



# ICAROB 2016

## PROCEEDINGS OF THE 2016 INTERNATIONAL CONFERENCE ON ARTIFICIAL LIFE AND ROBOTICS

January 29-31, 2016  
Okinawa Convention Center, Okinawa, JAPAN  
**International Meeting Series**

Editor-in-Chief  
Masanori Sugisaka  
Editors: Yingmin Jia, Takao Ito, Ju-Jang Lee  
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Proceedings of The 2016 International Conference on  
**ARTIFICIAL LIFE AND ROBOTICS**  
**(ICAROB 2016)**

January 29-31, 2016  
Okinawa Convention Center, Okinawa, Japan

Editor-in-Chief: Masanori Sugisaka  
Editors: Yingmin Jia, Takao Ito, Ju-Jang Lee,  
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M. Sugisaka (ALife Robotics Co., Ltd., Japan)

Takao Ito (Hiroshima University, Japan)

## **HISTORY**

The International Conference on Artificial Life and Robotics (ICAROB) resulted from the AROB-symposium whose first edition was held in 1996 and the eighteenth and last edition in 2013. The AROB symposium was annually organized by Oita University, Nippon Bunri University (NBU), and ALife Robotics Corporation Ltd., under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (Monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), the Commemorative Organization for the Japan World Exposition ('70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition ('70), and various other Japanese companies for their repeated support. The old symposium (this symposium has been held every year at B-Con Plaza, Beppu, Oita, Japan except in Oita, Japan (AROB 5th '00) and in Tokyo, Japan (AROB 6th '01).) was organized by the International Organizing Committee of AROB and was co-operated by the Santa Fe Institute (USA), RSJ, IEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB-symposium expanded much by absorbing much new knowledge and technologies into it. This history and character of the former AROB symposiums are passed on the current ICAROB conference and to this journal, International Journal of Robotics, Networking and Artificial Life (JRNAL). From now on, ALife Robotics Corporation Ltd. is in charge of management of both the conference and the journal. The future of the ICAROB is brilliant from a point of view of yielding new technologies to human society in the 21st century. This conference invites you all.



## **AIMS AND SCOPE**

The objective of this conference is the development of new technologies for artificial life and robotics which have been recently born in Japan and are expected to be applied in various fields. This conference presents original technical papers and authoritative state-of-the-art reviews on the development of new technologies concerning robotics, networking and artificial life and, especially computer-based simulation and hardware for the twenty-first century. This conference covers a broad multidisciplinary field, including areas such as:

- Artificial intelligence & complexity
- Artificial living
- Artificial mind research
- Artificial nervous systems for robots
- Artificial sciences
- Bipedal robot
- Brain science and computing
- Chaos
- Cognitive science
- Computational Molecular biology
- Computer graphics
- Data mining
- Disasters robotics
- DNA computing
- Empirical research on network and MOT
- Environment navigation and localization
- Evolutionary computations
- Facial expression analysis, music recommendation and augmented reality
- Foundation of computation and its application
- Fuzzy control
- Genetic algorithms
- Human-welfare robotics
- Image processing
- Insect-like aero vehicles
- Intelligence in biological systems
- Intelligent control
- Management of technology
- Medical surgical robot
- Micro-machines
- Multi-agent systems
- Nano-biology
- Nano-robotics
- Networking
- Neural circuits
- Neuro-computer
- Neuromorphic Systems
- Neuroscience

- Pattern recognition
- Quantum computing
- Reinforcement learning system & genetic programming
- Robotics
- Software development support method
- System cybernetics
- Unmanned underwater vehicles
- Unmanned Aerial Systems Technologies
- Unmanned Aerial Systems designing, controls and navigation
- Unmanned Aero vehicles
- Virtual reality
- Visualization

Hardware-oriented submissions are particularly welcome. This conference will discuss new results in the field of artificial life and robotic

### **GENERAL SESSION TOPICS**

**GS1** Neuromorphic Systems (5)

**GS2** Pattern Recognition & Image Processing(6)

**GS3** Reinforcement Learning System & Genetic Programming(6)

**GS4** Micro-Machine(4)

**GS5** Multi-Agent Systems & Visualization(2)

**GS6** Intelligent Control & System Cybernetics(3)

**GS7** Robotics I (6)

**GS8** Robotics II (5)

**GS9** Robotics III (4)

**GS10** Poster Sessions(5)

### **ORGANIZED SESSION TOPICS**

**OS1** Artificial Life and Quality Enhancement of Life(6)

**OS2** Intelligence Control System and Artificial Life(6)

**OS3** Construction Engineering and Management(6)

**OS4** Construction Technology and Management(5)

**OS5** Advanced Control Systems(6)

**OS6** Intelligent Control(6)

**OS7** Image Analysis and Content Security(5)

**OS8** Image, Circuit and Control(9)

**OS9** Modern approaches of MOT and Corporate Strategy(3)

**OS10** Reality Mining(3)

**OS11** Kansei Engineering and Application(4)

**OS12** Advanced Research on Computer Science and Information Processing(4)

**OS13** Automatic Generation, Creation, and Production of Narrative Contents(4)

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Accepted papers will be published in the proceeding of The 2016 International Conference on Artificial Life and Robotics (ICAROB 2016). Some of high quality papers in the proceeding will be requested to re-submit their papers for the consideration of publication in an international journal ROBOTICS, NETWORKING AND ARTIFICIAL LIFE under agreement of both Editor-in- Chief and 3 reviewers. All correspondence related to the conference should be addressed to ICAROB Office.

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## MESSAGES

**Masanori Sugisaka**

**General Chair of ICAROB**



**Masanori Sugisaka**  
**General Chair**

**(Professors, Open University  
(UK), University of Malaysia-  
Peris (Malaysia) and President  
of Alife Robotics Co., Ltd.  
(Japan))**

*Masanori Sugisaka*

It is my great honor to invite you all to The 2016 International Conference on Artificial Life and Robotics (ICAROB 2016).

This Conference is changed as the old symposium from the first (1996) to the Eighteenth (2013) annually which were organized by Oita University, Nippon Bunri University(NBU), and ALife Robotics Corporation Ltd. under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (Monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), The Commemorative Organization for the Japan World Exposition ('70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition ('70), Japanese companies for their repeated support.

The old symposium was organized by International Organizing Committee of AROB and was co-operated by the Santa Fe Institute (USA), RSJ, IEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB symposium was growing up by absorbing many new knowledge and technologies into it.

