AETA 2017

The 4th International Conference on Advanced Engineering - Theory and Applications 2017

07 – 09 December, 2017

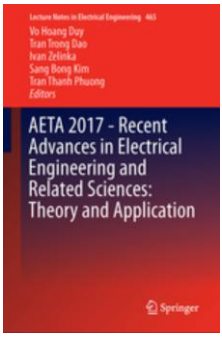
Conference Program

Organizer
Ton Duc Thang University, Vietnam

Co-Organizer
Technical University of Ostrava, Czech Republic
Pukyong National University, South Korea
Feng Chia University, Taiwan

Technically Co-Sponsors

Proceedings



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AETA 2017
Website: http://aeta2017.org/
E-mail: aeta@tdt.edu.vn

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CONFERENCE INFORMATION

I. Location:

Tan Phong Campus - Ton Duc Thang University

No. 19, Nguyen Huu Tho St., Tan Phong Ward, District 7, Ho Chi Minh City, Vietnam

II. Reception Desk:

The reception desk is located on the Ground floor of Building A and opened from 7:30 to 17:30 from 07 to 08 December, 2017.

III. Language

All sessions will be presented in English.

IV. Badges

Admittance to the venue is restricted to participants wearing their name badges. The wearing of badges is compulsory both inside the venue and at all events organized with its context.

V. Conference Room's Location

Conference will be held on the conference rooms of Buildings A, B, and C.

VI. Conference Room's Equipment

Each conference room will be equipped with an projector and a notebook computer.

VII. Guideline for Presentation

It takes 20 minutes for each presentation. Each paper will be presented orally for 15 minutes followed by 05 minutes discussion. Speakers will be noticed by service worker 5 minutes before ending.

VIII. Transportation

- Tan Son Nhat International Airport ⟺ Ton Duc Thang University (TDTU)

- ✓ BUS: Take No. 152 air-con airport bus to Ben Thanh Market and then take bus No. 86 to Ton Duc Thang University.

Time required: 60 minutes

Working Time: 06:00 ~ 18:30

Running Frequency: Every 30 minutes

Ticket price is 5.000 VND (approx. US$ 0.25)

Terminal stop - Ben Thanh Market (center of Ho Chi Minh city, bus 152), Ben Thanh market - Ton Duc Thang University (bus 86).

- ✓ TAXI: It takes about US$ 15-20, and about 30 minutes to arrive at Ton Duc Thang University.

IX. Parking

Participants with the conference invitation can park their cars at campus parking lots.

X. Lunch

The lunch will be served from 12:00 to 13:30 at the lobby on the Ground floor of Building A during the conference.

XI. Conference Banquet

The Organizing Committee requests the pleasure of meeting all registered guests at the Conference Dinner on Thursday, 07 December, 2017 at 07:00 pm, at Rex Hotel Saigon, 141, Nguyen Hue Blvd, District 1, Ho Chi Minh City.

XII. Contact

Mr. Dang Ngoc Minh Duc Mob. (0084) 989 699 299

Email: aeta@tdt.edu.vn

CONFERENCE VENUE

Ton Duc Thang University

No. 19, Nguyen Huu Tho Street, Tan Phong Ward, District 7, Ho Chi Minh City

Telephone: (84-28) 37 755 035

TON DUC THANG UNIVERSITY

"For accomplishment in human development and a society with sustainable, stable growth"

Ton Duc Thang University (TDTU) is a public and autonomous university. Established in 1997, it is situated in the center of Ho Chi Minh City - the commercial hub of Vietnam. The university has five campuses in Ho Chi Minh City (two campuses), Nha Trang City, Lam Dong Province and Ca Mau Province. The main campus is located in an area of 265,000 m^2 in Tan Phong Ward, District 7, Ho Chi Minh City, Vietnam.

TDTU is a young and dynamic provider in the higher education sector and is one of the largest universities in Vietnam. The university is committed to Vietnam's sustainable development of human resources. It strives to be a leading research-oriented university regionally and internationally.

The university has been fostering a unique culture that distinguishes itself from the others. Aiming to provide optimal opportunities for quality education, the university is devoted to the promotion of students' learning and research activities. All aspects of the university strive to constantly maintain an effective and efficient academic community for talents to be developed.

After 20 years of development, TDTU has become one of the fastest growing universities in the country. Currently, the university has 16 faculties, 15 centers for technology applications, 3 institutes, 2 journals, 1 foundation for science and technology, and several laboratories. The university offers over 60 programs at the vocational, undergraduate and postgraduate levels. There are approximately 22,000 students pursuing their study at the university.

Equipped for more than just studying, TDTU also provides facilities for post-study workouts. The main campus affords a sport complex in which lots of indoor games such as badminton, tennis, volleyball, basketball and many other activities can be played. Furthermore, there is a swimming pool and a FIFA 2-star football stadium. There are two fully equipped dormitories, which can accommodate up to 2,160 students.

TDTU considers the connection with international partners through strategic cooperation as an important prerequisite for its sustainable development. Thus, more and more research projects have been initiated, established and conducted in the university with the leadership of internationally recognized experts. The partnerships with nearly 60 universities from different parts of the world also allow the university to exchange students, staffs and training collaborations.

As a young and vibrant institution with numerous learning pathways for students internationally and diversified opportunities for academic development, TDTU is committed to being the best choice of students, academic staffs, researchers and all stakeholders.

PROGRAM AT A GLANCE – AETA 2017

DAY 1 – 07 December, 2017 Thursday

Time	Event			
07:30 ~	**Registration**			
	Hall A			
09:00 ~ 09:40	**Opening Ceremony**			
09:40 ~ 9:50	**Coffee Break**			
9:50 ~ 10:35	**Keynote Speech I: Under-Actuated Systems: Nonlinear Control Showcase** **Keynote Speaker: Prof. Mitsuji Sampei (Tokyo Institute of Technology, Japan)** Chair: Sang Bong Kim (Pukyong National University, South Korea)			
	Room A101	**Room B010**	**Room C010**	**Room A104**
10:40 ~ 12:20	Session A-1	Session B–1	Session C–1	Session D–1
12:20 ~ 13:30	Lunch			
	Room A403			
13:30 ~ 14:15	**Keynote Speech II: An Overview of Cyber Insecurity and Malicious Uses of Cyberspace** **Keynote Speaker: Prof. Rui Miguel Silva (Polytechnic Institute of Beja, Portugal) and Prof. Ivan Zelinka (Technical University of Ostrava, Czech Republic)** Chair: Pandian Vasant (University Teknologi Petronas, Malaysia)			
	Room A101	**Room B010**	**Room C010**	**Room A104**
14:30 ~ 16:00	Session A-2	Session B–2	Session C–2	Session D–2
16:00 ~ 16:10	Coffee Break			
15:40 ~ 16:10	Poster Session			
16:10 ~ 17:50	Session A–3	Session B–3	Session C-3	Session D–3
19:00 ~ 21:00	**Conference Banquet**			

DAY 2 – 08 December, 2017 Friday

Time	Event			
	Room A403			
08:30 ~ 09:15	**Keynote Speech III: Hybrid Functions in Fractional Calculus and Optimal Control Problems** **Keynote Speaker: Prof. Mohsen Razzaghi (Mississippi State University, USA)** Chair: Roman Senkerik (Tomas Bata University, Czech Republic)			
	Room A403	**Room B010**	**Room C010**	**Room A104**
09:30 ~ 10:50	Session A–4	Session B–4	Session C-4	Session D-4
10:50 ~ 11:00	Coffee Break			
11:00 ~ 12:20	Session A–5	Session B–5	Session C-5	Session D-5
12:20 ~ 13:30	Lunch			

DAY 3 – 09 December, 2017 Saturday

Time	Event
07:00 ~ 17:00	**Mekong River Tour**

Notes:

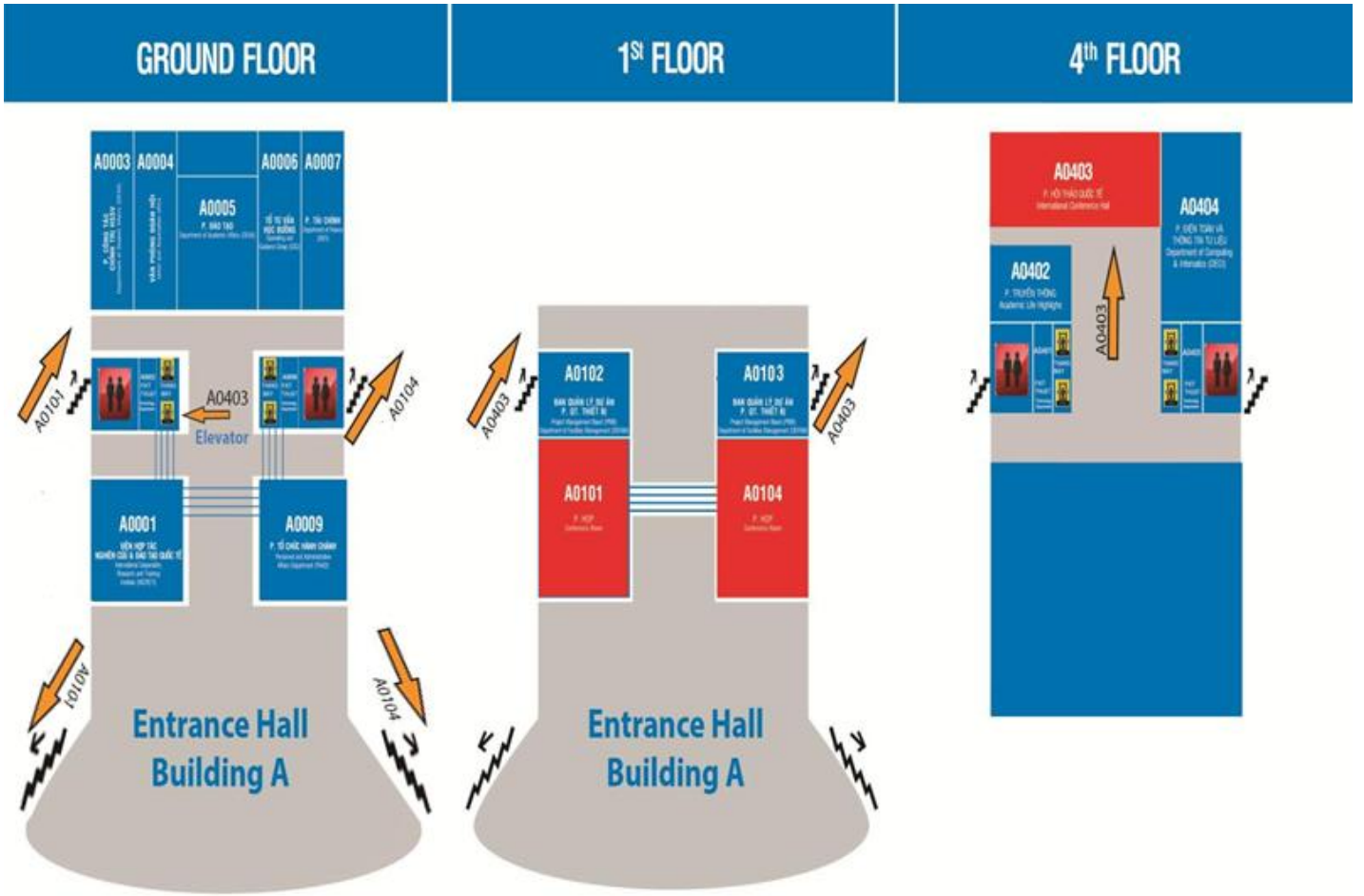
- **Hall A** is inside Building A (you can use any stair around Building A to go to 2nd floor, then follow the sign).
- **Room A101** is located at the first floor of Building A. Please use one of 2 stairs at the right side of Building A to access A101
- **Room A104** is also located at the first floor of Building A. Please use one of 2 stairs at the left side of Building A to access A104.
- **Room A403** is located at 4th floor of Building A. You can use the elevator or any stair around Building A to access Room A403.
- **Room B010** is located at the ground floor of Building B.
- **Room C010** is located at the ground floor of Building C.

TDTU MAP

BUILDING B
Conference Room B
(B010)

BUILDING C
Conference Room C
(C010)

BUILDING A
Main hall (Opening Ceremony)
Room A101
Room A104
Room A403


GROUND FLOOR
1ST FLOOR
4th FLOOR
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A0101
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A0403
Elevator
Entrance Hall
Building A
A0102
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Entrance Hall
Building A
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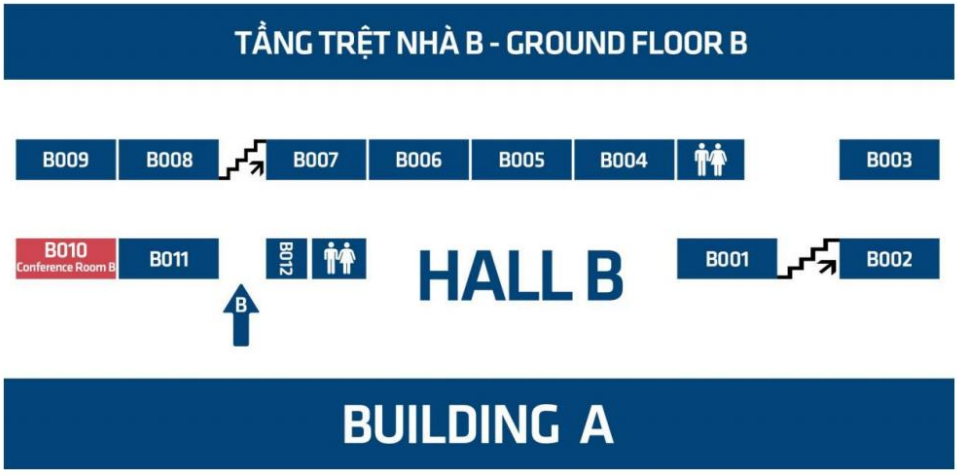
A0403


TẦNG TRỆT NHÀ B - GROUND FLOOR B
B009
B008
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Conference Room B
B011
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HALL B
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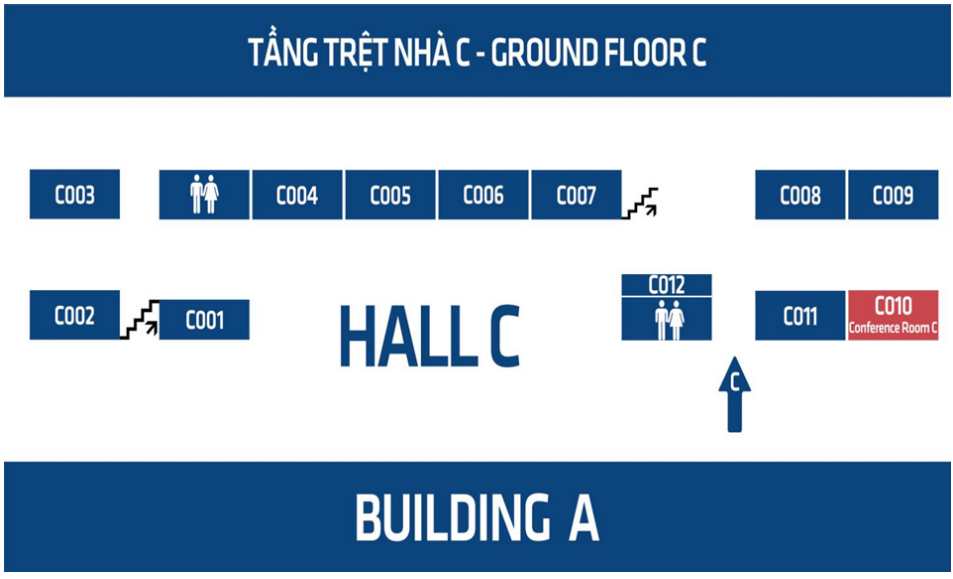
BUILDING A


TẦNG TRỆT NHÀ C - GROUND FLOOR C
C003
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HALL C
C012
C011
C010
Conference Room C
C
BUILDING A

KEYNOTE SPEAKERS

Professor Mitsuji Sampei

Professor Rui Miguel Silva – Professor Ivan Zelinka

Professor Mohsen Razzaghi

Professor Mitsuji Sampei
Department of Systems & Control Engineering
Tokyo Institute of Technology
Japan

Keynote Speech I
07 December 2017 Thursday
09:45 ~ 10:30
Hall A

Lecture title:
Under-Actuated Systems: Nonlinear Control Showcase

Biography:

Mitsuji Sampei received the B.Eng., M.Eng. and Dr.Eng. degrees in control engineering from Tokyo Institute of Technology in 1983, 1985, and 1987, respectively. From 1987 to 1993, he was Research Associate and then Associate Professor in Chiba University. Since 1993, he has been with Tokyo Institute of Technology where he is currently Professor in the Department of Systems and Control Engineering.

His current research interests are in the field of nonlinear system theory, including underactuated systems, nonholonomic systems, robotics and H-infinity control theory. He was NOC Chair of IFAC 3rd Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Systems (LHMNLC, 2006), Invited Session Chair of IEEE Conference on Control Applications (CCA, 2006), IPC Chair of IEEE Conference on Control Applications (CCA, 2010), IPC Chair of SICE Annual Conference (SICE 2011), IPC Chair of IEEE Conference on Decision and Control (CDC 2015).

Professor Rui Miguel Silva
Polytechnic Institute of Beja
Portugal

Keynote Speech II
07 December 2017
Thursday
13:30 ~ 14:15
Room A403

Lecture title:
An Overview of Cyber Insecurity and Malicious Uses of Cyberspace

Biography:

Rui Miguel Silva was born in 4 February 1971 in Beja, Portugal. He got his graduation in "Information Systems and Computer Engineering" from the Technical Superior Institute of the Technical University of Lisbon in 1996, then he got his MSc and PhD in "Electrical and Computer Engineering" also from the Technical Superior Institute of the Technical University of Lisbon in 2002 and 2009, respectively. His research focus, since 2002, is on Applied Offensive Security, namely on intrusive technics into computer systems, cooperating with several national and international organizations on Cyber Security and Cybercrime domains, like the Portuguese National Security Agency, Portuguese Army, Portuguese Military Academy, Portuguese Prosecutor General's Office, Portuguese Criminal Police and a specialized Cybercrime Group of INTERPOL.

Rui Miguel Silva is a Professor at the Polytechnic Institute of Beja, Portugal, for twenty years. He had several management positions in the institution, like Director of Engineering Department or Computer Science Engineering Degree Course Coordination. Currently he is the head of Lab UbiNET –

"Computer Science Security and Cybercrime" and Course Coordinator of the Master Degree in Computer Science Security Engineering.

