*

PHÂN BAN: KỸ THUẬT GIAO THÔNG VÀ CƠ SỞ HẠ TẦNG

SESSION: INFRASTRUCTURE ENGINEERING

EVALUATE HEALING PERFORMANCE OF ASPHALT MIXTURE CONTAINING STEEL SLAG BY USING INDUCTION AND MICROWAVE HEATING

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Abstract: This study aims to analyze healing performance of asphalt mixture, containing steel slag aggregate undergo induction and microwave healing treatment. A series of hot mix asphalt (HMA) mixtures were developed from 4 different levels of steel wool fiber (SWF) as a conductive additive. Besides, two types of aggregate were used: steel slag and conventional aggregate. The healing performance was investigated by damage-healing cycles with Three-Point Bending (TPB) test. The thermal distribution and optimum heating time of samples were recorded and analyzed with an infrared camera. Total 8 damage healing cycles were applied in all mixture to evaluate their healing performance under both healing treatments. In addition, the load-displacement behavior at each damage-healing cycle was recorded. The results recommended that steel slag aggregate is very promising due to its presence not only better healing level but also improve the load-displacement with higher ductile behavior. Moreover, adding 6% and 2% by weight of asphalt binder enhances healing performance of asphalt mixture under subjected to induction and microwave heating, respectively. Overall, the containing steel slag aggregate is a prominent solution which contributes toward sustainable development.

Keywords: *Healing performance, HMA, steel slag, steel wool fiber, induction heating, microwave heating, sustainable development.*

PRACTICAL PERFORMANCE OF MAGNETOSTRICTIVE VIBRATION ENERGY HARVESTER IN HIGHWAY BRIDGE

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Abstract: This study proposed and tested a high-sensitivity, high-durability, low-cost vibration power-generating device using a magnetostrictive element (Fe-Ga alloy) on a highway bridge to investigate its practical performance. The device comprises a Fe-Ga element of 4 × 0.5 × 16 mm attached to a U-shaped frame with a permanent magnet for magnetic bias wound about by a coil. First, a part of the elevated line of a highway bridge located in the Hokuriku district was tested to track the variation in the vibrational parameters of the bridge due to ordinary vehicle loads. Then, the weight attached to the tip of the U-shaped frame was adjusted to allow the frame to vibrate with the frequency of the vibration source. As the results, with an attached weight of 312.8 g, the frequency of the frame's oscillation matched the frequency of the vibration of the lateral brace between G1 and G2 main girders, which was estimated to be ~19 Hz. Moreover, an open-circuit voltage of ~8 V at an oscillation of ~19 Hz and 8.9 m/s^2 was recorded by free damped vibrations due to ordinary vehicle loads.

Keywords: *Vibration-based Power Generation; Magnetostrictive Material; Highway Bridge.*

AN EXPLORATORY TEST OF COMMUNICATIVE MOBILITY MANAGEMENT FOR PROMOTING MODAL SHIFT IN HO CHI MINH CITY

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Abstract: Mobility Management has been increasingly used to promote modal shift to environmental friendly modes. As an effort toward counterbalancing mode use in Ho Chi Minh city, this study explored the effectiveness of communicative mobility management measures to encourage students to change to use buses instead of motorcycles. We targeted at 83 students who frequently use motorcycles for school transport. In the study, smartphone app as an informative method on how to use bus was used together with requesting the participants to make behavioral plans and giving lecture about traffic problems. The results show that a combination of communicative techniques would be effective in persuading students to shift to use bus. Results of binary logit model on SP data has confirmed that together with travel times and costs, priority lane for bus, and the risk of traffic accident for MC are significant determinants of mode choice.

Keywords: *Mobility Management; Modal shift; Bus use; Motorcycle; Ho Chi Minh City.*

EFFECT OF EMULSIFIER CHARGE TYPE ON THE RHEOLOGY OF CEMENT ASPHALT MORTAR FOR FOULED RAILWAY BALLAST STABILIZATION

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Abstract: Cement asphalt mortar has recently been proposed as an ideal technique to stabilize fouled railway ballast. This new concept not only provides short construction time with simple application but also greatly enhance the structural performance of railway ballast. However, the effect of emulsifier charge type on the rheology of CA paste is seldom studied. Hence, the aim of this study is to identify the interaction between cement particles and asphalt droplets in asphalt emulsion (AE) through modification of emulsifier charge types. To cope with this objective, three types of AE are employed in this research including cationic AE, anionic AE, nonionic AE. Then, the best emulsifier type will be varied from 1% to 5% in CAM mixture to evaluate its content effect to the mechanical properties of CAM. The rheology of fresh cement asphalt mortar is determined by conducting flow cone test, mixing stability test, bleeding test, and workable time tracking test. The compressive strength of materials is figured out by using the unconfined compressive strength test. The results indicate that mixture composed of nonionic AE obtain the highest mixing stability with excellent flowability. Among mixture components, it is also revealed that cement imposes the strongest effect on the stable condition of asphalt droplets in AE. To ensure the quality cement asphalt mortar, proper emulsifier should be applied to generate optimum mixture conditions.

Keywords: *cement asphalt mortar, emulsifier charge type, cement hydration product, railway, fouled ballast*

OPTIMAL DESIGN FOR RUTTING RESISTANCE OF ASPHALT CONCRETE PAVEMENTS BY EXPERIMENTAL TESTING AND FINITE ELEMENT MODELLING

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Abstract: Asphalt pavement rutting is a major safety concern because it affects the handling of vehicles. Research into effectively predicting and developing optimal design for asphalt concrete pavement rutting resistance is considered extremely necessary as it can help provide extended pavement life and significant cost savings in pavement maintenance and rehabilitation. The objectives of this study are to develop numerical models to investigate the rutting of asphalt concrete pavements and to find optimal design of asphalt pavement mix for rutting resistance. Previous study's experimental tests including triaxial repeated compression loading and wheel track testing were used to evaluate the visco-elasto-plastic behavior and rutting resistance of different pavement mixes. Three-dimensional Finite Element models were first developed to simulate both the axial compression and wheel track testing in which a visco-elasto-plastic material model with the material parameters developed from experimental testing was used to predict the rutting (time-dependent characteristics) of the asphalt concrete pavements. The results were validated against the experimental wheel track testing results. Finally, optimization techniques using the Design Of Experiments method were applied to the simulation rutting results of varying material parameters to promote asphalt pavements mixes that had the most effective performance against rutting. The results of this paper clearly demonstrate an efficient and effective experimental-numerical method and tool set towards optimal design for asphalt concrete pavements for rutting resistance.

Keywords: Visco-elastic-plastic, Creep, Asphalt pavement, Rutting, Wheel track testing, Finite Element modelling, Design of experiments, Optimization.

APPLICATION OF BAILEY METHOD IN DETERMINING AGGREGATE GRADATION IN DENSE GRADED ASPHALT CONCRETE IN VIETNAM

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Abstract: The Bailey Method is a gradation design of asphalt concrete that has been used in many countries around the world and has not been used popular in Vietnam. This method is based on the combination of the coarse and fine aggregates to form a strong aggregate skeleton. Interlocking and proportion of coarse aggregates to fine aggregates are important factors for asphalt concrete that has high rutting resistance and long-term performance. Besides, rutting problem is the famous distress in Vietnam, especially in Ho Chi Minh city because of poor gradation, poor material, hot weather, and so on. As a result, in order to improve rutting performance of dense graded asphalt concrete, this paper shows the basic design steps of aggregate gradation for asphalt mixture using Bailey method. The paper also shows the effect of the method from laboratory tests including Marshall stability, indirect tensile strength and wheel tracking test.

Keywords: *Bailey method; Dense graded asphalt concrete; Aggregate gradation; Wheel tracking test; Indirect tensile strength; Marshall stability.*

PHÂN BAN: CÔNG TRÌNH THỦY VÀ VEN BIỂN

SESSION: HYDRAULICS AND COASTAL ENGINEERING

DECISION SCALING APPROACH TO ASSESS CLIMATE CHANGE IMPACTS ON WATER SHORTAGE SITUATION IN BA RIVER BASIN - VIETNAM

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Abstract: This article introduces Decision scaling approach, which combines bottom-up and top-down approach to assess impacts of climate change on water shortage in the Ba river basin - Vietnam. Interviews to water managers at different levels in the basin are implemented to identify performance thresholds of the system. Through MIKE HYDRO simulations, a parametrically varying process of temperature and precipitation is implemented to determine system climate response function and climate vulnerability space of water shortage in the basin. Total 43 GCM outputs are used in very last step of assessment to estimate relative probability of successful and failed situations of different water demand nodes in 3 future periods. The results show that, 8 water supply nodes and 27 irrigation nodes having reliability above the threshold in every climate change condition and 5 irrigation nodes that every GCM outputs come into the successful space. The rest 13 irrigation nodes are vulnerable to climate change in a certain number of GCM outputs. Projected climate risk assessment show that, with 75% of climate probability, the BRB is at risk of 5,670.75 ha; 4,926.62 ha and 4,926.62 ha of crops damaged in near future, Mid-century and End-Century, respectively. With 50% of climate probability, these number are 6,642.75 ha; 4,926.62 ha and 5,670.75 ha, respectively.

Keywords: *Climate Change; The Ba river basin; Decision Scaling; uncertainty; General Circulation Models.*

A PROPOSED MODEL FOR PREDICTING THE POTENTIAL OF CONTAMINATION INTRUSION IN WATER DISTRIBUTION SYSTEM

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Abstract: The potential of contaminant intrusion in the water distribution system through the leakages (break hole, crack, reservoir, tank, pump station,…) often exists in the cities. According to the literature review of recent researches, it is shown that the potential of contaminant intrusion is very high when three factors including pipe break, negative pressure and contamination source appear at the same time. Based on the theory of fuzzy logic with the membership function -Gaussian, S - Sigmoidal and Z - Sigmoidal, the forecasting model for the potential of contaminant intrusion in water distribution systems is proposed. The model is set up by using MATLAB with the fuzzy logic design (FLD) tool and SIMULINK tool, the result of model is to be able to predict the potential of contaminant intrusion in each pipeline. The water distribution system of district meter area HC05 of Hai Chau district of Da Nang city is selected for calibrating the model.

Keywords: *Water contamination, predicting model, water distribution system, fuzzy logic, SIMULINK.*

PHÂN BAN: ĐỊA TIN HỌC

SESSION: GEOMATICS

MONITORING RICE PLANT HEIGHT USING NON- SURVEY GRADE LASER SCANNER

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Abstract: UAV systems have an advantage of collecting dataset with high temporal and spatial resolution in the comparison of traditional platforms such as satellites. In the agricultural industry, the growing crops need to be observed carefully day by day. Therefore, UAV systems are considered as effective tools to collect information related to crops. In this study, the rice growth was observed by a small UAV-based laser-scanner system from above. For developing the system, DJI S800 was chosen as a platform in which a non-survey grade laser scanner HOKUYO UTM30LX-EW was mounted on. Field experiments were carried out from late June to late July 2016 in Nagaoka city, Niigata Prefecture, Japan. A method for computing rice plant height using point cloud data (LIDAR data) of rice plants based on percentile analysis was applied. As a result, the LIDAR-derived plant height was always lower than the measured plant height and the result also implied that there was a bias between them. Moreover, the developed UAV system has the capability to monitor rice plant height effectively in wide areas..

Keywords: *rice growth, rice plant height, laser scanner, UAV*

GENERATING CADASTRAL MAP PRODUCTS ON 1:2000 SCALE USING IMAGES CAPTURED BY THE TRIMBLE UX5 HP UNMANNED AIRCRAFT SYSTEM IN CHO MOI TOWN, CHO MOI DISTRICT, AN GIANG PROVINCE

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Abstract: UAV photogrammetry is an effective technology for inspection, surveillance, mapping, and 3D modeling issues. The applications in the short and close-range photogrammetry are introduced. UAV is a low-cost alternative to the classical manned aerial photogrammetry. It has a capacity of photogrammetric data acquisition with digital cameras. From the collected data, DSM/DTM, contour lines, textured 3D models, vector data, etc. can be produced. This paper reports the UAV image processing methods for generating 1: 2000 cadastral map in Cho Moi town, Cho Moi district, An Giang province, Vietnam. This study was carried out with the Trimble UX5 HP system, a professional aerial mapping system. As a result, the field work is reduced, productivity and economizing increase whereas the quality of the created map is ensured. Although the final cadastral map has not covered all of Cho Moi town yet, the capability of using the Trimble UX5 HP system for generating 1: 2000 cadastral map in the countryside is confirmed in this study.

Keywords: *UAV, Cadastral map,* Trimble UX5 HP

ACCURACY ASSESSMENT OF 3D POINT CLOUDS COLLECTED BY UAV- BASED LASER SCANNER SYSTEM

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Abstract: Unmanned Aerial Vehicles (UAVs) have popularly used as a controllable platform for remote data acquisition. Digital camera, multispectral sensor or laser scanner can be mounted on a UAV for developing an effective system for many purposes. In this study, a UAV- based laser scanner system was developed. The test flight was performed for assessing the accuracy of 3D point clouds in Kumamoto Prefecture, Japan. The experimental site is flat and small. There were 9 ground control points were arranged. Their coordinates were identified in the local coordinate system using a total station. The point clouds were collected at 1000 of the field of view and 0.250 of angular resolution. By using the magnetic data for determining flight direction, the 3D coordinate of point clouds was generated. From the intensity image, the locations of markers were identified, and their observed coordinates were manually measured. The 7 parameters transformation was applied with four ground control points. As a result, the developed system could achieve a mapping accuracy of 0.04m in both horizontal and vertical direction. This study showed the capability of generating a large- scale map with the low-cost UAV- based laser scanner system.

Keywords: *UAV, laser scanner, accuracy, point cloud*

STORAGE TANK INSPECTION BASED LASER SCANNING

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Abstract: Development of laser scanning has offer great opportunity to capture three-dimensional (3D) topographic information of objects' surfaces highly accurately and quickly. Particularly, a terrestrial laser scanner can product million points in second with a millimetre accuracy. As such, this technology has been widely used in many civil engineering applications, for example, surveying, construction management, and infrastructure inspections. Traditionally, tank inspection was carried out on-site physical inspectors associated with measurement equipment (e.g. tapes, staffs and a total station). This approach, albeit the most common one, has many downsides: subjective results, slow and expensive procedure, requirement of experienced and trained inspectors and close service of the tank. Additionally, all results were stored as hard copies, which lead to difficulty in tracking damage development and management. As such, this paper presents capacity of the laser scanner in capturing 3D geometric data of both internal and external tank and its components and investigate ability to use raw point clouds for assessing status of the tank, which can include deformation of the tank shell, floor, roof or column as well as a settlement.

Keywords: *Tank Inspection; Deformation; Feature extraction; Laser scanning; Point Cloud*

ESTIMATING VALUES OF THE CAN GIO MANGROVE ECOSYSTEM SERVICES USING REMOTE SENSING

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Abstract: The identification of the economic values of mangrove ecosystem services is an important information for managers to select solutions in effective use and management of mangrove forest ecosystems. The objective of this study was to estimate the values of Can Gio mangrove ecosystem services. In order to obtain the objective, a combine approach of remote sensing and household survey was used to evaluate the values of ecosystem services provided by Can Gio mangrove forest, including provisioning service (wood, fish-related products), regulating service (carbon sequestration), and cultural service (ecotourism). Landsat data in 2018 was utilized to identify land-use status and the household survey based on a semi-structured questionnaire on different ecosystem service types of the Can Gio mangrove forest was conducted in the study area in April 2018 to estimate the values of mangrove ecosystem services using market price and replacement cost approaches. The total value of the mangrove ecosystem services in Can Gio were approximately 600 million USD. The obtained results of this study provide a scientific basis for local managers in sustainable natural resources management and provide a reference for other studies in Vietnam.

Keywords: *Can Gio mangrove forest; ecosystem services; household survey; Landsat data; remote sensing;*

MONITORING THE SPATIO-TEMPORAL CHANGES OF CAN GIO MANGROVE FOREST USING GOOGLE EARTH ENGINE

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Abstract: Mangrove forests take the important role in coastal protection by collecting sediment from rivers and streams and slowing down the flow of water, provide protection and shelter against extreme weather events such as storm winds, floods, and protect human communities farther inland from natural disasters. Thus, monitoring spatiotemporal changes of mangrove forests is essential to provide managers/decision-makers with valuable information to effectively manage mangrove ecosystem. The objective of this study is to monitor the spatio-temporal changes of mangrove forest in the Can Gio biosphere reserve in Vietnam using Landsat data and Google Earth Engine cloud computing platform based on random forest algorithm. The classified mangrove forest map of Can Gio had an overall accuracy greater than 81% when validated with ground reference data. The results indicated approximately 30% conversion of mangrove forests to other land-use, mainly aquaculture land and about 40% recovered forest land. The obtained results of this study are likely to be useful for the sustainable management of mangrove forests in Can Gio to balance the benefits of economic development, environmental protection, and biodiversity conservation.

Keywords: *Can Gio mangrove forest; Google earth engine; Landsat data; random forest; remote sensing;*

PRECISE POINT POSITIONING ACCURACY WITH AMBIGUITY RESOLUTION AND MULTI-GNSS

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Abstract: Recently, the accuracy of precise point positioning (PPP) has improved significantly thanks to PPP products from several services. These services provide different PPP products in terms of the ability to ambiguity resolution (AR) and the number of available satellite systems. We would like to study how additional non -GPS systems and AR treatment affect PPP accuracy. By processing 24h GNSS data at 47 IGS permanent stations with different options for AR treatment and combination of different satellite systems, our results show that there is no accuracy improvement on the 24h solution (2.1, 2.0, 5.8mm in North, East and Up components). However the combination of GPS + GLONASS + GALILEO with GPS AR gives the best accuracy on the epoch solution (6.5, 6.3, 20.5mm). Compared with the cases of GPS only with AR, this option can improve the accuracy up to 23% on the Up component.

Keywords: *PPP; Multi-GNSS; IGS; ambiguity resolution*

MONITOR RICE AREA AND RICE CROP MAPPING USING MULTI-TEMPORAL SENTINEL-1 DATA WITH C-BAND IN MEKONG DELTA

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Abstract: Food security has become an important issue as the population has increased rapidly in the recent years in Asia and Vietnam in particular. Specially, the impacts of climate change due to global warming and sea level rise have affected on the agricultural activities in Mekong Delta which is almost rice growing area. Therefore, building a system to monitor changes of rice area and rice crop is essential and urgent. Recently, launches of SAR sensors are not affected by atmospheric, sunlight conditions and can get signal through clouds and smoke even in rainy season, in day or night if comparing with optical data. SAR data can provide sustainable solutions to the challenges on mapping and monitoring rice systems in Vietnam, the country located tropical monsoon. In this paper, we detected rice area and rice crop in Mekong Delta by using multi-temporal SAR images with C-band. This study has collected field survey data at the same period's time acquired of Sentinel-1 data. The classification results compared with the ground reference data evaluate the overall accuracy and Kappa coefficient. This study showed the potential application of multi-temporal Sentinel-1A data for rice crop mapping serving for agricultural management in the region scale.

Keywords: *Mapping, rice crop, Sentinel-1, multi-temporal, C-band, Mekong Delta.*

KHOA MÔI TRƯỜNG
VÀ TÀI NGUYÊN

FACULTY OF ENVIRONMENT AND
NATURAL RESOURCES

A BNR-MBR SYSTEM FOR NUTRIENT REMOVAL FROM BREWERY WASTEWATER

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Abstract: Membrane filtration was integrated into Anaerobic/Anoxic/Oxic system to form a Biological Nutrient Removal – Membrane Bioreactor (BNR-MBR) system for improving the system performance in terms of organic degradation and nutrient removal from brewery wastewater. The model of BNR-MBR system made from polyacrylic with the capacity of 42 liters was operated with hydraulic retention times decreased from 24 to 12 hours corresponding to organic loading rates increased from 0.5 to 1.0 kgCOD/m^3.day. The results showed that it was capable of achieving effluents with very low chemical oxygen demand (COD), NH_4^+-N and total nitrogen (TN) concentrations within the limits of Vietnam National Technical Regulation on Industrial Wastewater (QCVN 40:2011/BTNMT), column A. For loading rate of 0.75 kgCOD/m^3.day, treatment efficiencies of COD, NH_4^+-N, TN and total phosphorus (TP) of the model were the highest as 96.3, 98.5, 89.6 and 55.9 %, respectively. In this system, phosphorus removal would be probably influenced when taking nitrogen removal into the first consideration.