This history and character was inherited also from ICAROB 2014(The 2014 International Conference on Artificial Life and Robotics) to now. From now on, ALife Robotics Corporation Ltd. is in charge of management. This year we have The 2016 International Conference on Artificial Life and Robotics (ICAROB 2016). The future of The ICAROB is brilliant from a point of view of yielding new technologies to human society in 21st century.

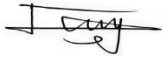
I hope that fruitful discussions and exchange of ideas between researchers during Conference (ICAROB 2016) will yield new merged technologies for happiness of human beings and, hence, will facilitate the establishment of an international joint research institute on Artificial Life and Robotics in future.

**Yingmin Jia**

**Co-General Chair of ICAROB**



**Yingmin Jia  
Co-General Chair  
(Professor, Beihang  
University,  
R.P. China)**

A handwritten signature in black ink, appearing to read 'Yingmin Jia'.

It is my great pleasure to invite you to The 2016 International Conference on Artificial Life and Robotics (ICAROB 2016), in Ginowan City, Okinawa, Japan from Jan. 29th to 31st, 2016.

ICAROB develops from the AROB that was created in 1996 by Prof. Masanori Sugisaka and celebrated her birthday of 21st years old in 1996. Doubtless, new mission and big challenges in the field of artificial life and robotics will promote ICAROB to start a new stage and attract wide interests among scientist, researchers, and engineers around the world.

For a successful meeting, many people have contributed their great efforts to ICAROB. Here, I would like to express my special thanks to all authors and speakers, and the meeting organizing team for their excellent works.

Looking forward to meeting you at ICAROB in Ginowan City, Okinawa and wishing you enjoy your stay in Japan.



**Takao Ito**  
**Co-General Chair**  
**(Professor Hiroshima**  
**University, Japan)**

A handwritten signature in black ink that reads "Takao Ito".

## **Takao Ito**

### **Co General Chair of ICAROB**

It is my great honor to invite you all to The 2016 International Conference on Artificial Life and Robotics (ICAROB 2016). This Conference is changed as the old symposium from the first (1996) to the Eighteenth I am pleased to welcome you to The 2016 International Conference on Artificial Life and Robotics in the wonderful city of Ginowan, Okinawa, Japan

The ICAROB has long history. The former organization of the ICAROB was developed under the strong leadership of the President, Professor. Masanori Sugisaka, the father of AROB. We gathered many researchers, faculty members, graduate students from all over the world, and published numerous high-quality proceedings and journals every year.

Over the years, dramatic improvements have been made in the field of artificial life and its applications. The ICAROB has becoming the unifying the exchange of scientific information on the study of man-made systems that exhibit the behavioral characteristic of natural living systems including software, hardware and/or wetware. Our conference shapes the development of artificial life, extending our empirical research beyond the territory circumscribed by life-as-we-know-it and into the domain of life-as-it-could-be. It will provide us a good place to present our new research results, good ideas, and valuable information about artificial intelligence, complex systems theories, robotics, management of technology, etc.

In order to provide an outstanding technical level for the presentations at the conference, we have invited more than 60 distinguished experts in the field of artificial life in the organizing committee and program committee. We will have 22 sessions during 3 days of conference, including 4 invited sessions.

The conference site is Okinawa Convention Center, one of the finest congress centers in Okinawa. It is situated near the center of the Ginowan city in Okinawa. You can find many fantastic scenic spots and splendid historical places in Naha city. Enjoy your stay and take your time to visit the city of Okinawa.

I am looking forward to meeting you in Okinawa during ICAROB 2016 and to sharing a most pleasant, interesting and fruitful conference



**Ju-Jang Lee**  
**Co-General Chair**  
**(Professor, KAIST)**

A handwritten signature in black ink, appearing to read 'J. Lee'.

## **Ju-Jang Lee**

### **Co-General Chair of ICAROB**

The First International Conference on Artificial Life and Robotics (ICAROB) was held in Oita City, Oita, Japan from Jan. 11th to 13th, 2014. This year's Conference will be held amidst the high expectation of the increasingly important role of the new interdisciplinary paradigm of science and engineering represented by the field of artificial life and robotics that continuously attracts wide interests among scientist, researchers, and engineers around the globe.

Distinguished researchers and technologists from around the world are looking forward to attending and meeting at ICAROB. ICAROB is becoming the annual excellent forum that represents a unique opportunity for the academic and industrial communities to meet and assess the latest developments in this fast growing artificial life and robotics field. ICAROB enables them to address new challenges, share solutions, discuss research directions for the future, exchange views and ideas, view the results of applied research, present and discuss the latest development of new technologies and relevant applications.

In addition, ICAROB offers the opportunity of hearing the opinions of well-known leading experts in the field through the keynote sessions, provides the bases for regional and international collaborative research, and enables to foresee the future evolution of new scientific paradigms and theories contributed by the field of artificial life and robotics and associated research area. The twenty-first century will become the century of artificial life and intelligent machines in support of humankind and ICAROB is contributing through wide technical topics of interest that support this direction.

It is a great honor for me as a Co-General Chair of the 3rd ICAROB 2016 to welcome everyone to this important event. Also, I would like to extend my special thanks to all authors and speakers for contributing their research works, the participants, and the organizing team of the 3rd ICAROB.

I'm looking forward to meeting you at the 3rd ICAROB in Naha City, Okinawa and wishing you all the best.

1/28(Thu.) 17:30-19:30	Welcome Party(Conference Site: Farm Café TAIYO ICHIBA)
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### TIME TABLE (1/29)

1/29(Fri.)	RoomB2	RoomB3	RoomB4
8:50-	Registration		
9:10-10:25	OS4 Construction Technology and Management(5) Chair: C. C. Chang Co-Chair: Y. C. Shiau	GS8 Robotics II (5) Chair: J. J. Lee	GS10 Poster Sessions (5)
10:25-11:40	Coffee break		
10:40-11:10	Opening Ceremony (RoomB2)		
11:20-12:00	Chair: T. Ito Invited Speech IS1(RoomB2) Luigi Pagliarini		
12:00-13:00	Lunch		
13:00-14:00	Chair: T. Ito Plenary Speech PS1(RoomB2) Henrik H. Lund		
14:00-14:20	Coffee break		
14:20-15:50	OS11 Kansei Engineering and Application(4) Chair: T. Hattori Co-Chair: Y. Imai	OS1 Artificial Life and Quality Enhancement of Life(6) Chair: S. H. Li Co-Chair: S. D. Wu	OS3 Construction Engineering and Management(6) Chair: Y. C. Shiau Co-Chair: Y. Y. Tsai
15:50-16:10	Coffee break		
16:10-18:10	OS2 Intelligence Control System and Artificial Life(6) Chair: K. H. Hsia Co-Chair: K. L. Su	GS1 Neuromorphic Systems(5) Chair: T. Kondo	GS4 Micro-Machine(4) Chair: J.M. Lee GS9 Robotics III (4) Chair: A. Boonyaprapasorn