Rui Miguel Silva is author and co-author of about 40 scientific publications and was co-founder of three companies, devoting his research activities to Applied Science on Offensive Security Domain. His interests are now focused in "Preemptive Penetration Tests" to allow companies to continually keep his systems aware and protected from vulnerabilities and weak configurations. He is "genetically an enthusiastic" researcher on the application of non-conventional algorithms and procedures to break Computer Science Security Systems.

Professor Ivan Zelinka
Faculty of Electrical Engineering and Computer Science
Technical University of Ostrava
Czech Republic

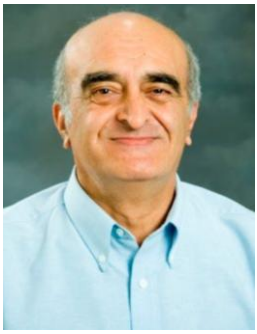
Keynote Speech II
07 December 2017
Thursday
13:30 ~ 14:15
Room A403

Lecture title:
An Overview of Cyber Insecurity and Malicious Uses of Cyberspace

Biography:

Ivan Zelinka is currently working at the Technical University of Ostrava (VŠB-TU), Faculty of Electrical Engineering and Computer Science and national supercomputing centre IT4Innovations. He graduated consecutively from the Technical University in Brno (1995 – MSc.), the UTB in Zlin (2001 – Ph.D.) and again from the Technical University in Brno (2004 – assoc. prof.) and VSB-TU (2010 - professor). Before his academic career, he held positions of TELECOM technician, computer specialist (HW+SW) and Commercial Bank supervisor (computer and LAN operations). During his academic career, he proposed and opened more than 10 different lectures. He also has been invited for lectures at universities in various EU countries as well as for keynote and tutorial presentations at various conferences and symposia. He is responsible for supervising the research grant from the Czech grant agency GAČR named Soft computing methods in control and was co-supervisor of the grant FRVŠ - Laboratory of parallel computing. Dr. Zelinka has also participated in numerous

grants and two EU projects as a member of the team (FP5 - RESTORM) and as supervisor of (FP7 - PROMOEVO) of the Czech team. Currently, he is the head of the Department of Applied Informatics and throughout his career he has supervised numerous MSc. and Bc. diploma theses in addition to his role of supervising doctoral students, including students from abroad. He was awarded the Siemens Award for his Ph.D. thesis and received an award from the journal Software news for his book about artificial intelligence. Ivan Zelinka is a member of the British Computer Society, IEEE (a committee of Czech section of Computational Intelligence), and serves on international program committees of various conferences and three international journals (Soft Computing, SWEVO, Editorial Council of Security Revue.) He is the author of numerous journal articles as well as books in Czech and the English language.



Professor Mohsen Razzaghi
Department of Mathematics and Statistics
Mississippi State University
USA

Keynote Speech III
08 December 2017
Friday
08:30 ~ 09:15
Room A403

Lecture title:
Hybrid Functions in Fractional Calculus and Optimal Control Problems

Biography:

Mohsen Razzaghi received his B.S. degree in Mathematics and Ph.D. degree in Applied Mathematics both from the University of Sussex in England. Since 1986, he has been with the Department of Mathematics and Statistics at Mississippi State University, where he is currently a Professor and Department Head. He was the recipient of two Fulbright scholarship programs; one from 2011-2012 and another in 2015-2016 in Romania.

His current area of research centers on orthogonal functions, optimal control, wavelets, fractional calculus and their applications in science and engineering. In particular, he is an expert in the field of numerical approximation using orthogonal functions and wavelet theory. His novel methods involving adaptive “hybrid functions” and “Legendre wavelets” have proven to be important tools in dynamical systems with jump discontinuities. He has over 170 refereed journal publications in mathematics, mathematical physics, and engineering. Most of his refereed papers are published in prestigious international journals. He was invited to write an article titled, "Walsh Functions" for inclusion in the Encyclopedia of

Electrical and Electronics Engineering, published by John Wiley & Sons in 1999. According to Google Scholar, one of his papers coauthored with one of his Ph.D. students at Mississippi State University was cited over 545 times.

ORAL PRESENTATION

Day 1 – 07 December, 2017 Thursday

Session A–1, B-1, C-1, D-1: 10:40 ~ 12:20

Session A–2, B-2, C-2, D-2: 14:30 ~ 16:00

Session A–3, B-3, C-3, D-3: 16:10 ~ 17:50

Day 2 – 08 December, 2017 Friday

Session A–4, B-4, C-4, D-4: 09:30 ~ 10:50

Session A–5, B-5, C-5, D-5: 11:00 ~ 12:20

Session A-1 – Computer Science
Day 1 – 07 December, 2017 Thursday
Time: 10:40 ~ 12:20; Venue: Room A101
Chair: Rui Miguel Silva (Polytechnic Institute of Beja, Portugal)
Paul Weng (SYSU-CMU Joint Institute of Engineering School of Electronics and Information Technology, China)

№	Time	Paper Title
1	10:40 ~ 11:00	**Firefly Algorithm: Enhanced Version with Partial Population Restart Using Complex Network Analysis** Tomas Kadavy, Michal Pluhacek, Adam Viktorin and Roman Senkerik Tomas Bata University in Zlin, Czech Republic
2	11:00 ~ 11:20	**A New Android Botnet Classification for GPS Exploitation Based on Permission and API Calls** Muhammad Yusof, Madihah Mohd Saudi, and Farida Ridzuan Universiti Sains Islam Malaysia, Malaysia
3	11:20 ~ 11:40	**Processing Big Data in Field of Marketing Models Using Apache Spark** Tomáš Janečko, Ondřej Grunt, Jan Plucar, Markéta Štáková and Ivan Zelinka VSB-Technical University of Ostrava, Czech Republic
4	11:40 ~ 12:00	**A Protocol for Securing E-Voting System** Hoang Duc Tho and Nguyen Thi Hong Ha Academy of Cryptography Techniques, Vietnam
5	12:00 ~ 12:20	**L-SHADE Algorithm with Distance Based Parameter Adaptation** Adam Viktorin, Roman Senkerik, Michal Pluhacek and Tomas Kadavy Tomas Bata University in Zlin, Czech Republic
12:20 ~ 13:30		Lunch Time

Session A-2 – Optimization
Day 1 – 07 December, 2017 Thursday
Time: 14:30 ~ 16:00; Venue: Room A101
Chair: Pandian Vasant (University Teknologi Petronas, Malaysia)
Ivan Zelinka (VSB-Technical University of Ostrava, Czech Republic)

1	14:30 ~ 14:50	**A Review of Real-World Applications of Particle Swarm Optimization Algorithm** [1]Michal Pluhacek, [1]Roman Senkerik, [1]Adam Viktorin, [1]Tomas Kadavy and [2]Ivan Zelinka [1]Tomas Bata University in Zlin, Czech Republic

		[2]VSB-Technical University of Ostrava, Czech Republic
2	14:50 ~ 15:10	**Application of the Box-Behnken Model Design to the Optimization of Process Parameters in the Convection-Drying of Channa Striata Fish** Vo Thien Nhan Ngo[1], Thi Thanh Dieu Phan[2], J.C. Beltrán-Prieto[3] and Huynh Bach Son Long Nguyen[1,3,4] [1]Chemical Association in Dong Nai, Vietnam [2]Ho Chi Minh City University of Food Industry, Vietnam [3]Tomas Bata University in Zlin, Czech Republic [4]Lac Hong University, Vietnam
3	15:10 ~ 15:30	**A Study on Real-World Disaster Evacuation System with Mathematical Network Problem Solving Algorithm** Jin-han Lee[1], Sang-hyun Park[1], Sim-in Kim[1], Moon-seob Jang[1], Se-Chan Lim[1], Tony Kim[2], La-Kyoung Weon[3] and Jang-won Choi[2] [1]Busan Transportation Corporation, South Korea [2]Cornerstones Technology, South Korea [3]Kosin University, South Korea
4	15:30 ~ 16:00	**Optimal Threshold Policies for Robust Data Center Control** Paul Weng[1], Zeqi Qiu[2], John Costanzo[2], Xiaoqi Yin[3] and Bruno Sinopoli[2] [1]SYSU-CMU Joint Institute of Engineering School of Electronics and Information Technology, China [2]Carnegie Mellon University, USA [3]Google
16:00 ~ 16:10		Coffee Break

Session A-3 – Optimization

Day 1 – 07 December, 2017 Thursday

Time: 16:10 ~ 17:50; Venue: Room A101

Chair: Vo Ngoc Dieu (Ho Chi Minh City University of Technology, Vietnam)

Nguyen Minh Tam (HCMC University of Technology and Education, Vietnam)

1	16:10 ~ 16:30	**A New Optimal Algorithm for Multi-objective Short-Term** **Fixed Head Hydrothermal Scheduling with Emission** Bach H. Dinh, Thang T. Nguyen Ton Duc Thang University, Vietnam
2	16:30 ~ 16:50	**Quantum-Behaved Bat Algorithm for Combined Economic Emission** **Dispatch Problem with Valve-Point Effect**

		Fahad Parvez Mahdi[1], Pandian Vasant[1], M. Abdullah-Al-Wadud[3], Junzo Watada[2] and Vish Kallimani[2] [1,2]Universiti Teknologi PETRONAS, Malaysia [3]King Saud University, Saudi Arabia
3	16:50 ~ 17:10	**Optimal Load Frequency Control in an Isolated Power System** Van Van Huynh[1], Bui Le Ngoc Minh[2] and Tam Minh Nguyen[2] [1]Ton Duc Thang University, Vietnam [2]Ho Chi Minh City University of Technology and Education, Vietnam
4	17:10 ~ 17:30	**Differential Evolution for Constrained Industrial Optimization** [1]Roman Senkerik, [1]Adam Viktorin, [1]Michal Pluhacek, [1]Tomas Kadavy and [2]Ivan Zelinka [1]Tomas Bata University in Zlin, Czech Republic [2]VSB-Technical University of Ostrava, Czech Republic
5	17:30 ~ 17:50	**Modified Flower Pollination Algorithm for Solving Economic Dispatch Problem** Pham Huu Ly[1], Ngo Hoang An[2] and Dao Thanh Tam[3] [1]Ton Duc Thang University, Vietnam [2]HCM University of Food Industry, Vietnam [3]HCM City Industry and Trade College, Vietnam

Session B-1 – Control Systems

Day 1 – 07 December, 2017 Thursday

Time: 10:40 ~ 12:20; Venue: Room B010

Chair: Duong Hoai Nghia (Ho Chi Minh City University of Technology, Vietnam)

Kim Zeen Chul (Ton Duc Thang University, Vietnam)

№	Time	Paper Title
1	10:40 ~ 11:00	**Aerial Attitude Control of Hopping Robots Using Reaction Wheels: Evaluation of Prototype II in the Air** Yurika Nomura and Jun Ishikawa Tokyo Denki University, Japan
2	11:00 ~ 11:20	**Vertical Motion Control of Crane Without Load Position Information Using Nonlinear Control Theory** Nhat Binh Le, Manh Son Tran, Suk Ho Jung and Young Bok Kim Pukyong National University, South Korea
3	11:20 ~ 11:40	**State Estimation of Internal Combustion Engine Based on Mathematical Model** Masahiro Yamazaki and Masami Iwase

		Tokyo Denki University, Japan
4	11:40 ~ 12:00	**Dynamic Programming Based Adaptive Optimal Control for Inverted Pendulum** Dao Phuong Nam, Nguyen Van Huong, Ha Duc Minh and Nguyen Thanh Long Hanoi University of Science and Technology, Vietnam
5	12:00 ~ 12:20	**Reference Trajectory Generation of Laser Beam in Consideration of Response Speed of Laser Processing Machine** Taichi Ishihara and Jun Ishikawa Tokyo Denki University, Japan
12:20 ~ 13:30		Lunch Time

Session B-2 – Control Systems

Day 1 – 07 December, 2017 Thursday

Time: 14:30 ~ 16:00; Venue: Room B010

Chair: Mohsen Razzaghi (Mississippi State University, USA)
Milan Anderle (Czech Academy of Sciences, Czech Republic)

1	14:30 ~ 14:50	**Model-Based Clustering of Time Series Based on State Space Generative Models** Bruce Wilcox and Fumio Hamano California State University, USA
2	14:50 ~ 15:10	**Analysis of the Relationship Between Operational Mastery Process and Balance Capability in Daily Life for Unstable Personal Vehicles** Kenta Nomura, Kazuki Obata and Masami Iwase Tokyo Denki University, Japan
3	15:10 ~ 15:30	**Backstepping-Based Adaptive Velocity Tracking Controller Design for a Winding Spindle System** Huy Hung Nguyen[1], Van Tu Duong[1], The Duy Pham[2], Min Saeng Shin[3], Hak Kyeong Kim[1], and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Posts and Telecommunication Institute of Technology, Vietnam [3]Dongwon Institute of Science and Technology, South Korea
4	15:30 ~ 16:00	**Feedback Control of Antagonistic-Type Twisted and Coiled Polymer Actuator** Motoya Suzuki and Norihiro Kamamichi Tokyo Denki University, Japan
16:00 ~ 16:10		Coffee Break

Session B-3 – Control Systems
Day 1 – 07 December, 2017 Thursday
Time: 16:10 ~ 17:50; Venue: Room B010
Chair: Chih-Keng Chen (National Taipei University of Technology, Taiwan)
Han Thanh Trung (Ton Duc Thang University, Vietnam)

1	16:10 ~ 16:30	**PI Sliding Mode Control for Active Magnetic Bearings in Flywheel** Van Van Huynh[1] and Yao-Wen Tsai[2] [1]Ton Duc Thang University, Vietnam [2]Da-Yeh University, Taiwan
2	16:30 ~ 16:50	**Performance Evaluation of Grasping Force Control Based on Fall Velocity Control of Grasping Object for Telemanipulation Systems** Shuichiro Shimizu, Masaru Saito and Jun Ishikawa Tokyo Denki University, Japan
3	16:50 ~ 17:10	**A Study for Learning Method of Modified PID Controller with On-line Hybrid Genetic Algorithm** Hwang Hun Jeong Korea Construction Equipment Technology Institute, South Korea
4	17:10 ~ 17:30	**Damping Control of Suspended Load for Truck Cranes in Consideration of Control Input Dimension** Mami Yoshikawa, Atsushi Iwatani and Jun Ishikawa Tokyo Denki University, Japan
5	17:30 ~ 17:50	**Model Predictive Control with Both States and Input Delays** Sofiane Bououden[1], Ilyes Boulkaibet[2], Mohammed Chadli[3] and Ivan Zelinka[4] [1]University Abbes Laghrour, Algeria [2]University of Johannesburg, South Africa [3]University of Picardie Jules Verne, France [4]VSB-Technical University of Ostrava, Czech Republic

Session C-1 – Mechanical Engineering
Day 1 – 07 December, 2017 Thursday
Time: 10:40 ~ 12:20; Venue: Room C010
Chair: Tan Tien Nguyen (Ho Chi Minh City University of Technology, Vietnam)
Nguyen Dinh Uyen (International University, Vietnam)

№	Time	Paper Title
1	10:40 ~ 11:00	**Building Management Algorithms in Automated Warehouse Using Continuous Cluster Analysis**

		Method Ngoc Cuong Truong[1], Truong Giang Dang[2] and Duy Anh Nguyen[1] [1]Ho Chi Minh City University of Technology, Vietnam [2]Ho Chi Minh City University of Transport, Vietnam
2	11:00 ~ 11:20	**Slip Analysis on a Non-holonomic Continuously Variable Transmission Using Magic Formula** Jinhyung Kong[1], Jungyun Kim[2], Ho-Young Kang[3] and Chan-Jung Kim[4] [1]Hyundai-Kia Motors, South Korea [2]Catholic University of Daegu, South Korea [3]Institute of Green Car Parts, South Korea [4]Pukyong National University, South Korea
3	11:20 ~ 11:40	**Sterilization of Edible Bird Nest Product Utilize Microwave Technology** Linh Thi My Than, Uyen Dinh Nguyen, Su Van Tran, Nguyen Hoai Ngo, and Khai Pham International University-VNU, Vietnam
4	11:40 ~ 12:00	**Optimal Design of RFECT System for Inspection of 16-inch Ferromagnetic Pipe** Jong Min Kim[1], Dae-Kwang Kim[2], Sung-Ho Cho[2], Hui Min Kim[3], Gwan Soo Park[3], Hui-Ryong Yoo[2], Jae-Jun Kim[2], Dong-Kyu Kim[2] and Sung-Jin Song[1] [1]Sungkyunkwan University, South Korea [2]Korea Gas Corporation, South Korea [3]Busan National University, South Korea
12:00 ~ 13:30		Lunch Time

Session C-2 – Mechanical Engineering

Day 1 – 07 December, 2017 Thursday

Time: 14:30 ~ 16:00; Venue: Room C010

Chair: SungJun Park (Hoseo University, South Korea, South Korea)

Vu Cong Hoa (Ho Chi Minh City University of Technology, Vietnam)

1	14:30 ~ 14:50	**Numerical Analysis of LBV150 ROV Thruster Performance Under Open Water Test Condition** Ngo Khanh Hieu, Phan Quoc Thien and Nguyen Ho Nghia Bach Khoa University (BKU), Vietnam
2	14:50 ~ 15:10	**A Method for Tuning the Frequency Series Wave Speed in Hydraulic Flexible Hose** Hwang Hun Jeong[1], Man Gon Kang[2], Ill Young Lee[3] and Jong Il Yoon[1] [1]Korea Construction Equipment Technology Institute, South Korea

		[2]Hyundai Construction Equipment, South Korea [3]Pukyong National University, South Korea
3	15:10 ~ 15:30	**Forming Limit Diagram Prediction of AA6061-T6 Sheet Using a Microscopic Void Growth Model** Tri Hao H. Nguyen[1], Trung N. Nguyen[2] and Hoa C. Vu[3] [1,3]Ho Chi Minh City University of Technology, Vietnam [2]Purdue University, USA
4	15:30 ~ 16:00	**Development of VR Based Authoring Tool for Smart Factory** Yongwon Hwang[1] and SungJun Park[2] [1]Yonsei University, South Korea [2]Hoseo University, South Korea
16:00 ~ 16:10		Coffee Break

Session C-3 – Electronics

Day 1 – 07 December, 2017 Thursday

Time: 16:10 ~ 17:50; Venue: Room C010

Chair: Ching-Hwa Cheng (Feng Chia University, Taiwan)
Cheng Guan Lim (Ton Duc Thang University, Vietnam)