Keywords: *brewery wastewater, BNR-MBR system, nitrogen removal, phosphorus removal.*

PREPARATION OF Zn/B MICRONUTRIENT NANOFERTILIZER BASED ON CHITOSAN-STARCH NANOCOMPOSITE, AND THEIR EFFICACY ON THE GROWTH AND PRODUCTIVITY OF COFFEE IN THE FIELD

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Abstract: Nanocomposite was prepared by drying spray the composite of chitosan and starch with various mass ratios. Chitosan starch nanocomposite was characterized by FT-IR, FE-SEM, zeta potential and size distribution. Zinc and boron were loaded on the nanocomposite to make micronutrient nanofertilizer. The size average of the nanoparticles ranged from 200 to 500 nm, zeta potential of the nanoparticles was from 15-30 mV, depend on the ratio between chitosan and starch. The adsorption capacity of zinc and boron on the nanocomposite was of 75 to 84%, respectively. The nanofertilizers were applied for coffee in the field. Impact of the micronutrient nanoferilizer on the nutrient uptake of the coffee leave was detected. The results showed that the nanofertilizer enhanced the uptake both macronutrients and micronutrients in the coffee leaves. Especially, zinc and boron content in the leaves in the treated plots increased clearly compared to the control and to be adequate for coffee requirements. The coffee bean productivity was increased up to 12% compared to the control. It is concluded that using of the Zn/B nanofertilizer is very potential for green production of coffee.

Keywords: *Chitosan, starch, micronutrient, nanocomposite, nanofertilizer, coffee.*

THE SITUATION OF SOLAR ENERGY USING IN HOUSEHOLD SCALE IN PHU NHUAN DISTRICT, HO CHI MINH CITY: OPPORTUNITIES AND CHALLENGES

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Abstract: Ho Chi Minh City's rapid population growth rate in Vietnam, that is make a great challenge in power demand. The main sources of electricity supply are from hydropower plant and thermal power plant, but it has overcome the ability supply. That's why renewable energy is considering as the potential source for electricity supply in future. As one of the metro-city in Vietnam, with 8,224,000 people in Ho Chi Minh City and terrain conditions, the solar energy has been evaluated as a potential renewable energy for electricity supply. The implement of large-scale solar energy in enterprise/company is widely with high capacity because it can reduce the electricity price and product price. Besides, the small scale of solar energy has been starting using for households in Ho Chi Minh. Phu Nhuan district is one of 24 districts belong to Ho Chi Minh City with crowded residential, that also has 1-2 houses applying solar energy. So, this research was investigated the potential using solar energy for household and viewpoint of resident about applying solar energy for their home. According this study, now there is 1 house using and rating positively about solar energy combine national power grid. Around 50% people (1,012/1,500 votes) think that using solar energy is potential applying in their home because it gains the economic efficiency for reducing electricity fee. According the survey in 15 wards of Phu Nhuan district were showed it's over 60% people agree to apply the solar energy. In addition, the national government released the policy to support the financial for apply solar energy in household, that is strongly encourage the resident changing their thinking and start considering applying solar energy at their house.

Keywords: *solar energy, renewable energy, electricity fee, Vietnam Electricity (EVN).*

GIS APPLICATION FOR MANAGING URBAN TREES OF DISTRICT 11 HO CHI MINH CITY

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Abstract: Street trees play a very important role in reducing pollution and protecting the environment. The management of urban trees is a practical need, so it is necessary to manage urban trees resources including street trees effectively in the context of building a clean, green city and sustainable development. However, the monitoring and management of green trees still face many difficulties. The geographic information system (GIS) with the advantage of multi-layer spatial analysis will provide technical assistance in the management and protection of street trees, creating more favorable conditions than traditional methods as statistical reports, forms.... The number of trees of September 2018 of District 11 is 1842, less 31 trees compared to 2011, in which the floating rooted trees account for the largest number 38 trees, 20 trees is decay rooted ... and many the road has almost no trees. For that reason, this paper build a database to serve greenery management for the study area and propose solutions to manage trees effectively.

Keywords*: Street trees, database, urban trees management, GIS in green management.*

THE CORRELATION BETWEEN DENGUE FEVER AND COMMUNITY HEALTH BY CLIMATE CHANGE IN NHA BE DISTRICT, HO CHI MINH CITY, VIETNAM

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Abstract: Climate Change (CC) is a global concern as the weather changes, that is going on under the negative trend. Temperature, rainfall, sea levels, and extreme weather events are increasing bulk entail consequences to the environment and humans. Especially, the impact of climate change to human health are being main targeted researching in nowadays.

Following to the Asian Development Bank (ADB) report in 2010, Ho Chi Minh City is one of the top 10 cities in the world, that is the most vulnerable by the climate change. And Nha Be district is belong to suburban of city. Through mechanical survey data of Ho Chi Minh City Statistical Office in 2017, the average population in Nha Be is 177,990 people. With geolocation riverine terrain of canals plus population is increasing mainly immigrants led to pressure on infrastructure, the disease situation stems from water sources is also likely to occur, especially affecting the quality of the environment and people's health district.

So, this research has been survey and evaluated the connection between bad weather in raining season and human's health about Hemorrhagic Fever's disease (DHF) in Nha Be district in 2018. By this investigated had been shown the diseases related to the respiratory tract such as bronchitis is at risk of frequent (64%), DHF is only 28%, respectively. And the report of Nha Be District Health Center had also show there are 1,987 cases of bronchitis is higher than other diseases (in 2017) by climate change. But dengue is easy to outbreaks of disease and difficult to control, that's why Preventive Medicine Center of Ho Chi Minh City is more concern and control about DHF, especially in Nha Be district.

Keywords: *Climate Change (CC), Hemorrhagic Fever (DHF), disease, bronchitis, outbreaks, flooding, raining season, Preventive Medicine Center of Ho Chi Minh City (PMC-HCMC).*

RECLAMATION OF FISHERY PROCESSING WASTE

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Abstract: Seafood such as shrimp, crab and squid are a unique source of nutrients. However, many marine processing byproducts, such as shrimp heads, shrimp shells, crab shells and squid pens, are discarded even though they are rich sources of structurally diverse bioactive nitrogenous components. Based on emerging evidence of their potential health benefits, these components show significant promise as functional food ingredients. The chitin-containing fishery waste contains significant levels of chitin and protein which represents a source for biofunctional chitin/chitosan and peptide mining. This paper provides an overview of the extraordinary potential of processing chitin-containing seafood byproducts via enzymatic and fermentation technologies, as well as their applications.

Keywords: *chitin, chitosan, shrimp shells, shrimp heads, squid pens, bioconversion.*

AMMONIUM REMOVAL OF SLAUGHTERHOUSE WASTEWATER BY UASB TECHNOLOGY COMBINED WITH EGSB USING ANAMMOX AND PVA GEL

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Abstract: Slaughterhouse wastewater (SWWs) are classified as one of the most detrimental industrial wastewaters to the environment. The organic and nutrient concentration in this wastewater is very high and the residues are moderately solubilized leading to polluting effect for environment and health of people. The objective of this study was to investigate the effective removal of ammonium in slaughter wastewater by Upflow anaerobic sludge blanket (UASB) technology combined with expanded granular sludge bed (EGSB) using anammox and PVA Gel. The system was operated in 2 phases. Average ammonium loading rates (NLRs) was increased from 0.25 kg N-NH_4^+ /m^3.day to 0.75 kg N-NH_4^+/m^3.day with hydraulic retention times (HRTs) was 12, 6 and 4 h. In phase 1, The combination of UASB technology and EGSB using anammox for removal of ammonium was investigated, ammonium removal efficiencies were about 37 % (NLRs = 0.25 kg N-NH_4^+/m^3.day), 64% (NLRs = 0.5 kg N-NH_4^+/m^3.day) and 55% (NLRs = 0.75 kg N-NH_4^+/m^3.day), Nitrite removal efficiencies were about 52 % (NLRs = 0.25 kg N-NH_4^+/m^3.day), 76% (NLRs = 0.5 kg N-NH_4^+/m^3.day) and 64% (NLRs = 0.75 kg N-NH_4^+/m^3.day). In phase 2, PVA Gel was supplied in EGSB as biomass carrier for growing anammox sludge. The result showed that ammonium removal efficiencies were about 56 % (NLRs = 0.25 kg N-NH_4^+/m^3.day), 68 % (NLRs = 0.5 kg N-NH_4^+/m^3.day) and 60% (NLRs = 0.75 kg N-NH_4^+/m^3.day), Nitrite removal efficiencies were about 55% (NLRs = 0.25 kg N-NH_4^+/m^3.day), 77% (NLRs = 0.5 kg N-NH_4^+/m^3.day) and 73% (NLRs = 0.75 kg N-NH_4^+/m^3.day). After the research process, anammox bacteria has grown on the surface of PVA Gel.

Keywords: *Anammox, EGSB, Ammonium removal, PVA Gel.*

HYDROGEN PRODUCTION FROM GREEN ALGAE TETRASPORA SP. CU2551 AND CHLORELLA SP. KLSC59

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Abstract: Green microorganisms including cyanobacteria and green algae are good models for many environmental and biochemical fields of research. It is because cells require a shorter life-cycle time when compared to that from plant cells. During their cultivation, they need simple medium compositions, no arable land, and sunlight as an energy source with a capacity in trapping the atmospheric carbondioxide to partially change to their biomass. Algal biomass could be predominantly utilized in many applications for example using as a starting material in bioenergy production. In the talk, hydrogen production from *Tetraspora* sp. CU2551 and *Chlorella* sp. KLSc59 would be discussed with the pathway of hydrogenase enzyme and photosynthetic-related pathway. The production optimization as well as prolongation in hydrogen production system using cell immobilization technique would also be discussed. Besides, a posibility of hydrogen production to a large scale production together with futuristic production aspects will also be discussed.

Keywords: *Green algae, biohydrogen production, cell immobilization*.

INNOVATIVE SPONGE-BASED MOVING BED – ANAEROBIC OSMOTIC MEMBRANE BIOREACTOR/MEMBRANE DISTILLATION (SMB-ANOSMBR/MD) HYBRID SYSTEM FOR MUNICIPAL WASTEWATER TREATMENT

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Abstract: Anaerobic osmotic membrane bioreactor has been recently attracted more attention due to its high-water quality and biogas product. However, the most challenge in traditional AnOsMBR system is membrane fouling in long term operation. For the first time, an innovative concept of combining sponge-based moving bed (SMB) and a submerged anaerobic osmotic membrane bioreactor (OsMBR), known as the SMB-AnOsMBR hybrid system, were investigated using 0.2 M $MgCl_2$ coupled with 0.2 M Na_3PO_4 salt as the draw solution to treat the wastewater. In this study, continuous moving sponge around the bioreactor based on magnetic stirred could help reduce fouling on the FO membrane surface leading to maintained water flux. Morever, AnOMBR integrated with periodic microfiltration (MF) extraction can simultaneously reduce the salt concentration and at the same time in the AnOMBR and recover the phosphorus in the precipitated struvite. The SMB-AnOsMBR/MD results showed that an average water flux of 3 L/(m^2 h) were achieved in a 50-day operation and the removal efficiency of organic and nutrient compounds was higher 99%. At optimum condition of pH 9.5, the recovered precipitate contained 20% (wt/wt) of phosphorus. The overall performance results demonstrated that SMB-AnOsMBR/MD hybrid system could simultaneously recover phosphorus and water for reuse.

Keywords: Submerged anaerobic osmotic membrane bioreactor, phosphorus recovery, sponge, struvite.

ORGANIC SENSITIZERS USING INDOLIUM AS ACCEPTOR FOR DYE-SENSITIZED SOLAR CELLS

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Abstract: Organic dye sensitizers have been molecularly engineered and employed in dye-sensitized solar cells (DSSCs) where the power conversion efficiencies (PCEs) is looking forward to be better and better. In order to absorb sunlight more effectively, the structure of organic dyes usually apply a π-conjugated system with a strong electron donor moiety and a strong electron withdrawing moiety that lead to an intermolecular charge transfer (ICT) absorption band of the dyes. In this work, we synthesized a series of metal-free organic dyes by using different amine-based electron donors (D), and indolium as the electron acceptor (A). Because the strong electron withdrawing ability of indolium moiety, these D-π-A dyes possess strong molecular dipole such that an intermolecular charge transfer band with high molar extinction coefficient was measured. The electrochemical properties of the indolium-based were measured and the molecular geometry of the dyes were investigated by using theoretical calculations. In addition, the device performance of the DSSCs applying the indolium-based dyes as sensitizers was characterized.

Keywords: *Dye-sensitized solar cells, metal-free organic dyes, indolium.*

WATER LEVEL FORECASTING FOR DAU TIENG RESERVOIR USING ARTIFICIAL NEURAL NETWORKS.

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Abstract: Forecasting hydrological factors, particularly reservoir water level, plays an important role in reservoir operation and management. To meet this requirement, many studies have been carried out using the traditional statistical methods (e.g., auto-regression and autoregressive moving average) and recently Artificial Neural Networks (ANNs). Compared to the traditional methods, ANNs has the advantage of solving the complex non-linear problems with the number of input parameters and/or limited data. In this study, ANN is applied to forecast the average 5-day ahead water level in the rainy season at Dau Tieng Reservoir in Vietnam. This ANN model used the back-propagation algorithm, which can transmit the output error signals backward from the output node to the input nodes in order to adjust model parameters. The input data used include the water level, discharge and rainfall in the reservoir basin in the period of 2001 - 2006. The results of training and validation processes proved that the proposed model had a good simulation with the coefficient of efficiency (CE) of from 0.98 to 0.99. With the set of the weights obtained, the water level was also forecasted quite well in the rainy season in 2007 (CE = 0.986).

Keywords: *Reservoir water level; forecasting; ANN.*

A THERMOSTABLE CHITOSANASE FROM SHRIMP HEADS CONVERSION BY *PAENIBACILLUS MUCILAGINOSUS* TKU032 AND ITS APPLICATION IN THE PREPARATION OF BIOACTIVE CHITOSAN OLIGOSACCHARIDES

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Abstract: Chitosanase has attracted great attention due to its potential applications in medicine, agriculture, and nutraceuticals. In this study, *P. mucilaginosus* TKU032, a bacterial strain isolated from Taiwanese soil, exhibited the highest chitosanase activity (0.53 U/mL) on medium containing shrimp heads as the sole carbon and nitrogen (C/N) source. Using sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) analysis, a chitosanase isolated from *P. mucilaginosus* TKU032 cultured on shrimp heads medium was determined at approximately 59 kDa. The characterized chitosanase showed interesting properties with optimal temperature and thermal stability up to 70°C. Three chitosan oligosaccharide (COS) fractions were isolated from hydrolyzed colloidal chitosan that was catalyzed by TKU032 chitosanase. Of these, fraction I showed the highest α-glucosidase inhibitor (aGI) activity (65.86% at 20 mg/mL) and its inhibitory mechanism followed the mixed noncompetitive inhibition model. Fractions II and III exhibited strong 2,2-diphenyl1-picrylhydrazyl (DPPH) radical scavenging activity (79.00% at 12 mg/mL and 73.29% at 16 mg/mL, respectively). In summary, the COS fractions obtained by hydrolyzing colloidal chitosan with TKU032 chitosanase may have potential use in medical or nutraceutical fields due to their aGI and antioxidant activities.

Keywords: *chitin; chitosan; Paenibacillus; chitosanase; chitosan oligomers; α-glucosidase inhibitor; antioxidant.*

UTILIZATION OF SQUID PENS FOR COST - EFFECTIVE PRODUCTION OF ANTI-NEMATODES AGENTS VIA MICROBIAL FERMENTATION

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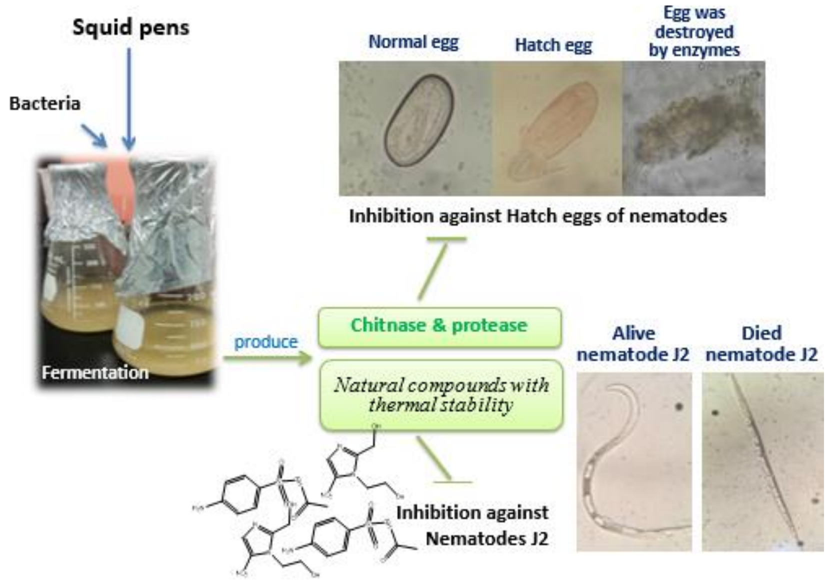
Abstract: Squid pens powder (SPP) has been used for the production of various bioactive materials, including chitin/chitosan, exopolysaccharides, chitin/chito oligomers, enzymes, prodigiosin, anti-cancer agents, antioxidants, anti-diabetic and anti-NO compounds. In this study, SPP was effectively utilized for the production of new bioactive materials, anti-nematodes agents. SPP was used as sole carbon/nitrogen (C/N) source for the screening of active bacterial strains. The fermented SPP by the most active bacterial strains was tested its effect on nematode egg hatch. Its enzyme activities and major constituents were also determined.

Keywords: *Squid pens; process biochemistry; nematodes; anti-nematodes agents; bio-control; black pepper.*



YEAST TWO-HYBRID SCREENING OF EBNA2 INTERACTING PROTEINS IN THE HUMAN LYMPHOCYTE CDNA LIBRARY

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Abstract: EBNA2 interacting proteins were screened from human lymphocyte cDNA library by yeast two-hybrid method. High-efficiency method was developed in order to saturate the screening. The interacting proteins expressed from the library would be selected in the specific medium.

Keywords: *yeast two-hybrid, EBNA2, human lymphocyte.*

EFFECT OF NANO-BUBBLE WATER ON ANAEROBIC METHANE FERMENTATION OF LIGNIN

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Abstract: Vietnam is a country that generates a huge amount of crop residues (lignocellulosic biomass). However, the improper disposal of crop residues in Vietnam brings about many environmental problems. Anaerobic digestion (AD) is regarded as a suitable technology for the conversion of lignocellulosic biomass into methane that can be used for heating and electricity generation. Although lignocellulosic wastes are attractive materials for methane generation, the methane production efficiency from lignocellulosic biomass is low, mainly due to its refractory components. Lignin is a major barrier to the bioconversion of lignocellulosic materials, which also resists the hydrolysis of lignocellulose, thus limiting its AD process. In recent years, nanobubble technology has been paid much attention in environmental field. Previous researches show that nanobubbles have some unique properties such as stable existence in water for a long time and generation of highly reactive free radicals that can be applied for fermentation to achieve enhanced organic degradation. Therefore, this study aimed to investigate the effect of nanobubble water (NBW) on lignin reduction and its methane production during AD.

This study was divided into three phases to determine the effect of nanobubble water on methane production from lignin. In Phase 1, nitrogen nanobubble water (N_2-NBW) and carbon dioxide nanobubble water (CO_2-NBW) were added individually into the reactors to investigate their appropriateness for the AD of lignin. In Phase 2, the suitable NBW obtained in Phase 1 was further used to determine the effect of NBW on mono-digestion of lignin and co-digestion of lignin with acetic acid (HAc). Phase 3 analyzed the appropriate ratio of HAc to lignin that could have the highest methane production promotion effect with NBW addition.