### TIME TABLE (1/30)

1/30(Sat.)	RoomB2	RoomB3	RoomB4
8:50-	Registration		
9:10-10:40	GS2 Pattern recognition & image processing(6) Chair: T. Fujita	GS7 Robotics I (6) Chair: A. Yamaguchi	OS5 Advanced Control Systems(6) Chair: Y. Jia Co-Chair: F. Wang
10:40-11:00	Coffee break		
11:00-11:40	Chair: Y. Jia Invited speech IS2(RoomB2) Kaoru Sumi		
11:40-13:00	Lunch		
13:00-14:00	Chair: Y. Jia Plenary Speech PS2(RoomB2) Ju-Jang Lee		
14:00-14:20	Coffee break		
14:20-15:50	OS8 Image, Circuit and Control(6) Chair: F. Dai Co-Chair: H. Jia	OS6 Intelligent Control(6) Chair: Y. Jia Co-Chair: W. Zhang	GS5 Multi-Agent Systems & Visualization(2) Chair: S. Mabu GS6 Intelligent Control & System Cybernetics(3) Chair: M. C. Lee
15:50-16:10	Coffee break		
16:10-17:10		OS12 Advanced Research on Computer Science and Information Processing(4) Chair: T. Ito Co-Chair: M. Sakamoto	OS8 Image, Circuit and Control(3) Chair: F. Dai Co-Chair: H. Jia
18:00-20:00	Banquet: Culture Resort Festone		

### TIME TABLE (1/31)

1/31(Sun.)	RoomB3	RoomB4
8:50-	Registration	
9:10-9:55	OS10 Reality Mining(3) Chair: M. Kubo Co-Chair: S. Iwanaga	OS9 Modern Approaches of MOT and Corporate Strategy(3) Chair: T. Ito Co-Chair: S. Matsuno
9:55-10:10	Coffee break	
10:10-11:25	OS13 Automatic Generation, Creation, and Production of Narrative Contents(4) Chair: T. Ogata Co-Chair: Y. Kawamura	OS7 Image Analysis and Content Security(5) Chair Y. Yoshitomi Co-Chair: M. Tabuse
11:25-13:00	Lunch	
13:00-14:30	GS3 Reinforcement Learning Systems & Genetic Programing(6) Chair: K. Kobayashi	
14:40-15:40	Farewell Party (Conference Site: Farm Café TAIYO ICHIBA)	

GS1 Neuromorphic Systems(5) GS2 Pattern Recognition & Image Processing(6) GS3 Reinforcement Learning Systems & Genetic Programing(6) GS4 Micro-Machine(4) GS5 Multi-Agent Systems & Visualization(2) GS6 Intelligent Control & System Cybernetics(3) GS7 Robotics I (6) GS8 Robotics II (5) GS9 Robotics III (4) GS10 Poster Sessions(5)	OS1 Artificial Life and Quality Enhancement of Life(6) OS2 Intelligence Control System and Artificial Life(6) OS3 Construction Engineering and Management(6) OS4 Construction Technology and Management(5) OS5 Advanced Control Systems(6) OS6 Intelligent Control(6) OS7 Image Analysis and Content Security(5) OS8 Image, Circuit and Control(9) OS9 Modern Approaches of MOT and Corporate Strategy(3) OS10 Reality Mining(3) OS11 Kansei Engineering and Application(4) OS12 Advanced Research on Computer Science and Information Processing(4) OS13 Automatic Generation, Creation, and Production of Narrative Contents(4)
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## **The 2016 International Conference on ARTIFICIAL LIFE AND ROBOTICS (ICAROB 2016)**

### **January 28 (Thursday)**

**17:30-19:30 Welcome Party (Conference Site: Farm Café TAIYO ICHIBA)**

### **January 29 (Friday)**

**Room B2 10:40-11:10**

#### **Opening Ceremony**

**Chair: Jiwu Wang (Beijing Jiaotong University, China)**

##### **Welcome Addresses**

- 1. General Chairman of ICAROB** M. Sugisaka (ALife Robotics Corporation Ltd. Japan)
- 2. Co-General Chairman of ICAROB** Y. M. Jia (Beihang University, China)
- 3. Co-General Chairman of ICAROB** T. Ito (Hiroshima University, Japan)
- 4. Co-General Chairman of ICAROB** J. J. Lee (KAIST, South Korea)

### **January 30 (Saturday)**

#### **Banquet: Culture Resort Festone**

**18:00-20:00**

**Chair: T. Ito (Hiroshima University, Japan)**

##### **Welcome Addresses**

- Prof. Yingmin Jia (Beihang University, P.R. China.)  
Prof. Jang-Myung Lee (Pusan National University, South Korea)  
Prof. Kaoru Sumi (Future University Hakodate, Japan)  
Prof. Saori Iwanaga (Japan Coast Guard Academy, Japan)

## TECHNICAL PAPER INDEX

### January 29 (Friday)

#### 08:50-Registration

#### Room B2

##### 9:10-10:25 OS4 Construction Technology and Management (5)

Chair: Ching-Ching Chang (Chung Hua University, Taiwan)

Co-Chair: Yan-Chyuan Shiau (Chung Hua University, Taiwan)

- OS4-1     *Study on the Promotion of Steel Slags Recycling in Taiwan*  
Shu-Chen Chang, Ching-Jung Chang (Chung Hua University, Taiwan)
- OS4-2     *The Research on the Utilization of Green Building Ecological Index Group in Campus Environment – Taking of Elementary Schools at Houli District, Taichung City as Example*  
Ching-Jung Chang, Yung- Feng Hsu, Chun-Hsien Chen (Chung Hua University, Taiwan)
- OS4-3     *The Assessment and Research on the Reconstruction of Enclosing Wall into Open Type in Elementary School Campus – Taking of Erlin Township, Changhua County as Example*  
Ching-Jung Chang, Chia-Chen Li, I-Chen Wu (Chung Hua University, Taiwan)
- OS4-4     *The Study and Analysis on the Reuse and Transformation Strategy of Tile Kiln Space – Taking of San-He Tile Kiln as Example*  
Ching-Jung Chang, Hsiao-Yu Lin, Ying-Yu Su (Chung Hua University, Taiwan)
- OS4-5     *The Research on the Influence of Economic Benefit for High-Rise Buildings Constructed by Different Excavation Method – Taking of Residence Buildings at New Taipei City as Example*  
Ching-Jung Chang, Cheng-Min Yang, Hsiu-Hsiung Hsu (Chung Hua University, Taiwan)