1	16:10 ~ 16:30	**EMG-Based Interface Multi-degree of Freedom and Optionality** Taiki Kobayashi, Risako Hiroki, Masami Iwase and Jun Inoue Tokyo Denki University, Japan
2	16:30 ~ 16:50	**Experimental Evaluation of Steady State Visual Evoked Potentials for Brain Machine Interface** Hitomi Honoki, Trongmun Jiralerspong, Fumiya Sato and Jun Ishikawa Tokyo Denki University, Japan
3	16:50 ~ 17:10	**MicroEYE: A Wireless Multiple-Lenses Panoramic Endoscopic System** Jian-Lin Zeng[1], Yu-Hsiang Cheng[2], Tsung-Yi Wu[3], Don-Gey Liu[1] and Ching-Hwa Cheng[1] [1,2]Feng Chia University, Taiwan [3]National Changhua University of Education, Taiwan
4	17:10 ~ 17:30	**A Deep Through-Microhole Fabricated Inside a Glass Optical Fiber by Use of a Near Ultraviolet Femtosecond Laser** Masahiko Shiraishi[1], Kazuhiro Watanabe[2] and Shoichi Kubodera[2] [1,2]Soka University, Japan
5	17:30 ~ 17:50	**Simulation of Ridge-Waveguide AlGaInP/GaInP Multiple-Quantum Well Diode Lasers** Thanh-Nam Tran and Le The Vinh Ton Duc Thang University, Vietnam

Session D-1 – Robotics
Day 1 – 07 December, 2017 Thursday
Time: 10:40 ~ 12:20; Venue: Room A104
Chair: Masaki Yamakita (Tokyo Institute of Technology, Japan)
Tran Thanh Trang (Ho Chi Minh City University of Food Industry, Vietnam)

№	Time	Paper Title
1	10:40 ~ 11:00	**Continuous Genetic Algorithm Aiding to Quadcopter Controller Design** Huu Khoa Tran[1] and Tran Thanh Trang[2] [1]Ton Duc Thang University, Vietnam [2]Ho Chi Minh City University of Food Industry, Vietnam
2	11:00 ~ 11:20	**Path Following Control of Bike Robot** Ryotaro Miyahara and Masaki Yamakita Tokyo Institute of Technology, Japan
3	11:20 ~ 11:40	**Online Training the Radial Basis Function Neural Network Based on Quasi-Newton Algorithm for Omni-directional Mobile Robot Control** Tung Thanh Pham[1], Dong Van Huong[2], Chi-Ngon Nguyen[3] and Thanh Le Minh[1] [1]Vinh Long University of Technology Education, Vietnam [2]Ho Chi Minh City University of Transportation, Vietnam [3]Can Tho University, Vietnam
4	11:40 ~ 12:00	**Walking Figure Generating in Consideration of Ground Reaction Force** Kousuke Sato, Shoshiro Hatakeyama, and Masami Iwase Tokyo Denki University, Japan
5	12:00 ~ 12:20	**Simulation and Experiment of Underwater Vehicle Manipulator System Using Zero-Moment Point Method** Ngoc-Duc Nguyen[1], Hyeung-Sik Choi[1] Ngoc-Huy Tran[2] and Seo-Kang Kim[1] [1]Korea Maritime and Ocean University, South Korea [2]Ho Chi Minh City University of Technology, Vietnam
12:20 ~ 13:30		Lunch Time

Session D-2 – Robotics

Day 1 – 07 December, 2017 Thursday

Time: 14:30 ~ 16:00; Venue: Room A104

Chair: Mitsuji Sampei (Tokyo Institute of Technology, Japan)
Dinh Hoang Bach (Ton Duc Thang University, Vietnam)

1	14:30 ~ 14:50	**Tracking Controller Design for Omni-Directional Automated Guided Vehicles Using Backstepping and Model Reference Adaptive Control** Huy Hung Nguyen[1], Chang Kyu Kim[1], Cuu Ho Van[2], Thanh Luan Bui[3], Hak Kyeong Kim[1], Choong Hwan Lee[4] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Sai Gon University, Vietnam [3]HUTECH University of Technology, Vietnam [4]Dongwon Institute of Science and Technology, South Korea
2	14:50 ~ 15:10	**A Study on Looking for Shortest Trajectory of Mobile Robot Using A* Algorithm** Duy Lan Bui and Tri Cong Phung Ho Chi Minh City University of Technology, Vietnam
3	15:10 ~ 15:30	**Development of a Module Robot for Glass Façade Cleaning Robot** Shunsuke Nansai[1], Keichi Onodera[1] and Mohan Rajesh Elara[2] [1]Tokyo Denki University. Japan, [2]Singapore University of Technology and Design, Singapore
4	15:30 ~ 16:00	**Development of Ray-Type Underwater Glider** Ngoc-Duc Nguyen[1], Hyeung-Sik Choi[1] Ngoc-Huy Tran[2] and Seo-Kang Kim[1] [1]Korea Maritime and Ocean University, South Korea [2]Ho Chi Minh City University of Technology, Vietnam
16:00 ~ 16:10		Coffee Break

Session D-3 – Robotics

Day 1 – 07 December, 2017 Thursday

Time: 16:10 ~ 17:50; Venue: Room A104

Chair: Masami Iwase (Tokyo Denki University, Japan)
Tuong Quan Vo (Ho Chi Minh City University of Technology, Vietnam)

1	16:10 ~ 16:30	**Study on Design, Analysis and Control an Underwater Thruster for Unmanned Underwater Vehicle (UUV)** Ngoc-Huy Tran[1],Quoc Tien-Dung Tran[2], Ngoc-Duc Nguyen[3] and Hyeung-Sik Choi[3]

		[1]Ho Chi Minh City University of Technology, Vietnam [2]National Key Laboratory of Digital Control and System Engineering, VNUHCM, Vietnam [3]Korea Maritime and Ocean University, South Korea
2	16:30 ~ 16:50	**Study on Determining the Number of Fin-Rays of a Gymnotiform Undulating Fin Robot** Van Dong Nguyen[1], Dinh Khanh Phan[1], Canh An Tien Pham[1], Dae Hwan Kim[2], Viet Tuan Dinh[3] and Tan Tien Nguyen[1] [1]Hochiminh City University of Technology, Vietnam [2]Pukyong National University, South Korea [3]Dalat University, Vietnam
3	16:50 ~ 17:10	**Nonlinearities Compensation Method for Application to Robot Manipulators Using Time-Delay Estimation** Manh Son Tran, Suk Ho Jung and Young Bok Kim Pukyong National University, South Korea
4	17:10 ~ 17:30	**Modeling of Rolling Locomotion on a Reconfigurable Quadruped Robot with Servos for State Estimation** Takuma Nemoto[1], Keichi Onodera[1,2], Rajesh Elara Mohan[1] and Masami Iwase[2] [1]Singapore University of Technology and Design, Singapore [2]Tokyo Denki University, Japan
5	17:30 ~ 17:50	**Modeling and Evaluating Motion Performance of Robotic Fish with a Pair of Non-uniform Pectoral Fins** Van Anh Pham, Tan Tien Nguyen and Tuong Quan Vo Ho Chi Minh City University of Technology, Vietnam

Session A-4 – Telecommunications

Day 2 – 08 December, 2017 Friday

Time: 09:30 ~ 10:50; Venue: Room A403

Chair: Miroslav Voznak (VSB-Technical University of Ostrava, Czech Republic)

Tran Thanh Phuong (Ton Duc Thang University, Vietnam)

№	Time	Paper Title
1	9:30 ~ 9:50	**Enhanced Self-sorting Based MAC Protocol for Vehicular Ad-Hoc Networks** Quynh Tu Ngo and Duc Ngoc Minh Dang Ton Duc Thang University, Vietnam
2	9:50 ~ 10:10	**Analytical Study of the IEEE 1609.4 MAC in Vehicular Ad Hoc Networks**

		Duc Ngoc Minh Dang[1], Quynh Tu Ngo[1], Hanh Ngoc Dang[2] and Phuong Luu Vo[3] [1]Ton Duc Thang University, Vietnam [2]HCM City University of Technology, Vietnam [3]International University - VNUHCM, Vietnam
3	10:10 ~ 10:30	**Adaptive TDMA and CSMA-Based MAC Protocols for Vehicular Ad Hoc Networks: A Survey** VanDung Nguyen and Choong Seon Hong Kyung Hee University, South Korea
4	10:30 ~ 10:50	**Multi-sensor Data Fusion Technique to Detect Radiation Emission in Wireless Sensor Networks** Sergej Jakovlev[1], Mindaugas Kurmis[2], Darius Drungilas[3], Zydrunas Lukosius[3] and Miroslav Voznak[4] [1,3]Klaipeda University, Lithuania [2]Klaipeda State College, Lithuania [4]VSB-Technical University of Ostrava, Czech Republic
10:50 ~ 11:00		Coffee Break

Session A-5 – Materials

Day 2 – 08 December, 2017 Friday

Time: 11:00 ~ 12:40; Venue: Room A403

Chair: Shoichi Kubodera (Soka University, Japan)

Cheng Guan Lim (Ton Duc Thang University, Vietnam)

1	11:00 ~ 11:20	**The Impact of Distance Between Two Phosphor Layers on Luminous Flux and Color Quality of Remote Phosphor Package** Nguyen Thi Phuong Thao[1,2], Miroslav Voznak[2] and Nguyen Doan Quoc Anh[1] [1]Ton Duc Thang University, Vietnam [2]VSB-Technical University of Ostrava, Czech Republic
2	11:20 ~ 11:40	**The Thixoforming Process with Different Pressing Speed for Aluminum Material** Nguyen Vinh Du[1], Pham Son Minh[2] and Luu Phuong Minh[3] [1]Department of Science and Technology, Ho Chi Minh City, Vietnam [2]Ho Chi Minh City University of Technology and Education, Vietnam [3]Ho Chi Minh City University of Technology, Vietnam
3	11:40 ~ 12:00	**Simulation Study of Microstructure of the Amorphous ZnO** Le The Vinh[1], Nguyen Doan Quoc Anh[1], Vo Hoang Duy[1], Nguyen Kieu Tam[1], Tran Thanh Nam[1], Mai Van

		Dung[2,3] and Nguyen Manh Tuan[2] [1]Ton Duc Thang University, Vietnam [2]Vietnam Academy of Science and Technology, Vietnam [3]Thu Dau Mot University, Vietnam
4	12:00 ~ 12:20	**A Novel Approach to Fabricate Silicon Nanowire Field Effect Transistor for Biomolecule Sensing** Chi-Chang Wu[1], Yankuba B. Manga[2], Jia-Yang, Hung[2] and Wen-Luh Yang[1] [1]Feng Chia University, Taiwan [2]Graduate Institute of Biomedical Materials and Tissue Engineering, Taiwan
5	12:20 ~ 12:40	**Improving the Optical Properties of the 8500 K In-cup Packaging WLEDs by Using the Green-emitting $CaF_2:Ce^{3+}$, Tb^{3+} Phosphor** Tran Hoang Quang Minh and Le Anh Vu Ton Duc Thang University, Vietnam
12:40 ~ 13:30		Lunch

Session B-4 – Control Systems

Day 2 – 08 December, 2017 Friday

Time: 09:30 ~ 10:50; Venue: Room B010

Chair: Roman Senkerik (Tomas Bata University, Czech Republic)
Dae Hwan Kim (Pukyong National University, South Korea)

№	Time	Paper Title
1	9:30 ~ 9:50	**State Estimation of a Yoyo Based on a Model with Elasticity of a String** Takuma Nemoto[1], Sho Komagata[2], Koichi Asada[2] and Masami Iwase[2] [1]Singapore University of Technology and Design, Singapore [2]Tokyo Denki University, Japan
2	9:50 ~ 10:10	**Optimal Pump Scheduling to Pressure Management for Large-Scale Water Distribution Systems** Pham Duc Dai, Le Quang Cuong and Bui Van Dai Thuy Loi University, Vietnam
3	10:10 ~ 10:30	**On the Hamiltonian Approach to the Collocated Virtual Holonomic Constraints in the Underactuated Mechanical Systems** Sergej Čelikovský and Milan Anderle Czech Academy of Sciences, Czech Republic
4	10:30 ~ 10:50	**Variable Structure Load Frequency Control of Power System** Van Van Huynh[1], Bui Le Ngoc Minh[2] and Tam Minh Nguyen[2]

		[1]Ton Duc Thang University, Vietnam [2]Ho Chi Minh City University of Technology and Education, Vietnam
10:50 ~ 11:00		Coffee Break

Session B-5 – Energy

Day 2 – 08 December, 2017 Friday

Time: 11:00 ~ 12:20; Venue: Room B010

Chair: Dinh Hoang Bach (Ton Duc Thang University, Vietnam)

Kim Zeen Chul (Ton Duc Thang University, Vietnam)

1	11:00 ~ 11:20	**A Research on the Thermal Daily Performance of Hybrid Solar Collector with Fin-and-Tube Heat Exchanger in Winter** R. Fatkhur, H.U. Choi, Y.B. Kim, C.H. Son, J.I. Yoon and K.H. Choi Pukyong National University, South Korea
2	11:20 ~ 11:40	**Numerical Design of Solar Collector Trough System for Integrated Solar Combine Cycle** Nguyen Dao and Quang Dung Nguyen Ton Duc Thang University, Vietnam
3	11:40 ~ 12:00	**A Study on the Heat Exchange Performance of Hybrid Solar Collector with Air to Water Heat Exchanger Type** H.U. Choi, R. Fatkhur, Y.B. Kim, C.H. Son, J.I. Yoon and K.H. Choi Pukyong National University, South Korea
4	12:00 ~ 12:20	**A Study of the Power Factor Improvement by Using Harmonic Filter in Busan Urban Railway Substation with Thyristor Rectification Method** Seong Gyu Kim[1], Sung Woo Han[1], Seung Sam Seo[1], Jong Il Bae[2] and Gi Sig Byun[2] [1]Busan Transportation Corporation, South Korea [2]Pukyong National University, South Korea
12:20 ~ 13:30		Lunch

Session C-4 – Electronics
Day 2 – 08 December, 2017 Friday
Time: 09:30 ~ 10:50; Venue: Room C010
Chair: Tang-Chieh Liu (Feng Chia University, Taiwan)
Dang Ngoc Minh Duc (Ton Duc Thang University, Vietnam)

№	Time	Paper Title
1	9:30 ~ 9:50	**Motion and Force Estimation Based on the NARX with an EMG Signal** Yuuto Ohno, Jun Inoue, Masami Iwase, and Shoshiro Hatakeyama Tokyo Denki University, Japan
2	9:50 ~ 10:10	**A Low-Power Embedded IoT Microprocessor Design and Validation** Ching-Hwa Cheng Feng Chia University, Taiwan
3	10:10 ~ 10:30	**Enhancement of Distributed Fiber Optic Vibration Sensors** Vít Novotný Brno University of Technology, Czech Republic
4	10:30 ~ 10:50	**Real-Time Root Monitoring of Hydroponic Crop Plants: Proof of Concept for a New Image Analysis System** Erdem Erdemir[1] and Timothy Darrah[2] [1]Tennessee State University, USA [2]Vanderbilt University, USA
10:50 ~ 11:00		Coffee Break

Session C-5 – Image Processing
Day 2 – 08 December, 2017 Friday
Time: 11:00 ~ 12:20; Venue: Room C010
Chair: Jun Ishikawa (Tokyo Denki University, Japan)
Nguyen Huu Khanh Nhan (Ton Duc Thang University, Vietnam)

1	11:00 ~ 11:20	**A New Approach of 2D Measurement of Injury Rate on Fish by a Modified K-means Clustering Algorithm Based on L*A*B* Color Space** Minh Thien Tran[1], Huy Hung Nguyen[1], Jotje Rantung[1], Hak Kyeong Kim[1], Sea June Oh[2] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Korea Maritume and Ocean University, South Korea
2	11:20 ~ 11:40	**The Estimation Method of Force by Using Kinect Camera** Ryosuke Okada, Shoshiro Hatakeyama and Masami

		Iwase Tokyo Denki University, Japan
3	11:40 ~ 12:00	**Recognition and Grasping Objects from 3D Environment by Combining Depth and Color Stereo Image in the Mobile Picking Robot System** Trong Hai Nguyen[1,3], Jong Min Oh[1], Dae Hwan Kim[1], Sang Kwun Jeong[2], Hak Kyeong Kim[1] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Korea Polytechnic Colleges, South Korea [3]Hutech High Technology Research Institute, Vietnam
4	12:00 ~ 12:20	**Determination of the Fish Surface Area and Volume Using Ellipsoid Approximation Method Applied for Image Processing** Rantung Jotje[1], Minh Thien Tran[1], Hwan Yeol Jang[1], Jin Woo Lee[2], Hak Kyeong Kim[1] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Korean Occupational Safety and Health Agency, South Korea
12:20 ~ 13:30		Lunch

Session D-4 – Robotics

Day 2 – 08 December, 2017 Friday

Time: 09:30 ~ 10:50; Venue: Room A104

Chair: Woong Yeol Joe (Tennessee State University, USA)
Nguyen Sy Dung (Ton Duc Thang University, Vietnam)

№	Time	Paper Title
1	9:30 ~ 9:50	**Study on the Combined Underwater Tracked Vehicle System with a Rock Crushing Tool** Mai The Vu, Hyeung-Sik Choi, Dong-Wook Jung and Hyun-Joong Son Korea Maritime University, South Korea
2	9:50 ~ 10:10	**Design and Implement a Fuzzy Autopilot for an Unmanned Surface Vessel** Nhat Minh Do[1], Hong Hai Vo[2] and Duy Anh Nguyen[1] [1]HCM City University of Technology, Vietnam [2]Vietnam Maritime University, Vietnam
3	10:10 ~ 10:30	**Development of the Removable Electric Drive System for Wheelchair Running on Public Road** Yuki Iwami, Jun Inoue, Masami Iwase and Shoshiro Hatakeyama Tokyo Denki University, Japan
4	10:30 ~ 10:50	**Designing Optimal Trajectories and Tracking Controller for Unmanned Underwater Vehicles**

		Mai The Vu, Hyeung-Sik Choi, Thieu Quang Minh Nhat and Dong-Wook Jung Korea Maritime University, South Korea
10:50 ~ 11:00		Coffee Break

Session D-5 – Motor Control

Day 2 – 08 December, 2017 Friday

Time: 11:00 ~ 12:20; Venue: Room A104

Chair: Han Thanh Trung (Ton Duc Thang University, Vietnam)