The addition of nanobubble water showed a positive effect on methane production and lignin reduction. The increase in methane production followed a descending order as N_2-NBW (22% increase) > CO_2-NBW (17% increase) > the control (control group was added with deionized water). The results showed that the addition of N_2-NBW was appropriate for the enhancement of methane production from lignin. High methane yield was obtained in the co-digestion of lignin with HAc (837 mL $CH_4/gTOC_{removal}$ from the control reactor and 1061 mL $CH_4/gTOC_{removal}$ from the NBW addition reactor), while methane production from mono-digestion of lignin was low (only 23 ml $CH_4/gTOC_{removal}$ from the control reactor and 40 ml $CH_4/gTOC_{removal}$ from the NBW addition reactor). This result indicated that methane production from co-digestion of HAc with lignin was much higher than the mono-digestion of lignin. The results implied that AD using lignin as the sole carbon source was ineffective, while co-digestion of lignin with HAc was successful with high methane production. The ultimate methane potential with NBW addition was examined in the reactors with four different HAcs to lignin ratios. Methane production was determined as 1054, 1028, 1061, and 824 mL $CH_4/gTOC_{removal}$ for the ratios of 97.5:2.5, 95:5, 90:10, and 80:20 correspondingly, while the highest lignin reduction of 43% was achieved in the HAc/lignin ratio of 95:5. This result indicated that the substrate with a ratio of 95:5 (HAc/lignin) was the most favorable for lignin reduction and methane enhancement.

Keywords: *Anaerobic digestion; Methane production; Lignin reduction; Nanobubble water.*

CONVERSION OF WHEAT BRAN TO XYLANASES VIA STREPTOMYCES THERMOCARBOXYDUS

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Abstract: Xylan-containing agricultural byproducts possess significant application in many fields. In this study, six sources of carbon, including rice bran, wheat bran, spent coffee ground, coffee husk, xylan from birchwood and carboxymethyl cellulose, were investigated for xylanase production by *Streptomyces thermocarboxydus* TKU045, a xylanolytic actinomyces isolated from Taiwanese soils. *S. thermocarboxydus* TKU045 expressed the highest xylanase productivity (0.803 U/mL) when cultured on a medium containing 1% of wheat bran as substrate and 1% of nitrogen source (KNO_3) was selected as suitable micronutrient, when fermented for 3 days at 37 °C. The molecular weight of *S. thermocarboxydus* TKU045 was determined at approximately 15 kDa by Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) analysis. The characterized xylanase expressed some interesting properties, such as a various pH stability (pH 4-9) and a higher temprature optimum (60 ºC). TKU045 xylanase was purified 81.7-fold with an activity yield of 1.0 % and a specific activity of 5.056 U/mg. Thus, *S. thermocarboxydus* TKU045 may have potential in xylanase production and the solve environment problems.

Keywords: *Xylanase; Wheat bran; Agricultural waste; Streptomyces thermocarboxydus.*

THE EFFECT PRESENCE OF SILICA IONS ON PHOSPHATE AND AMMONIUM RECOVERY FROM FERTILIZER WASTEWATER

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Abstract: Phosphate and ammonium currently recovery from wastewater to produce magnesium ammonium phosphate (MAP). Several previous studies have founded precursor ions has an impact on MAP formation, such as the presence of calcium, sulfate, fluoride, and other ions. In the petrochemical company that also produces fertilizer, the wastewater contains a high concentration of ammonium, phosphate, and silica. This study aims to determine the effect presence of silica on MAP precipitation.

This research was conducted in a batch system using a jar test at an optimum speed of 158 rpm for 60 minutes. $MgCl_2$ used as a precipitation agent. This study was carried out by using synthetic wastewater. The molar ratio for synthetic wastewater of $[Mg^{2+}]:[NH_4^+]:[PO_4^{3-}]$ and $[Si^{2+}]$ was predicted using the PHREEQC model. The pH variations of the sample were 8; 8.5 and 9. The silica concentration was varied in the range of 20 mg/L to 1000 mg/L. The parameters measured were pH, silica, phosphate, ammonium, and magnesium concentration, and MAP morphology.

Silica has an impact on MAP precipitation with increasing the concentration of silica in wastewater. Recovery of phosphate and ammonium reduced respectively until 20% and 10% with the concentration of silica was 1000 mg/L under pH 9±0.2. pH has a great impact on pH 9 because the solubility of silica was increased in this pH condition. The morphology of MAP by SEM also showed that silica has an impact on the purity of the MAP.

Keywords: *ammonium, magnesium, phosphate, silica, struvite.*

APPLICATION OF A CONCEPTUAL MODEL GR4J IN THE STREAM FLOW SIMULATION AND PREDICTION FOR CAI-PHAN RANG RIVER BASIN

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Abstract: The use of hydrological models in stream flow simulation and prediction is considered as one of the most effective measures to support the integrated water resources management in Vietnam, particularly in arid or semi-arid regions like Ninh Thuan province. However, predicting stream flow in semi-arid regions is challenging because the regions often have poor recorded data, i.e. there are not many hydrological gauges in these catchments. In this study, a daily conceptual rainfall-runoff model (namely GR4J) is applied to the Cai - Phan Rang River Basin (CPRB) in Ninh Thuan province. This study aims to evaluate the performance of GR4J in terms of spatial and temporal scales using the Nash–Sutcliffe model efficiency coefficient (NSE). The optimal model parameters obtained are then used to simulate and predict the flow in the CPRB in the context of climate change. The results demonstrate that GR4J has a good performance in simulating the stream flow in the CPRB with the NSE of over 0.8 for both spatial and temporal scales. The predicted stream flows are plausible, and thus can be used to support decision makers in water resources management in Ninh Thuan province.

Keywords: *conceptual rainfall-runoff model; GR4J; stream flow; semi-arid; Nash-Sutcliffe Efficiency*.

TREATMENT OF PETROL STATION WASTEWATER BY PERSULFATE AND FERROUS ION

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Abstract: This research aimed to study the treatment of synthetic wastewater from lubricant with the COD concentration of about 10,000 mg/L, and a pH value of about 5-6. The optimum conditions for the treatment by persulfate/ferrous ion with and without the sonication process were determined. The study factors were as follows: the amount of ferrous ion 0.0-0.5 mole/L, the molar ratio of ferrous ions per persulfate 1: 0 - 1: 5, pH 2-6, reaction time 0-60 minutes, and sonication time 0-40 minutes. Testing was on distilled water as a blank. All experiments were repeated three times to find the mean and standard deviation. The results indicated that COD reduced more than 94% when using 0.04 mole/L ferrous ion, ferrous ions: persulfate 1: 1, pH 3, and 40 minutes reaction time. The reaction time could reduce to 30 minutes when applying the sonication process to the treatment. However, synthetic wastewater from this research still could not be released into public water because it exceeded the effluent standard (200 mg/L) prescribed by the Department of Industrial Works. Co-treatment of the wastewater with other methods is necessary to meet the effluent standards.

Keywords: *COD, ferrous ion, persulfate, sonication, wastewater.*

EXPLORATION OF NOVEL DRAW SOLUTION IN HYBRID FORWARD OSMOSIS – NANOFILTRATION (FO/NF) SYSTEM FOR SLUDGE DEWATERING

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Abstract: Forward osmosis (FO) technology is an alternative process for dewatered solid–liquid stream which has the potential to be innovative and sustainable. However, the applications have still been hindered by high reverse salt flux and membrane fouling. In this study, a hybrid forward osmosis–nanofiltration (FO/NF) process was designed for dewatering high nutrient containing sludge and recovering draw solution with minimum energy using EDTA-2Na coupled with Triton X114 as novel draw solution. Results showed that 0.06 M EDTA-2Na combined with 0.8 mM Triton X114 achieved the lower reverse salt flux than that of 0.06 M EDTA-2Na as draw solution in FO process. The after 20 h of FO operation, final sludge concentration reached 35,000 mg/L. Moreover, nutrient compounds in sludge were successfully removed by the FO membrane with a removal efficiency of approximately 95% of NH_4+ –N and 99% of PO_4^{3-} –P, which was attributed to the multi-barrier layers of sludge forming on membrane surface and the steric effect of the FO membrane. Furthermore, NF-TS80 membrane was used to recovery draw solution could reach more efficiency with approximately 95%.

Keywords: *forward osmosis; draw solution; surfactant; hydrophobic; reverses salt flux.*

CHANGE OF VEGETATION COVER AND ITS RELATIONSHIP WITH ENVIRONMENTAL FACTORS, A CASE STUDY ON LY SON ISLAND

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Abstract: Vegetation cover (VC) plays an important role in regulating the water, decreasing the drought and soil erosion... VC variation can break the ecological balance, affect the animals and human activities. Google Earth Engine (GEE) has been proved as a powerful tool by providing accessing right, analyzing images and data on integrated system. Furthermore, it possesses the ability to perform spatial aggregations over global-scale data at a high computational speed, supports both spatial and temporal analysis. This paper presents application of remote sensing method, based on GEE platform to monitoring and evaluate VC change on Ly Son island, in Quang Ngai province from 1990 to 2018. The results show that VC has close relationship with environmental factors, and severely influenced by human activities on a large scale. Environmental factors like temperature and rainfall have close relationship with VC. This is shown in increasing NDVI during rainy season and it repeats year by year in research term. Human activities affect VC by large-scale and continuous construction work. The research results contribute the local government the understanding about VC change, in order to recommend solutions for better managing the island environment.

Keywords: *environmental factors, Google earth engine (GEE), remote sensing, time series analysis, vegetation cover.*

DEVELOPING PORTABLE LIQUID CRYSTAL-BASED SENSORS FOR NITRITE DETECTION BY USING DIAZOTIZATION REACTION

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Abstract: A liquid crystal (LC)-based sensor for detecting nitrite in aqueous solutions was developed by using diazotization reaction as the sensing mechanism. Firstly, tetradecyl 4-aminobenzoate (14CBA) was synthesized and doped into a nematic LC 4-cyano-4'-pentylbiphenyl (5CB). When the LC mixture was casted on a glass substrate then immersed into aqueous solution without nitrite, the orientation of LC was planar and the LC image was bright. In the presence of nitrite, it would react with alkylanilines to give diazonium ions with positive charge, which would align at the LC/aqueous interface and resulted in homeotropic orientation of the LC. As a result, a bright-to-dark transition of the LC image can be observed. The limit of detection (LOD) of this system for nitrite is 25 μM with high selectivity, and it can work in environmental water samples such as tap water and pond water. In addition, the structural effect of alkylanilines on the performance of the nitrite detection by using LC-based sensors was investigated. Finally, we demonstrated that the optical signals of LC can be measured and recorded by using a built-in camera of smartphone, which means this system is suitable for portable and on-site applications.

Keywords: *Liquid crystal, liquid crystal-based sensor system, portable sensor, nitrite detection, diazotization reaction.*

TEXTILE POTENTIAL BORON DELIVERY AGENTS FOR BORON NEUTRON CAPTURE THERAPY APPLICATION: SODIUM BOROCAPTATE (BSH) CONJUGATED FOLIC ACID/BIOTIN VIA THIOL-MALEIMIDE "CLICK'' REACTION

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Abstract: Boron neutron capture therapy (BNCT) is a potential approach to treat cancer and Sodium borocaptate (BSH) has been used for BNCT application as a boron delivery agent. Even though, BSH were used in clinical trials, this agent till exhibits some disadvantage in the case of selective targeting of cancer cells and cellular uptake ability. Folic acid and biotin were considered as an excellent targeting ligand which can help to overcome the disadvantage of BSH in BNCT application.

In this study, we prepared the natural sodium borocaptate (BSH) from natural abounded starting materials and we also successfully conjugated this potential BNCT agent with folic acid/biotin using 1-(2-Aminoethyl)maleimide as the short crosslinker. Folic acid/biotin-conjugated BSH exhibited the potential boron delivery agent which decreased the cytotoxicity of BSH treatment effects on the Human Bone Osteosarcoma Epithelial Cells, the U2OS cell line. Interestingly, folate-conjugated products which showed two maleimide groups and it also exhibited the high fluorescence emission. Of these, this complex might provide a new strategy to enhance and also detect the boron accumulation. These observations offered two of new BSH delivery platforms which were described as a small molecule weight and highly targeting of cancer cells and could potentially be used in further investigation.

Keywords: *Boron neutron capture therapy BNCT, Sodium borocaptate BSH, Folate-conjugated, Biotin-conjugated, Maleimide.*

AUTOMATIC METER READING (AMR) APPLICATION IN HIGH-RISE BUILDING CONSTRUCTION

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Abstract: Managing water supply demand of households is one of top concerns of apartment management boards, especially in water meter reading due to high cost, time-consuming, labors waste, and non-effective. Recently, Ho Chi Minh City developed a new method for water meter reading based on principle of remotely radio receiving and transmitting. This is remotely meter reading method. This method was performed by applying of combination of Auriga water meter, Izar Radio transmitter, and Nogema installed on smart phone to determine the optimal distance for radio receiving and transmitting in buildings. The results indicated that optimal distance at where the best radio receiving and transmitting devices ranged from 16-25 m. This distance at where amount of water meters were mostly founded.

Keywords: *building, radio wave, automatic meter reading.*

USING IRON ALUM IN SURFACE WATER TREATMENT

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Abstract: Surface water contains clay, minerals, bacteria, microorganisms, dissolved metals, organic matter, color and other suspended solids. The purpose of coagulation and flocculation is to remove these suspended particles. The choice of coagulant and appropriate dosage in treatment plays a decisive role in ensuring the water treatment performance of the plants. Improper use of coagulant dose affects water quality after treatment, in addition to operation problems and production costs. A study is being conducted at water treatment plant uses surface water at Dong Nai River with the capacity of 300,000 m^3 / day, the treatment process of plant use iron alum ($FeCl_3$) for coagulation-flocculation. Due to the high corrosion property of iron alum and the residue effects of the quality of treated water, it requires strict control in the treatment process as well as the dosage of chemicals. The main aim of this study is to determine appropriate amount of alum used for the coagulation-flocculation process at the water treatment plant. Research method is data collection, data include: turbidity, pH, flowrate of raw water and dose of iron alum, lime and polymer are used in current treatment process. From there, find the model using iron alum by linear regression analysis method and BMA (Bayesian Model Average) method on R tool platform. Next, verify the appropriate model of linear regression of iron alum by experiment Jar test in the laboratory. Results revealed that the BMA model is not suitable for application, because one of the Jar test results has a mean turbidity value greater than 4 NTU, does not meet the water quality requirements after sedimentation tank due to regulation of the water treatment plant. The results of linear regression analysis showed that the raw water turbidity and season are two independent factors related to the amount of alum used, these two factors explain about 78% of the differences in iron alum dose that affect to coagulation-flocculation process. This study was successful in determining the appropriate dose of iron alum for the water treatment plant, and can be applied similarly to build appropriate chemical model for water treatment plants that use surface water as raw water resource.

Keywords*: Coagulant, Iron Alum, Ferric Chloride, Surface water treatment.*

TRANSITION-METAL-CATALYZED ADDITION REACTION OF C-N MULTIPLE BONDS

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Abstract: Our developed methodologies in the late transition-metal-catalyzed coupling reactions[1-4] involving the addition of C-N multiple bonds (nitrile and imine) are briefly divided into four reaction types and shown below. As indicated in the following scheme, the different behaviors of addition could be carried out through the different transition-metal complexes. In addition, applications to the synthesis of natural alkaloids, bioactive compounds and medicine candidates could be carried out as well.

ENHANCING SIGNAL INTENSITY AND PRECISION OF LIQUID CRYSTAL-BASED SENSOR BY USING FINE GRIDS MADE BY PHOTOLITHOGRAPHY OF PHOTORESIST

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Abstract: In past studies, conventional LC-based sensors apply metal grids on glass substrate to fill with LCs as the sensing platform to detect the analytes in aqueous or gas phases that in contact with LCs. This platform is easy to prepare, and it has been applied to detect various analytes such as proteins, proteases, small molecules and metal ions…etc. However, the LC-based sensing platforms applied metal grids have some drawbacks including the metal grids are easy to deform when handling, the positon on metal grids on the substrate may move in a flow aqueous system and metal grids may influence the arrangement of LCs. Therefore, the practical applications of LC-based sensors in current environmental and biological detection are still limited.

In this study, we prepared the fine grids patterned on glass substrate by using photolithography of negative photoresist. These fine grids were filled with LCs to construct the LC-based sensors. Owing to the good mechanical strength, photostability and chemical stability of photoresist, the advantages of this approach to construct the LC-based sensors includes the grids are not easy to deform, the grids are firmly adhered to the glass substrate and the grids would not influence the arrangement of LCs. On the other hand, the signal ratio of photoresist grids is about one hundred times higher than metal grids. Based on this phenomenon, it can have a better signal discrimination rate when analyze data, and can also reduce the chance of misjudging the signal.

Keywords: *Liquid crystal, liquid crystal-based sensor system, portable sensor. photoresist grids.*

UTILIZATION OF *SPIRODELA POLYRHIZA* FOR ETHANOL PRODUCTION

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Abstract: *Spirodela polyrrhiza*, commonly known as duckweed, is a species of small aquatic flowering plants that are commonly found in local ponds. The species was considered a potential candidate as an alternative source for ethanol production. This study aimed to investigate conditions for liquefaction using alpha-amylase as well as growth rates, reducing sugar contents and ethanol productivity of three different *S. polyrrhiza* strains BKK1, BKK2 and BKK3. During the growth period of 24 days, the growth rate of strains BKK1 and BKK3 were significantly higher than that of strain BKK2 as indicated by fresh and dry weight. Examination of conditions used for liquefaction showed that the best conditions yielding the highest reducing sugar content were 3 hours of digestion with α-amylase at 50°C and pH6. After liquefaction with α-amylase and saccharification with pullulanase and amyloglucosidase, the reducing sugar contents of strains BKK1, BKK2 and BKK3 were 27.68$\pm$0.59, 29.63$\pm$0.50 and 13.49$\pm$0.42 mg mL^{-1}, respectively. However, the average ethanol content obtained from strain BKK3 (6.25$\pm$0.08 g L^{-1}) was significantly higher than that from strain BKK1 and BKK2 after fermentation with *Saccharomyces cerevisiae* strain TISTR 5606. These results suggest that genotypic differences between *S. polyrrhiza* strains affect growth rate, reducing sugar content and ethanol production.

PREPARATION OF OIL-BASED STABLE SLIVER DISPERSIONS FOR PRINTABLE ELECTRONICS

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Abstract: In this study, we focused on how to development an oil-based stable silver nanoparticle suspension of conductive ink, to enhance the attachment of ink onto the substrate, and to seek the best condition for printing quality. Furthermore, the stability mechanism and related applications were discussed in detail, such as the use of prepared dispersion solution to produce a conductive film, and further to obtain a conductive pattern. First, silver nitrate was used as the metal precursor and ascorbic acid was added as the reducing agent with the addition of the surfactant and the protective agent. Through a series of formulations to obtain the best performance, we developed the oil-based conductive silver ink, whose dispersion could maintain stable more than one year with no obvious precipitates. The ink was coated onto a glass slide via drop-casting method, and a conductive film was obtained by sintering at 250 °C having a sheet resistance of lower than 0.6 Ω/sq. Moreover, we also prepared the conductive pattern with a resistance of 3 Ω via desktop dispensing robot.