#### 10:40-11:10 Opening Ceremony

#### 11:20-12:00

Chair: Takao Ito (Hiroshima University, Japan)

**Invited Speech (IS1)** *Redefining robot based technologies for elderly people assistance: a survey.*

<sup>1,2</sup>Luigi Pagliarini, <sup>1</sup>Henrik Hautop Lund (<sup>1</sup>Technical University of Denmark, Denmark, <sup>2</sup>Academy of Fine Arts of Macerat, Italy)

#### 13:00-14:00

**Plenary Speech (PS1)** *Disrupting the Industry with Play*

Henrik Hautop Lund (Technical University of Denmark, Denmark)

#### **14:20-15:20 OS11 Kansei Engineering and Application (4)**

**Chair: Tetsuo Hattori** (Kagawa University, Japan)

**Co-Chair: Yoshiro Imai** (Kagawa University, Japan)

OS11-1 *Automated Multiple-Brightness Peak Image Processing Method Using Curvature and Variance Estimation*

<sup>1</sup>Yusuke Kawakami, <sup>2</sup>Tetsuo Hattori, <sup>2</sup>Yoshiro Imai, <sup>2</sup>Kazuaki Ando, <sup>2</sup>Yo Horikawa  
(<sup>1</sup>DynaxT Co., Ltd. <sup>2</sup>Kagawa University, Japan)

<sup>3</sup>R. P. C. Janaka Rajapakse (<sup>3</sup>Tainan National University of the Arts, Taiwan)

OS11-2 *Histogram Matching Based on Gaussian Distribution on the HSB Color System*

<sup>1</sup>Yusuke Kawakami, <sup>2</sup>Tetsuo Hattori, <sup>2</sup>Yoshiro Imai, <sup>2</sup>Kazuaki Ando, <sup>2</sup>Yo Horikawa  
(<sup>1</sup>DynaxT Co., Ltd. <sup>2</sup>Kagawa University, Japan)

<sup>3</sup>R. P. C. Janaka Rajapakse (<sup>3</sup>Tainan National University of the Arts, Taiwan)

OS11-3 *Quantitative Evaluation of Flash-based Educational Visualizing Simulator*

Kei Takeichi, Yoshiro Imai, Kazuaki Ando, Yusuke Kawakami, Tetsuo Hattori  
(Kagawa University, Japan)

OS11-4 *Relation between Optimal Stopping Solution and NSPR for Structural Change Point Detection Problem*

<sup>1</sup>Tetsuo Hattori, <sup>1</sup>Yoshihide Koyama, <sup>1</sup>Yoshiro Imai, <sup>1</sup>Yo Horikawa, <sup>2</sup>Hirromichi Kawano  
(<sup>1</sup>Kagawa University, <sup>2</sup>NTT advanced technology Company Ltd, Japan)

#### **16:10-17:40 OS2 Intelligence Control System and Artificial Life (6)**

**Chair: Kuo-Hsien Hsia** (Far East University, Taiwan)

**Co-Chair: Kuo-Lan Su** (National Yunlin University of Science & Technology, Taiwan)

OS2-1 *Modified Quantum Particle Swarm Optimization for Chaos Synchronization*

Ching-I Lee, Chia-Nan Ko (Nan Kai University of Technology, Taiwan)

OS2-2 *A Simulation Model of Hall Sensor Misalignment in BLDC Motors*

Chung-Wen Hung, Chu-Lin Hsu

(National Yunlin University of Science & Technology, Taiwan)

OS2-3 *Using Multi-Target Tracking and Identification TLD Algorithm for Intelligent Mobile Robot*

Jr Hung Guo, Kuo-Hsien Hsia, Kuo-Lan Su

(National Yunlin University of Science & Technology, Taiwan)

OS2-4 *Handheld Mobile Devices for Remote Monitoring of Factory*

Bing-Gang, Jhong, Jian-Sing, Hu, Mei-Yung, Chen

(National Taiwan Normal University, Taiwan)

OS2-5 *Task Assignment and Checking Process for Pattern Reformation on a Square Grid Plane*

Kuo-Hsien Hsia<sup>1</sup>, Bo-Yi Li<sup>2</sup>, Kuo-Lan Su<sup>2</sup> (<sup>1</sup>Far-East University, <sup>2</sup>National Yunlin University of Science & Technology, Taiwan)

OS2-6 *The Design of a Multifunctional Acousto-Optical Device With a Mobile Power Pack*

Yi-Yu Lu, Wen-Bin Lin, Zheng-Ying Li (Far-East University, Taiwan)

## Room B3

### 9:10-10:25 GS8 Robotics II (5)

Chair: Ju-Jang Lee (KAIST, South Korea)

GS8-1 *Visual-servo Control of 4-DOF Robot Manipulator for Sorting Moving objects*

Longtan Wang, Seon-woo Kim, Hyun-Wook Ha, Jang-Myung Lee  
(Pusan National University, South Korea)

GS8-2 *Self-identification of Mental State and Self-control through Indirect Biofeedback -Indirect Representation and Placebo Effect-*

Madoka Takahara, Ivan Tanev, Katsunori Shimohara (Doshisha University, Japan)

GS8-3 *Construction of a sense of force feedback and vision for micro-objects: Recreate the response and a sense of force of objects*

Yusei Ishii, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

GS8-4 *Dynamic Behavior Selection Model based on Emotional States for Conbe-I robot*

Wisanu Jitviriyaya, Jiraphan Inthiam, Eiji Hayashi (Kyushu Institute of Technology, Japan)

GS8-5 *Consideration on a Crawler Robot with Six Legs*

Toyomi Fujita, Taiga Sasaki (Tohoku Institute of Technology, Japan)

### 14:20-15:50 OS1 Artificial Life and Quality Enhancement of Life (6)

Chair: Shang-Hui Li (Far East University, Taiwan)

Co-Chair: Sheu-Der Wu (Cheng Shiu University, Taiwan)

OS1-1 *The development of new products of pineapple cheesecakes*

Sheu-Der Wu<sup>1</sup>, Hung-Wen Su<sup>2</sup> (<sup>1</sup>Cheng Shiu University, <sup>2</sup>Far East University, Taiwan)

OS1-2 *The study on ballroom service quality to affect customer satisfaction*

Hsiu-Min Lin, Yang Wu, Jei-Fu Ho (Far East University, Taiwan)

OS1-3 *The relationship between employees' personality traits, work values and job involvement with the contribution to their companies – For the micro food service industry*