Duy Anh Nguyen (Ho Chi Minh City University of Technology, Vietnam)

1	11:00 ~ 11:20	**Fast Maximum Power Point Tracking Control for Variable Speed Wind Turbines** Tan Luong Van[1], Dung Quang Nguyen[2], Vo Hoang Duy[3] and Hung Nguyen[4] [1]Ho Chi Minh City University of Food Industry, Vietnam [2]Sai Gon University, Vietnam [3]Ton Duc Thang University, Vietnam [4]Hutech University of Technology, Vietnam
2	11:20 ~ 11:40	**High-Gain Observer Based Output Feedback Controller for a Two-Motor Drive System: A Separation Principle Approach** Dao Phuong Nam[1], Pham Tuan Thanh[2], Tran Xuan Tinh[2], Tran Thanh Dat[1] and Vu Minh Van[2] [1]Hanoi University of Science and Technology, Vietnam [2]Le Quy Don University, Vietnam
3	11:40 ~ 12:00	**A Fuzzy-Based Supervisory Controller Development for a Series Hydraulic Hybrid Vehicle** Tri-Vien Vu[1] and Chih-Keng Chen[2] [1]Ton Duc Thang University, Vietnam [2]National Taipei University of Technology, Taiwan
4	12:00 ~ 12:20	**Study on Hybrid Method for Efficiency Optimization of Induction Motor Drives** Trong Hai Nguyen[1,2], Jeong Rim Son[1], Khanh Pham Hung Kim[2], Nam Soo Jeong[3], Hak Kyeong Kim[1] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Hutech High Technology Research Institute, Vietnam [3]Dongwon Institute of Science and Technology, South Korea
12:20 ~ 13:30		Lunch

POSTER PRESENTATION

Day 1 – 07 December, 2017 Thursday

Session P: 15:40 ~ 16:10

Session P – Robotics – Control System – Electrical Engineering
Day 1 – 07 December, 2017 Thursday
Time: 15:40 ~ 16:10; Venue: Lobby A101

№	Paper Title
1	**Control System Design of Four Wheeled Independent Steering Automatic Guided Vehicles (AGV)** Dae Hwan Kim[1], Hyuk Yim[2], Woong Yeol Joe[3] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Nsquare Company, South Korea [3]Tennessee State University, USA **Abstract.** This paper four wheeled independent steering automatic guided vehicle (4WIS-AGV) is a developed AGV that has four wheeled configuration in which each wheel is steerable. Because of this wheel configuration, 4WIS-AGV can have higher maneuverability and flexibility in narrow working space. However, controlling the four wheeled independent steering AGV is not easy. Therefore, this paper proposes a control system to steer 4WIS-AGV. To do this task, the followings are done. First, the single track vehicle model is used to represent the 4WIS-AGV model. The single track vehicle model is obtained by reducing an ordinary four wheeled vehicle model to a two wheeled vehicle model with the wheels in the centerline of the vehicle. Second, backstepping control method is applied to make the 4WIS-AGV track a given path well. Finally, simulation is carried out to verify the effectiveness of the proposed controller in tracking the given path. The simulation results show that the proposed control system is capable of tracking the reference trajectory successfully. **Keywords:** Automatic guided vehicle, backstepping, control design, four wheel independent steering.
2	**A Guide to Selecting Path Planning Algorithm for Automated Guided Vehicle (AGV)** Dae Hwan Kim[1], Nguyen Trong Hai[1] and Woong Yeol Joe[2] [1]Pukyong National University, South Korea [2]Tennessee State University, USA **Abstract.** This paper presents a guide to selecting path planning algorithm for automated guided vehicle. To solve the problem that users cannot choose the right algorithm due to a lack of comparative analysis of path planning algorithms, the following tasks are done. Firstly, a guide containing explanation and comparison of A* and D* Lite algorithms is presented. Then, suggestions in algorithm selection are proposed. Finally, simulation and experimental results are shown. In large area and complex work environment, D* Lite algorithm usually plans shorter path faster than A* algorithm does. However, D* Lite algorithm might be less effective than A* algorithm in small area and simple work environment. For those reasons, the characteristics of

	system which algorithm is going to be applied to should be considered in algorithm selection. **Keywords:** Automatic guided vehicle, Guide, Path planning algorithm, D* Lite, A* algorithm
3	**Effect of Minimum Quantity Lubrication on Surface Roughness in Milling Machining** Nguyen Thanh Son, Than Trong Khanh Dat, Nguyen Ngoc Quynh, Tran Thien Phuc Ho Chi Minh city University of Technology, Vietnam **Abstract.** This paper presents the selection of optimal technology parameters of Minimum Quantity Lubrication (MQL) method (rotation angle of nozzle to feed direction, ratio of soluble lubricant and water, distance from the nozzle spray to cutting zone) on outside end-milling machining for SKD 11 steel. The process of analyzing the effects of technological parameters is based on mathematical models, experimental models. The results obtained in this paper provide the optimal MQL parameters for end-milling machine process on steel SKD11 with reliability and effectiveness. **Keywords:** Minimum quantity lubrication (MQL), end-milling machining, nozzle position, face milling, surface roughness.
4	**Independent Joint Control System Design Method for Robot Motion Reconstruction** Manh Son Tran[1], Nhat Binh Le[1], Van Trong Nguyen[1], Dac Chi Dang[2], Eun Ho Choi[1] and Young Bok Kim[1] [1]Pukyong National University, South Korea [2]Cao Thang Technical College, Vietnam **Abstract.** It is a challenging and hard problem to control the multi-joint robot manipulators due to the nonlinearities which are extremely and strongly coupled in the set of dynamic equations governing the motion dynamics of the robot system. This paper presents a robot control technique for definitely reconstructing motions. The controlled robot is used in small industries such as welding and painting work. The proposed method is a simple one and decentralized linear joint control strategy. Exactly describing, it is an user-oriented method and no need complex computation. In this study, at first, the mathematical model of each joint of the 5 DOF robot arm is derived individually. Secondly, to improve the control performance in transient response, nonlinear controllers such as feedback linearization as well as sliding mode control are exploited to compensate the nonlinearities and uncertainties. Finally, experiments are carried out to verify the effectiveness and feasibility of the presented approach, and the results are compared to those of the tuned PID controller. The results point out that the proposed control scheme is simple, realistic and can be easily employed on robot manipulators in the real world. **Keywords:** Motion control, sliding mode control, decentralized control, motion regeneration.
5	**Modeling and Control System Design of Four Wheel Independent**

	Steering Automatic Guided Vehicle (AGV) Dae Hwan Kim[1], Yong Won Hwang[2] and Sang Bong Kim[1] [1]Pukyong National University, South Korea [2]Yonsei University, South Korea **Abstract.** This paper proposes a modeling and a control system design of Four Wheel Independent Steering Automatic Guided Vehicle (4WIS-AGV) based on optimal control method. Because of narrow working space in warehouse, 4WIS-AGV which each wheel of the vehicle is driven by a driving motor and a steering motor is developed due to its high maneuverability and flexibility. The single track vehicle model is used as the model of 4WIS-AGV. The single track vehicle model is obtained by reducing an ordinary four wheel vehicle model to two wheel vehicle model with the wheels in the centerline of the vehicle. The optimal controller is proposed to make the 4WIS-AGV able to follow the desired vehicle sideslip angle and yaw rate. The proposed model and control system are verified by simulation that shows their effectiveness in controlling the 4WIS-AGV. **Keywords:** Four Wheel Independent Steering, Automatic Guided Vehicle, Optimal control
6	**PI-Based Fuzzy Speed Controller with PWM Direct Torque Control for Induction Motor Drive** Hau H. Vo[1], Pavel Brandstetter[2], Martin Kuchar[2], Chau S. T. Dong[1], Thinh C. Tran[1] and Duy H. Vo[1] [1]Ton Duc Thang University, Vietnam [2]VSB-Technical University of Ostrava, Czech Republic **Abstract.** The paper describes a fuzzy speed controller with direct torque control for induction motor drive. Classical PI speed controller with fixed proportional and integral coefficients is not appropriate for exact motor speed regulation in a wide range of reference speed. Fuzzy logic, one of simplest soft computing techniques, can make PI controllers more flexible. In the paper, a simple fuzzy algorithm is proposed for online update coefficients of PI speed controller. The use of a pulse-width modulator in the direct torque control structure is to ensure the constant switching frequency. The control structures of the induction motor drive are implemented into a control system with digital signal processor. Experimental results confirm that speed controller with proposed fuzzy algorithm gives response of actual motor speed with lower overshoot, shorter settling time, and smaller speed accuracy than classical speed controller does. **Keywords:** Induction motor drive, fuzzy logic, pulse-width modulation, direct torque control.
7	**Feedback-Linearization-Based Direct Power Control of DFIG Wind Turbine Systems Under Unbalanced Grid Voltage** Tan Luong Van[1], Hung Nguyen[2] and Minh Tuan Tran[3] [1]Ho Chi Minh City University of Food Industry, Vietnam [2]HCMC University of Technology, Vietnam [3]RMIT University, Vietnam

	Abstract. In this paper, a power control strategy based on feedback linearization (FL) control has been proposed at the rotor-side converter (RSC) of the doubly-fed induction generator (DFIG) wind turbine system under unbalanced grid voltage. With this method, the nonlinear model is linearized, not by small signal analysis, which makes it simpler to design the controllers. Furthermore, the oscillations of active power and generator torque can be much reduced. The effectiveness of the proposed methods is verified by the simulation results for the 2 [MW]-DFIG wind turbine system under unbalanced grid voltage conditions. **Keywords:** direct power control, doubly-fed induction generator, feedback linearization, un-balanced grid voltage, wind turbine.
8	**Rotor Time Constant Estimation of Induction Motor Using Online PI-Adaptive and GA-Adaptive Model** Thinh Cong Tran[1], Pavel Brandstetter[2], Vo Hoang Duy[1], Hau Huu Vo[1], Cuong Dinh Tran[1] and Sang Dang Ho[1] [1]Ton Duc Thang University, Vietnam [2]VSB-Technical University of Ostrava, Czech Republic **Abstract.** The paper presents an application of the genetic algorithm for parameter findings in the control structure of the A.C. drive with the vector controlled modeling. The mathematical model of DFOC control of the induction motor with the speed controller is described in the first section. The second part presents the PI-Adaptive model for estimating rotor time constant (T_r), the third is the GA-Adaptive online model combining genetic and adaptive algorithms to estimate rotor time constant, Simulative results in the Matlab-Simulink environment indicate that the value and responsiveness of the T_r of GA-Adaptive model are better than PI-Adaptive when the T_r values change during operation. **Keywords:** A.C. drive, induction motor, vector control, rotor time constant, adaptive controller, genetic algorithm, optimization.
9	**Estimate Parameters of Induction Motor Using ANN and GA Algorithm** Thinh Cong Tran[1], Pavel Brandstetter[2], Vo Hoang Duy[1], Chau Dong[1], Cuong Dinh Tran[1] and Sang Dang Ho[1] [1]Ton Duc Thang University, Vietnam [2]VSB-Technical University of Ostrava, Czech Republic **Abstract.** This paper presents methods for estimating induction motor parameters such as stator resistance, stator inductance, rotor inductance, rotor time constant ... by artificial neural network (ANN) and genetic algorithm (GA). The first part is the mathematical basis for estimating motor parameters by neural and genetic algorithms, the second part is the motor model for data collection for estimation, the third part is simulation. As a result of the simulation, the results show that it is possible to accurately estimate the parameters of the induction motor by ANN or GA algorithm. **Keywords:** A.C. drive, induction motor, vector control, artificial

	neural network, genetic algorithm, estimating parameters, rotor time constant, stator resistance, optimization.
10	**Path Planning for Automatic Guided Vehicle with Multiple Target Points in Known Environment** Chang Kyu Kim, Sung Won Kim, Huy Hung Nguyen, Dae Hwan Kim, Hak Kyeong Kim and Sang Bong Kim Pukyong National University, South Korea **Abstract.** Today, Automatic Guided Vehicles (AGVs) with a path planning algorithm are being used in many industrial fields. There are A*, D*, and D* lite algorithms in the path planning algorithm. In this paper, propose a modified D* lite algorithm using the most efficient D* lite among these algorithms. The modified D* lite path planning algorithm is proposed to improve these D* lite path planning algorithm's weaknesses such as traversing across obstacles sharp corners, or traversing between two obstacles. The modified D* lite path planning algorithm has function to set target points differently from the existing D* lite path planning algorithm. To do this task, the followings are done. First, a work space is divided into square cells. Second, cost of each edge connecting current node to neighbor nodes is calculated. Third, the shortest paths from the initial point to all multiple target points are computed and the shortest paths from any target point to remaining target points including the goal point are computed by using Hamilton path. Fourth, a cost-minimal path is recalculated as soon as the laser sensor detects an obstacle and make an updated list of target points. Finally, the validity of the proposed modified D* lite path planning algorithm is verified through simulation and experimental results in known environment. **Keywords:** Path planning, D* lite algorithm, automatic guided vehicle, laser sensor, multiple targets.
11	**Study on Optimized Guidance and Robust Control for the Ship Maneuvering** Ngoc-Huy Tran [1], Nguyen Nhut-Thanh Pham[2], Bao Hong-Vo Thai[1] and Tat-Hien Le[1] [1]Ho Chi Minh City University of Technology, Vietnam [2]Key Laboratory of Digital Control and System Engineering, VNUHCM, Vietnam **Abstract.** This paper presents an optimal path-following controller design for a ship. The main concern is to ensure the system output follows a planning path with the desired heading angle and speed. For the pre-processing, the quality of planning path will be optimized by using curve technique such as non-uniform b-spline instead of cubic spline. The backstepping control law which overcomes the defects of PID control law, be also robust and not require the number of signal input to equal the number of signal output. Hence in this paper, the backstepping algorithm is applied to solve this maneuvering problem. Simulation results on MATLAB/SIMULINK demonstrate the reliability and effectiveness of the proposed method.

	Keywords: non-uniform b-spline, backstepping, Lyapunov, ship dynamics.
12	**Advanced Control Strategy of Dynamic Voltage Restorers for Distribution System Using Sliding Mode Control Input-Ouput Feedback Linearization** Tan Luong Van[1], Ngoc Minh Doan Nguyen[2], Le Thanh Toi[1] and Tran Thanh Trang[3] [1]Ho Chi Minh City University of Food Industry, Vietnam [2]Sai Gon University, Vietnam [3]National Key Laboratory of Digital Control and System Engineering, Vietnam National University Ho Chi Minh City, Vietnam **Abstract.** In this paper, a nonlinear control scheme for dynamic voltage restorer (DVR) under grid voltage sags and nonlinear loads is proposed to mitigate the voltage disturbances for loads. First, the nonlinear model of the system consisting of LC filter based on a feedback linearization technique is obtained in the d-q synchronous reference frame. Then, the controller design of the linearized model is performed by employing the sliding mode control, where the load voltages are kept constant by controlling the d-q axis components of the DVR output voltages. With this scheme, the power quality is significantly improved, compared with the tradition-al methods with the PI controller under grid voltage sags and nonlinear loads. Also, the system cost and power loss of the proposed DVR is significantly minimized thanks to the use of a smaller number of power switches (four-switch three-phase inverter) with a lower rating voltage without degrading the compensation performance of the DVR. Simulation studies are performed to verify the validity of the proposed method. **Keywords:** dynamic voltage restorer, feedback linearization, nonlinear load, sliding mode control, voltage sags.
13	**Heading and Depth Control of Autonomous Underwater Vehicles via Adaptive Neural Network Controller** Chau Giang Nguyen[1], Viet Anh Pham[2] and Duy Anh Nguyen[1] [1]Ho Chi Minh City University of Technology, Vietnam [2]Ho Chi Minh City University of Transport, Vietnam **Abstract.** This paper describes the application of neural network technique in the design of autopilots for control the heading and depth of an autonomous underwater vehicle (AUV) that is an uncertain nonlinear dynamical one with unknown nonlinearities. Autopilots are designed using Adaptive Neural Network by Adaptive Interaction (ANNAI) controller to control its heading and depth. To demonstrate the effectiveness and feasibility of the neural network controller under the influence of noise and submarine current, computer simulations of control tasks are presented (using Matlab software). The achieved results confirm the ANNAI controller's effectiveness and it is also useful for control of nonlinear systems. **Keywords:** Autonomous underwater vehicles, autopilots, neural networks.

Firefly Algorithm: Enhanced Version with Partial Population Restart Using Complex Network Analysis

Tomas Kadavy, Michal Pluhacek, Adam Viktorin and Roman Senkerik
Tomas Bata University in Zlin, Czech Republic

Abstract. In this paper, we are presenting an interesting method for controlling population diversity of the Firefly Algorithm (FA). Presented method is using the advantages of complex networks and their several characteristics that can be helpful for the detailed analysis of metaheuristic algorithm inner dynamic. Through this work, we are trying to present a simple workflow for building and analysis of network and the most suitable choices in each step to achieve better results of FA, especially, when focusing on population diversity.
Keywords: Firefly Algorithm, FA, Complex Network, Population restart.

A New Android Botnet Classification for GPS Exploitation Based on Permission and API Calls

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Abstract. The target of botnet attacks has shifted from the personal computers to smartphones and mobile devices due to computational power and functionality of the mobile devices. Mobile botnet is a network consists of compromised mobile devices controlled by a botmaster through a command and control (C&C) network. Nowadays mobile botnets attacks are increasingly being used for advanced political or financial interest. Due to its popularity amongst the mobile operating system, Android has become the most targeted platform by the mobile botnets. The popularity of Android attracts the attackers to develop malicious applications with the botnet capability to hijack users' devices. In this paper, a new Android botnet classification based on GPS exploitation based on permissions and API calls is proposed using feature selection. The training was carried out using malware dataset from the Drebin and tested using 800 mobile apps from the Google Play store. The experiment was conducted using static analysis and open source tools in a controlled lab environment. This new classification can be used as a reference for other researchers in the same field to secure against GPS exploitation from Android botnet attacks.
Keywords: mobile botnet, android smartphone, machine learning, mobile botnet classification, static analysis.

Processing Big Data in Field of Marketing Models Using Apache Spark

Tomáš Janečko, Ondřej Grunt, Jan Plucar, Markéta Štáková and Ivan Zelinka
VSB-Technical University of Ostrava, Czech Republic

Abstract. This paper presents an application of Apache Spark cluster for processing of selected marketing data. Based on available realistic data, Azure cluster is reused. Due to a complexity of the infrastructure and running environment, we used cloud resources for deploying and executing target simulations. Outputs then represents analysis of the links between the structured data and performance measurements.
Keywords: Apache Spark, big data, data analysis, cloud computing, statistics, telemetry.