Keywords: *silver nanoparticles, conductive ink, oil-based dispersion.*

PREPARATION OF TITANATE NANOTUBES FOR PHOTOCATALYTIC REMOVAL OF HCHO UNDER INDOOR CONDITION

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Abstract: In this study, we aimed to prepare and modify various types of titanate nanotubes (TNTs) and apply them for removal of indoor formaldehyde by photocatalysis. The TNTs materials were synthesized by hydrothermal method and then modified by treatment at different acidic - basic conditions (pH 1 – 9) and annealing at different temperatures (100 – 900 ºC). The effect of environmental factors such as inlet concentration, exposed surface area, residential time, light intensity, and catalyst amount was also investigated. Results showed that the materials treated at pH 1.6 and calcined at 400 ºC had the highest formaldehyde removal efficiency, which could be due to the suitable condition of anatase crystallinity and surface area. For reaction condition, the highest removal efficiency of 99% was found at condition of 2 UV light bulbs, 29 second for retention time, 0.11 g of TNTs, 15 ppm of HCHO, and 3 glass substrates. These parameters could be very useful for further design of a photocatalytic device which can be applied for removal of air pollutants in indoor air.

Keywords: *titanate nanotubes, formaldehyde, indoor air pollution control, environmental photocatalysis.*

SYNTHESIS OF DRIED EGGSHELL POWDER–CHITOSAN GEL MATERIAL AND ITS APPLICATION FOR BATCH AND COLUMN ADSORPTION OF REACTIVE DYES

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Abstract: In this study, commercial reactive dyes were effectively removed from water samples through adsorption on eggshell powder-chitosan gel (EPCG) material. The EPCG material was synthesized from waste eggshell with industrial chitosan in order to form a novel core-shell material in which chitosan was coated as a thin layer on the surface of eggshell. SEM and FTIR results showed that the porous structure of dried EPCG is very potential for adsorption application. In dyes adsorption tests, Langmuir and Freundlich equations well described the adsorption isotherms with maximum capacity of 2.3 mg/g and the adsorption process followed pseudo-second-order kinetic. Adsorption behavior as well as the breakthrough curves of reactive dyes in fixed-bed adsorber was also evaluated, where the adsorption was better described by the Clark model than by the Bohart – Adam model. These results suggest that EPCG, as an environmental-friendly material produced from waste eggshell, is very promising for wastewater treatment applications.

Keywords: *Reactive dye, eggshell, chitosan gel, adsorption model.*

STUDY ON ENHANCING THE COD REMOVING UTILIZING CATIONIC STARCH REPLACE THE PAC IN COAGULATION-FLOCCULATION PROCESS FOR FISHERY PROCESSING WASTEWATER

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Abstract: An ability to use Cationic Starch as a material to replace a part of PAC chemical in the case of tackling the polluted wastewater from the fishery processing company with a high COD value by Coagulation-Flocculation Process is concerned in this study. The Jar-test was conducted for the optimal PAC concentration of 600mg/l used to solve, which was replaced a part of 25%, 50%, 75%, and 100% in the experiment, respectively. As the results denoted, it seemed not to be effective in reducing COD when using the total of the cationic starch solution to treat the sample. Additionally, the ratio of 150 mg/l PAC solution mixed with 450 mg/l Cationic starch solution (ratio 1 to 3) was only 31.90 %, compared to the higher efficiency of the control sample with 48.14%. Meanwhile, the mixture of ratio 1 to 1 could treat better, 2.07% higher than the sample blank. Furthermore, the ratio 3 to 1 illustrated the value which reached a peak of 55.98%, making it become the optimal ratio of mixing two types of material.

Keywords: *cationic starch, PAC, coagulation-flocculation process, fishery processing wastewater.*

STUDY THE EXISTING OF THE HEAVY METALLIC ELEMENTS IN THE VIETNAM JOSS-PAPER MATERIALS AND EFFECTS OF ASH APPLIED ON LAND TO GERMINATION RATE

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Abstract: Using joss paper is a traditional and long-term historical custom in Vietnam. In those countries having this custom such as China, Taiwan, there were many studies conducted on measuring air polluted particles, particulate matters releasing during the burring process of joss paper in worship activities. Most of the joss papers sample had shown the existing of heavy metallic elements to be in the order of Al>Fe>Mn>Cu>Pb>Zn>Cd. Those metal contents will be released to the environment by ash. The metal contents in ash samples showed that Cu content is higher according to the standard of QCVN 03-MT:2015/BTNMT for land with 100 ppm. Gold ingot paper ash –T1: 236.21 ppm; gold paper ash –T2: 78 ppm; printing paper ash –T3: 415.87ppm. In particular, ash from burning gold ingot paper (T1) had the highest heavy metal contents: Cd (4.93 ppm) comparing to the threshold of the standard is 5ppm; Pb 128.60 ppm higher than the standard (120 ppm). This result will help to assess the risk of T1 to the soil. These experiments showed that heavy metal in the mixture between ash and soil affected on tree germination rate.

Keywords: joss paper; heavy metal; germination rate.

RESEARCH ON APPLICATION OF GEOPHYSICAL PENETRATING RADAR IN UNDERGROUND INFRASTRUCTURE LOCATING

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Abstract: This research was carried out to apply the non-invasive method of Ground-Penetrating Radar (GPR) technology in surveying underground constructions in Ho Chi Minh City by using a GSSI (Geophysical Survey Systems) GPR system using a 350 MHz radio frequency GPR antenna. GPR uses safe, low-power radar, and operates by transmitting pulses into to the ground, then recovering the reflected energy resulting from dielectric contrasts in the subsurface layers. The survey was conducted by scanning perpendicular to the suspected pipeline and determining the location of the pipeline based on images displayed on a tablet. The location of the pipelines are displayed by hyperbolic targets, resulting from changes in the dielectric (velocity) created as the antenna approaches and passes over the targets. This research has successfully determined the locations of 2 pipelines along the surveying area, with depths of 0.7 and 1.2m. From there, we can appreciate the suitability, accuracy and value of of using GPR technology in HCMC.

Keywords*: detecting surveying underground construction, survey, infrastructure, radar, GPR*

PHENYL-CARBAZOLE BASED BILAYER INTERFACE EXCIPLEX FOR GREEN ORGANIC LIGHT EMITTING DIODES

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Abstract: Two carbazole-based molecule, i.e., PhCzp-Me and PhCzm-Me, were synthesized through metal-catalyzed coupling reactions. The maximum absorption band of PhCzp-Me and PhCzm-Me located at 348 nm and 298 nm, while the maximum emission band located at 371 nm and 369 nm, respectively. The density functional theory calculations showed that the dihedral angle of PhCzp-Me and PhCzm-Me are 52.9^{o} and 92.9^{o}. In the applications of OLEDs, we applied PhCzp-Me to co-deposit with CN-T2T to form excilplex as the emitting materials of OLEDs. The device with the structure ITO/HATCN (10 nm)/TAPC (35 nm)/PhCzp-Me (20 nm)/PhCzp-Me:CN-T2T 1:1 (30 nm)/CN-T2T (40 nm)/LiF (1 nm)/Al (100 nm) exhibited a maximum external quantum efficiency (EQE) of 5.7% with the maximum emission wavelength at 510 nm and CIE coordinate of (0.268, 0.512). Our results showed that PhCzp-Me and PhCzm-Me could form exciplex with CN-T2T and applied as the host or emitting materials for OLEDs with good device performance.

Keywords: *TADF, exciplex, OLED, Host.*

THIENOISOINDIGO-BASED DOPANT-FREE HOLE TRANSPORTING MATERIAL FOR EFFICIENT P−I−N PEROVSKITE SOLAR CELLS WITH THE GRAIN SIZE IN MICROMETER SCALE

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Abstract: In this study, a series of 2,2'and 3,3'substituted thienoisoindigo (TII)-based small molecules (H3−H7) were synthesized by using 1,3-di(9H-carbazol-9- yl) benzene, N-phenylcarbazole, triphenylamine, and benzene as electron donor (D) at the periphery, while TII as electron acceptor (A) at the core. The highest occupied molecular orbital energy levels of H3−H7 range from -5.31 to -5.43 eV, while their lowest unoccupied molecular orbital energy levels range from -3.43 to -3.59 eV. Under AM 1.5 condition, the perovskite solar cell (PSC) with inverted p−i−n device structure using H7 as the dopant-free hole transporting material achieved a power conversion efficiency (PCE) of 12.1%, which is comparable to that using PEDOT:PSS as the hole transporting material (12.0%). Under an argon atmosphere, the PCE of H7-based PSC did not decay within

168 h, and it can retain 86.3% of its original PCE after 1000 h. The morphology study revealed that the film of H3−H7 was smooth and hydrophobic, while the perovskite film spin-coated on H3−H7 film was uniform with the grain size in micrometer scale. Although the time-resolved photoluminescence spectra of the perovskite films suggested that the hole extraction capability of H7 is weaker than that of PEDOT:PSS, the improved film morphology of the film in H7-based PSC accounts for its comparable PCE to PEDOT:PSS-based PSC.

Keywords: *Hole Transporting Material, p−i−n, Perovskite, Dopant-Free.*

CONVERSION OF SHRIMP HEADS WASTE FOR PRODUCTION OF A THERMOTOLERANT, DETERGENT-STABLE, ALKALINE PROTEASE BY PAENIBACILLUS SP

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Abstract: Fishery processing byproducts have attracted numerous researches due to their great application in many fields. In this study, five kinds of marine chitinous byproducts including squid pens powder (SPP), shrimp shell powder (SSP), demineralized shrimp shell powder (deSSP), shrimp head powder (SHP), demineralized shrimp shell powder (deSSP) have been used to provide the carbon/nitrogen (C/N) source for producing a protease from *Paenibacillus* sp. TKU047. *Paenibacillus* sp. TKU047 possessed the highest protease productivity (2.98 U/mL) when cultured on the medium containing 0.5% of SHP for 2 days. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) analysis revealed the molecular weight of TKU047 protease was approximately 32 kDa. TKU047 protease displayed the optimum activity at 70°C-80°C and pH 9 with a pH range of stability from 6 to 11. It was also found that TKU047 protease showed stability in the presence of detergents and surfactants. Base on their excellent properties, *Paenibacillus* sp. TKU047 protease may be a feasible candidate for inclusion in laundry detergent.

Keywords: *marine chitinous byproducts;Paenibacillus;protease;shrimp head.*

SYNTHESIS OF BORON-CONTAINING ISOCYANIDES AND THEIR SYNTHETIC APPLICATIONS

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Abstract: A facile synthesis of isocyano arylboronate esters is presented. Although tri-coordinate boron functional groups are commonly recognized as vulnerable to nucleophilic attack, the newly reported tri-coordinate isocyano arylboronate esters were found to be stable, albeit owing to the presence of an isocyano group. Theoretical calculations, using the DFT/B3LYP/6-31G(d,p) method, revealed that the electron delocalization between the aryl group and the boron atom might contribute to this stability. UV-vis spectroscopic investigations on 2-(4-isocanophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane were in agreement with the theoretical studies, showing a red-shifted absorption compared with that of phenylisonitrile. The reported strategy allows boronate ester substrates to survive throughout multiple steps operations. These building blocks were exploited in two isocyanide-based multicomponent reactions and tetrazole formation reactions.

Keywords: *boron, isocyanide, Ugi, Passerini, microwave, multicomponent reaction.*

SECONDARY TREATED WASTEWATER OF LATEX PROCESSING – REUSING FOR IRRIGATION OR TREATMENT BY MEMBRANE FILTRATION

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Abstract: Wastewater of natural rubber industry contains high pollution content. Drainage of rubber industry consists of latex, organic matter and nitrogen containing compounds. Concentrations of contaminants are 1.500 ÷ 7.000 mg/L (COD), 3.500 ÷ 14.000 mg/L (BOD), 200 ÷700 mg/L (SS), 200 ÷1.800 mg/L (TN), 500 ÷ 2.000 (Sulphate). The wastewater is studied for reuse in agricultural irrigation due to high nitrogen concentration. Pollution reduction of irrigation water when irrigating plants is carried out in a laboratory scale. Experimental models are constructed of soil from rubber field. The research results show that after irrigation, the concentration of pollutants is lower than the permitted level of National Technical Regulation of Vietnam. Membrane filtration technology is also applied to rubber waste after secondary treatment. Material of membrane is needed to be considered on cost-effective, membrane fouling and membrane cleaning. Both microfiltration (MF) and ultrafiltration (UF) can be used for wastewater treatment but depending on particle size of solutions. MF membrane has pore size ranging from 0.1 to 10 μm and UF ranging from 0.1 to 0.01 μm. Experimental results with Polyacrylonitrile (PAN) membrane showed that the ability to remove pollutants remaining in secondary treatment wastewater is over 98%. The results of this study are the basis for managers to choose the appropriate solution for the rubber latex processing industry.

Keywords: *Latex processing, tertiary treatment, membrane filtration, National Technical Regulation of Vietnam.*

CONVERSION OF SHRIMP HEAD POWDER TO PROTEASES AND CONGO RED BIOSORBENT VIA PAENIBACILLUS MUCILAGINOSUS

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Abstract: In this study, production of Protease from SHP(shrimp head powde) by Some Paenibacillus and Bacillus Strains, SHP was used as the sole sources of C/N with concentration of 1%. After 3 days fermentation, the supernatants were tested for their protease activities using the assays mentioned in the materials and methods section. based on protease activity, Paenibacillus mucilaginosus TKU032 was selected for further study. TKU032 to Comparison Protease Production from Different Chitinous Materials Source in 0.5% SHP has the best Protease activity at 48 hours.The TKU032 protease exhibited optimum temperature of 50°C, optimum pH of 8, thermal stability of 10-50°C, and pH stability of 5-10. Also, the enzyme activity was found stimulated with Na^{2+} Ca^{2+} Fe^{2+} metal ions. In Substrate the azo casein better than the others

Keywords: *Paenibacillus mucilaginosus, Congo Red, Shrimp Head Powder.*

UNDERSTANDING THE COMMUNITY'S PRIORITIZATION FOR BENEFITS OF SUSTAINABLE URBAN DRAINAGE SYSTEM: A CASE STUDY IN NHIEU LOC – THI NGHE SUB-BASIN, HO CHI MINH CITY

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Abstract: This study aims to understand how the residents prioritize the benefits of urban sustainable drainage techniques and identify the predictors for their prioritization. We conducted a face-to-face survey with a sample of 228 residents in Nhieu Loc - Thi Nghe sub-basin, one of the main drainage catchments in Ho Chi Minh City. After importing data to SPSS software, we used the Wilcoxon signed-rank test to examine the statistically significant difference in pairwise groups of benefits. As the results, while the respondents set the least priority to amenity creation, they expressed the same preference for flooding control and environmental enhancement. The independent variables in logistic regression models are divided into two groups: personal information and location characteristics (neighborhood environment). The findings from this study will be the significant input of multi-criteria decision-making in retrofitting sustainable urban drainage system in Nhieu Loc - Thi Nghe sub-basin.

Keywords: *flood management, logistic regression, Nhieu Loc – Thi Nghe sub-basin, sustainable urban drainage system.*

PECTINASE PRODUCING AND PURIFICATION FROM MICROBES ISOLATED FROM SOIL

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Abstract: There has been a great increase in industrial applications of pectinase owing to their significant biotechnological uses. In this study, over 150 bacterial strains were isolated from Taiwanese soils using medium containing pectin as the sole source of carbon/nitrogen. Based on pectinase activity, TKU049 was selected for further study. Optimized culture conditions revealed TKU049 could produce the highest pectinase activity (1.18U/mL) when cultured in a medium containing 1.5% (w/v) pectin at 40°C for 3 days. The purified pectinase exhibited optimum temperature of 60°C, optimum pH of 9, thermal stability of 20-50°C, and pH stability of 6-10. Also, the enzyme activity was found stimulated with Mn^{2+} metal ions. Moreover, it was stable on EDTA, Trixton-100, Tween 40, and Tween 20.

After purification by Macro-Prep High Q chromatography, the fractions (fraction number 79-88) with pectinase activity were collected. The specific activity of pectinase was increased from 0.037 U/mg to 0.07 U/mg but the activity yield decreased dramatically from 21.7 % to 14.1 %. Further, HPLC analysis using KW802.5 column showed that the specific activity of pectinase was 0.04 U/mg and the activity yield was 1.1%.

Keywords: *pectinase, pectin, enzyme assay.*

IMPACT OF SULFATE ION ADDITION ON ELECTROCHEMICAL OXIDATION OF ANAEROBICALLY TREATED LANDFILL LEACHATE USING BORON-DOPED DIAMOND ANODE

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Abstract: Anaerobic process is one of alternative methods commonly applied for the treatment of leachate stream generated from solid waste landfill. However, this method becomes less effective to degrade contaminants containing lower biodegradability organics with higher salinity and nutrient constituents, particularly in the later stage of landfill operation. Thus, further treatment is required to efficiently meet the effluent standard. Among the physico-chemical methods, electrochemical oxidation using boron-doped diamond can be applied as a post-treatment due to its effectiveness. Boron-doped diamond anode may promote the generation of active species, such as radical anions ($OH^{\bullet}$, $Cl^{\bullet}$, $Cl_2^{\bullet-}$, and $SO_4^{\bullet-}$) as well as other oxidative agents, creating more indirect oxidation processes of non-biodegradable organic contaminants. Therefore, the aim of this study was to evaluate the efficiency of electrochemical oxidation using boron-doped diamond for the treatment of anaerobically treated leachate effluent. The impact of sulfate ion addition on the overall performance of the electrochemical oxidation was also investigated. This study was conducted using a laboratory scale of three-compartment electrochemical reactor, consisting of anode, cathode, and central compartments. A 2-L of the treated leachate was recirculated in a batch electrochemical system by applying constant current density of 25; 37.5; and 50 mA cm^{-2}. The highest removal of organic (measured as chemical oxygen demand, COD) and total nitrogen, i.e., 93% and 59%, respectively, was achieved at a current density of 37.5 mA cm^{-2}, with molar ratio of $[SO_4^{2-}]:[Cl^-]$ = 1:1. This equals to the removal of 2.28 g of COD and 1.77 g of total nitrogen, thus the total energy required was 5.7 Wh g^{-1} COD and 7.5 Wh g^{-1} N, respectively. Furthermore, the result confirms that the addition of sulfate ion seems to benefit the removal of COD through indirect oxidation and lead to the formation of nitrate without overall removal of total nitrogen.

Keywords: *Anaerobically treated leachate, boron-doped diamond, current density, electrochemical oxidation, sulfate ion.*

MAKING BIOLOGICAL PRECIPITATION AND COAGULATION MATERIAL EXTRACTED FROM TAMARIND SEED AND INVESTIGATING THE APPLICABILITY OF NIKEL (Ni^{2+}) REMOVAL

Abstract: The study of treating assumed wastewater with Ni^{2+} by using Biogum – a bio- material extracted from tamarind seeds. The term "Gums" is used to describe a group of natural polysaccharides containing glucose, xylose and galactose which are widely found in industrial applications due to their gel or viscosity capabilities. The analysis of infrared spectrum diagram shows that Biogum extracted from tamarind seeds has functional groups - OH, carboxylate −COO−, C - H in CH_3, C - N in Amine aliphatic or in Alcohol. The best efficiency of Ni^{2+} removal is at 50ml biogum at optimal pH of 5 and time of treatment reaching equilibrium at 60 minutes. The results are similar to previous studies and are applicable to the treatment of wastewater containing heavy metals.

Keywords: *Biogum, precipitation-coagulation, tamarind.*

COMPUTATIONAL STUDIES ON PROTEIN-DNA INTERACTIONS

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Abstract: The expression of genes is encoded at multiple levels of complexity. Transcription, for example, initiates the reading and encoding of genetic information from DNA molecules. This process very often is regulated by a variety of transcription factors, which are a type of proteins that can enhance or suppress the translation of other genes into protein. Microscopically, transcription is carried out via protein-DNA interaction at the molecular level. However, the underlying molecular mechanism is still not clear. Using a nucleoid-associated protein Fis in *E-coli* as an example, we specifically look into the process of Fis dissociating from DNA. While being primarily non-specific in binding DNA, the dissociation kinetics of Fis is largely influenced by its surroundings. More concretely, the dissociation rate increases as the concentration of Fis in solution-phase increases, as evidenced by recent single-molecule experiments. This unusual behavior, called facilitated dissociation, challenges the standard thermodynamic model of gene regulation. Theoretical modeling and simulation techniques are very useful for probing possible intermediates that are difficult to explore via experimental methods alone. In this talk, I will show that the hybrid computational protocol that we develop, namely AWSEM-3SPN protein-DNA force field, allows us to explore the binding energy landscape of Fis protein with DNA so as to reveal essential dynamics of protein-DNA interaction. The simulations uncover several different pathways for the dissociation of the protein from DNA. These dissociation pathways involve different protein stoichiometries which correspond to different functional outcomes for the systems biology of gene regulation by Fis.