Hsiu-Chen Chung<sup>1</sup>, Chiou-Lan Chien<sup>1</sup>, Lung-Chi Tsai<sup>2</sup> (<sup>1</sup>Tainan University of Technology, <sup>2</sup>Southern Taiwan University of Science and Technology, Taiwan)

- OS1-4 *Consumer's acceptance to the new product- pineapple jam as example*  
Shang-Hui Li, Jei-Fu Ho (Far East University, Taiwan)
- OS1-5 *Development of an innovative design process for green products*  
Ming-Chieh Wang (Far East University, Taiwan)
- OS1-6 *Research on Nail Art 3D design with Different Materials - A Case Study of the Tang Dynasty Style*  
Mei-Yin Lee, Kung-Yu Liu, Sih-Jie Guan, Jei-Fu Ho (Far East University, Taiwan, ROC)

### **16:10-17:25 GS1 Neuromorphic Systems (5)**

**Chair: Tadashi Kondo** (Tokushima University, Japan)

- GS1-1 *Compensating Temperature-Dependent Characteristics of a Subthreshold-MOSFET Analog Silicon Neuron*  
Ethan Green, Takashi Kohno (The University of Tokyo, Japan)
- GS1-2 *Medical image analysis of brain X-ray CT images by deep GMDH-type neural network*  
Tadashi Kondo, Junji Ueno, Shoichiro Takao (Tokushima University, Japan)
- GS1-3 *Medical image diagnosis of lung cancer by deep feedback GMDH-type neural network*  
Tadashi Kondo, Junji Ueno, Shoichiro Takao (Tokushima University, Japan)
- GS1-4 *Feature Linking by Synchronized Response in Chaotic Cellular Neural Network for Visual Stimulus of Moving Objects*  
Akihiro Yamaguchi<sup>1</sup>, Satoshi Arakane<sup>1</sup>, Masao Kubo<sup>2</sup> (<sup>1</sup>Fukuoka Institute of Technology, <sup>2</sup>National Defense Academy of Japan, Japan)
- GS1-5 *An FPGA-based cortical and thalamic silicon neuronal network.*  
Takuya Nanami, Takashi Kohno (The University of Tokyo, Japan)

## **Room B4**

### **9:10-10:25 GS10 Poster Sessions (5)**

- GS10-1 *Analysis of Postgraduates' Entrance Examination Scores Based on Linear Regression with Dummy Variables*  
Ning Xiaojun, Huang Ruocheng, Liang Xiaoyi, Ai Dongmei  
(University of Science and Technology Beijing, P.R. China)
- GS10-2 *Clinical Evaluation of UR-System 2 for Recovery of Motor Function of Plegic Upper Limb after Stroke*  
<sup>1</sup>Hirofumi Tanabe, <sup>1</sup>Masahiro Mitsukane, <sup>2</sup>Norihiro Toya, <sup>2</sup>Ryosuke Takeichi, <sup>2</sup>Hitomi Hattori, <sup>2</sup>Yoshifumi Morita, <sup>3</sup>Yoshiaki Takagi, <sup>3</sup>Norio Hasegawa (<sup>1</sup>Shonan University of Medical Sciences, <sup>2</sup>Nagoya Institute of Technology, <sup>3</sup>Sanyo Machine Works, Ltd., Japan)

- GS10-3 *Knee Android Model Reproducing Internal-External Rotation with Screw-Home Movement of Human Knee*  
Daichi Yamauchi, Sho Takei, Noritaka Sato, Yoshifumi Morita  
(Nagoya Institute of Technology, Japan)
- GS10-4 *Wood Species Recognition System based on Improved Basic Grey Level Aura Matrix as feature extractor*  
<sup>1</sup>Mohd Iz'aan Paiz Zamri, <sup>1</sup>Anis Salwa Mohd Khairuddin, <sup>1</sup>Norrima Mokhtar, <sup>2</sup>Rubiyah Yusof  
(<sup>1</sup>University of Malaya, <sup>2</sup>Universiti Teknologi Malaysia, Malaysia)
- GS10-5 *Evaluation the Performance of a New Quadrotor Model Based on the Arm's Length Variation*  
Yasameen Kamil N., D. Hazry, Khairunizam Wan, Zuradzman M. Razlan  
(University Malaysia perlis, Malaysia)

### **14:20-15:50 OS3 Construction Engineering and Management (6)**

**Chair: Yan-Chyuan Shiau** (Chung Hua University, Taiwan)

**Co-Chair: Yi-Yin Tsai** (Chung Hua University, Taiwan)

- OS3-1 *Discussion on Factors Influencing the Performance of Hospital Renovation Engineering Taking one Medical Center in Taiwan as Example*  
Wen-Lung Lin, Yan-Chyuan Shiau, Ting-Chi Lai, Chen-Chung Liu  
(Chung Hua University, Taiwan)
- OS3-2 *Discussion on Land Expropriation Compensation System*  
Hung-Chi Liu, Yan-Chyuan Shiau, Yao-Shan Huang, Chen-Chung Liu  
(Chung Hua University, Taiwan)
- OS3-3 *Study on User Satisfaction of Pick Areas for Elementary Schools – Using Nanyang Elementary School in Taichung City as Example*  
Chun-Feng Chang, Yan-Chyuan Shiau, Kuan-Yin Chen  
(Chung Hua University, Taiwan)
- OS3-4 *Study on User Satisfaction in Sport Site Facilities for Senior Students of Elementary Schools in Taichung City*  
Pei-Ling Lin, Yan-Chyuan Shiau, Ling-Lin Chang (Chung Hua University, Taiwan)
- OS3-5 *The Establishment of the Sustainability Performance Indicators for Wetland Ecological Project: Using Construction Inspection Phase as Example*  
Ching-Mei Miao, Yan-Chyuan Shiau, Chen-Chung Liu, Jen-Kuo Chang  
(Chung Hua University, Taiwan)
- OS3-6 *Development of Type Control Guidelines for the Old Town District of Hsinchu City*  
Yi-Yin Tsai (Chung Hua University, Taiwan)