A Protocol for Securing E-Voting System

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Abstract. E-voting is a kind of election in which voters use digital ballots to present their civil rights, and e-voting gradually becomes an essential need for every organization and nation. There are some requirements in the e-voting process: confidential, integrity, authentication, and privacy of ballot. As a result, conducting an e-voting protocol is an important task to ensure the security requirements for e-voting process. In the previous works, researchers have proposed some properties of an esoteric e-voting protocol. The result of analyzing existed protocols shows that these protocols do not fully match properties of the esoteric protocol yet. In this paper, a new protocol which can meet requirements better than the formers is proposed.
Keywords: e-voting, protocol, cryptography.

L-SHADE Algorithm with Distance Based Parameter Adaptation

Adam Viktorin, Roman Senkerik, Michal Pluhacek and Tomas Kadavy
Tomas Bata University in Zlin, Czech Republic

Abstract. In this paper a modification to the adaptive mechanism in Success-History based Adaptive Differential Evolution (SHADE) with Linear decrease in population size (L-SHADE) is proposed in order to overcome the premature convergence, while optimizing higher dimensional problems. This modification can be also useful in constrained optimization, where the improved exploration could help in overcoming constrained areas. The proposed modification of the algorithm is tested on the CEC2015 benchmark set and compared to its basis – L-SHADE.
Keywords: L-SHADE; Parameter Adaptation; Scaling Factor; Crossover Rate; Distance Based Adaptation.

Session A-2 – Optimization

A Review of Real-World Applications of Particle Swarm Optimization Algorithm

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[1]Tomas Bata University in Zlin, Czech Republic
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Abstract. In this work, we present an overview of the various real-world application of Particle Swarm Optimization Algorithm. We argue that the PSO is showing superior performance on different optimization problems such as temperature prediction, battery storage optimization or leukemia diagnosis. The diversity of real-world applications covers the fields of electronic, informatics, energetics, medicine and many other areas of industry and research. This study should encourage new researchers for applying this method and take advantage of its unique inner dynamic and performance.
Keywords: swarm intelligence, particle swarm optimization, real-world application, industry application.

Application of the Box-Behnken Model Design to the Optimization of Process Parameters in the Convection-Drying of Channa Striata Fish

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[2]Ho Chi Minh City University of Food Industry, Vietnam
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[4]Lac Hong University, Vietnam

Abstract. This study was aimed to identify the optimum parameters of the convention-drying Channa Striata fish using the Box-Behnken response surface methodology. The optimal experiments were designed with three factors including: density of loading Channa Striata fish, drying time and air speed. The results showed that drying temperature of 50oC, air speed of 0.25m/s, fish density of 6 pieces / tray (60x80 cm) and drying time of 196.82 minutes were determined to be the optimum parameters. Experiments were also made to verify the optimal conditions and evaluate the authenticity of the design model of drying fish.
Keywords: Channa Striata fish, convection-drying, Box-Behnken model, optimization.

A Study on Real-World Disaster Evacuation System with Mathematical Network Problem Solving Algorithm

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[1]Busan Transportation Corporation, South Korea
[2]Cornerstones Technology, South Korea
[3]Kosin University, South Korea

Abstract. The purpose of this study is to improve the evacuation efficiency in the event of a disaster by applying a disaster evacuation algorithm for disaster accidents that may occur at any time in industrial sites, major facilities, large buildings, railway facilities, and ships. Therefore, this study is a study on a disaster evacuation system combining the algorithm with Internet of Things (IoT) which can guide the maximum number of people to the optimal path in the shortest time in the event of a disaster, and this study shows the studying results applying the disaster evacuation algorithm to large shopping malls and urban railways.
Keywords: time expanded modeling, shortest path, optimal evacuation path, time expanded, minimum-cost, maximum-flow.

Optimal Threshold Policies for Robust Data Center Control

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Abstract. With the simultaneous rise of energy costs and demand for cloud computing, efficient control of data centers becomes crucial. In the data center control problem, one needs to plan at every time step how many servers to switch on or off in order to meet stochastic job arrivals while trying to minimize electricity consumption. This problem becomes particularly challenging when servers can be of various types and jobs from different classes can only be served by certain types of server, as it is often the case in real data centers. We model this problem as a robust Markov Decision Process (i.e., the transition function may not be known precisely). We give sufficient conditions (which seem to be reasonable and satisfied in practice) guaranteeing that an optimal threshold policy exists. This property can be exploited in the design of an efficient solving method that we provide. Finally, we present some experimental results demonstrating the practicability of our approach and compare with a previous related approach based on model predictive control.
Keywords: data center control, Markov decision process, threshold policy, robustness

Session A-3 – Optimization

A New Optimal Algorithm for Multi-objective Short-Term Fixed Head Hydrothermal Scheduling with Emission

Bach H. Dinh, Thang T. Nguyen
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Abstract. With the purpose of environment protection, polluted emissions should be considered as an additional criteria, besides the fuel cost objective, to implement the optimal operation of hydrothermal power systems which are included thermal and hydro power plants. This paper proposes a novel cuckoo search algorithm (NCSA), developed from cuckoo-inspired optimization algorithm, to solve the multi-objective short-term fixed-head hydrothermal scheduling (HTS) problem which considers both fuel cost objective and emission cost objectives. In the proposed approach, there are two modifications, merging the exploration and exploitation phases and setting one rank parameter to handle the inequality constraints, to improve the convergence rate and the performance of NCSA. To verify its performance, some test systems with the quadratic fuel cost function of thermal units accompanied with emission objective functions have been implemented. The results have revealed that the NCSA method is a very promising method for solving the multi-objective short-term fixed-head HTS problem.
Keywords: Novel cuckoo search algorithm, multi-objective functions, short-term hydrothermal scheduling, quadratic fuel cost function.

Quantum-Behaved Bat Algorithm for Combined Economic Emission Dispatch Problem with Valve-Point Effect

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Abstract. Combined economic emission dispatch (CEED) is a multi-objective optimization problem that deals with the minimization of total fuel cost and total emission of hazardous gases in thermal power generation system, while satisfying all equal and inequality constraints. In this research, quantum-behaved bat algorithm (QBA) is proposed and applied to solve non-linear multi-objective CEED problem. Valve-point effect is considered along with CEED as a practical constraint of power generation system. QBA is applied to 10-unit power generation system and compared separately as single objective economic and emission dispatch problems as well as multi-objective CEED problem with other existing methods like ABC_PSO, DE, NSGA-II, SPEA-2 and SA. The obtained results and comparison of results demonstrate the power of

QBA in terms of solution quality, convergence characteristics and computational efficiency.
Keywords: Quantum-behaved bat algorithm, combined economic emission dispatch, economic dispatch, emission dispatch, valve-point effect, multi-objective and optimization.

Optimal Load Frequency Control in an Isolated Power System
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Abstract. The load frequency control (LFC) problem for Isolated Power System is considered from the viewpoint of optimal control theory. However, the practical implementation of the optimal controller requires the measurement of all the state variables. This is a serious limitation because of the difficulties involved in their measurement. Output feedback will allow us to design plant controllers of any desired structure. This is another reason for preferring it over full-state feedback. In the regulator problem, we are interested in obtaining good time responses as well as in the stability of the closed-loop system. Therefore, we shall select a performance criterion in the time domain. The simulation results indicate that the proposed control scheme works well. In addition, they show that the controlled system is robust to bounded input disturbances acting on the system.
Keywords: Load frequency control, multi-area power systems, controller design.

Differential Evolution for Constrained Industrial Optimization
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Abstract. This research deals with the constrained industrial optimization task, which is the optimization of technological parameters for the waste processing batch reactor. This paper provides a closer insight into the performance of connection between constrained optimization and different strategies of Differential Evolution (DE). Thus, the motivation behind this research is to explore and investigate the differences in performance of basic canonical strategies of DE as well as by the state of the art strategy, which is Success-History based Adaptive Differential Evolution (SHADE). The simple experiment has been carried out here and 30 times repeated. Consequences of different DE strategies performances are briefly discussed within conclusion section of this paper.
Keywords: Differential Evolution, SHADE, Constrained Optimization.

Modified Flower Pollination Algorithm for Solving Economic Dispatch Problem

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Abstract. This paper proposes a new Modified Flower Pollination algorithm (MFPA) for solving economic load dispatch (ELD) problems in which transmission power losses are taken into consideration. The MFPA is developed in this paper by modifying the several modifications on the conventional Flower Pollination algorithm (FPA) to enhance the performance of the FPA. The MFPA is tested on a system with the transmission power losses. The performance of the MFPA is evaluated by comparing obtained results with FPA and other existing algorithms available in the study. As a result, it can be concluded that the MFPA outperforms the PFA and is very strong for solving the ELD problem.

Keywords: Modified Flower Pollination algorithm, transmission power losses, economic load dispatch.

Session A-4 – Telecommunications

Enhanced Self-sorting Based MAC Protocol for Vehicular Ad-Hoc Networks

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Abstract. Self-sorting based MAC protocol by Zhongyi Shen is proposed to improve the performance of safety application in high density Vehicular Adhoc Networks (VANETs). The protocol, however, has not taken into account the mechanism for control message transmission of service application. This paper proposed an access mechanism that enhances the self-sorting protocol in the aspect of effective time usage for safety application and incorporates the mechanism for service application transmission. The proposed protocol's performance is investigated through comparing with self-sorting protocols and others in various network scenarios.
Keywords: VANETs, multi-channel MAC, TDMA, queuing.

Analytical Study of the IEEE 1609.4 MAC in Vehicular Ad Hoc Networks

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Abstract. Vehicular Ad hoc Network (VANET) is developed to enhance the safety, comfort and efficiency of driving. The IEEE 802.11p/WAVE [1] is a standard intended to support wireless access in VANETs. The IEEE 1609.4 [2] is a MAC extension of IEEE 802.11p [1] to support multi-channel operations. In this paper, we propose an analytical model to evaluate the performance for safety and non-safety applications of IEEE 1609.4 under non-saturation condition. The 2-D Markov model is used to model two access categories in the IEEE 1609.4. The analytical model is validated by the extensive simulation, and it shows the effect of different parameters to the network performance.
Keywords: IEEE 1609.4, WAVE, MAC, VANET, performance analysis.

Adaptive TDMA and CSMA-Based MAC Protocols for Vehicular Ad Hoc Networks: A Survey

VanDung Nguyen and Choong Seon Hong
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Abstract. Vehicle Ad Hoc Network (VANET) created between vehicles or between vehicles and centralized infrastructures is a dynamic network. Specifically, VANET can support many services such as safety, traffic management, and user-oriented services to improve transportation efficiency. Medium Access Control (MAC) protocol in VANETs not only responds the different requirements of these services but also improves the efficient broadcasting safety messages. One such protocol is to employ both TDMA and CSMA schemes in the Control CHannel (CCH), called a hybrid MAC protocol. A vehicle will send safety message without collision on the TDMA-based period during its reserved time slot and utilize the SCH resources on the CSMA-based period for the non-safety message. In addition, the TDMA-based period can be adjusted according to vehicle density. Hence, these systems can adapt themselves to various traffic conditions and improve the throughput for safety messages. In this survey, we compare different hybrid MAC protocols using dynamic TDMA-based periods as well as their benefits and limitations. Finally, we discuss some issues and promising future research which can be satisfied different QoS requirements and efficiently support both safety and non-safety services.
Keywords: VANET, MAC protocols, dynamic TDMA-based period, various traffic conditions.

Multi-sensor Data Fusion Technique to Detect Radiation Emission in Wireless Sensor Networks

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Abstract. Detection of objects emitting radiation is a classical problem widely analyzed by many authors worldwide; however, new computerized data analysis wireless sensor network and systems are emerging daily and require application of optimal sensors data fusion methods to increase their effectiveness even further. Conventional monitoring and other radiation emission detection systems lack optimal resources allocation in harsh and huge environments with shielding materials preventing in-time easy event detection. That is why many security issues are partially omitted in our daily lives and even in industry, including international cargo transportation operations, due to the need for a larger amount of high precision sensors to be deployed on larger areas with different technological standards and their high procurement and exploitation costs. Such conventional sensor systems are already used in many areas including detection of dirty bombs in

containers (US Homeland Security initiative - Container security initiative (CSI)), but only in certain areas with relatively low efficiency. In this paper, a theoretical mathematical model is presented and discussed to lower the radiation emission detection time using DAI-DAO data fusion technique in crucial security systems. A known problem of dirty bomb detection in a container terminal is presented as an example to demonstrate the problem area and the effectiveness of the proposed solution.
Keywords: DAI-DAO, sensor data fusion, wireless sensor networks.

The Impact of Distance Between Two Phosphor Layers on Luminous Flux and Color Quality of Remote Phosphor Package

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Abstract. In this paper, we propose and present a method to enhance luminous efficiency, color rendering property and color scale quality of the multi-chip white LED lamps (MCW-LEDs). This can be done by changing the distance between two phosphor layers in remote phosphor layer with a dual-layer structure. Index, with the appropriate distance between two phosphor layers could offer a great increase on the optical performance of MCW-LEDs. Simulation results demonstrated that the luminous efficiency, the color rendering property, the color scale quality of MCW-LEDs significantly improve with distance from 0 to 0.1 mm, meanwhile the optical performance slightly decreases with the distance from 0.1 to 0.7 mm. To obtain the highest lumen output efficiency and the best color rendering index, the distance around 0.1 mm should be suggested.
Keywords: Dual-layer structure, remote phosphor package, luminous flux, color rendering index, color quality scale, multi-chip white LED lamp.

The Thixoforming Process with Different Pressing Speed for Aluminum Material

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Abstract. The thixoforming process is becoming more and more important in the field of metal-forming. In this process, the most difficult part is heating the sample while keeping the temperature uniform. The pressing speed is one of the main parameters that impacts strongly on product quality. In this paper, the die for studying the effect of pressing speed was designed and manufactured. The Deform 3D software was applied for observing the relationship between the pressing speed and the force history, stress, and temperature distribution. The results show that a pressing speed of v = 8 mm/s results in the smallest stress. The stress depends on many elements. For example, the pressing speed of v = 6 mm/s makes the heating process happen fast. The billet is cooled faster so the stress increases and even changes the structure unexpectedly. When

the pressing speed is too high, the metal on the surface of the billet flows with high speed so it collides with the folding segments causing great resistance thus creating high stress.
Keywords: pressing speed, microstructure, thixoforming, deform 3D, die design.

Simulation Study of Microstructure of the Amorphous ZnO

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Abstract. The simulation of microstructure have been done for amorphous zinc oxide by mean of molecular dynamic method. The microstructure has been analyzed through the pair radial distribution function, coordination number and bond-angle distribution. The evolution of changes take under compression has been observed and analyzed. Data obtained are compared with the experimental results. The simulation shows that the major structural changes take place from an tetrahedral network structure at low density to a closed packedlike structure at high density which mainly contains also fivefold and sixfold structural units.
Keywords: computer simulation, microstructures, zinc oxide.

A Novel Approach to Fabricate Silicon Nanowire Field Effect Transistor for Biomolecule Sensing

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Abstract. A novel silicon nanowire field effect transistor (SiNW-FET) was fabricated using complementary metal oxide semiconductor (CMOS) compatible technology. The shrank nanowire with high surface-to-volume ratio and individual back gate were achieved by the local-oxidation of silicon (LOCOS) process. The width of nanowire by this technique can be shrank down to sub 100 nm. The drain current versus gate voltage (Id-Vg) characteristic of the SiNW-FET exhibits about five orders of magnitude of Ion/Ioff current ratio, and the threshold voltage shifts positively after hybridization of 1fM concentrations of HBV X gene DNA fragments and 3ng/mL concentrations of the cancer marker, respectively. The results show that the back-gated nanowire device has the capability of acting as a real-time, label-free, highly sensitivity and excellent selectivity SiNW-FET biosensor in detecting biomolecules.
Keywords: silicon nanowire, field effect transistor, SiNW, biosensor, LOCOS.

Improving the Optical Properties of the 8500 K In-cup Packaging WLEDs by Using the Green-emitting $CaF_2:Ce^{3+}, Tb^{3+}$ Phosphor

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Abstract. In last few decades, Light emitting diode (LED) with a series of excellence advantages is considered as the next generational light source. In this research, by co-doping the Green-emitting $CaF_2:Ce^{3+},Tb^{3+}$ phosphor to yellow-emitting YAG:Ce phosphor compound, an innovative approach for improving optical properties of the 8500 K in-cup phosphor packaging white LED lamps (WLEDs) is proposed, investigated, and demonstrated. By using Mie Theory with Mat Lab and Light Tool software, the obtained results show that the optical properties of the 8500 K in-cup phosphor packaging WLEDs is significantly influenced by the Green-emitting $CaF_2:Ce^{3+},Tb^{3+}$ phosphor's concentration. From the research results, the correlated color temperature deviation (D-CCT) decreased from 9200 K to 3700K, and the luminous flux increased from 940 lm. to 1500 lm., respectively. The results indicated that the green-emitting $CaF_2:Ce^{3+},Tb^{3+}$ phosphor could be considered as a potential solution for manufacturing the in-cup packaging phosphor WLEDs with high CCT shortly.

Keywords: the in-cup phosphor packaging WLEDs, green-emitting $CaF_2:Ce^{3+},Tb^{3+}$ phosphor, optical properties.

Session B-1 – Control Systems

Aerial Attitude Control of Hopping Robots Using Reaction Wheels: Evaluation of Prototype II in the Air

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Abstract. This paper proposes an aerial attitude control of a practical hopping robot in consideration of acceleration disturbance in taking-off and landing. The proposed system uses reaction wheels to control the attitude, and as a first step of development, an attitude control unit with no hopping mechanism to stabilize the pitch angle has been prototyped for evaluation (Prototype II). The reaction wheels can be used as tires when the robot runs on the grounds. Since the acceleration of gravity used in calculating static attitude angles cannot be observed in free fall, a dynamic attitude angle obtained from gyro sensor is temporarily fed back to the controller for flight duration of about 0.5 s. An experiment, where the robot is horizontally catapulted in the air at an angle of elevation of 30 deg, has been conducted, and the results showed that the proposed attitude controller can keep the robot orientation almost all horizontal during the flight. Future works will be to develop a hopping mechanism and to integrate it to the attitude control unit to realize a practical hopping robot.
Keywords: Aerial robot, motion control, attitude angle estimation, sensor fusion.