Keywords: *protein-DNA interaction, coarse-grained molecular dynamics simulation, energy landscape theory, transcription factor.*

THE ENHANCEMENT OF BIODEGRADABILITY INDEX OF MATURE LANDFILL LEACHATE BY ELECTROCHEMICAL OXIDATION PROCESS USING DSA AND BDD ANODE

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Abstract: Mature solid waste landfill produces stabilized leachate with extremely low biodegradability. It renders the leachate untreatable biologically. Therefore, a pretreatment aimed to increase leachate biodegradability deems necessary prior to biological treatment. The objective of this study is to investigate the effectiveness of electrochemical oxidation process in enhancing leachate's index of biodegradability, expressed as BOD_5/COD ratio. Different types of anodes were employed, namely DSA (dimensionally stable anodes) and BDD (boron-doped diamond), to represent active and non-active anode, respectively. A 2, 1.5, and 1 L leachate samples were treated in a batch recirculation reactor using a 200 mL single compartment electrochemical cell where the initial pH was set to 3, and flow rate to 5 mL s^{-1}. The reactor was operated under constant current, with a current density of 10, 30, and 50 mA cm^{-2}. Both DSA and BDD anode could reach targeted BOD_5/COD ratio above 0.5, as an indication of biological treatability of pretreated leachate. Under the current density of 30 mA cm^{-2}, the highest BOD_5/COD ratio of 0.5759 and 0.5999 was obtained using BDD and DSA, respectively, at which operation condition the COD removal was 72% and 67%, respectively, after 4-h electrochemical oxidation.

Keywords: *biodegradability index, boron-doped diamond anode, dimensionally stable anode, electrochemical oxidation, stabilized leachate.*

REMOVAL OF ARSENIC FROM CONTAMINATED GROUNDWATER USING NANO COBALT-FERROUS OXIDE ($COFe_2O_4$)

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Abstract: Groundwater is one of the main water supply sources for domestic purposes in rural areas of Vietnam. However, Arsenic contamination of groundwater in many has posed threats to human health, in particularly in rural areas. According to statistical data of Ministry of Health, there are approximately 21% of Vietnam's population is consuming Arsenic contaminated water sources which exceeds permitted level. Particularly, the situation is exacerbated in the Red River and the Mekong Delta region. The purpose of this paper is to present the efficiency of Arsenic removal by using magnetic nano material – cobalt ferrous oxide ($CoFe_2O_4$) with the performance of optimization of pH, dose usage and removal time. Scanning electronic microscopy (SEM) and Fourrier Transformation Infrared (FTIR) were deployed to identify nanoparticle and peaks. The results of SEM showed that the nanoparticle is 70 – 95 nm in diameter, and the measurement of FTIR showed typical peaks of magnetic nano at 568 cm^{-1} and 446.44 cm^{-1} as well as typical peaks found at 1640 cm^{-1}, 2920 cm^{-1} and 2857 cm^{-1} found are corresponding to bonds of C-O, C-O-H functionalgroups, which are able to adsorb heavy metals in the water environment. The results also showed that at the pH 6.5 with 70mg of $CoFe_2O_4$ in 40 minutes, arsenic (removal) treatment efficiency is 71.64%. Further, this nanoparticle is highly applicable due to it can be recovered and reused 580 cm^{-1} and 446.44cm^{-1}.

Keywords: *Nano Cobalt Ferrous ($CoFe_2O_4$), Arsenic removal, treatment efficiency.*

MAKING DENATURED BIOCHAR FROM CASSIA FISTULA L. SEED AND ITS APPLICATION ON REMOVING METHYLENE BLUE IN INDUSTRIAL WASTEWATER

Abstract: Textile and dyeing industry play an important role to Vietnam's economy. This industrial process consumes a huge volume of water, and also discharges a large amount of pollutants. Particularly, color agents – a group of non-decomposable contaminants naturally, which are a vital concern in treatment engineering. Several physio-chemical techniques were applied for removing color from wastewater with different advantages and disadvantages. In addition, adsorption technique by using bio-materials, which are environmentally friends, operation with ease, and reuse post-adsorptive materials, is a preferable approach to others. This present study used biochar activated by H_3PO_4 and denatured by HNO_3, which was made from seeds of Cassiatora Linn (Cassia fistula L.), for removing color of Methylene Blue (MB) in textile and dyeing wastewater. Scanning electronic microscopy (SEM) and Fourrier Transformation Infrared (FTIR) techniques were deployed to investigate the surface and structure of biochar. The results showed that biochar activated by H_3PO_4 and denatured by HNO_3 has an adsorption capacity at 20.974 mg/g and 25.013 mg/g, respectively. Performance results of SEM showed denatured biochar has rough surface and hollowness, and FTIR results found functional groups of O-H, C=C, C=O, and C≡C. These spelled that activated biochar has a better color adsorption in comparison with other materials. Further, using adsorbent biochar (denatured by HNO_3) for removing methylene blue at 50 mg/L, the removal efficiency is 99.229% after 60 minutes. This findings showed that biochar made from Cassia fistula L. has potential color adsorption, and is an initial investigation of future wastewater treatment applications for other industrial wastewater types.

ELECTROCATALYTIC REGENERATION OF ORGANIC HYDRIDE AS HYDROGEN CARRIER WITH RH-MODIFIED PT NANOPARTICLE-LOADED CARBON CATALYSTS

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Abstract: Rh-modified Pt/C (Rh/Pt/C) catalysts with different Rh loading amounts were prepared by bubbling hydrogen in Pt/C suspensions containing different concentrations of Rh precursor to evaluate the effect of Rh modification on catalytic activity of Pt/C for electrochemical regeneration of organic hydride, methylcyclohexane (MCH), from toluene (TL). X-ray diffraction patterns and X-ray photoelectron spectra showed that Rh did not form any alloys with Pt. Transmission electron micrographs and energy dispersive X-ray line analysis data exhibited that Rh was deposited only on Pt nanoparticles. Linear sweep voltammograms exhibited that hydrogenation current density at 0 V vs. RHE was improved by Rh loading. Furthermore, it is clarified by gas chromatography/mass spectroscopy that MCH was sole hydrogenation product. In galvanostatic electrolysis, the faradaic efficiency for MCH production and conversion of TL to MCH for the Rh/Pt/C catalysts were higher than those for Pt/C. These results clearly indicate that the Rh/Pt/C catalysts were superior in electrochemical regeneration of MCH to Pt/C.

Keywords: *Electrochemical hydrogenation, Rh-modified Pt/C nanoparticle, organic hydride, Toluene/methylcyclohexane.*

ELECTROCHEMICAL GLYCEROL OXIDATION REACTION WITH RHODIUM ELECTRODE

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Abstract: Direct glycerol fuel cell (DGFC) using glycerol, a by-product of biodiesel fuel production, as fuel is a promising power source because it can generate electricity with low environmental load and high energy efficiency. However, sluggish glycerol oxidation reaction (GOR) kinetics, low selectivity to CO_2 and catalyst poisoning inhibit the practical use of DGFC. We found that Rh was a promising catalyst due to smaller GOR overpotential than Pt, a common catalyst for alcohol oxidation reaction. Nevertheless, GOR current for Rh was much smaller than that for Pt, which is an issue to overcome. In this study, a Rh electrode surface was modified by Ag or Pt (Ag/Rh or Pt/Rh) to improve the GOR activity. The modification of Rh electrode was conducted by potentiostatic method. The deposition of foreign metals was verified by X-ray photoelectron spectroscopy (XPS). The GOR activity of polycrystalline Rh, Ag/Rh and Pt/Rh electrodes was evaluated in alkaline glycerol solution by cyclic voltammetry at temperatures from 25 to 60 ºC. Although the GOR activity of Pt and Pd was significantly enhanced by Ag-modification, the Ag deposition on Rh hardly amplified the GOR current or lowered the overpotential. Otherwise, for the Pt/Rh electrode, the onset potential of GOR current negatively shifted with increasing Pt loading, and the GOR current density became five-time higher than for the Rh electrode. The activation energy for GOR, which was evaluated from the Arrhenius plot at -0.4V (vs. Hg/HgO), diminished with an increase in the Pt loading, which is attributed to the increase of Pt surface area. In addition, oxidations of intermediates generated during GOR on Pt/Rh electrode were also promoted, and their activation energy was lower than those evaluated for the Rh electrode.

Keywords: *Electrocatalyst, Pt-modified Rh, Glycerol oxidation reaction, Activation energy.*

INDUCTION OF HELICAL CHIRALITY OF FOLDAMER POSSESSING TRIETHYLENE GLYCOL CHAINS

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Abstract: Synthesis, formation of helix structure, and induction of helical chirality of a novel foldamer **poly-1** were investigated. The **poly-1** forms random coil and helix structures in less polar and polar solvents, respectively. The helical chirality of helix of **poly-1** is induced by external chiral sources such as L-serine or (–)-α-pinene. Interestingly, the helical chirality induced upon addition of (–)-α-pinene can be switched depending on various conditions, namely, stoichiometry of (–)-α-pinene, solvent polarity, and temperature.

Keywords: *foldamer, helix structure, chiral induction, circular dichroism, solvophobic effect.*

A PRELIMINARY RELEASE OF JAPANESE AQUATIC MACROINVERTEBRATE REFERENCES (J-AMIR) ON INTERNET WEB

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Abstract: Digital data (photographic images and DNA sequences) of aquatic macroinvertebrates inhabiting Japan are preliminarily released on the internet web site (http://www.b.s.osakafu-u.ac.jp/~mkato/J-amir_home.htm) along with the sampling information. Physical collections (specimens) are stored at the laboratory of Riverine Metagenomics Research Group (RMRG lab.) of Osaka Prefecture University, from which genomic DNA was isolated and the specific DNA sequences (partial coding regions of 18S rRNA, histone H3, and mitochondrial cytochrome *c* oxidase subunit I genes) were determined. Everyone interested in the contents of J-amir, can access the physical specimens for inspection, can get full resolution digital images upon request to the RMRG laboratory, and can retrieve DNA information from International DNA Databases (GenBank/DDBJ/ENA). DNA information associated with properly identified specimens in the databases is mandatory for the metabarcoding studies and environmental DNA (eDNA) analyses. Also, high resolution digital images of well characterized specimens are useful for taxonomy education. As of the end of July 2019, our collections include 76 species of Ephemeroptera out of 152 species, 52 species of Trichoptera out of 483 species, 26 species of Odonata out of 211 species, 18 species of Plecoptera out of 202 species that are identified to inhabit Japan, respectively, and a few taxa in the other groups. We are currently working to expand the collections of specimens including planktons and fishes to establish the Japanese aquatic living organism references on the internet web (J-alor).

Keywords: *DNA barcoding, DNA taxonomy, aquatic insects.*

PROTECT THE ENVIRONMENT AND SAVE WATER RESOURCES BY METHODS OF SEDIMENTATION, FILTRATION, CIRCULATION, AND REUSE OF WASTEWATER FOR MOTORBIKES WASH STATIONS

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Abstract: Water and water environments play a special role in human life, on the other hand, society is growing, industrial waste is increasing along with the habit of discharging untreated waste, making lips school and water contaminated. Therefore, saving and protecting water resources is becoming a big problem for the community. The paper presents methods of treatment, sedimentation, filtration and reuse of wastewater, after washing and washing stations, by methods: reverse circulation and reverse osmosis, will help save water resources, types removal: oil, grease, mud, soil and organic pollutants, before being discharged into the environment.

Keywords: *Circulating filtering, wastewater treatment, reuse of water resources.*

FLOC SIZES AND RESUSPENSION RATES FROM FRESH DEPOSITS: INFLUENCES OF SUSPENDED SEDIMENT CONCENTRATION, TURBULENCE AND DEPOSITION TIME

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Abstract: Cohesive mud flocs in coastal waterways can go through repeated cycles of deposition and erosion before being sequestered in a final deposit. Unlike sand and gravel, mud flocs have the potential to change size and density during their time on the bed. For example, it is conceivable that flocs could increse in density or aggregate with other flocs while on the bed. Such changes could influence the rate of resuspension or the size characteristics of resuspended flocs relative to those that do not spend time on the bed. Here we use laboratory experiments to quantify the influence of sediment and water-column properties on resuspension characteristics of mud flocs. Specifically, we examine how concentration at the time of deposition, the length of time for which the deposited material is on the bed, and the turbulence levels in the water column while the flocs are on the bed all impact the nature of the flocs on the bed and their resuspension characteristics. The resuspension characteristics we quantify are: (1) the difference between the floc size population before and after resuspension, (2) the rate of resuspension, and (3) the difference between the concentration at the time of deposition and at full resuspension. The experiments show that flocs grow in size while on the bed, but that resuspended flocs quickly revert to size populations that are in equilibrium with the local water column conditions. This occurs regardless of the time on the bed between deposition and resuspension. The results also show that under low turbulence levels, flocs moving around on the bed increase in size relative to their suspended counterparts, and that such flocs can be more difficult to resuspend. Furthermore, the time that the flocs are on the bed (0.25 to 12 day) has little impact on the resuspension rates unless sediment concentration in the water column at the time of deposition is above a critical value for the onset of a space and load-bearing network. For concentrations above this critical value, freshly deposited mud begins to consolidate and become more resistant to erosion with time.

Keywords: *resuspension, flocculation, erosion rate, consolidation.*

IMPACTS OF LAND SUBSIDENCE AND SEA-LEVEL RISE IN HO CHI MINH CITY, VIETNAM

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Abstract: The HCM City locates at the soft soil and the low elevation of the land, rivers and canals form a complex network that is affected by tide. This paper discusses the relation between land subsidence and sea level-rise that impacts of the flood on low-lying land due to the combined effect of tide and land subsidence. Groundwater exploitation is a major cause of land subsidence has resulted in tides moving into low-lying areas that were previously above high-tide levels. Evaluating the subsidence rates (annual average, 1997 – 2018) by analysis of Permanent Scatterer InSAR (PS InSAR) Technique showed that over 140 km^2 of the area has suffered the land subsidence (0.67% area of HCM city) with the maximum rate of subsidence is 10 - 15 mm/year. In addition, HCM city dominantly consists of plains of which the percentages are 60 % is that ground elevation level is below +1.5m while current max tide level: +1.68 m. The effect of land subsidence and sea level rise caused residents in many wards suffered water-logging of between 0.4 - 0.5m. Each year, climate change could cause sea levels to rise by 3mm and land subsidence makes this situation even worse. These results provide an important step towards flood prevention plan that aims to achieve the sustainable urban development.

Keywords: *groundwater exploitation; land subsidence; sea level rise; flood prevention.*

GLOBAL WARMING POTENTIAL FROM UNMANNED OFFSHORE PLATFORM FACILITY USING LIFE CYCLE ASSESSMENT

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Abstract: Crude oil exploration is high risk activity that require skilful manpower and advance technology. Current exploration in Indonesia not only focus on onshore facility but also offshore facility since oil reservoir is much larger in the ocean subsurface. Global warming potential (GWP) is determined by how much carbon dioxide (CO_2) is generated. Usually, carbon dioxide is monitored manually using sensor in the stack or flare. However this method has no advantage to cover carbon dioxide generation from entire activity in the platform and limited to the substance in the certain place. In this research, we studied global warming potential generated by offshore platform facility using life cycle analysis model. We gather representative variables that used for generating life cycle analysis model and analysed using ReCiPe method on midpoint level. Result show that GWP has also generated from different activity other than flare and stack. In addition, this result also show that GWP based on life cycle analysis may be a good addition for monitoring report since it provide specific environmental impact data based on activity while manual monitoring cover real time emission measurement. GWP result for 100 years prediction is 26, 11 kton CO_2 eq/ton product analysed using ReCiPe 2016 Midpoint (H) V1.02.

Keywords: *global warming potential, offshore platform facility, life cycle analysis.*

STUDY ON THE POTENTIAL FOR RECOVERY OF METHANE FROM BIOWASTE AFTER THERMAL PRETREATMENT

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Abstract: Municipal Solid Waste includes organic and inorganic substances, in which organic part is a potential energy source that can be recovered and profitable if appropriate treatment technology is applied. This study evaluates the effectiveness of anaerobic digestion of the organic fraction of municipal solid waste, especially the ability to recover energy from municipal solid waste. The research investigated the methane gas recovery efficiency after biowaste was heat pretreated at different organic loads corresponding to 10g VS/g sludge, 15gVS/g sludge, 20g VS/g sludge. Biowaste was taken from the markets in Ho Chi Minh city. The activated sludge used for the anaerobic decomposition was taken from the UASB tank of a brewery wastewater treatment plant.

The experimental results show that the amount of methane gas collected from biowaste with thermal pretreatment was 60-80% higher than the untreated waste. More than 85% of methane production from biowaste was recovered within the first 6 days, indicating that the waste after being thermal hydrolyzed are easily decomposed. The production volume of methane gas collected from the biowaste decomposition ranged from 315 to 350 L CH_4/kg VS, with an average of 320 L CH_4/kgVS. At organic loads of 10gVS/g sludge, 15gVS/g sludge, and 20g VS/g sludge, the decomposition rate were K = 0.18, 0.26, and 0.38 respectively

Keywords: *Anaerobic Digestion, Municipal Solid Waste, Recovery of methane.*

STRUCTURE AND TOUGHNESS IMPROVEMENT OF POLY (LACTIC ACID) BLENDS

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Abstract: Biodegradable polymers have attracted a great deal of attention in decades owing to the environmental concern and sustainability issue. Among them, poly(lactic acid) (PLA) is the most used biodegradable polymer which is derived from renewable resources and considered as non-toxic for humans and the environment. However, it is well known that PLA is a brittle plastic with low resistance to fracture. We therefore tried to increase flexibility and toughness of PLA by melt-blending with other materials, including octadecenylsuccinic anhydride as a low-molecular-weight plasticizer, poly(hydroxybutyrate) as another biodegradable polymer, and a modified montmorillonite as an inorganic filler. Structures, thermal properties and mechanical properties of all these blends were investigated. Their mechanical properties revealed that the toughness could be improved to some extent by blending with these materials; and among them, the PLA/clay nanocomposite at 1 phr clay exhibited significant stress-whiting and necking behavior with a large extension, elongation at break being increased to 208%, up to 37-fold increment compared to the neat PLA.

Keywords: *biodegradable polymers, poly(lactic acid), polymer blends, toughness.*

IMIDACLOPRID DECOMPOSITION IN WASTEWATER BY ELECTRO FENTON PROCESS WITH FE_3O_4/MN_3O_4 AS CATALYST

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Abstract: Imidacloprid is the main content in many popular pesticides in Vietnam. These products were imported and manufactured to supply for agriculture needs. Wastewater generated from these factories contains high amount of Imidacloprid, which is difficult to remove traditional methods. In this study, Electro Fenton process is used to decompose Imidacloprid in wastewater. Fe_3O_4/Mn_3O_4 is used as a catalyst for its good characteristics: strong catalytic potential, easily separated and reused by magnet. A synthetic wastewater source with 237 mg/l Imidacloprid was synthesized. pH, catalyst dosage, current density was investigated to find suitable treatment conditions. The results showed that, at pH of 7.3, current density of 20.8 mA/cm^2, and catalyst dosage of 0.45 g/l, the removal of TOC was 98.3%, corresponded to a TOC content of 0.48 mg/l. In addition, Imidacloprid was not detected in the effluent. Besides, the mechanism of Imidacloprid decomposition by Electro Fenton process with Fe_3O_4/Mn_3O_4 catalyst is also recommended.