## **16:10-18:10 GS4 Micro-Machine (4) + GS9 Robotics III(4)**

### **GS4 Micro-Machine (4)**

**Chair: Jang-Myung Lee** (Pusan National University, South Korea)

- GS4-1 *Applying Fuzzy Sliding Mode Control on Electrowetting on Dielectric System*  
<sup>1</sup>Arsit Boonyaprapasorn, <sup>2</sup>Thavida Maneewarn, <sup>2</sup>Eakkachai Pengwang (<sup>1</sup>Chulachomkloa Royal Military Academy, <sup>2</sup>King Mongkut's University of Technology Thonburi, Thailand)
- GS4-2 *Development of Micro-Permanent Magnet Synchronous Reluctance Generator for TPMS on Smart Robots*  
<sup>1</sup>Chun-Chieh Chang, <sup>1</sup> Cheng-Tang Pan, <sup>1</sup>Shao-Yu Wang, <sup>1</sup>An-Yun Yang, <sup>1</sup>Gu-Xuan Lin, <sup>2</sup>Roger Chenglung Lee, <sup>2</sup> Ting-Hung Chung, <sup>1</sup>Yu-Jen Wang  
(<sup>1</sup>National Sun Yat-sen University, <sup>2</sup>Naroller Electronics, Taiwan)
- GS4-3 *Study of Micro-Flux-Switching Permanent-Magnet Generator for TPMS on Smart Robots*  
<sup>1</sup>An-Yun Yang, <sup>1</sup> Cheng-Tang Pan, <sup>1</sup>Shao-Yu Wang, <sup>1</sup>Chun-Chieh Chang, <sup>1</sup>Gu-Xuan Lin, <sup>2</sup>Roger Chenglung Lee, <sup>2</sup>Ting-Hung Chung, <sup>1</sup>Yu-Jen Wang  
(<sup>1</sup>National Sun Yat-sen University, <sup>2</sup>Naroller Electronics, Taiwan)
- GS4-4 *MEMS Microrobot Controlled by Mounted Neural Networks IC with Two Types Actuators*  
Kei Iwata, Hirozumi Oku, Yuki Okane, Yohei Asano, Masaki Tatani, Yuki Ishihara, Kazuki Sugita, Satoshi Chiba, Satoko Ono, Mizuki Abe, Minami Takato, Ken Saito, Fumio Uchikoba  
(Nihon University, Japan)

### **GS9 Robotics III(4)**

**Chair: Arsit Boonyaprapasorn** (Chulachomkloa Royal Military Academy, Thailand)

- GS9-1 *Social Expression of Pet Robot Based on Artificial Consciousness and Biologically Inspired On-line Topological Method*  
Sakmongkon Chumkamon, Eiji Hayashi (Kyushu Institute of Technology, Japan)
- GS9-2 *Anthropomorphic robot modelling with virtual height inverted pendulum approach in Simulink: step length and period influence on walking stability*  
Ramil Khusainov, Ilya Afanasyev, Evgeni Magid (Innopolis University, Russia)
- GS9-3 *A low cost genetic algorithm based control scheme for wheelchair control in hospital environment*  
Karam Dad Kallu, Muhammad Jawad Khan, Wang Jie, Min Cheol Lee  
(Pusan National University, South Korea)
- GS9-4 *Simultaneous Localization and Mapping (SLAM) algorithm base on EKF and SPKF.*  
Zolghadr Javad, Yuanli Cai ,Yekkehfallah Majid (Xi'an Jiaotong University, P.R. China)

## **January 30 (Saturday)**

### **08:50-Registration**

#### **Room B2**

##### **09:10-10:40 GS2 Pattern Recognition & Image Processing (6)**

**Chair: Toyomi Fujita** (Tohoku Institute of Technology, Japan)

- GS2-1 *An accurate method for the extraction of structured light stripe*  
Jiwu Wang<sup>1</sup>, Yaodong Li<sup>1</sup>, Zhijing Jian<sup>1</sup>, Sugisaka Masanori<sup>2</sup>  
(<sup>1</sup>Beijing Jiaotong University, P.R. China) (<sup>2</sup>Alife Robotics Corporation Ltd, Japan)
- GS2-2 *Feature Acquisition From Facial Expression Image Using Convolutional Neural Networks*  
Taiki Nishime, Satoshi Endo, Koji Yamada, Naruaki Toma, Yuhei Akamine  
(University of The Ryukyus, Japan)
- GS2-3 *Estimating Age on Twitter Using Self-Training Semi-Supervised SVM*  
Tatsuyuki Iju, Satoshi Endo, Koji Yamada, Naruaki Toma, Yuhei Akamine  
(University of The Ryukyus, Japan)
- GS2-4 *Interactive musical editing system to support human errors and offer personal preferences for an automatic piano*  
Kenji Tsunenari, Eiji Hayashi (Kyushu Institute of Technology, Japan)
- GS2-5 *Geometric parameters measurement of wheel tread based on line structured light*  
Jiwu Wang<sup>1</sup>, Zhijing Jian<sup>1</sup>, Yaodong Li<sup>1</sup>, Chao Yang<sup>1</sup>, Sugisaka Masanori<sup>2</sup>  
(<sup>1</sup>Beijing Jiaotong University, P.R. China), (<sup>2</sup>Alife Robotics Corporation Ltd, Japan)
- GS2-6 *Study on the ORB algorithm in the application of Monocular SLAM*  
Jiwu Wang<sup>1</sup>, Shunkai Zheng<sup>1</sup>, Masanori Sugisaka<sup>2</sup>  
(<sup>1</sup>Beijing Jiaotong University, P.R. China), (<sup>2</sup>Alife Robotics Corporation Ltd, Japan)

### **11:00-11:40**

**Chair: Yingmin Jia** (Beihang University, P. R. China)

#### **Invited Speech (IS2) Affective Human Computer Interaction**

**Kaoru Sumi** (Future University Hakodate, Japan)

### **13:00-14:00**

#### **Plenary Speech (PS2) A Study on Differential Evolution Using BetaCOBL, B<sup>3</sup>R, and TPBO**

So-Youn Park, **Ju-Jang Lee** (KAIST, South Korea)

### **14:20-15:50 OS8 Image, Circuit and Control (6)**

**Chair: Fengzhi Dai** (Tianjin University of Science and Technology, P.R. China)

**Co-Chair: Hongyan Jia** (Tianjin University of Science and Technology, P.R. China)

- OS 8-1 *Image Encryption Implementation Based on fractional-order Chen System*  
Hongyan Jia, Qinghe Wang (Tianjin University of Science and Technology, P.R. China)
- OS 8-2 *Mobile Camera based Motion Segmentation by Image Resizing*  
Chunyu Yu (Syracuse University, USA)
- OS 8-3 *Synchronization of the fractional-order permanent magnet synchronous motor*  
Xue Wei, Li Xue (Tianjin University of Science and Technology, P.R. China)
- OS 8-4 *Analog Circuit Implementation and Full State Observation of Chua's Circuit*  
Hong Niu, Dongchen Tan, Yongjun Wu  
(Tianjin University of Science and Technology, P.R. China)
- OS 8-5 *Research on visualizational rescue robot*  
YuanLi Yue, Fengzhi Dai, Qijia Kang, Pengfei Xie  
(Tianjin University of Science and Technology, P.R. China)
- OS 8-6 *Development of training instrument for upper limb muscle rehabilitation*  
Qijia Kang, Fengzhi Dai, Yuanli Yue, Bo Liu, Hongtao Zhang  
(Tianjin University of Science and Technology, P.R. China)