Vertical Motion Control of Crane Without Load Position Information Using Nonlinear Control Theory

Nhat Binh Le, Manh Son Tran, Suk Ho Jung and Young Bok Kim
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Abstract. When a load is lifted by a crane system, the load position may be unexpectedly vertically vibrated due to the elasticity of the rope. This problem reduces the system stability and load positioning accuracy. To resolve this actual problem, this paper describes a model for studying the dynamic behavior of the offshore crane system such that a control system design method is introduced to occupy desirable performance. The obtained model allows evaluating the fluctuations of the load arising from the elasticity of the rope. In addition, the rope is modeled as a mass-damper-spring system, and the winch as the main actuator coefficients are identified via experiments and simulation. Especially, in this paper, the authors design a control system in which winch a rotation angle and a rope tension are used to make control signals without load position information. In the real plants, the load position cannot be accurately measured because the load type is various and other environmental

constraints. Considering these facts, the controller design based on input-output feedback linearization theory is presented which can handle the effect of the elasticity of the rope and track the load target trajectory. Besides that, for comparison study, a full order observer is designed to estimate unknown states. Finally, the experimental results show that the proposed method can successfully make something good control performance.
Keywords: Load position, tension, experimental results, rope dynamics, crane system, input-output feedback linearization.

State Estimation of Internal Combustion Engine Based on Mathematical Model
Masahiro Yamazaki and Masami Iwase
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Abstract. This research aims to estimate an engine torque, an in-cylinder pressure and an amount of intake in a cylinder accurately by applying a crank-shaft angle. The appropriate discretization methods of an engine model are verified to improve the estimation accuracy. In addition, an air intake system model is added to the engine model consisting of piston-crank dynamics and combustion process. These states are estimated applying the Unscented Kalman Filter based on the engine model. An effectiveness of the appropriate discretization method and an extended model were verified through comparing the estimated results and the measured data.
Keywords: State estimation, air intake system, discretization.

Dynamic Programming Based Adaptive Optimal Control for Inverted Pendulum
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Hanoi University of Science and Technology, Vietnam

Abstract. This work presents the problem of adaptive optimal control law for a class of continuous-time systems with input disturbance and unknown parameters. The main objective is to find an adaptive optimal control law based on the adaptive dynamic programming (ADP) method and it is able to stabilize the closed-loop system. Besides, the convergence properties of proposed algorithm is pointed out. The theoretical analysis and simulation results demonstrate the performance of the proposed algorithm for inverted pendulum.
Keywords: Adaptive dynamic programming (ADP), adaptive optimal control law, inverted pendulum.

Reference Trajectory Generation of Laser Beam in Consideration of Response Speed of Laser Processing Machine

Taichi Ishihara and Jun Ishikawa
Tokyo Denki University, Japan

Abstract. This paper proposes a reference trajectory generation method to modify laser beam trajectories for laser processing machines using a galvanometer scanner. In the proposed method, inverse dynamics, which are derived by system identification of the galvanometer scanner, i.e., the controlled plant, is used for reference trajectory modification. The modified reference trajectories are implemented to the laser processing machines as common user commands. This allows users to make no change in neither hardware nor firmware to enhance the machine performance that they have already purchased. The validity of the proposed method has been confirmed by experiments using an actual galvanometer scanner system. In the experiments, it has been proved that the proposed method has been achieved a square-shaped processing trace with less deformation than that of no reference modification. Moreover, the proposed method can be used not only for the square shape evaluated in the experiment but also for processing other shapes.

Keywords: Reference trajectory generation, inverse dynamics, high-speed control, galvanometer scanner, laser processing machine.

Session B-2 – Control System

Model-Based Clustering of Time Series Based on State Space Generative Models

Bruce Wilcox and Fumio Hamano
California State University, USA

Abstract. Recently refined Markov Chain Monte Carlo techniques for Bayesian inference are combined with the elegant and computationally advantageous specification of state space models to develop and evaluate an approach for the clustering of time series of fixed-income financial instruments. This approach is based upon the specification and estimation of a finite mixture model where each mixture component is represented by a time series generative model that is specified in linear state-space form.
Keywords: Kalman filters, Gibbs sampling, time series, clustering.

Analysis of the Relationship Between Operational Mastery Process and Balance Capability in Daily Life for Unstable Personal Vehicles

Kenta Nomura, Kazuki Obata and Masami Iwase
Tokyo Denki University, Japan

Abstract. This research aims to analyze a relation between balance ability in daily life and process of attaining a maneuvering skill for unstable vehicles such as unicycle, Segway and balance board. For the analysis, the subjects have carried out the balance ability test on the flat ground and the holding balance experiment on the balance board. As a result, the balance ability on a balance board correlated with the static balance ability. Hence, a model, which integrated human with balance board, has been derived in order to analyze relation between balance ability of both legs and control performance. In conclusion, the model which integrated human with balance board, have been stabilized by control system design.
Keywords: Human Balance ability, unstable vehicle, proficiency support.

Backstepping-Based Adaptive Velocity Tracking Controller Design for a Winding Spindle System

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Abstract. This paper presents a backstepping-based modified model reference adaptive velocity tracking controller design method to track a trapezoidal reference type of rotational velocity for a winding spindle system (WSS). To design the proposed controller, the followings are done. Firstly, the system modeling of the WSS is obtained as a combined form of direct current motor and mechanical parts. Secondly, a modified model reference system with known parameters is chosen according to the dimension of the given system such that its rotational velocity output tracks the trapezoidal reference input of the winding spindle system. Then, the rotational velocity output of the winding spindle system is controlled to track the rotational velocity output of the modified model reference system by designing update laws for updating the adaptive controller parameters. Thirdly, since the system modeling of the winding spindle system is constructed as a recursive structure system, the modified model reference adaptive controller is developed based on backstepping approach. Finally, the effectiveness and performance of the proposed controller are evaluated with comparison to those of a conventional PID controller by experimental results.
Keywords: Modified model reference adaptive control, single input-single output, external disturbance, input constraint.

Feedback Control of Antagonistic-Type Twisted and Coiled Polymer Actuator

Motoya Suzuki and Norihiro Kamamichi
Tokyo Denki University, Japan

Abstract. A novel artificial muscle actuator called as twisted and coiled polymer actuator can be easily fabricated by commercially available Nylon fibers. It can be thermally activated and has remarkable properties such as large deformation and flexibility. If conductive Nylon fibers are applied to the actuator, it can be electrically activated by Joule heating. However, asymmetric response characteristics due to a speed difference of heating-cooling remain a problem. In case of actuation in the air, the cooling speed depends on the external temperature, and is slower than heating speed. To solve these problems, we apply an antagonistic structure. The validity of the applied method was investigated through numerical simulations and experiments.
Keywords: Soft actuator, twisted and coiled polymer actuator, feedback control.

Session B-3 – Control Systems

PI Sliding Mode Control for Active Magnetic Bearings in Flywheel

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Abstract. This paper proposes the PI sliding mode control approach in order to control the nonlinear multiple-input-multiple-output active magnetic bearing system in fly-wheel. A nonlinear model of a one degree of freedom (DOF) active magnetic bearing system in flywheel obtained using Lagrange's equation is proposed. In this model, the current in each coil is treated as a state variable and the control input is the voltage applied to each coil, this approach offers more advantages than current control input approach. The proportional and integral switching surface is constructed for active magnetic bearing system to improve system dynamic performance in reaching intervals. The robust controller is proposed by the reaching law method to assure that the rotor stays close at the desired displacement even when disturbance and dynamic effect of rotating are taken into considering.
Keywords: flywheel energy storage system (FESS), active manegtic bearing (AMB), model predictive control (MPC), nonlinear system.

Performance Evaluation of Grasping Force Control Based on Fall Velocity Control of Grasping Object for Telemanipulation Systems

Shuichiro Shimizu, Masaru Saito and Jun Ishikawa
Tokyo Denki University, Japan

Abstract. This paper proposes a grasping force control system by using a series-elastic actuator and an optical mouse sensor for master-slave systems. In the proposed system, the grasping force is controlled by controlling the falling velocity of the grasping object to be a very small value near zero, for example, 1 mm/s. During slipping with very low velocity condition, the applied force to the object is kept near the minimum value to hold the object. This gives information about what is the minimum force to keep the object held. To evaluate the validity of the proposed system, experiments were conducted by implementing it to a two-stage series-elastic actuator (SEA) system that has two springs with different stiffness. By designing the force control system based on a two-stage SEA, the grasping force can be finely controlled. Also, the optical mouse sensor which can measure the displacement of the grasping object is implemented to control the falling velocity of the grasping object. The experimental results showed that the falling velocity can be controlled to be around 1 mm/s and that the grasping force to prevent slipping was applied to it when the unexpected disturbance was applied to it by setting

the target value to a more minute value, 0.1 mm/s. Therefore, an appropriate minimum force to grasp the object can be successfully found by using the proposed method.
Keywords: Grasping force control, series-elastic actuator (SEA), telemanipulation system, friction modeling.

A Study for Learning Method of Modified PID Controller with On-line Hybrid Genetic Algorithm
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Abstract. The PID control system is one of the most famous controllers in the industrial products because it doesn't need theoretical knowledge to adjust unknown variable in the controller. In former study, a GA (genetic algorithm) was used to tune the parameters of PID. These studies attempt to find PID one and their results is pretty good. But these trials work on off line because it still needs too much calculating time.

This study is concerned about learning method of online GA. At the first, the limitations of variables of PID are selected by relay feedback. At the second, the time range for object function also has limited by the time constant in the Ziegler-Nichols Method. At the final, parameters of PID are optimized by online GA that is hybrid GA based on micro GA.
Keywords: Machine Learning, micro GA, on-line GA, PID tuning.

Damping Control of Suspended Load for Truck Cranes in Consideration of Control Input Dimension
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Abstract. This article proposes a controller design that takes into account the control input dimension to be use in damping control of suspended load for crane systems. Many researches on transporting and anti-swaying control of cranes have been reported. However, most of those researches deals with overhead cranes. Only few studies deal with truck cranes since in the truck cranes, the suspended load should be controlled by using booms that have physical nonlinearity. Also, when introducing a new control system, the users would like to use the same control input dimension as the previous controller. For this purpose, a crane model is extended with a hydraulic control valve model, and a controller is designed based on this extended model. This allows to generate control inputs in the same dimension as the purchased valve controller. To show the validity of the proposed method, experiments using a truck crane has been conducted. The experimental results showed that the proposed controller has been successfully worked and the sway of the suspended load has been damped well.

Keywords: Damping control, truck crane, motion sensor.

Model Predictive Control with Both States and Input Delays

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Abstract. This study investigates the problem of model predictive control (MPC) for active suspension systems with both states and input delays. The model uncertainty is assumed to be polytopic, and sufficient conditions are proposed in terms of linear-matrix inequalities (LMIs), which can be easily solved by an efficient convex optimization algorithm. The problem of minimizing an upper bound on the 'worst-case' performance objective function is reduced to a convex optimization involving linear matrix inequalities (LMIs). At each time set, a feasible state feedback is obtained by minimizing an upper bound of the 'worst-case' quadratic objective function over on infinite horizon subject on constraints on inputs. Finally, a quarter-vehicle model is exploited to demonstrate the effectiveness of the proposed method.
Keywords: Model predictive control, active suspension systems, time delays, optimization, linear-matrix inequalities (LMIs).

Session B-4 – Control Systems

State Estimation of a Yoyo Based on a Model with Elasticity of a String
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Abstract. This paper presents an approach to estimate a state of a yoyo, as one of tools including a deformable component like a string, based on its detailed model. In the proposed approach, we model a yoyo describing the elasticity of its string with a tension provided by a spring-damper model and employ the unscented Kalman filter on the estimation. We design an estimator based on the approach and evaluate its performance through numerical simulations. The simulations results demonstrate the effectiveness of the proposed approach in conclusion.
Keywords: state estimation, UKF, yoyo, deformable object.

Optimal Pump Scheduling to Pressure Management for Large-Scale Water Distribution Systems
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Abstract. Water loss is a global problem. Water loss in leakages in water distribution systems (WDSs) can be significantly reduced as pressures at outlets of pumping stations are optimized. Due to the introduction of binary variables for describing on/off operations of pumps, the optimal pressure management is formulated as a large-scale mixed integer nonlinear programming (MINLP) problem which is extremely difficult to be solved by MINLP algorithms. Many studies have employed meta-heuristic algorithms to solve such the MINLP problem, but only applied for small-scale networks and it took an expensive computation time. This paper develops an efficient formulation of MINLP for optimal pressure managing problem. It is due to the fact that the large-scale MINLP can be decomposed into small-scaled MINLPs, hence it can be solved efficiently by MINLP solvers based gradient methods in an reasonable computation time. To demonstrate the efficiency of our solution approach, the real-world water distribution systems in Thainguyen city in Vietnam will be considered for optimization of pressure management. The resulted pumping schedules lead to higher reduction of excessive pressures and water leakage amounts in comparison with those by the current pumping schedule.
Keywords: Water distribution systems, MINLP, leakage reduction.

On the Hamiltonian Approach to the Collocated Virtual Holonomic Constraints in the Underactuated Mechanical Systems

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Abstract. In this paper, the collocated virtual holonomic constraints for the underactuated mechanical system are represented in a special canonical form using its Hamiltonian description. This form is used to provide an alternative, backstepping based, algorithm how to impose these constraints. Its robustness is illustrated by simulated swinging up the mechanical four link chain with precisely unknown masses of its links.

Keywords: Hamiltonian approach, collocated virtual holonomic constraints, underactuated systems.

Variable Structure Load Frequency Control of Power System

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Abstract. Power-system load-frequency control by variable structure controller is proposed. To ease the design effort and improve the performance of the controller, second order variable structure control combine with integral sliding is developed. Overall system is asymptotically stable, for all admissible system parametric uncertainties, when all the local load frequency controllers are working together. Simulations confirm that the proposed second order variable structure control can rebalance power and resynchronize bus frequencies after a disturbance with significantly improved transient performance.

Keywords: power system control, power system dynamics, load frequency control.

A Research on the Thermal Daily Performance of Hybrid Solar Collector with Fin-and-Tube Heat Exchanger in Winter

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Abstract. A hybrid solar collector, in this study, means the flat plate solar collector that has fin-and-tube heat exchanger beneath absorbing plate. It was focused on the combination with heat pump system. Solar thermal energy obtained from the collector can be used as a heat source of evaporator of heat pump, and the C.O.P.(coefficient of performance) of heat pump can be increased because of the increment of evaporating temperature. In case of this hybrid solar collector, different with traditional collector, it can get a thermal energy from ambient air for heating circulated water when the solar radiation is not enough. Hence, the collector can supply thermal energy to evaporator of heat pump using heated water by ambient air or solar energy selectively depending on the weather. So, in this study, thermal performance of this collector on daily operation was investigated with various flow rate of water experimentally for confirming how much solar energy can be obtained by this collector in winter. As a result, maximum thermal efficiency was shown from 55% to 62% enough to make hot water according to mass flow rate even the fin-and-tube heat exchanger was installed beneath absorbing plate instead of insulator of traditional flat plate solar collector and it was increased with increment of flow rate. But the overall heat loss coefficient also increased similar with thermal efficiency and from those efficiency curves, it was confirmed that the optimal operating condition need to be investigated in the further study before applying to heat pump system.
Keywords: Solar thermal energy, solar assisted heat pump, heat pump, flat plate solar collector, fin-and-tube heat exchanger.

Numerical Design of Solar Collector Trough System for Integrated Solar Combine Cycle

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Abstract. Recently, integrated solar combined cycle plants (ISCC) have been introduced in the power generation sector as a technology with high potential to simultaneously reduce fossil fuel usage, environment pollution and to help reduce the costs of solar energy. This paper introduces a calculation method to design of a solar collector trough system integrated in an ISCC with capacity 100 MW. The solar collector trough system supplying heat for a haft of 50 MW steam turbine, which work at nighttime and daytime. The proposed formulations are verified

by experiments, and can be applied to the design of a real system in practice.
Keywords: Integrated solar combine cycle, design, solar energy, and solar trough.

A Study on the Heat Exchange Performance of Hybrid Solar Collector with Air to Water Heat Exchanger Type
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Abstract. Solar assisted heat pump system is the heat pump system using solar thermal energy as a heat source of evaporator of the heat pump and most of these systems have been used ordinary solar collector that can get a thermal energy only from solar radiation. Thus, the hybrid solar collector that has air to water heat exchanger of fin-and-tube type have been developed for obtaining thermal energy from not only solar radiation but also ambient air. It is the flat plate solar collector installed fin-and-tube heat exchanger beneath absorbing plate. Thus the thermal energy obtained from ambient air can be supplied to evaporator of heat pump when the solar radiation is not enough. At this time, heat exchange performance between air and circulated water is one of most important factor. Hence, in this study, heat exchange performance of hybrid solar collector and effect of parameters that affect heat exchange performance were investigated experimentally. As a result, heat transfer rate between air and water was shown from 180W to 820W and it was increased linearly with increment of temperature difference between inlet air and water. In case of effectiveness, it was shown from 0.5 to 0.6 and it was increased by decrement of air mass flow rate independently on temperature difference between inlet air and water. From these results, heat exchange performance of the collector is considered as a sufficient capacity for applying for heat pump system and it also could be confirmed that optimal operation condition of solar assisted heat pump system integrated with hybrid solar collector need to be established base on the relationship obtained from this research as a further study.
Keywords: Solar thermal energy, solar assisted heat pump, flat plate solar collector, fin-and-tube heat exchanger, energy saving.

A Study of the Power Factor Improvement by Using Harmonic Filter in Busan Urban Railway Substation with Thyristor Rectification Method
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Abstract. The electric power required to operate the urban railway supplies DC 1,500V to the electric train through trolly wire. The rectifier which converts AC to DC has a rectification method using a diode and a rectification method using a thyristor. The thyristor rectification method is easier to adjust the trolly wire voltage than the diode rectification method. In addition, it is possible to reuse the regenerative electric power generated when the electric train stops, thereby helping to reduce the operating cost of the Urban railway operator and to reduce the greenhouse gas. However, the thyristor rectification method has a disadvantage in that the power factor of an urban railway substation is lowered because a harmonic current is generated during rectification and the reactive power becomes large. In this paper, we analyze the harmonic currents generated of Busan Urban railway substation system using thyristor rectifier, we propose an optimal harmonic filter to achieve a power factor of over 90% by simulation.
Keywords: Thyristor dual converter, harmonic current, power factor, regenerative power, urban rail DC substation equipment, railway technology.