Keywords: *Imidacloprid, Electro Fenton process, Fe_3O_4/Mn_3O_4*

ELECTROCHEMICAL OXIDATION OF LANDFILL LEACHATE USING BORON DOPED DIAMOND, Ti/IrO_2, AND Ti/Pt ANODES PRETREATED BY MOVING BED BIOFILM REACTOR

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Abstract: Application of emerging technologies and integration of different treatment processes to degrade recalcitrant organic and inorganic compounds contained in stabilized landfill leachate is of concern recently in waste management. Thus, efficient treatment methods are required to meet the effluent standard. Electrochemical oxidation is one of the emerging technologies developed for the treatment of landfill leachate. Boron-doped diamond (BDD) has been reported as the most promising anode due to its effectiveness in removing chemical oxygen demand and nitrogen in leachate. However, other anodes which are less expensive such as Ti/ IrO_2 and Ti/Pt can be seen as alternatives, particularly for the treatment of pre-treated leachate. It is expected that the remaining non-biodegradable organics, salinity and nitrogen constituents can be electrochemically treated effectively. Therefore, this study aims to investigate the performance of Ti/ IrO_2 and Ti/Pt anodes in comparison with BDD for the treatment of landfill leachate previously treated by Moving Bed Biofilm Reactor. This study was conducted using a laboratory scale of the undivided electrochemical reactor. In all experiments, stainless steel was used as the cathode with the same surface area of 6 cm^2. Three applied constant current densities were evaluated to determine the treatment efficiency. The results showed that the optimum current density achieved on the Ti/Pt anode was 66.7 mA/cm^2 to eliminate 78% COD. This equals to 56.7 Wh g-1 of energy consumption. In the case of Ti/IrO_2 and BDD anodes, the optimum current density was achieved at 58.3 mA cm^{-2} with the 76% and 85% of COD was removed, consuming the amount of energy about 58.9 Wh g-1 and 36.9 Wh g-1 respectively. Although BDD was confirmed as the best anodes with the lowest energy investment, the other anodes are still applicable for the post-treatment of landfill leachate.

Keywords: *Boron-Doped Diamond, Current Density, Electrochemical Oxidation of Pretreated Leachate Ti/IrO_2, Ti/P.*

LITERATURE RESEARCH OF INVERSE VULCANIZED POLYMERS AND THEIR DYE AND MERCURY CAPTURING APPLICATIONS

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Abstract: Polymers are almost the most important mass-produced materials in chemical industry. Alternative raw materials are required to ensure sustainable production of polymers and functional materials. After the discovery of inverse vulcanization, sulfur was used as the main component of the polymers and the elemental sulfur is produced in large quantities as a by-product of the petrochemical industry. However, sulfur cannot used to produce functional materials because decomposes back to its monomer since polymeric sulfur is unstable. To overcome this issue, inverse vulcanization technique has been used to produce stable polymeric materials containing high sulfur content. These polymers are used in some environmental processes by the advantages of sulfur’s high mercury and dye capturing property. The applications of these materials will be discussed by doing some literature research touching upon environmental benefits. The articles that are published between 2016 and 2019 in Royal Society of Chemistry about this subject are investigated.

Keywords: *Green Chemistry, Inverse vulcanized polymers, Environmental chemistry.*

DENSITY FUNCTIONAL THEORY STUDY OF OXYGEN REDUCTION REACTION ON THE DEFECT TRANSITION METAL DICHALCOGENIDE WTE2

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Abstract: Proton-exchange membrane fuel cells are potential technologies that can replace fossil fuel combustion engines, but their performance needs to be improved due to the slow rate of oxygen reduction reaction on the cathode. In this work, we investigate the reaction intermediates, the mechanism, and the reaction rate of the oxygen reduction reaction on the monolayer of transition metal dichalcogenide WTe2 with Te vacancy (denoted as WTe2d) as the cathode catalyst of the fuel cells. By using the density functional theory calculations, we study the reaction intermediates on the surface of WTe2d. We then propose the reaction mechanisms. Finally, the Gibbs free energy calculations are used to clarify the thermodynamic properties of the reaction. There is no research available for oxygen reduction reaction on WTe2d; therefore, the obtained results in this work should be new.

Keywords: *DFT, WTe2, TMDC, ORR.*

CHITOSAN HOLLOW HYDROGELS AS A NEW GASTRORETENTIVE SYSTEM FOR CONTROLLED RELEASE OF DRUGS

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Abstract: The aim of the present study was to develop a new gastroretentive delivery vesicle for drugs in form of hollow hydrogels fabricated from chitosan. The hydrogels were simply prepared by ionotropic gelation of chitosan and sodium tripolyphosphate without any toxic crosslinking reagent. It was observed that the hydrogels exhibited a very clear hollow with distinguished core-shell structure. Their size range was 2.09 to 2.52 mm. The performance of these hollow microspheres in drug delivery was studied using ampicillin and cefaclor as model drugs. The loading efficiency was calculated to be 76.35 % and 75.23 %, respectively for ampicillin and cefaclor. The sodium tripolyphosphate cross-linked chitosan hollow microspheres showed high acid resistance for up to 24 hours in simulated gastric fluid. The drug release in simulated gastric fluid exhibited a linear profile. The antimicrobial activity of the released ampicillin was confirmed by Escherichia coli bioassay. These findings strongly suggested that chitosan hollow hydrogels could be considered a potential candidate for sustained drug release.

Keywords: *Chitosan, hollow hydrogels, drug release, ionic gelation.*

ROLE OF THE GTP-BINDING PROTEIN RAC1 IN INSULIN-STIMULATED GLUCOSE UPTAKE IN ADIPOCYTES

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Abstract: Insulin stimulates glucose uptake in skeletal muscle and adipose tissue, thereby regulating the blood glucose level. Insulin-dependent glucose uptake in these tissues occurs via the translocation of the glucose transporter GLUT4 from intracellular storage vesicles to the plasma membrane. A signaling pathway consisting of phosphoinositide 3-kinase (PI3K) and the protein kinase Akt2 has been shown to play an important role in this insulin signaling.

We have recently demonstrated that the Rho family small GTPase Rac1 is another key regulator that acts downstream of Akt2 in skeletal muscle insulin signaling. Although the uptake of glucose is also stimulated by insulin in adipose tissue, the role for Rac1 in adipocyte insulin signaling remains controversial. In this study, we aimed to clarify the role for Rac1 in insulin-stimulated glucose uptake in adipocytes. First, we examined activation states of Rac1 in mouse white adipocytes by an immunofluorescent microscopy-based assay, demonstrating that Rac1 was indeed activated following intraperitoneal injection of insulin. Furthermore, ectopic expression of constitutively activated PI3K and Akt2 induced Rac1 activation. Second, we tested whether GLUT4 translocation and glucose uptake in mouse white adipocytes are impaired by rac1 gene knockout. Intraperitoneal insulin injection stimulated GLUT4 translocation as determined by a reporter assay in control, but not rac1-knockout, mouse white adipocytes. On the other hand, ectopic expression of constitutively activated PI3K and Akt2 as well as intraperitoneal insulin injection enhanced 2-deoxy-D-glucose uptake in control white adipocytes. In contrast, all of these enhanced 2-deoxy-D-glucose uptakes were diminished in rac1-knockout white adipocytes. Collectively, these results provide evidence that Rac1 plays an important role in insulin-stimulated glucose uptake not only in skeletal muscle, but also in white adipocytes.

Keywords: *Adipocytes, Insulin signalin, Rac1, Glucose uptake, Insulin.*

CHANGES IN NITROGEN COMPOSITION OF SURFACE WATER TREATED WITH A PILOT-SCALED BIOFILTRATION COUPLED WITH OZONATION

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Abstract: Increasing in urbanization and agricultural activities has resulted in the deterioration of Sai Gon river water, one of the crucial water supply sources for Ho Chi Minh City. The presence of elevated concentrations of nitrogen-containing species, together with other contaminants, has induced a requirement for pretreating the raw water before entering conventional treatment processes. At Tan Hiep water treatment plan, the raw water is pretreated through chlorination. This process is not only costly but also creates favorable conditions for the formation of harmful disinfectant by-products (DBPs). Therefore, the combination of biological and chemical processes could be a promising method for Sai Gon treating Sai Gon river water. In this study, the raw Sai Gon river water was treated in a pilot-scale system comprising of biofiltration and ozonation, and the change in nitrogen-containing species in this system was investigated. At an input flow of 1 m^3/h, experimental results showed that the biofiltration could oxidize ~ 0.5 g NH_4+-N/m^2/d to nitrite and nitrate. Also, the assimilation of nitrogen by microorganisms and denitrification resulted in the removal of more than 15% of total nitrogen. The returning of ozonated water to the biofiltration has no observable effects on the transformation of nitrogen species in the studied systems.

Keywords: *water treatment, biofiltration, ozonation, nitrogen, ammonia.*

POST-ANTIBODY DRUGS: GENERATION OF A NOVEL CLASS OF DRUG MODALITIES BASED ON MOLECULAR-TARGETING HELIX-LOOP-HELIX (HLH) PEPTIDES

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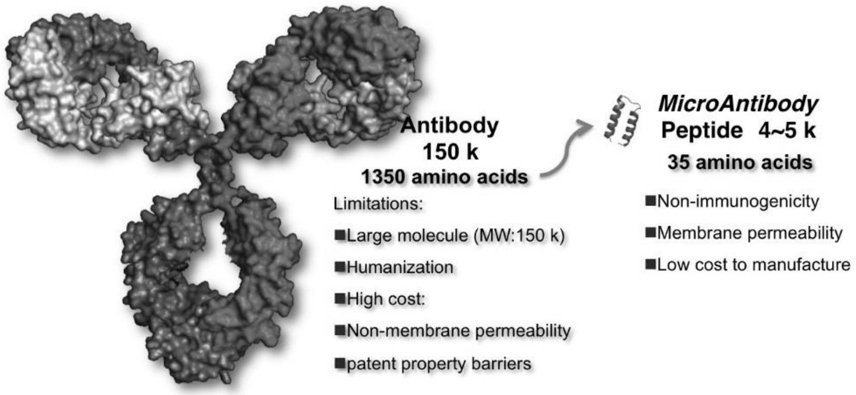
Abstract: Antibodies are indisputably the most successful reagents in molecular-targeting therapy. However, use of antibodies has been limited due to the biophysical properties and the cost to manufacture. To enable new applications where antibodies show some limitations, we have developed an alternative-binding molecule with non-immunoglobulin domain. The molecule is a helix-loop-helix (HLH) peptide, which is stable against enzyme degradations in *vivo* and is too small to show immunogenicity. Here, we introduce our HLH molecular-targeting peptides, termed "*microAntibodes*", that show antibody-like functions, high affinity and high specificity for the targeted proteins.

Since the HLH peptide folds by virtue of hydrophobic and electrostatic interactions between the amino acid residues positioned inside the molecule, the outside solvent-exposed residues are possible to be mutated with a variety of amino acids to give a combinatorial library of the HLH peptides (Fig. 1). Based on our technology of phage-displayed libraries for catalytic antibodies, we constructed a phage-displayed library of the HLH peptides. The library was screened against G-CSF receptor to give a binding peptide, which was cyclized by a thioether linkage between the N- and C-termini. The cyclic peptide showed a strong binding affinity (K_d of 4 nM) to the receptor and a long half-life (>2 weeks) in mouse sera, proving an enzyme-resistant property. Immunization of the HLH peptide to mice showed no induction of the antibody production (non-immunogenic).



We have applied our HLH peptide libraries for VEGF, IgG/Fc, interleukins (IL-5, IL-6), and kinases (Aurora A) to obtain their molecular-targeting peptides *"microAntibodies"*. In addition, we used the HLH peptide as a scaffold for generating cell permeable molecular-targeting peptides through bi-functional grafting: epitope grafting to provide binding activity and arginine grafting to endow cell-permeability. In this symposium, recent advances of our studies on molecular-targeting HLH peptides will be introduced and discussed in detail

Keywords: *in vitro evolution, helix-loop-helix peptides, phage-displayed libraries.*

KHOA QUẢN LÝ
CÔNG NGHIỆP

SCHOOL OF INDUSTRIAL
MANAGEMENT

PHÂN BAN: BỆNH VIỆN THÔNG MINH

SESSION: SMART HOSPITAL

DIGITAL REFORMATION

SMART HOSPITAL DIGITAL REFORMATION TOUCHING POINTS

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Abstract: In reality, the hospital is dated operation and mostly out-of-date to adopt or use technology compared to other business. Between 2000 and 2007, the "Digital Hospital" is crushing the market to overall implementation of EHR's and other technology-based health services. Now, new buzz word, the "Smart Hospital" (2007 to present) is targeting the "Triple Aim" concept to help the healthcare delivery system. The triple aims are to (1) balance clinical outcome excellence, (2) operational/ supply chain efficiency and (3) strong patient/provider experiences using technology.

It's a cutting edge opportunity to digitalize hospital and be a technology driven service to the patient and caregivers. But one problem! Reformation touching point is missing; nobody is considering how to overcome those challenges! All vendors including AI [Artificial Intelligence], LoT, device, drug companies are much 'Smarter' than hospital's people. That's why they can invent SMART technology and they know how to do business, how to do marketing, how to do co-creation, even crowdsourcing. They are smart, expert, and highly knowledgeable of SMART business and well aware of future situations.

Besides, hospital people are not well trained with digital transformation. So, there is always a gap of understanding on digital transformation in relation to objectives, practice and achievement of SMART technology. Actually, these gaps are major barrier and resistance to technology adaptation for being a smart hospital. Now, it's time for to understand the touch points of those gaps and turn hospital people into digital! Only, then the real 'Smart hospital' evolve in the market! Otherwise, it will be spotting dotted success without full picture of connection!

In last 'digital hospital' period [2000-2007], most hospitals suffer a lot with EHR [Electronic Health Record] which is around million dollar project and hospital adjust the fund with a hope to be a paperless. But what's in reality? Still using paper and scan it into the EHR system where data captivation is an issue. So, 100% paperless project fails! Most problems are adaptation issues; the vendors kept 'source code' and if hospital requests to change anything, each time dollar counts. The power control of EHR is in vendor's hand. So end of the day, the EHR is a mess and still the hospital is using hybrid MR system. The EHR project didn't accomplish the objectives!

Henceforth, reformation is necessary especially to upskilled or reskilled the hospital professional to implement SMART hospital! The reformation needs to start with medical and nursing school. The school should start with paperless education system and Vietnam is driving for that goals. Fortunately, Ministry of Health of Vietnam is initiated 23 programs to digitalize medical education system including nursing and midwives. This is one goal to be a SMART hospital strategic revolution in Vietnam.

SMART hospital integration starts from digital foundation of the hospital. The hospital can't be start unless it is digital. So, the first condition to be SMART hospital is to practice 100% paperless EHR system. And this is a big challenge for most hospitals. Now, there are more than 1120 EHR vendors [According to WB report on 2017] those are working to make cost effective EHR system to support hospital for digitalization. Choice one or upgrade system for your hospital to be a SMART one.

Next issue is to target patient right and education practice of which SMART hospital system can takeover 50% of the hospital services. This is a cost effective where patient can use self KIOS or Mobile applications to use the appointment system. Think like UBER or GRAB, the company doesn't have the website but they are running multimillion dollar business with Apps. Most importantly, the website is going to absolute within

next 1-2 years. Unfortunately, still few hospitals are investing in upgrading website or call centre. Is it NOT waste of money? Think about it!

The patient's right in SMART hospital includes that they can handle their appointment system thru apps, complaints, satisfaction, sharing lab and imaging data, care plan, diagnosis, prescription, all education materials, and discharge summary including home care instruction. The app gives reminder of the patient for medication management, instruction needs to do after operation, give reminder of their follow up appointment. This will reduce re-admission rate of the hospital. And most importantly, 100 start-ups company [Adams start-ups report of 2018] are already in the market with those apps. You need to make a choice which one is fit for your hospital. This reduces the workload of nurses and doctors. You can check one good App like 'Catex Healthcare App' that is redefining healthcare practice in India with low cost setting.

Wearable devices and dashboard of early sign of patient is one of the good tools from Philips and so many other start-ups. Choice one for your hospital, the nurses and doctors are getting warning sign thru their mobile. 60% patient life can save thru this warning sign tool [WHO report on 2016].

So the strategic road map for hospital to be a SMART hospital is to make a brainstorming session among the leaders including nursing, doctor, HR, operation, finance and CEO to choice which option is suitable for your hospital. Don't jump on big investment like Watson AI project, better think about small projects, small dash board and integrate with your EHR system. If your EHR doesn't support tablet or SMART mobile, then you need to upgrade your EHR. Otherwise, you can never dream of SMART hospital. Then think about one patient App suitable for your hospital and connect with your EHR system. So when doctors give data input [Doesn't mean to write in paper and scan] in discharge summary, the summary needs to integrate with patient app so that patient knows their homecare instruction, follow up education and warning sign when patient needs to come emergency. It doesn't mean that robotic surgery is the way to be a SMART hospital, robotic application is one of the 100 preconditions for SMART hospital.

Most importantly you need to think within your management or Board on how you want to see your hospital within next 4-5 years either SMART or stay status co. The risk of Status-co is that, your hospital may close down or some technology company like UBAR/GRAB/Microsoft will take over your operation in ear future. However, before jump on investing SMART technology, train and educate your clinical staff on how to use the SMART technology. Precondition of a SMART hospital, country needs a SMART medical or nursing school where student can have exposure of SMART technology!

TO MAKE SMART HOSPITALS AND CREATE SMART HEALTH SERVICES

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Asian Health Literacy Association & International Health Literacy Association

Abstract: Healthcare services are essential jobs of modern societies and governments. In the 2016-2020 ASEAN health clusters, there were interests in PROMOTING HEALTHY LIFESTYLE, which was comparable with the SDG Goal #3 to Ensure healthy lives and promote well-being for all at all ages. The goals have helped set a priority agenda for many countries in their health programs. On the other hands the World Health Organization in its Sold Facts for health literacy addressed the case for policy action to strengthen health literacy, mentioning evidence, including the results of the European Health Literacy Survey, supported a wider and relational whole-of-society approach to health literacy that considered both an individual's level of health literacy and the complexities of the contexts within which people act. The Institute of Medicine further addressed in the "Ten Attributes of Health Literate Health Care Organizations" that the health care organizations made it easier for people to navigate, understand, and use information and services to take care of their health. Moreover, the health literate health care organizations benefited not only those who had limited health literacy, but also the majority of Americans (citizens) who had difficulty understanding and using currently available health information and health services (ODPHP, 2008). It is apparent time that healthcare services take actions to address health literate organizations that help patients and staffs with better skills and platforms, to provide smart health services for the citizens and patients, families and societies. The presentation will address the new approaches by the enhancement of health literate individuals and to facilitate development of smart hospitals and the create smart health services in the smart cities and health systems.

OPTIMIZE RADIOLOGICAL PROTECTION IN THE SMART HOSPITAL

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Abstract: Over the last decade, Radiological application on medicine including diagnosis, IVR, radiation therapy, and nuclear medicine devoted improvement of healthcare, it also increased radiation exposure of human life. With regard to medical exposure of patients, it is not appropriate to apply dose limits or dose constraints, because such limits would often do more harm than good. Often there are concurrent chronic, severe or even life-threatening medical condition that are more critical than the radiation exposure.

Consideration of optimize radiological protection in hospital, equipment features that facilitate patient dose management are likely to be most effective approaches, and harmless radiation shielding materials adopted to build the imaging room is good solution for radiation protection to workers and general public.

The International Commission on Radiological Protection (ICRP) publication 103 :2007, the Radiological Protection in Medicine , is the most applicable guidance and recommendation for radiologist, radiological physician, medical physicist, and hospital management department.