## Room B3

### 09:10-10:40 GS7 Robotics I (6)

Chair: A. Yamaguchi (Fukuoka Institute of Technology, Japan)

- GS7-1 *Haptic system with fuzzy controller for extended control of Teleoperation mine detector wheeled robots*  
Yekkehfallah Majid, Guao Yang, Yuanli Cai, Naebi Ahmad, Zolghadr Javad  
(Xi'an jiaotong university, P.R. China)
- GS7-2 *Effect of System Parameters and Controlled Torque on the Dynamics of Rigid-Flexible Robotic Manipulator*  
Sachindra Mahto (North Eastern Regional Institute of Science & Technology, India)
- GS7-3 *Modeling of Mobile Manipulator and Adaptive Super-Twisting Backstepping Control*  
Seong Ik Han, Hyunuk Ha, Jangmyung Lee  
(Pusan National University, South Korea)
- GS7-4 *Self-tuned Local Feedback Gain Based Decentralized Fault Tolerant Control of Reconfigurable Manipulators*  
Bo Zhao<sup>1</sup>, Bo Dong<sup>2</sup>, Yan Li<sup>2</sup>, Fumitoshi Matsuno<sup>3</sup>, Yuanchun Li<sup>2</sup>  
(<sup>1</sup>Chinese Academy of Sciences, <sup>2</sup>Changchun University of Technology, P.R. China),  
(<sup>3</sup>Kyoto University, Japan)

- GS7-5 *Study on Decentralized Integral Nested Sliding Mode Control for Constrained Reconfigurable Manipulator with Harmonic Drive Transmission*  
Bo Dong<sup>1</sup>, Zeyu Dong<sup>1</sup>, Bo Zhao<sup>2</sup>, Yan li<sup>1</sup>, Fumitoshi Matsuno<sup>3</sup>, Yuanchun Li<sup>1</sup>  
(<sup>1</sup>Changchun University of Technology, <sup>2</sup>Chinese Academy of Sciences, P.R. China),  
(<sup>3</sup>Kyoto University, Japan)
- GS7-6 *A Number of Mobile Manipulator Control for Moving Object by using Cooperative Control*  
Deok-Su Kim, Dong-Eon Kim, Seong-Ik Han, Jang-Myung Lee  
(Pusan National University, South Korea)

#### **14:20-15:50 OS6 Intelligent Control (6)**

**Chair: Yingmin Jia** (Beihang University, P. R. China)

**Co-Chair: Weicun Zhang** (University of Science and Technology, P. R. China)

- OS6-1 *Adaptive Control of Discrete-Time Systems Using Multiple Fixed and One Adaptive Identification Models*  
Zhang Yuzhen, Li Qing, Zhang Weicun  
(University of Science and Technology Beijing, P. R. China)
- OS6-2 *Adaptive Polynomial Regression and Its Applications to Gene Selection of Rat Liver Regeneration*  
Juntao Li, Yimin Cao, Xiaoyu Wang, Cunshuan Xu (Henan Normal University, P.R. China)
- OS6-3 *Adaptive Consensus via Dynamic Output Feedback for Lipschitz Nonlinear Multi-Agent Systems*  
Lin Li, Heyang Wang (University of Shanghai for Science and Technology, P.R. China)
- OS6-4 *Iterative Learning based Thrust Ripple Suppression for PMLSM*  
Caixia Gao, Fuzhong Wang, Ziyi Fu (Henan Polytechnic University, P.R. China)
- OS6-5 *Adaptive Sliding Mode Control for A 2-DOF Magnetic Levitation System with Uncertain Parameters*  
Meng Duan, Yingmin Jia (Beihang University, P.R. China)
- OS6-6 *Undershoot Reduction in Discrete-Time ADRC of NMP Plant by Parameters Optimization*  
Tong Wu, Weicun Zhang (University of Science and Technology Beijing, P.R. China)

#### **16:10-17:10 OS 12 Advanced Research on Computer Science and Information Processing (4)**

**Chair: Takao Ito** (Hiroshima University, Japan)

**Co-Chair: Sakamoto Makoto** (University of Miyazaki, Japan)

- OS12-1 *Development of a Tool to Keep Consistency between a Model and a Source Code in Software Development Using MDA.*  
Yuuki Kikkawa<sup>1</sup>, Tetsuro Katayama<sup>1</sup>, Yoshihiro Kita<sup>2</sup>, Hisaaki Yamaba<sup>1</sup>, Kentaro Aburada<sup>3</sup> and Naonobu Okazaki<sup>1</sup> (<sup>1</sup>University of Miyazaki, <sup>2</sup>Tokyo University of Technology, <sup>3</sup>Oita National College of Technology, Japan)

- OS12-2 *Necessary spaces for seven-way four-dimensional Turing machines to simulate four-dimensional one-marker automata*  
Makoto Nagatomo<sup>1</sup>, Shinnosuke Yano<sup>1</sup>, Makoto Sakamoto<sup>1</sup>, Satoshi Ikeda<sup>1</sup>, Takao Ito<sup>2</sup>, Tsutomu Ito<sup>2</sup>, Yasuo Uchida<sup>3</sup>, Tsunehiro Yoshinaga<sup>4</sup>, and Hiroshi Furutani<sup>1</sup>  
(<sup>1</sup>University of Miyazaki, <sup>2</sup>Hiroshima University, <sup>3</sup>Ube National College of Technology, <sup>4</sup>Tokuyama College of Technology, Japan)
- OS12-3 *Analysis for 4×12 board of Othello*  
Yuki Takeshita<sup>1</sup>, Satoshi Ikeda<sup>1</sup>, Makoto Sakamoto<sup>1</sup>, Takao Ito<sup>2</sup>  
(<sup>1</sup>Miyazaki University, <sup>2</sup>Hiroshima University, Japan)
- OS12-4 *A space lower-bound technique for four-dimensional alternating Turing machines*  
Makoto Nagatomo<sup>1</sup>, Shinnosuke Yano<sup>1</sup>, Makoto Sakamoto<sup>1</sup>, Satoshi Ikeda<sup>1</sup>, Takao Ito<sup>2</sup>, Tsutomu Ito<sup>2</sup>, Yasuo Uchida<sup>3</sup>, Tsunehiro Yoshinaga<sup>4</sup>, and Hiroshi Furutani<sup>1</sup>  
(<sup>1</sup>University of Miyazaki, <sup>2</sup>Hiroshima University, <sup>3</sup>Ube National College of Technology, <sup>4</sup>Tokuyama College of Technology, Japan)