Building Management Algorithms in Automated Warehouse Using Continuous Cluster Analysis Method

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Abstract. Optimizing warehouse space and travel distance are important tasks in cold warehouse management. It is not only help to save operation cost and travel time, but also helps to manage goods more easily. This paper presents the method of arranging goods in the warehouse according to continuous clusters, that mean the goods are always arranged in adjacent positions and the nearest the depot. It will help to decrease travel distance and minimize the empty location among goods. In Addition, first come first serve and first in first out algorithms are applied in storage and retrieval process to determine the exact storage location. A software is built to simulate these algorithms. The simulated warehouse contain 240 storage locations, separated by 2 storage aisles and 1 pick aisle.
Keywords: continuous cluster, storage location, travel distance, optimal storage space.

Slip Analysis on a Non-holonomic Continuously Variable Transmission Using Magic Formula

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Abstract. Non-holonomy in input-output systems can be characterized by a reachable space whose dimension is larger than that of its input space. Among the various mechanical examples of non-holonomy, we have dealt with the friction drive type semi-spherical continuously variable transmission (SS-CVT) in this paper. SS-CVT transmits power by rolling friction and realizes the neutral, forward and reverse states of output shaft without any additional devices. A spherical shaped variator in SS-CVT transmits power and changes its gear ratio keeping contact with an output disc. It is necessary to consider the friction forces along with in two-directional slip on the contact point, because the directions of friction forces to transmit power and to change gear ratio are perpendicular to each other. For this, the friction forces must be analyzed by using the slip ratio and slip angle on the contact patch. Therefore, we have determined the planar friction variables by the dimensional analysis, and the SS-CVT test bench. Finally, the empirical formula for evaluating the two friction

forces has been proposed based on the experimental results. And the numerical results regarding the dynamics of SS-CVT have been addressed.
Keywords: Non-holonomy, semi-spherical CVT(SS-CVT), slip analysis, friction drive, magic formula, shifting dynamics.

Sterilization of Edible Bird Nest Product Utilize Microwave Technology
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Abstract. Since the introduction of microwave in the 1940s, the microwave has been an integrated part of the military and communication industries. Recently, the Food and Drug Administration (FDA) of the United States of America, has approved the microwave energy to be used as the thermal processing for packaging food. The new emerging microwave technology has shown to be able to eliminate or sterilize food pathogens and food spoiled microorganisms in 5 to 8 minutes. Due to the fairly new usage of microwave in the food industry, there are lack of available microwave sterilization pertain to Edible-Bird-Nest (EBN) products. The goal of this research is to design the microwave applicator structure for an industrial sterilization device that is an integral part of the current manufacturing process and can be used to sterilize EBN products. The microwave applicator structure will be designed to be able to eliminate two pathogens, *Salmonella* species and *Escherichia coli (E. coli)*, and to reduce energy consumption.
Keywords: Microwave applicator, sterilization, HFSS, microwave food processing.

Optimal Design of RFECT System for Inspection of 16-inch Ferromagnetic Pipe
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Abstract. An effective approach to optimal design of Remote Field Eddy Current Testing (RFECT) system was introduced in this paper. Although the RFECT technique has unique advantages over other nondestructive testing methods, related information is not easy to be accessed by public. Designing approaches to two major components of the RFECT system – exciter and receiver coil - are documented in this paper. Simple equations including some novel investigation to predict performance of

the coils are introduced. Then, to validate the proposed approach, performance of the RFECT system equipped with the designed coils was evaluated by an experiment. The experiment was conducted on 16-inch ferromagnetic pipe using the RFECT system showed good performance by detecting all defects machined on the pipe.
Keywords: Remote Field Eddy Current Testing, design Approach, ferromagnetic pipe inspection.

Numerical Analysis of LBV150 ROV Thruster Performance Under Open Water Test Condition

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Abstract. Remotely operated vehicles (ROVs) research has increased remarkably because of the technological improvements in ROV's. The LBV150 ROV is a highly-maneuverable miniROV of the SeaBotix Incorporation serving a range of military, commercial, and scientific, which uses HPDC 1507 thrusters for the propulsion system. In this article, the simulation for the LBV150 ROV thruster performance during forward mode under open water test condition is developed together with OpenFOAM. The static thrust coefficient of the thruster obtained from the simulation is validated by the acceptance testing of this thruster in the open water channel at BKU. So, the other characteristics of the thruster performance including thrust coefficient, power coefficient, efficiency, pressure distribution as well as velocity of flow around the thruster, etc. could be produced as the result of the simulation. The proposed numerical analysis could help to develop a simulation tool for the design of miniROV propulsion system.
Keywords: ROV's thruster performance, numerical analysis with OpenFOAM, ROV's thruster testing system.

A Method for Tuning the Frequency Series Wave Speed in Hydraulic Flexible Hose

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Abstract. The hydraulic system has a pump that converts the mechanical energy to the hydraulic one. This pump is a source of system's noise which is generated from flow pulsation and pressure's violent fluctuation in cylinder chambers. This noise is propagated with tube and structural object. A wave speed can be used to calculate the flow pulsation and pressure one in the transfer matrix method which is express the tube's mathematical model. So it is important to know about a wave speed in the hose for reduce the system's noise. But a wave speed is not constant in flexible hose. This study is a method to find a transfer function of wave speed in the flexible tube's wall model. This wall model already had been suggested. And 3 parameters of this wall model also had been tuned by trial and error method in the former studies. But it is so difficult to apply this method to the 5 parameters model because searching ranges of wall

model variable are too large. A RCGA (real coded genetic algorithm) can be answer to solve this problem in this study.
Keyword: wave speed, flexible tube, transfer matrix, RCGA.

Forming Limit Diagram Prediction of AA6061-T6 Sheet Using a Microscopic Void Growth Model
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Abstract. In this paper, a fracture ductile criterion based on the micro-void growth mechanism in metallic material was employed to predict the forming limit diagram (FLD) of AA6061-T6 aluminum alloy sheet. The constitutive model is implemented through a user-defined subroutine in Abaqus/Explicit software. The material parameters were identified via the tensile tests and calibrated by the inverse engineering. The seven Nakajima deep drawing tests are conducted to obtain various plastic deformation states of material. The limit strain values of FLD are then attained by the linear best fit and cross-section approaches.
Keywords: Forming limit diagram, micro-void growth, McClintock model, micro-crack mechanism.

Development of VR Based Authoring Tool for Smart Factory
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Abstract. We propose a Virtual Authoring Tool based on Game Technologies for smart factory. The smart factory is the software technology for increasing productivity by applying digital technology to industrial fields and conducting simulation through analysis and predictions. Many of the Smart Factory related software supports 2D analysis and monitoring. The 2D Smart Factory solution is gradually changing into the more intuitively convenient 3D and then VR based Virtual Factory. This study developed a VR based 3D authoring tool in which the users can intuitively objects and simulate a production site through VR visualization. Testing and evaluates were performed through a performance and error rate experiment, and the authoring tool was actually applied to a factory to test its application.
Keywords: VR, smart factory, authoring tool, game engine.

Session C-3 – Electronics

EMG-Based Interface Multi-degree of Freedom and Optionality

Taiki Kobayashi, Risako Hiroki, Masami Iwase and Jun Inoue
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Abstract. We aim to develop a myoelectric interface, which is excellent at voluntary and multi-degree of freedom. In this paper, joint angle of a wrist is estimated by myoelectric signal for the purpose. In previous study, NARX model has been a method applicable to estimate joint angle of a wrist. Multi-input and multi-output NARX model, MIMO-NARX model, is selected to develop a interface because it is able to estimate angle of multi-degree of freedom. Moreover, Bayesian network is used to decide orders of MIMO-NARX model. As a result, MIMO-NARX model has been created to estimate volar flexion-dorsal flexion motion and pronation-supination motion of forearm, and then it has been estimated with the error of mean square as 10^{-1} orders. The Bayesian network had been defined a causal relationship between myoelectric signal and joint angle of a wrist and it has been clarified the impact of Electric-Myo-Delay, EMD, on dynamic characteristics. In the future, estimate accuracy will be improved by entertaining the domain decomposition method again because the estimate accuracy is not enough. Moreover, NARX model will be developed by considering EMD and defining a causal relationship between myoelectric signal and hand joint.
Keywords: NARX model, Bayesian network, estimation of wrist joint angle.

Experimental Evaluation of Steady State Visual Evoked Potentials for Brain Machine Interface

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Abstract. This paper presents a signal processing technique to recognize human mental states from steady state visual evoked potentials. In this method, multiple band pass filter is applied to the electroencephalographic signals in order to extract feature points. A neural network classifier is used to recognize the type of LED stimulus that the user is gazing at in real-time. Three experiments were conducted on three participants to evaluate the classification performance, recognition speed, and information transfer capability of the proposed system. In each of these experiments, participants gazed at three types of LEDs flickering at different frequencies. Experimental results showed that the proposed method has achieved 80% of the mean of the correct recognition rate, and it was found that the average of the recognition time was 4.74 seconds. Although the recognition time was about 5 seconds,

another online classification experiment shows that the average number of decisions per minutes 6.8, and the correct recognition rate was 66.6%.
Keywords: Steady State Visual Evoked Potentials (SSVEP), Brain Machine Interface (BMI), Artificial Neural Network.

MicroEYE: A Wireless Multiple-Lenses Panoramic Endoscopic System
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Abstract. In modern medical technology, there is not only a need for effective surgery operation; reducing mistake during the administration of surgery cannot be ignored. A wireless multiple-lenses panoramic endoscopic system is introduced in this paper. We will outlook the whole system and review several key design technologies. In the software design, there are several programs are developed to assist doctors, including image-stitching, scalpel-tracking, lesions-identification functions. A combination of CPU and GPU heterogeneous computing platform is utilized for surgical image-processing functions. In hardware system design, a dual-voltage dual-core low-power motion estimation chip is adopted to reduce power consumption by 20%~30% in different clock frequency. The whole system integration and animal in-vivo experiment are accomplished.

A Deep Through-Microhole Fabricated Inside a Glass Optical Fiber by Use of a Near Ultraviolet Femtosecond Laser
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Abstract. We have demonstrated an inline/picoliter fiber optic spectrometer cell for providing a new method of optical fiber sensing. The spectrometer cell consisted of a microhole fabricated by femtosecond laser drilling. Sample solutions were introduced into the spectrometer cell which had a sensing volume of several picoliters. The microhole was preferable as penetrating through the optical fiber because of introducing the liquid samples smoothly. In this paper, the parameters of laser system in order to make the microhole penetrating through a glass optical fiber were unraveled. A near ultraviolet 400 nm of femtosecond laser pulse launched into the glass optical fiber. A pulse duration and a repetition rate were 350 fs and 500 Hz, respectively. The femtosecond laser pulses with energy of 70 μJ were focused by an objective lens with numerical aperture of 0.65. After 180 shots, the through-microhole which corresponded the depth of 125 μm was structured.
Keywords: Femtosecond laser drilling, glass fiber optic, fabrication of microhole, spectrometer cell.

Simulation of Ridge-Waveguide AlGaInP/GaInP Multiple-Quantum Well Diode Lasers

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Abstract. The output characteristics of the ridge-waveguide AlGaInP/GaInP multiple quantum well diode lasers have been investigated via ATLAS simulation tool. Three ridge-waveguide parameters including the ridge width, ridge height and the cavity mirror reflectivity have been analyzed in order to achieve the optimal performance of the diode lasers. Simulation results show the significant improvement of the laser output power when increasing the ridge width, the ridge height (etch through the active region) and when applying the optical coatings on the laser facets. There are still some limitations regarding these approaches, but one could potentially figure out the optimal set of the ridge-waveguide parameters for optimal performance of the AlGaInP/GaInP diode lasers.

Keywords: Ridge-waveguide, AlGaInP/GaInP lasers, multiple quantum well, optical coating, L-I characteristic.

Motion and Force Estimation Based on the NARX with an EMG Signal

Yuuto Ohno, Jun Inoue, Masami Iwase, and Shoshiro Hatakeyama
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Abstract. The purpose of this research is to identify the force estimation model from an ElectroMyoGraphy (EMG) signal, and develop a power assist apparatus considering physical features. In this paper, the angle and the force estimation model based on the Nonlinear Auto-Regressive eXogenous (NARX) model is identfied from the EMG signal in volar/dorsal flexion of the wrist and the wrist angle or the force, and estimated the wrist angle or the force. In addition, the model that it matched in a human motion cycle is built by downsampling the EMG signal, the wrist angle and the force. Results of identifying the NARX model, the wrist angle and the force is estimated with high precision with even the different sampling time.
Keywords: Nonlinear Auto-Regressive eXogenous (NARX) model, angle estimation, force estimation, ElectroMyoGraphy (EMG) signal.

A Low-Power Embedded IoT Microprocessor Design and Validation

Ching-Hwa Cheng
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Abstract. In this paper, the four proposed low-power design techniques are used to design an ARM-lite Internet-of-Thing (IoT) embedded microprocessor. The four techniques are gated-clock, memory-interleaving, structure-reordering, and instruction-coding. These four mechanisms are implemented within this microprocessor, and then Xilinx FPGA is used to validate whether the design is functionally correct. Here, the gate-level low-power design techniques are focused for IoT embedded microprocessors; it can be found that the proposed low-power schemes are application program dependent. From our experimental results, after applying the four techniques, there was an average of 18% less power consumption and without delay time penalty than the original design. The gated-clock and memory-interleaving techniques achieved better power-saving effectiveness than the other techniques. The proposed gate-level low-power schemes are also suitable for other special purpose microprocessors. From experimental results, for specific-application IoT microprocessor, there is better power-saving to incorporate more detailed software analysis. However, for the general-application IoT microprocessor, the future circuit-level low-power techniques need to be included for more effective power-saving.
Keywords: low-power, embedded IoT microprocessor.

Enhancement of Distributed Fiber Optic Vibration Sensors

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Abstract. The paper deals with the enhancement of sensor system utilizing the standard single mode optical fiber as a distributed sensor of the mechanical vibrations. Many up-to-date solutions are based on detection of backscattered signals from interrogating optical pulses sent down the sensing optical fiber. Previous solutions suffer from insufficient frequency of optical pulses that is limited by the length of sensing fiber and so is the sample frequency from single point along the fiber, which makes classification of an event less accurate and false alarms may arise. This article presents a technique of information enrichment based on frequency-time division principle.
Keywords: distributed optical fiber sensor, mechanical vibrations, optical modulator, AOM, pulse multiplier, frequency shifter, ϕ-OTDR.

Real-Time Root Monitoring of Hydroponic Crop Plants: Proof of Concept for a New Image Analysis System

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Abstract. This paper presents a new autonomous system that allows for the capturing and analysis of root systems of hydroponic crop plants without removing them from the growing environment. Disturbing the delicate roots of these plants can cause stress and increase the chance of mechanically spreading diseases. The first task carried out was the taking of simple measurements of root thickness and assess the feasibility of this concept. The second task involved inflicting two of four plants with an arbitrarily chosen plant sickness, in this case aluminum toxicity, and autonomously capture pictures of each plant over the course of approximately three weeks. Then, image analysis and machine learning techniques were applied to identify sick plants from healthy plants.

Session C-5 – Image Processing

A New Approach of 2D Measurement of Injury Rate on Fish by a Modified K-means Clustering Algorithm Based on L*A*B* Color Space

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Abstract. Based on basic properties of L*A*B* color space, this paper proposes a new approach of 2D image processing which is used for measurement of injury rate on fish by a modified K-means clustering algorithm and Otsu's threshold algorithm. Then, experimental results of the proposed method are compared to the results of a manual threshold method on L*A*B* color space. To do this issue, the following tasks are done. Firstly, an original color image is transferred into L*A*B color space. Secondly, channel "a" is separated from L*A*B* color space image. Thirdly, the value of channel "a" is adjusted by changing the contrast algorithm. Fourthly, the modified K-means clustering algorithm on a new channel "a" image is applied to define and divide data elements into different groups. Fifthly, Gaussian Filter is used to filter the random "noises" in shape of injury and fish images. Sixthly, Otsu's threshold algorithm is used to transfers the filtered images into binary images. Seventhly, final images are obtained after filtering the rest of "noises" by morphological processing. Finally, the areas of injury and fish shapes are obtained by counting pixels on both of the final binary images. The experiment results show that the proposed new approach is closer to the real injury and injury rate on fish than the results of the manual threshold method on L*A*B color image.
Keywords: Injury rate, Modified K-means clustering algorithm, L*A*B* color space, Otsu's threshold method, Gaussian filter, segmentation image.

The Estimation Method of Force by Using Kinect Camera

Ryosuke Okada, Shoshiro Hatakeyama and Masami Iwase
Tokyo Denki University, Japan

Abstract. The purpose of this paper is an estimation of driving torque by using an external sensor. This paper deals with an estimation method of driving torque and physical parameters. This research have been estimated the driving torque of each joints as the force. Future, this research will design an estimation system of a myoelectric signal using an external sensor. Moreover, we aim to design an evaluation system of the ability to exercise using obtained biosignal.
Keywords: Kinect, estimation, force.

Recognition and Grasping Objects from 3D Environment by Combining Depth and Color Stereo Image in the Mobile Picking Robot System

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Abstract. This paper proposes recognition and grasping objects from 3D environment by combining depth and color stereo image in the mobile picking robot system. To do this task, the followings are done. Firstly, an image processing system including Kinect camera sensor is described. Secondly, RGB color map and new depth map for image inpainting are obtained using Kinect SDK mapping function to align RGB image with depth image. Thirdly, the new depth map are segmented to distinguish between the image background and the objects that should be recognized. The feature colours are generated based on colour histograms. Euclidean distance is used to measure the similarity between the feature vectors computed from the colour image and the feature vectors stored in a database. Fourthly, by converting RGB map and new depth map into 3D point clouds, an algorithm for localizing handle-like grasp affordances is proposed. The main idea is to search the point cloud for neighborhoods that satisfy handle-like grasp affordances and can be grasped by the end-effector of the manipulator. Finally, the effectiveness of the proposed algorithms is verified by using experiment. The experimental results show that the mobile picking robot successfully detects an object and finds its grasping points with an acceptable small error.
Keywords: Mobile robot, object recognition, object localization, grasping object, 3D point cloud.

Determination of the Fish Surface Area and Volume Using Ellipsoid Approximation Method Applied for Image Processing

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Abstract. This paper proposes determination of the fish surface area and volume using ellipsoid approximation method applied for image processing based on two views of fish images. The fishes are considered as ellipsoid shapes on three view sides that appropriate analytical models for their surface and volume estimation. To do this task, the followings are done. Firstly, mathematical modeling of surface area and volume of

ellipsoid analytically are presented. Secondly, ellipsoid shape is segmented to determine surface area and volume for computation. Finally, surface area and volume of fish are measured by image processing technique. The surface area and volume computed are compared with analytical and experimental results.
Keywords: Fish, surface area, volume, ellipsoid mathematical modeling, image processing.