CHUYỂN ĐỔI KỸ THUẬT SỐ TẠI BỆNH VIỆN NGUYỄN TRI PHƯƠNG: CƠ HỘI VÀ THÁCH THỨC

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Tóm Tắt: Chuyển đổi kỹ thuật số là sử dụng các công nghệ dữ liệu để cải thiện hiệu quả sử dụng tài nguyên, tạo ra các giá trị mới để cải thiện khả năng cạnh tranh. Trong chăm sóc sức khỏe, các công nghệ mới như điện toán đám mây, khoa học dữ liệu và điện thoại thông minh đã thực sự phá vỡ mô hình dịch vụ y tế truyền thống. Trong khi xem xét chuyển đổi kỹ thuật số trong bệnh viện, lãnh đạo phải đối mặt với nhiều vấn đề, bao gồm:

- Chiến lược và tầm nhìn
- Thiết kế cơ sở
- Thiết kế quy trình làm việc bao gồm cả y khoa và hành chính
- Đánh giá công nghệ, lựa chọn công nghệ
- Quản lý chương trình / dự án
- Nguồn đầu tư tài chính và quản lý tài chính dự án
- Lựa chọn và triển khai ứng dụng / công nghệ
- Quản lý hai hệ thống đồng thời giấy và số
- Tích hợp hệ thống các ứng dụng số

Chuyển đổi số không chỉ đơn giản là việc chuyển các dạng và quy trình tương tự thành các phiên bản điện tử giống nhau. Các tổ chức chăm sóc sức khỏe muốn đạt được lợi thế phải bắt đầu ngay bây giờ và phải làm đúng ngay từ đầu. Ưu tiên phải tập trung vào cơ sở vật chất, công nghệ và phải hỗ trợ quá trình chăm sóc, điều trị người bệnh.

PHÂN BAN: QUẢN LÝ CÔNG NGHIỆP

SESSION: INDUSTRIAL MANAGEMENT

KAIZEN IN QUALITY IMPROVEMENT AT SPBV FACTORY

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Abstract: Kaizen is an effective tool to improve productivity, efficiency, quality and business in general. The objective of this paper is to present an application of Kaizen to reduce cap defects at SPVB factory. The 10-step Kaizen method of SBF Group has been applied for an improvement project. Based on 10-step-Kaizen implementation, the improvement project has reduced the cap defect rate of Oolong Tea+ from 0.14% to 0.03%. The paper then shows issues that need further improvement for SPVB.

Key words: *Continuous improvement, quality, Kaizen, defect rate.*

APPLYING KANO MODEL TO CLASSIFY THE CHARACTERISTIC OF SERVICE QUALITY AT OUTPATIENT DEPARTMENT TRUNG VUONG HOSPITAL

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Abstract: The quality of hospital in Viet Nam is one of the issues which not only have been taken care of by patient but also over the society. However, the great number of hospitals do not consider factors which influent the satisfaction or not of the patient. The essay aims to determine and classify the characteristic of service quality as well as factors which impact significantly on satisfaction or dissatisfaction of external patients at Trung Vuong hospital. The research framework is inherited and developed from the research of Harijith R G, Dr. Haris Naduthodi (2017). The qualitative survey results have selected 33 quality characteristics that affect the satisfaction of patients. In term of the quality factor, "Short waiting time" is the index has the highest Satisfaction (0.76) and "the competency of Doctor which resolve patients' health problems" is the index has "the lowest satisfaction Level "(-0.91). Based on the research results, the recommendations are proposed to improve service quality, to meet the current and potential needs of patients.

Keywords: *Quality of Vietnam hospital, Kano model, improvement of service quality.*

LEANNESS ASSESSMENT: A STUDY ON JVN COMPANY

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Abstract: This study focuses on reviewing, analyzing, comparing lean assessment methods/tools from previous researches, and selecting an appropriate method/tool, and then applying the selected one to evaluate the leanness level in the specific company. Literature review and case study research at JVN-Company are conducted in this study. The result finds that: *(a)* LAT developed by Pakdil & Leonard (2014) is the effective tool to measure efforts in implementing Lean and identify wastes from Lean perspective within an enterprise; and *(b)* JVN has achieved the leanness level at 68.58%; while Customer dimension has the highest LAT score showing that JVN has high customer satisfaction and loyalty. However, Delivery dimension, particularly late delivery, is in special need of improvement in comparison with other dimensions. Accordingly, a few proposals have been recommended for JVN to consider and adopt the appropriate ones to improve its performance. Overall, the results of this study provide helpful references for manufacturing companies in Vietnam to self–assess their leanness comprehensively, thereby developing the proper and effective roadmap for Lean transformation.

Keywords: *Manufacturing companies, Lean assessment methods/tools, Leanness level, Lean manufacturing, Vietnam.*

AN INTEGRATED APPROACH OF KANO'S MODEL AND IMPORTANCE PERFORMANCE ANALYSIS FOR IMPROVING QUALITY OF INTERNET SERVICE – A STUDY OF FPT TELECOM

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Abstract: Due to enormous benefits to social and economic development which Internet brings to us, the Internet usage growth rate has been increasing significantly. Therefore, it is essential for Internet Service Provider (ISP) to categorize and identify the importance of each attribute of the service as well as how much they now satisfy their customers in order to develop effective quality improvement activities. Through surveying 107 current customers of FPT Telecom, this study integrated Kano's Model and Importance-Performance Analysis to figure out the prioritized attributes which FPT need to be advanced to get the customer satisfactions. The findings show that there are 1 attractive quality attribute, 1 must-be quality attribute and 14 one-dimensional quality attributes among 26 investigated attributes of Internet service. In addition, 9 quality attributes of FPT Internet service need to be advanced are proposed based on Kano-IPA result.

Keywords: *IPA, Kano's Model, Internet service quality.*

APPLYING IT IN WORK IMPROVEMENT AT COLD ROLLING MILL OF TNAS STEEL MANUFACTURING COMPANY

Bui Duc Tri

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Abstract: In this booming development of Information and Technology (IT), terminologies that are becoming more and more common such as “Artificial Intelligence”, “Cloud Computing”, “Big Data”, “e-Commerce”, “Robotics”, “the 4th Industrial Revolution”, etc. Parallelly, demand for applying technologies to standardize and improve employees’ work manipulation or operational competence has been more significant. The consideration of applying IT in operation management is essential to analyze and evaluate possibility of computerizing manual works by computer algorithms, stimulation and actualization by robotics. On the other hand, it is to contemplate if the role of employees in this pre-4.0 era is still important. To answer those questions and justify employee’s vital role in this time, it is necessary to study methods and measure performance time of professional manipulations and how to apply advanced technology into analysis and design of work. This paper presents the importance of technological application in work analysis and design for enterprises, for employees, for environment and society. Moreover, through practices at weighing station for finished rolls and finished cold rolling warehouse of TNAS Steel Manufacturing Company, we expect to justify the benefits of Work Design through application of technology to some extent.

Keywords: *Applying IT in work improvement/ work design; MES; ERP in Steel Manufacturer.*

PUBLIC TRUST IN THE HEALTHCARE PROVIDER IN HO CHI MINH CITY

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Abstract: Nowadays, public trust in medical service providers is increasingly being paid attention. There are many studies on patient satisfaction, in which the trust is one of the most influential factors on satisfaction. In addition, trust also affects the number of customers of health service, long-term relationship with to medical service providers, treatment compliance and results of treatment for patients. However, there are not many studies in Vietnam about public trust in healthcare services. The objectives of the study are to determine the impact factors and how much these factors influence on people's trust in health service providers in Ho Chi Minh City. Moreover, assess and compare, determine the role of each factor affecting on the trust. The research framework is inherited and developed from research by Peter and Youssef (2016). The results of this research show that there are 4 factors influencing on public trust in healthcare services, including: Quality of care, Patient – centered focus of providers, Communication and information provision, Effect of policies within the healthcare system; in which Quality of care has the strongest impact on the trust. Based on the research results, there are some proposals to increase public trust of healthcare service providers.

Keywords: *Trust, healthcare provider, trust and quality of care.*

PHÂN BAN: QUẢN TRỊ KINH DOANH

SESSION: BUSINESS ADMINISTRATION

BOARD INDEPENDENCE AND EARNINGS MANAGEMENT

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Abstract: Board independence is reflected in many aspects, the most common of which is the existence of independent non-executive directors and the separation of Chairman and CEO roles. This study examines whether a highly independent board deters earnings management by its managers. Discretionary accruals are used to measure earnings management while current operating cash flow divided by lagged assets of current and future are used to measure manager's incentives. With a sample of 1230 observations from 244 HOSE companies that belong to VNX Allshare index in the period 2012-2017, this study provides significant evidence for corporate governance issues of Vietnamese listed companies. Specifically, the experimental results show that when current period performance is poor and expected future period performance is good, and if one person holds both Chairman and CEO roles, he will carry out the transfer of a part of the future profits to the present to improve current year's performance to satisfy personal interests. Unfortunately, all variables related to independent directors are not statistically significant, confirming the fuzzy role of independent directors in monitoring and preventing earnings management in particular and agency problems in general. This study contributes implications for the effectiveness and substance of the independent role of the board of directors in Vietnamese enterprises.

Keywords: *Corporate governance, Earnings management, Board independence.*

OWNERSHIP STRUCTURE AND RISK OF COMMERCIAL BANKS IN VIETNAM

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Abstract: This study examines the impact of ownership structure, classified into four types of ownership (i.e., concentrated, institutional, foreign, and government), on bank risk measured by Z-score (an inverse measure of risk). The empirical framework is based on GLS estimation technique (controlling for heteroskedasticity and autocorrelation problems) to analyze an unbalanced panel data set including 21 Joint Stock Commercial Banks in Vietnam from 2010 to 2018. We then further investigate the moderate effects of market discipline (Listed variable as a proxy) on the relationship between ownership structure and bank risk. The results suggest that a negative association between 3 proxies of ownership structure (ownership concentration, institutional ownership, and government ownership) and bank risk, and that foreign ownership do not have any significant relationship on risk measure in the direct relationship model. However, the results for the model where interaction variables are included show that foreign shareholders help improve bank stability and reduce risk in listed banks. In addition, the relationship between institutional ownership and bank risk is reinforced for listed banks, while the relationships between the other two (concentration and government) and bank risk are not influenced by listed status.

Keywords: *Ownership structure, Bank risk, Commercial banks, Z-score.*

SOME ANTECEDENTS AND OUTCOMES OF INFORMAL LEARNING BEHAVIOR IN VIRTUAL TEAMS

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Abstract: Virtual teams are commonly used in businesses to meet employee's need of teleworking. Meanwhile, informal learning is a social phenomenon that influences team outcomes. Understanding informal learning behavior with its important antecedents and outcomes is necessary, especially in the context of teleworking via electronic communication media as virtual team. This paper proposes and examines a structured model that describes the relationships among employee-coworker relationship quality, psychological empowerment, informal learning behaviors, job performance and job satisfaction of virtual team members. The results are: (1) job performance positively affects job satisfaction, (2) informal learning behavior positively affects job performance, (3) psychological empowerment positively affects informal learning behavior, (4) employee-coworker relationship quality positively affects psychological empowerment. The employee-coworker relationship quality, psychological empowerment and informal learning behaviors explained 30.3% of the variance of job performance, that shows the role of informal learning behavior and its antecedents on the work outcomes of virtual team members.

Keywords: *Employee–coworker relationship quality, informal learning, psychological empowerment, virtual team*

MAPPING THE REASONS FOR RESISTANCE TO USING PUBLIC TRANSPORTATION IN HO CHI MINH CITY

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Abstract: Travelling by bus brings passengers many benefits. However, the number of passengers using bus as a means to travel is increasing as more slowly as the number of population growth and that of individual transportation. This fact makes a serious pressure on urban traffic in Hochiminh city (HCMC). This study aims to explore attributes of the bus system in HCMC driving to a various of values, which prevents passengers from travelling by bus. The study employs Means-end chain theory, and soft-laddering interview to collect data. Data collected from 36 interviewees, including 25 passengers and 11 experts, is analysed by Association Pattern Technique (APT) and presented in a Hierarchical Value Map (HVM). The research findings show that there are 18 attributes preventing passengers from travelling by bus. These attributes leads to a negative impact on some key values, such as Safety, Time control, Health problem, Convenience, and Respectfulness. From these findings, some suggestions are proposed to improve the frequency of bus using in HCMC.

Keywords: *Public transportation, bus, Mean-ends chain theory, laddering interview.*

THE RELATIONSHIPS OF TECHNOLOGY READINESS, PERCEIVED VALUE, SATISFACTION, AND CONTINUANCE INTENTION – A STUDY OF SELF-SERVICE TECHNOLOGIES IN VIETNAM

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Abstract: Technologies have changed the way of doing business remarkably. Marketplace is being replaced by marketspace where almost all products/services are embodied in digital forms and delivered through information-based channels. As a result, the present work aims at investigating the relationships among technology readiness (TR), perceived value, customer satisfaction, and continuance intention (CI) in using self-service technologies (SSTs), a form of marketspace. Data of surveying 179 users of SSTs (including internet banking, airline ticket online booking, tour online booking) in HCMC, Vietnam were analyzed using PLS-SEM. The results show that all of the six hypotheses were empirically supported. The findings indicate that the TR has strong positive influence on perceived value, customer satisfaction, and continuance intention. Perceived value also shows positive impact on satisfaction, and both have significantly positive effects on continuance intention. Theoretical contributions and managerial implications are discussed.

Keywords: *technology readiness, continuance intention, satisfaction, perceived value, self-service technologies.*

EXPLORING THE EFFECTS OF CUSTOMER'S PERSONAL VALUES ON MOTIVATION AND CO-CREATION BEHAVIOR – A STUDY OF EDUCATION SERVICE

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Abstract: Marketing theories recently emphasize the role of customers in value co-creation process to create value for themselves. To perform any behavior, from self-determination theory, intrinsic motivation is the key driver. The question is why there is the difference between customer's intrinsic motivation when they participate in the value co-creation process? This study is aimed to propose the model about the effects of three types of personal values, including self-direction: thought, achievement, and tradition on customer's intrinsic motivation. The analysis is based on the context of higher education in Vietnam. The results indicate that all three types of personal values have a positive impact on customer's intrinsic motivation. In addition, customer's intrinsic motivation has significantly affected to their value co-creation behaviors.

Keywords: *Intrinsic motivation, Personal values, Value co-creation. Customer participation.*

FACTORS INFLUENCING THE INTENTION TO USE E-LEARNING IN VIETNAM

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Abstract: The study aims to test and measure the impact of factors affecting the intention to use an online English Learning in Vietnam. Among the behavioral theory of conceptual research concepts of the TAM (Technology Acceptance Model), the intention to use an online English learning is considered a predictor of customer behavior. Therefore, this study aims to explore a number of factors that influence the intention to use an online English learning. Through the expansion of the TAM (Technology Acceptance Model), the exploratory factors include: Online course design, User interface design, Previous online learning experience, Perceived Interaction. The research results show that the External variables of the TAM are online course design, user interface design, Previous online learning experience and Perceived interaction. All four components affect the intention to use an online English Learning.

Keywords: *E-learning, TAM, online English learning, intention to use.*

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STRESS ANALYSIS FOR NEWLY DEVELOPED SHRINK FITTED CONNECTIONS USED UNDER HIGH TEMPERATURE IN STEEL MANUFACTURING INDUSTRIES

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Abstract: This review paper considers cylindrical shrink-fitted connections useful in steel manufacturing industries. For example, most suitable dissimilar materials can be chosen for a shrink-fitted rolling work roll, and the shaft can be reused by replacing the damaged sleeve. In this paper, therefore, several studies of those connections are discussed. First, when an all ceramic roll is dipped into molten metal, thermal stresses are discussed for the safety of the structure. Next, for the maintenance of a shrink-fitted conveying roll, how to separate a ceramics sleeve by heating from steel shafts is considered without causing failure. Last, interfacial creep is discussed when a bimetallic rolling rolls are used in the roughing stands of hot rolling stand mills.

Keywords: *shrink fitting, roll, sleeve, thermal stress, separation, slippage.*

PROCESS AND PROPERTIES OF HIGH-PRESSURE VESSEL WHICH IS MADE OF FRTC

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Abstract: Using molten polypropylene resin with E glass fiber winds aluminum 6061 lining, is spiral winding and ring winding,eg. two layer ring winding, two layer 54.4spiral winding, and so on .The head of vessel is used by geodesic winding. According to the study of the high-press vessel’s fabrication and experimental verification, Finally, the high-press vessel is produced.

Keywords: *high-pressure vessel；polypropylene filament；recycling.*

RELIABILITY CENTERED MAINTENANCE FOR LARGE VOLUME OF PUMPING PROCESS: A CASE STUDY

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Abstract: This paper is presenting a deep understanding of the application of Reliability Centered Maintenance (RCM) and cost effective data analysis. The objective is to provide a reliability assessment of the four water process pump. It concentrates on how key elements of the RCM process can be amalgamated with appropriate strategies and policies for managing a system's failure modes and their consequences, using an RCM decision making procedure. The most prominent objective of Reliability Centered Maintenance is to optimize reliability of assets with cost effective. Furthermore, life cycle of the system is analyzed using Weibull distribution algorithm. The Median Rank Regression method is used to estimate the parameters of Weibull distribution. The system is then matched with one of the six most widely accepted patterns of failure. The plan is in compliance with RCM SAE JA1011 standard.

Keywords: *RCM, failure mode, reliability, weibull analysis, failure management policy.*

SIMULATION AND EXPERIMENT RESEARCH ON THE FULFILL MATERIALS IN THE CLOSED DIE PROCESS IN PRECISION FORGING BEVEL GEAR

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Abstract: Precision forging method is a cost-effective way to produce net-shape or near-net shape components. In recent years, there has been an increased interest in the production of gears by the net-shape forging technique. This has specific advantages over the traditional manufacturing processes of cutting gears such as hobbing, turning, and grinding including savings on cost and raw material, increased productivity. The effect of the shape of the workpiece in the precise forging process in cold forging bevel gear is presented in this study. The Deform 3D software is employed to simulate the fulfill material into the die process and experiments are performed to evaluate the ability to fulfill material into die.

Keywords: *Precision forging, Bevel gear, Deform 3D.*

EXPERIMENTAL INVESTIGATION ON THE EFFECTS OF SURFACE MECHANICAL ATTRITION TREATMENT ON SURFACE COVERAGE AND SURFACE ROUGHNESS OF THE ALUMINUM ALLOY

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Abstract: Currently, there are many methods to increase fatigue ***life*** for mechanical parts, one of the methods to obtain the above requirements is the Surface mechanical attrition treatment (SMAT) or ultrasonic shot peening method. The ultrasonic shot peening method is a mechanical surface treatment in which spherical balls are impacted on the metal surface, spherical balls are accelerated by vibrating chamber by an ultrasonic generator. This paper presents the effect of the shot peening time on the surface coverage and the roughness of the treated aluminum sample, the results evaluate the method's impact on the detailed surface. From there, giving conclusions and applying the method into practice and industry.

Keywords: *Surface mechanical attrition treatment, ultrasonic shot peening, coverage, surface roughness, mechanical properties.*

STUDY ON MODELING AND SIMULATION OF SMALL HUMANOID ROBOT BALANCE USING MOVABLE MASS

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Abstract: In this paper, Study on Modeling and Simulation of Small Humanoid Robot Balance using Movable Mass. The first is a small humanoid model that balances using movable mass to be completed. Next is the position control where the movable mass position must be controlled according to the position of the robot according to the desired ZMP trajectory. At the same time, the phase control of the movable mass coincides with the moving phase of the robot. Finally, the effectiveness of the proposed method is expressed by simulation results.

Keywords: *Small Humanoid Robot, Movable Mass Modeling, Trajectory, ZMP.*

STUDY ON DESIGN AND MODELLING OF A COAXIAL BRUSHED DIRECT CURRENT MOTOR FOR AUTONOMOUS UNDERWATER VEHICLE APPLICATIONS

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Abstract: The main goal of this paper studies modeling of a direct current coaxial motor (DCCM) and testing the main parameters of DCCM on the experimental model. The DCCM contains two rotors named inner runner and outer runner. The inner runner and the outer runner rotate in opposite directions to each other. The shaft of the inner runner and the shaft of the outer runner are coincident and inserted on two separate bearings. To prove this idea, the mathematic model is achieved by a combination of a mathematic model of DC motor and mathematic model of single phase coaxial motor. Simulation result of the mathematic model in Matlab shows the truth of the hypothesis of the design. The result of testing DCCM of the experimental model is fit to the result of simulation of DCCM in Matlab. Consequently, the DCCM can substitute for other kinds of propellers especially in marine applications.

Keywords: *Small Humanoid Robot, Movable Mass Modeling, Trajectory, ZMP.*

NUMERICAL STUDY OF THE FORWARD AND BACKWARD THERMOCAPILLARY MIGRATION OF A WATER DROPLET IN A MICROCHANNEL UNDER LASER HEAT SOURCES

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Abstract: The transient thermocapillary migration of a water droplet in a microchannel is numerically investigated in this study. Both the upper wall and the lower wall of the microchannel are set to be an ambient temperature. Two 40mW heat sources activated periodically are placed on the left side and the right side of the droplet in a microchannel. When the heat source is turned on, a pair of asymmetric thermocapillary convection vortices is formed inside the droplet. The isotherms inside the droplet are extremely distorted by the thermocapillary convection. The forward and backward thermocapillary migration results in the net thermocapillary momentum which drives a water droplet moves from the hot side of the open channel to the cold side. The actuation velocity of the liquid droplet first increases significantly, and then decreases continuously for various interval times. The dynamic contact angle is strongly affected by the forward and backward oil flow motion and the net thermocapillary momentum inside the droplet. It is alternated due to the pressure difference acting on the free interface between two immiscible fluids during actuation process.

Keywords: *Numerical Simulation; Thermocapillary Migration; Surface Tension; Dynamic Contact Angle; Heat Source.*

THE INFLUENCE OF THE CONVENTIONAL AND SEVERE SHOT PEENING PROCESS ON MICROSTRUCTURE, HARDNESS AND SURFACE ROUGHNESS OF LOW ALLOY STEEL

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Abstract: While shot peening is a well-established technique used in applications where compressive stresses need to be imparted to the material to improve fatigue life, there is still very little fundamental research published. To many, the process is considered to be an art rather than a science. This research aims to investigate the effects of the shot peening process parameters on the surface topography and properties of low alloy steel. The experimental work was performed under different parameter conditions such as pressure, media type (media S230 and S110). The measurement shows that the shot peening pressure and media type have a noteworthy effect on the microstructure, hardness, roughness, friction, wear resistance of steel.

Keywords: *shot peening, coverage, surface roughness, mechanical properties.*

EFFECTS OF INLET CONFIGURATIONS ON HYDROKINETIC PROPERTIES OF THE GAS-LIQUID CYLINDRICAL CYCLONE SEPARATOR

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Abstract: The Gas Liquid Cylindrical Cyclone (GLCC) separator is an attractive compact separator alternative to the conventional vessel-type separator and widely used in the petroleum industry with potential field applications. CFD simulations in GLCC separators are hard for most of new researchers. The main objective of this study is to study GLCC configuration including inclined inlet angle, number & cross section of inlet influences to flow hydrodynamic by numerical simulation in 2 cases: Only one single and gradually reduced inlet nozzle, together with dual inclined inlets nozzle of GLCC.

To study hydrokinetic of turbulent & swirl flow with different inlet configurations of GLCC and compare with experimental data of axial and tangential velocities is the best way to investigate the optimal inlet configuration of GLCC. This research has performed eleven CFD models with different inclined inlet angles for both single and dual inlet GLCCs. The distribution of radial, axial and tangential velocity profiles and their maximum magnitudes with respect to the change of inlet angle were carefully considered in this study.

Keywords: *Multiphase flow, GLCC, Separator, Oil-gas, Turbulence model, Swirl.*

STUDY ON A SOLUTION IN CALCULATING MEETING POINTS BASED ON COMBINING TARGET MOVEMENT ESTIMATION AND BALLISTIC TABLE

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Abstract: Meeting point calculation is the process of calculating and determining the meeting point between bullets and targets. Factors that affecting the results of calculating meeting points parameters are movements of ship, target, bullet, atmospheric pressure, wind as well as parameters of ship shaking. In the ship's firing calculation devices, it is often assumed that the ship and the target move evenly in the horizontal plane or the target dive with a constant speed. Many researchers have come up with different solutions but none has solved the problem of meeting point thoroughly. The approach of this article based on a assumption that the target and the firing ship moving in any directions. The meeting point parameter is calculated based on the continuous function of the shot table. Calculation results are simulated and analyzed between

Keywords: *Shooting zone, Target Movement, Ballistic Table.*

MOTION CONTROL FOR TWO WHEELED MOBILE INVERTED PENDULUMS USING A MIMO ROBUST SERVO CONTROLLER

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Abstract: This paper proposes a MIMO robust servo controller design for two-wheeled Mobile Inverted Pendulums (MIPs) with an external disturbance to track desired linear displacement and orientation reference inputs using a linear shift invariant differential (LSID) operator. To do this task, the followings are done. Firstly, based on Newton's 2nd law, the modeling of the two-wheeled MIP is presented. Secondly, by operating the LSID operator to the state space model and the output error vector, a new extended system and a new control law are obtained. Thirdly, a proposed MIMO robust servo controller for the given two-wheeled MIP is designed by using the pole assignment approach. Fourthly, by operating the inverse LSID operator, a servo compensator for the MIMO system is obtained. Finally, in order to verify the effectiveness of the proposed MIMO robust servo controller, the simulation results are shown. The simulation results show the good tracking performance of the proposed MIMO robust servo controller under a step type of disturbance and the step linear displacement and angular reference signals.

Keywords: *MIMO, MIP, LSID, Operator, Robust servo controller.*

PERFORMANCE ANALYSIS OF EDGE DETECTION METHODS BASED ON DEGRADING OF PEAK SIGNAL TO NOISE RATIO

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Abstract: This paper proposes a performance analysis of an edge detection method based on the degrading of peak signal to noise ratio (PSNR). Edge detection is a fundamental tool for image processing and segmentation. There are several edge detection methods available for pre-processing in computer vision. The computer vision investigates the sub-regions of the composite images, and brings out commonly used and important edge detection operators with a wide-range comparative with the statical approach. To do this task, the followings are done. Firstly, for edge detection methods, the popular five operators such as Sobel, Roberts, Prewitt, Laplacian of Gaussian (Log) and Canny are used. Secondly, each of these operators is compared by the means of checking PSNR and Mean Squared Error (MSE) of the final edge detection image. Finally, the performance of each operator by PSNR and elapsed time are evaluated. The PSNR and MSE results are numeric values. Based on those, the performance of the used operator is analyzed. The time required for each operator to detect edges is also shown. The performance of every edge detection operator is proven by experimental results. The experimental results show that the Canny edge detection operator among them is best for accurate edge detection.

Keywords: *Edge Detection, image processing, Computer vision, PSNR, MSE.*

DESIGN THE AUTO TOOTHBRUSH FEEDING SYSTEM

Nam Trinh Hoai, Thong Nguyen Phi, Tan Tien Nguyen

ABSTRACT: The paper present the solution for the automatic feeding toothbrushes for the HoongA N8 packaging machine in the Colgate toothbrush manufacturing factory in order to boost up the factory automation and saving labor cost. The current packaging process included toothbrush color mixing, toothbrush shape and orientation and the speed of the HoongA packaging machine were the input of the design. Simulation and prototyping are using as method to adjust the mechanical design and the results from actual simulation on the prototype demonstrate the feasibility of the proposed solution.

Keywords: *Toothbrush automatic supply system, Step feeder, Star wheel mechanism.*

CARBON BASED-ELECTRODE FABRICATION AND START-UP OF BIOELECTROCHEMICAL ANAEROBIC DIGESTION FOR SEWAGE SLUDGE

Qing Feng, Young-Chae Song

Abstract: Bioelectrochemical anaerobic digestion (BEAD) is a technology which exploits the potential of microorganism by supplying a small amount of additional energy in an anaerobic digester. The electrode material is one of the most important parts of a bioelectrochemical system. For the anodes and cathodes of the BEAD process, Graphite fiber fabric (GFF), a carbon based material with good biocompatibility and non-corrosive property, was selected and its conductivity was modified by depositing carbon nanotube (CNT) via electrophoresis deposition (EPD) method. The organic matter in the reactor is oxidized at the anode forming proton, carbon dioxide and electron. The electron produced is transferred to the cathode due to the potential difference between anode and cathode, followed by methane production at cathode resulting from the combination of carbon dioxide, electron and proton. The biochemical reactions at the electrodes can be controlled by the electrode potentials. When the potential between anode and cathode was maintained at 0.3V using an external power supply, the BEAD digester showed remarkable performance at 20 days of HRT. The stability of the digester was very good in terms of pH (7.2~7.5), alkalinity (4,500~5,200mg/L as $CaCO_3$), methane content in biogas (77.3%), and volatile fatty acid levels (VFA < 250mg HAc/L). During steady state, the specific methane production rate and VS reduction were stabilized at 412 mL CH_4/L.d and 72.5% respectively, which were much higher than the conventional anaerobic digestion. The introduction of bioelectrochemical technology to anaerobic digestion provides a chance to overcome the disadvantages of conventional anaerobic digestion.

Keywords: *Bioelectrochemical, Anaerobic digestion, Carbon based-electrode, Methane production, Sewage sludge.*

PRIMARY ENERGY CONVERSION PERFORMANCE OF "PENDULOR" WAVE ENERGY DEVICE WITH A BOTTOM GAP

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Abstract: The "Pendulor" wave energy device is the first notable Oscillating Wave Energy Converter (OWSC) consists of a top hinged flap which oscillates in a bounded caisson. It was proven to have 40-50% energy conversion efficiency from the sea tests done by Muroran Institute of Technology, Japan. Yet there are unresolved issues particularly on the physical configurations of the caisson and flap combination when adopting it in to different sea conditions. Therefore, the main objective in this research is to find out the parametric interactions of caisson configurations on the conversion efficiency. The paper describes the test facility arrangements and model test results particularly on primary energy conversion efficiency of the device for selected configurations. 3-D model tests were carried out in a wave tank to investigate the behavior for straight caisson for 1/40th scale following Froudian scaling for regular waves. Two different wave flumes were used due to logistic placement of the main researcher and availability of advanced test facilities. Test were done for conventional caisson arrangement (Flap without a gap in the caisson) and for the flap with a bottom gap. The test results obtained on power extraction for different combinations of damping torque and wave frequencies were discussed and concluded in this paper.

Keywords: *Wave Energy, Power capture, OWSC, Bottom gap, Caisso.*

HYDRODYNAMICS OF TOP HINGED OWSC WAVE ENERGY DEVICE THE "PENDULOR" WITH A BOTTOM GAP

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Abstract: Pendulor device is kind of a top hinged Oscillating Wave Surge Converter (OWSC) type device operates inside a caisson (with one side open to the sea) by the action of standing waves generated inside the caisson at one quarter wave length distance from the back wall of the caisson. Previous research activities had a prime focus on reducing this distance and later numerical simulations reveled that an additional resonance mode occurs at one eighth of wave length distance from back wall when the flap has a bottom gap. That mode is identified as "pumping mode" and this research is focus on investigating essential hydrodynamics of this "pumping mode" in order to find possibilities energy capturing potential. Computational Fluid Dynamics (CFD using STAR CCM+) and Particle Image Velocimetry (PIV) are compared to identify the bottom gap hydrodynamics while studying the suitability of CFD to model the shallow water OWSCs. Current work revealed the occurrence of the "pumping mode" and generation of evanescence waves when the flap has a bottom gap.

Keywords: *Wave Energy, Hydrodynamics, OWSC, Evanescence waves, PIV, STAR CCM+.*

A NOVEL APPROACH FOR A LONG-LIFE AND MULTI-VOLTAGE BATTERY MODEL FOR IOT DEVICES

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Abstract: In this paper we test and select the type of battery cell with low self-discharge as a long-time power supply. We design the voltage converter circuit that consumes low power and has the amount of capacity consumed to predict the remaining capacity. The results show that the Li-SClO2 battery have the self-discharge requirements, and IC LTC3335 Nano power Buck-Boost DC/DC converter with an integrated coulomb counter, which can high precision predict of remaining capacity. The article also mentions a solution to provide a source for intermittent signaling applications when high current requirements are required.

Keywords: *Internet of Things, battery cell, Buck-Boost DC/DC.*

APPLICATION OF REMOTE SENSING AND MODELLING TO ASSESS SHORELINE CHANGE AND RIVER BED LEVEL UNDER THE PRESSURE OF SAND MINING ACTIVITIES – A CASE STUDY IN KRONG NO RIVER, DAK NONG PROVINCE

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Abstract: Krong No is one of the main rivers in Dak Nong province which is under severe pressure with four sand mining units along the river with a total licensed mining capacity over 120,000 m^3/year. Sand mining is considered as such disturbance that can affect sediment with flow and change the river morphology. This paper aims to observe the change of shoreline and river bed by utilizing combination of remote sensing and modelling. Remote sensing method is applied to obtain erosion distance and area in study area by observing shoreline change in five years 2014 – 2018. Besides, a two dimensional hydrodynamic module in MIKE21 model and a sand transport (ST) model are combined, which are used to investigate the erosion and sedimentation patterns. The hydrodynamic model (HD) has a good performance with the NASH index for calibration (0.94) and validation (0.89) that the model gives acceptable results to apply ST module. Bed resistance is used as calibrate parameter. Based on the research results, it raises a concern about sustainability with regard to the exploitation of sand and ensure that this activity is conducted in a responsible manner for the future.

Keywords: *Erosion, Shoreline change, Hydrodynamic model, Remote sensing, MIKE21.*

CFD ANALYSIS FOR BASEMENT VENTILATION IN CASE OF A FIRE

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Abstract: Basement parking lot providing a certain number of car spaces for clients is an effective solution for parking in crowded cities. The required ventilation system design is generally based on number of air changes per hour provided by the standards of local authorities. The design of proper ventilation system plays an important role to ensure a safety environment for people in case of a fire. The objective of this study is to establish the smoke spread behavior and tenability criteria while considering a case of fire among the adopted ventilation systems for a basement car park by using CFD software of Autodesk CFD 2019. The chosen smoke ventilation systems include the ductwork and combination of impulse and ductwork system. Temperature contours, flow patterns and smoke contours for a fire source from a 4MW car fire are shown in order to provide clear smoke-free access, protect means of escape from the car park for the ventilation systems.

Keywords: *Basement Ventilation, CFD, Smoke Behavior, Fire.*

APPLYING ARTIFICIAL NEURAL NETWORKS FOR FAULT CLASSIFICATION AND DIAGNOSIS OF AIR COMPRESSOR

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Abstract: Fault diagnosis is an important requirement to supervise the operation process of a compressor system. Artificial Intelligent (AI) algorithms are being used as effective approaches for establishing fault detection models with high performance. This paper presents an approach to data classification and fault diagnosis of an air compressor based on pressure and temperature parameters by using a softmax regression algorithm. Operation data of compressor obtained from sensors and store to build a dataset of system. Then, an artificial neural network based on a supervised learning model was applied for training the feature data to classify and diagnose faults. The achived accurency indicates that the proposed approach is highly reliable and applicable in fault classification of industrial compressor.

Keywords: *Regression Algorithm, Fault Diagnosis, Artificial Intelligent.*

VISION-BASED TARGET FOLLOWING AND AUTO LANDING FOR QUADCOPTER MODEL

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Abstract: Nowadays, unmanned arial vehicles with image processing functions implemented are widely researched all around the world. This paper focus on 2 tasks: building vision-based target following function and auto landing function for quadcopter model. This model is controlled by a Raspberry Pi and a Pixhawk controller board which is used to control motors, communicated with each other through ROS. The algorithms used in this paper include an image processing program that uses the Haar Cascade method and linear Kalman filter to detect object and then calculate the distance between the plane and object, height maintaining and velocity control programs for the quadcopter to follow target and a landing control program using Fuzzy Controller – PD.

AN IMPROVED GPS/INS INTEGRATED NAVIGATION SYSTEM WITH TIGHTLY-COUPLED METHOD

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Abstract: The world is getting more advanced day by day with innovative technologies, which leads to the engagement of robots in replacing people in harsh working condition or in dangerous environments. There are numerous problems arising when dealing with a mobile robot, but one of the most important tasks is motion tracking. GPS and INS are two well-known solutions, however, they have their shorcomings, individually. GPS signal is not always received due to geographical and artificial obstacles. Meanwhile, INS navigation error is accumulated with operating time. Fortunately, the integrated GPS/INS system can fix those limits with their complementary features. This paper introduces the integrated GPS/INS system with loosely coupled method and improves the process with tighly coupled method. Experimental results will clarify the enhancement of tighly coupled navigation under GPS outage condition.

Keywords: *Navigation, GPS/INS integration, Loosely coupled, Tightly coupled.*

DESIGN OF A TRACKING CONTROLLER FOR A FORKLIFT AUTOMATED GUIDED VEHICLE

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Abstract: This paper studies on the design of a controller for a forklift automated guided vehicle (AGV) applied for automated storage and retrieval system. Firstly, some common structures of forklift AGV was introduced. Secondly, a tricycle drive unit of the forklift AGV for tracking is mathematically modelled with linear position errors and angular errors under the condition for anti-skid. Then, a simple robust controller for the forklift AGV based on Lyapunov stability theory is proposed. Simulation results are used for demonstration the effectiveness of the proposed controller

Keywords: *Forklift AGV, Path Tracking, Lyapunov Stability.*

STUDY ON DESIGN OF MODULARIZED A LURKING TYPE AGV USING TRACTION DRIVE UNIT

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Abstract: This paper briefs on the design of a modularized lurking type automated guided vehicle (AGV) using traction drive unit is presented. Firstly, some traditional structures of AGV are carried out to investigate the advantage/disadvantage in feature of each one. Secondly, the design of traction drive unit is used for a lurking type AGV is introduces. Thirdly, a kinematic modelling of tricycle unmanned robot is achive to develop a kinematic based position controller. Finally, some simulation result are used for demonstating the effectiveness of the proposed controller.

Keywords: *Automated guided vehicle (AGV), path tracking, Lyapunov stability, Linearization feedback control.*

OPTIMIZATION IN ROUTING AND ASSIGNING IN WAREHOUSE USING HEURISTIC AND METAHEURISTIC APPROACHES

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Abstract: Combinatorial optimization problems are becoming more and more important as its applications take place in many aspects, especially in logistics which planning and management of warehouse are mostly based on. Using exhaustive search for a precise solution is likely not preferable due to the complexity of input, so people attempt to look for a method which could provide a reasonably good solution with fast response, which heuristic and metaheuristic approaches are superior. In this paper, we will discuss briefly about some common heuristics and metaheuristics, as well as their principles and how they are applied to seek the optimal routes in a predefined graph. Then we come to a realistic application in logistics that AGVs have to allocate the best routes and order to achieve the tasks given, by simulation in MATLAB GUI program.

Keywords: *Heuristics, Metaheuristics, Optimal routes, Combinatorial optimization.*

STUDY ON SERIES ELASTIC ACTUATOR APPLYING FOR PALLETIZING ROBOT

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Abstract: For along time, palletizing robot use stiffness motor to perform its movement. Its motor will be damaged easily when robot stops suddenly. This paper is about new approachment, applying series elastic actuator to control the robot because of its pros: the vibration will be controlled, controlling force without force sensor which make the robot low cost and easy to control

Keywords: *Palletizing Robot, Series Elastic Actuator (SEA), Force-sensing SEA, Reaction Force-sensing Elastic Actuator.*

VELOCITY CONTROL FOR GYMNOTIFORM UNDULATING FIN MODULE

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Abstract: Inspired by the fish swimming motion of gymnotiform type, an undulating fin module has been developed in the effort to replace the traditional propulsion system of autonomous underwater vehicles. Base on the modelling of force generated in the undulating process of gymnotiform undulating fin module, the force has the non-linear relationship with frequency and velocity of the fin. This paper proposes an estimated function of force generated and design a back stepping sliding mode model for velocity control of gymnotiform undulating fin module.

Keywords: *Gymnotiform undulating fin, velocity control, back stepping sliding mode.*

NHÀ XUẤT BẢN ĐẠI HỌC QUỐC GIA TP. HỒ CHÍ MINH

ISBN: 978-604-73-7264-5