Session D-1 – Robotics

Continuous Genetic Algorithm Aiding to Quadcopter Controller Design

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Abstract. The practicability of the continuous Genetic Algorithm (GA) is exploited to optimize the Proportional Integral Derivative (PID) controller gains, in this paper. By minimize the Integral of Square Error (ISE) fitness function of the control performance, the advantages of the continuous GA, such as create and update the new and contiguous parameters, are presented. The proposed controller design is then implemented to Quadcopter models to illustrate the better performances in shortly saving operation time.
Keywords: continuous GA, PID, ISE, Quadcopter.

Path Following Control of Bike Robot

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Abstract. In this paper we consider about path following control of a bike robot which have been studied for a long time in our laboratory and propose a method to generate paths to avoid obstacles based on the sensor information. In the proposed path generation algorithm, BiRRT, smoothing method, and RRT* are combined to generate paths on line. The validity of the proposed method is demonstrated by numerical simulations.
Keywords: bike robot, path following, output zeroing control.

Online Training the Radial Basis Function Neural Network Based on Quasi-Newton Algorithm for Omni-directional Mobile Robot Control

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Abstract. A radial basis function neural network (RBFNN) is a branch of neural network which performs good to control the dynamics system. Several researchers have proposed many approaches to train RBFNN such as Gradient Descent (GD), Newton's method, Conjugate Gradient, Quasi-Newton, Levenberg Marquardt. This paper presents the Quasi-Newton method with Broyden – Fletcher – Grodfarb - Shanno (BFGS) for online training the RBFNN. The Quasi-Newton method was studied as one of the most effect optimization algorithms based on the gradient

descent. After being trained, the RBFNN is applied to control Omni-directional mobile robot based on sliding mode controller. The RBFNN is considered as an adaptive controller. The simulation results in MATLAB Simulink show that the proposed algorithm is efficient, the response of adaptive sliding mode controller with Quasi-Newton algorithm converge to reach the trajectory.
Keywords: Quasi-Newton, Radial Basis Function Neural networks, omnidirectional mobile robot, sliding mode control, adaptive control

Walking Figure Generating in Consideration of Ground Reaction Force
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Abstract. In the case of using a multi-legged robot in a disaster area or a similar location, it is necessary to grasp the condition of the road surface by estimating the ground reaction force for a coordinated a gait generation, as a climbing up and down steps. In this research, a ground reaction from the road surface adding to a foot of a hexapod robot is estimated by the disturbance observer. Moreover, a sensorless gait is generated by perceiving a situation of road surface and a position of robot. In this report, the motion equation of an unipod in the hexapod robot is developed by Lagrange's method. Furthermore, the ground reaction force is estimated by the developed disturbance observer.
Keywords: walking figure generating, disturbance observer, ground reaction force.

Simulation and Experiment of Underwater Vehicle Manipulator System Using Zero-Moment Point Method
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Abstract. Underwater vehicle-manipulator system (UVMS) has been known as the useful underwater vehicle to perform various tasks under the water. When the UVMS performs the manipulative operation, the movement of manipulator causes stability problems of the UVMS system. To solve this problem, an algorithm for stabilizing the UVMS is necessary. In this paper, Zero Moment Point (ZMP) algorithm is used to improve the stability of the UVMS while the manipulator tracks the given trajectory. Since the UVMS system is the redundant system, some constraints for optimal purposes are necessary. For this, the distance between the ZMP and the mass center of the vehicle is adopted as the performance index. Gradient Projection Method (GPM) is used to

minimize the performance index through null space solution of the redundancy resolution. Finally, simulation and experiment will be conducted to verify the algorithm.
Keywords: redundant underwater manipulator, underwater vehicle-manipulator system, zero moment point.

Tracking Controller Design for Omni-Directional Automated Guided Vehicles Using Backstepping and Model Reference Adaptive Control

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Abstract. This paper proposes a tracking controller for omni-directional automated guided vehicle using backstepping and model reference adaptive control. To design the proposed controller, the followings are done. Firstly, a system modeling is obtained by analyzing a dynamic modeling of an OAGV. Secondly, a backstepping technique is utilized to design the proposed controller since a system modeling has a recursive structure. Moreover, there exist uncertain parameters in the system modeling, a known reference model is utilized so that the output of the reference model tracks a virtual control input. Thirdly, uncertain parameters are estimated by update laws in order that the velocity vector of the OAGV tracks the output vector of the reference model control input. Finally, the stability of the proposed controller is analyzed by Lyapunov theory and the effectiveness of the proposed controller are verified by simulation results.
Keywords: Model reference adaptive control, backstepping, automated guided vehicle, reference trajectory, omni-directional wheel.

A Study on Looking for Shortest Trajectory of Mobile Robot Using A* Algorithm

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Abstract. Mobile robots are studied and researched popularly in the world. The global problems about looking for trajectory and avoiding obstacles are interested. This paper presents a study on looking for shortest trajectory of mobile robot between the started position and the goal position. Firstly, a design of mobile robot is introduced. After that, the paper concentrates on using A* algorithm to look for shortest trajectory. In this paper, an algorithm for avoiding obstacles is also considered during looking for trajectory. This algorithm is simulated in MATLAB. Finally, an experimental model is done to verify the proposed algorithm.
Keywords*:* mobile robot, shortest trajectory, A* algorithm, global problem.

Development of a Module Robot for Glass Façade Cleaning Robot

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Abstract: Our ultimate goal is to develop a glass facade cleaning robot capable of adapting to any skyscrapers. Reconfigurable modular robot system allows to realize different morphology through assembling/ disassembling/ organizing system of each module. This paper proposes the modular robot strategy for the glass facade cleaning robot, and implements a module robot, which compose most basic role, including both design/development of the real robot and design of a control system on a glass surface. Firstly, design challenges of the glass facade cleaning robot is discussed from sides of glass cleaning process and area coverage, and our basic strategy based on the modular robot system is proposed. And, a control system for a biped type module robot based on the strategy consists of the inverse kinematics, the fifth polynomial interpolation and the sequential control. Finally, an experiment of the developed module on a glass surface is performed.
Keywords: glass facade cleaning robot, wall climbing robot, module robot.

Development of Ray-Type Underwater Glider

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Abstract. Underwater Glider is now the powerful tool for ocean sampling using torpedo shape. Inspired by the manta ray with their effective maneuverability, the ray-type underwater glider is developed with a dual buoyancy engine and a movable mass. The shape of this platform allows for larger payload of battery and sensors. The analysis of fluid resistance performance is carried out through Computational Fluid Dynamics (CFD) for the optimum shape. Simulation of gliding dynamics of ray-type glider is studied for understanding the advantage of what nature has already done for the shape of the manta ray.
Keywords: ray-type underwater glider, underwater glider, glider dynamics, movable mass, buoyancy control.

Study on Design, Analysis and Control an Underwater Thruster for Unmanned Underwater Vehicle (UUV)

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Abstract. Unmanned underwater vehicle (UUV) is a type of robot that operates underwater for multi purposes such as underwater exploration purpose, hydro-meteorological exploration, and military purposes.... One of the most important part in the UUV is its thruster. This paper presents the design, analysis and control results of an underwater thruster of 300W, which can be used for a small-sized UUV. The underwater thruster is designed by integrating different modules and built according to each system from mechanical design, hardware design, and control algorithm to ensure the thruster can operate underwater continuously in the depth of 100 meters lifespan (equal to 145psi) for long time. The thruster use magnetic coupling for waterproof and also can perform the overload protection for thruster. The housing and magnetic coupling were analyzed by using finite element analysis to optimize the thickness of the housing in deep water level. The mathematical model and simulation result of the speed control using PID and Fuzzy controllers are also presented.
Keywords: Magnetic coupling, thruster, UUV, BLDC, fuzzy

Study on Determining the Number of Fin-Rays of a Gymnotiform Undulating Fin Robot

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Abstract. This paper focuses on calculating the optimal number of fin-rays in one wavelength. First, the mathematical model for the problem is derived. Then the experiments is conducted on a simulation model of the featherback's continuous fin, followed by the discretization within one wavelength for feasibility in mechanical design. The results in both computation and experiment suggest that the optimal thrust is achieved with 16 fin-rays in one wavelength. This research seeks to contribute to

the aim of boosting the propulsive efficiency of the gymnotiform-inspired biomimetic robot.
Keywords: fin-rays, propulsive efficiency, gymnotiform-inspired.

Nonlinearities Compensation Method for Application to Robot Manipulators Using Time-Delay Estimation
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Abstract. The challenging and difficult issue in controlling multi-joint robot manipulators is high nonlinearity, strong coupling, and payload gravity in the system dynamics of the manipulator. This paper proposes a straightforward approach for motion control applied to robot manipulators using the nonsingular terminal sliding mode control design working together with time-delay estimation technique (TDE). In this approach, each joint actuator is considered as a free-inertia system without modeling nonlinear terms such as dynamic couplings, Coulomb friction, and gravitational payload thanks to the TDE. Implementation of the proposed control scheme is simple because it does not need to calculate the highly complicated dynamic equations of the robot. In this sense, this technique does not require the exact model of the joint actuator. Despite its simplicity, the proposed control scheme provides high-precision control and robustness against parameter variations. Experiments are implemented on a 2-DOF robot arm to verify the simplicity and feasibility of the proposed scheme, and the results are compared to those of the tuned PID controller. The results reveal that the proposed control scheme is realistic and simple for applying on practical robot manipulators.
Keywords: Motion control, decentralized control, nonsingular terminal sliding mode, time-delay estimation.

Modeling of Rolling Locomotion on a Reconfigurable Quadruped Robot with Servos for State Estimation
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Abstract. Motivated by the need for accurately monitoring a condition of a reconfigurable robot in autonomy, in this paper, we present a model of rolling locomotion on a reconfigurable quadruped robot, Scorpio, for state estimation. The quadruped robot can crawl on uneven grounds ensuring high degree of stability and mobility and roll on the flat ground and downhills offering greater speed and efficiency. For the state estimation of the rolling quadruped robot, its model combines servo

characteristics of leg joints and considers collision between the robot and the ground and following discontinuous velocity variation. We verify the adequacy of the robot model through numerical simulations. The simulations results show that the rolling quadruped robot can roll continually on the flat ground receiving target angles of leg joints as input and demonstrate the adequacy of the proposed robot model.
Keywords: modeling, reconfigurable robot, servos, rolling.

Modeling and Evaluating Motion Performance of Robotic Fish with a Pair of Non-uniform Pectoral Fins
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Abstract. Pectoral fins play an essential role in generating the locomotion and balance for fishes and especially for fish robots. The adaptation to shapes and mechanism structure of pectoral fin types helps to improve the swimming motion of the main body effectively, that results in the high flexibility and maneuverability of locomotion. This paper proposes a hydrodynamic model of a fish robot using a pair of flexible pectoral fins, which can be used to increase the robotic fish motion efficient and reduce the consumed energy. The pectoral fin uuuhas the symmetrical shape and varying thickness along the symmetrical axis. The body motion is considered as a rigid body motion. Based on the Lagrange energetic method, Assumed Mode Method (AMM), and Kirchhoff's equation, the mathematical model of the pectoral fin's deformation and robot body is described explicitly, where the natural frequency and mode shape of pectoral fins are derived by the Rayleigh-Ritz method. The effect of inertia and damping factors are modeled by the Morison force. The numerical simulations of the fins motion and the main body are conducted to show the effectiveness of the proposed model. This model and the analyses processes are expected to support in optimal issue and controller design for biomimetic robotic fish effectively.
Keywords: Flexible pectoral fin, rigid body, assume mode method, Rayleigh-Ritz method, non-uniform fin.

Session D-4 – Robotics

Study on the Combined Underwater Tracked Vehicle System with a Rock Crushing Tool

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Abstract. In this paper, an analysis on the design and mechanics of the underwater tracked vehicle (UTV) with a rock crusher (RC) tool for rock excavation has to be considered and performed. The objective of this paper is to analyze the mechanics of the UTV system that are affected by the RC force and torque for underwater rock cutting. For this, the forces and moments on the RC tool based on the analysis of the mechanics of the individual cutter tool are determined. Also, a mathematical expression is derived for the forces and moment of the combined UTV system with RC tool for rock excavation. For the design of the UTV system, the required tractive thrust and down thrust force were analysed, and the moment to the rotor carriage caused by the cutting system is studied. To support the validity of the analyses, a number of numerical simulations are performed using the derived equations.
Keywords: Rock Crusher (RC), Underwater Tracked Vehicle (UTV), Tractive Thrust, Down Thrust, Simulation.

Design and Implement a Fuzzy Autopilot for an Unmanned Surface Vessel

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Abstract. Autopilot system are valuable for many applications, such as: oceanographic, military purposes, maritime transport… which offer greater self-adaptive capacity and cost-effectiveness compared to traditional systems. Especially, this is a common and an essential problem for Unmanned Surface Vessel (USV) due to the non-linearity of the system and the changing environmental conditions. The vessel's parameters is determined by using Kempf's method. This paper focus on design, modelling and simulation a Fuzzy heading control for an USV. The heading deviation and rate of heading deviation are treated as Fuzzy inputs and the rudder angle command is the Fuzzy output. The Fuzzy-controller for USV is verified by Matlab simulation and experimental. The archived results confirm the heading control's effectiveness using Fuzzy controller.
Keywords: Autopilot, fuzzy logic controller, Kempf's Zig-zag maneuver.

Development of the Removable Electric Drive System for Wheelchair Running on Public Road

Yuki Iwami, Jun Inoue, Masami Iwase and Shoshiro Hatakeyama
Tokyo Denki University, Japan

Abstract. The purpose of this research is to develop a Removable Electric Drive System (REDS) running on a public road without changing the wheelchair. When a wheelchair user goes out alone, the existing manual wheelchair and electric wheelchair use different optimal wheelchairs depending on the distance and road conditions. For this reason, a drive system is attached to a manual wheelchair, and apparatuses that serve as both a manual wheelchair and an electric wheelchair have been developed. However, when traveling a long distance in a short time, it is necessary to have a device capable of running public roads changing public roads. In this research, we will develop a towing machine based on the target speed and the inclination angle, assuming to travel on the public road. As a result of running verification by prototype, we confirmed that it is possible to run at the target speed.
Keywords: Wheelchair, life Support, welfare engineering.

Designing Optimal Trajectories and Tracking Controller for Unmanned Underwater Vehicles

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Abstract. In this paper, we present the designing optimal trajectories and a tracking controller for the depth control of an unmanned underwater vehicle (UUV). These optimal trajectories are explicit functions derived from solving analytically the nonlinear second order differential equation representing the depth motion of the vehicle. In order to control the depth motion of UUV under disturbance effects and uncertainties of system, a sliding mode controller is proposed. By applying this proposed control scheme to uncertain linear time-varying second order system of UUV depth motion, the shortest travel time or minimum energy consumption maneuver are expressed in a closed-form equation if ranges of parametric uncertainties, torque limits, and reference inputs are specified. To support the validity of the analyses, we perform the computer simulation using this approach. Through the simulation results, effectiveness and robustness of the approach was demonstrated even with uncertainties.
Keywords: optimal trajectories, tracking controller, depth control, sliding mode method, uncertainty.

Session D-5 – Motor Control

Fast Maximum Power Point Tracking Control for Variable Speed Wind Turbines

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Abstract. This paper proposes a maximum power point tracking (MPPT) scheme for permanent magnet synchronous generator (PMSG) wind turbine systems. In this method, the proportional controller is added to the optimal torque controller, in which its proportional gain is tuned online, depending on a trade-off between the system dynamic behavior and the transient load of the drive train. Thus, the MPPT control method can improve the tracking performance effectively and thereby increase its energy yield. The effectiveness of the proposed methods is verified by simulation results for the 2[MW]-PMSG wind turbine system.
Keywords: maximum power point tracking, permanent magnet synchronous generator, torque control, wind turbine.

High-Gain Observer Based Output Feedback Controller for a Two-Motor Drive System: A Separation Principle Approach

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Abstract. Multi-motor drive systems are nonlinear, multi-input multi-output (MIMO) and strong-coupling complicated system, including the effect of friction and elastic, backlash. The control law for this dive system much depend on the determining of the tension. However, it is hard to obtain this tension in practice by using a load cell or a pressure meter due to the accuracy of sensors or external disturbance. In order to solve this problem, a high-gain observer is proposed to estimate the state variables in this drive system, such as speeds, tension. An emerging proposed technique in the control law is the use of high-gain observers together with state feedback control to obtain a separation principle property for the stabilization of whole system. The theory analysis and simulation results point out the good performance of the proposed output feedback for the drive system.
Keywords: high-gain observer, multi-motor drive systems, sliding mode control, tension, output feedback controller.

A Fuzzy-Based Supervisory Controller Development for a Series Hydraulic Hybrid Vehicle

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Abstract. This paper presents a fuzzy-based control strategy for a 3.5-ton series hydraulic hybrid truck in term of improving fuel economy. In this work, the vehicle speed demand is considered as the input of the fuzzy logic controller. The output of the controller is the reference value of the accumulator pressure. A PID controller will be used to regulate the accumulator pressure by adjusting the power of the engine. With the flexibility characteristic of the fuzzy logic controllers, its membership function can be further modified to achieve smoother control surface. The effectiveness of the proposed controller is evaluated under different driving condition. The performance of the system is acceptable in comparison with other rule-based control strategies.
Keywords: fuel economy improvement, fuzzy logic controller, series hydraulic hybrid vehicle.

Study on Hybrid Method for Efficiency Optimization of Induction Motor Drives

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Abstract. This paper proposes a new hybrid method for efficiency optimization of induction motor drives. To do this task, the followings are done. Firstly, the induction motor drive with 3 phases is modeled by using copper loss and core loss to find out the optimal efficiency of the power losses. Secondly, golden section technique is used to optimize the drive efficiency by searching for an optimal value according to the reference rotor flux current. In this way, the electrical input power of the system can also be minimal. Finally, the improved algorithm is proposed to enhance the system response speed and reduce torque ripple. The simulation is done to validate the proposed algorithm. The simulation results show that the proposed algorithm can be better than a convention method such as loss model control (LMC) and search control (SC) in terms of lower torque ripple and higher response speed.
Keywords: induction motor, efficiency optimization, power losses, golden section technique.