## RoomB4

### 9:10-10:40 OS5 Advanced Control Systems (6)

**Chair: Yingmin Jia** (Beihang University, P.R. China)

**Co-Chair: Fuzhong Wang** (Henan Polytechnic University, P.R. China)

- OS5-1 *Socialized Multi-Agent System Rendezvous via Networks of Networks*  
Yunzhong SONG, Ziyi FU, Fuzhong WANG (Henan Polytechnic University, P.R.China)
- OS5-2 *Global sensor selection for maneuvering target tracking in clutter*  
Wenling Li, Yingmin Jia (Beihang University, P.R. China.)
- OS5-3 *Attitude/Position Estimation of Rigid-Body using Inertial and Vision Sensors*  
Shihao Sun, Yingmin Jia (Beihang University, P.R. China)
- OS5-4 *Modeling and Control of a Suspended Gravity Compensation System with the Rigid-Flexible Coupling*  
Jiao Jia, Yingmin Jia, Shihao Sun (Beihang University, P.R. China)
- OS5-5 *Trajectory Tracking Control for Omnidirectional Mobile Robots with Input Constraints*  
Wenhao Zheng, Yingmin Jia (Beihang University, P.R. China)
- OS5-6 *Parameters Tuning Approach for Prescribed Performance Function Based Active Disturbance Rejection Control*  
Wei Wei, Bo Liang, Weijun Su (Beijing Technology and Business University, P.R. China)

**14:20-15:35 GS5 Multi-Agent Systems & Visualization (2) +GS6 Intelligent Control & System Cybernetics (3)**

**GS5 Multi-Agent Systems & Visualization (2)**

**Chair: Shingo Mabu** (Yamaguchi University, Japan)

- GS5-1 *Moving Robots Lies and Their Minds with Degree of Confidence in a Decentralized Autonomous FMS*  
Shizuka Tanaka, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)
- GS5-2 *Conquest Oriented Robot Knowing Its Own Availability*  
Sho Yamauchi, Keiji Suzuki (Future University Hakodate, Japan)

**GS6 Intelligent Control & System Cybernetics (3)**

**Chair: Min Cheol lee** ((Pusan National University, South Korea)

- GS6-1 *A Consideration on Feature Extraction for Operation Skill Based on Control Engineering Approach*  
Kazushige Koiwai<sup>1</sup>, Liao Yantao<sup>1</sup>, Toru Yamamoto<sup>1</sup>, Takao Nanjo<sup>2</sup>, Yoichiro Yamazaki<sup>2</sup>, Yoshiaki Fujimoto<sup>2</sup>  
(<sup>1</sup>Hiroshima University, <sup>2</sup>KOBELCO Construction Machinery CO., LTD., Japan)
- GS6-2 *Design of a Data-Driven Control System for a Hydraulic Excavator*  
<sup>1</sup>Takuya Kinoshita, <sup>1</sup>Yasuhito Oshima, <sup>1</sup>Kazushige Koiwai, <sup>1</sup>Toru Yamamoto <sup>2</sup>Takao Nanjo, <sup>2</sup>Yoichiro Yamazaki, <sup>2</sup>Yoshiaki Fujimoto  
(<sup>1</sup>Hiroshima University, <sup>2</sup>KOBELCO Construction Machinery CO., LTD, Japan)
- GS6-3 *An Optimization of Spatio-Spectral Filter Bank Design for EEG Signal Classification*  
Masanao Obayashi, Takuya Geshi, Takashi Kuremoto, Shingo Mabu  
(Yamaguchi University, Japan)

**16:10-16:55 OS8 Image, Circuit and Control (3)**

**Chair: Fengzhi Dai** (Tianjin University of Science and Technology, P.R. China)

**Co-Chair: Hongyan Jia** (Tianjin University of Science and Technology, P.R. China)

- OS 8-7 *Design and Analog Circuit Implementation of a Dynamic Feedback Control System Based on RLC Series Circuit*  
Hong Niu, Yongjun Wu, Dongchen Tan (Tianjin University of Science & Technology, P.R. China)
- OS 8-8 *Maximal power point tracking technology for the solar photovoltaic battery based on model predictive control*  
Xia Zhao, Huailin Zhao (Shanghai Institute of Technology, P.R. China)
- OS 8-9 *Analysis and unidirectionally coupled synchronization of a novel chaotic system*  
Li Xue, Xue Wei (Tianjin University of Science and Technology, P.R. China)

## **January 31 (Sunday)**

### **8:50- Registration**

#### **Room B3**

##### **9:10-9:55 OS10 Reality Mining (3)**

**Chair: Masao KUBO** (National Defense Academy of Japan, Japan)

**Co-Chair: Saori Iwanaga** (Japan Coast Guard Academy, Japan)

- OS10-1 *Fast collective photographic subject detection without pixels by an assumption about a shot and its elevation angle*  
Sora Tanioka, Masao Kubo, Hiroshi Sato (National Defense Academy of Japan, Japan)
- OS10-2 *Evaluation of a safety map generated from a collection of difference of Individuals*  
Masao Kubo, Dang Viet-Chau, Hiroshi Sato, Akira Namatame  
(National Defense Academy of Japan, Japan)
- OS10-3 *Endeavor to adopt GIS data on evacuation decision making model*  
<sup>1</sup>Saori Iwanaga, <sup>2</sup>Akira Namatame  
(<sup>1</sup>Japan Coast Guard Academy, <sup>2</sup>National Defense Academy of Japan, Japan)

##### **10:10-11:10 OS13 Automatic Generation, Creation, and Production of Narrative Contents (4)**

**Chair: Takashi Ogata** (Iwate Prefectural University, Japan)

**Co-Chair: Yoji Kawamura** (Kinki University, Japan)

- OS13-1 *Automatic Generation, Creativity, and Production of Narrative Contents*  
Takashi Ogata (Iwate Prefectural University, Japan)
- OS13-2 *A Design Plan of a Game System including an Automatic Narrative Generation Mechanism: The Entire Structure and the World Settings*  
Jumpei Ono, Takashi Ogata (Iwate Prefectural University, Japan)
- OS13-3 *A Way for using the Verb Conceptual Dictionary in an Integrated Narrative Generation System: Focusing on the use of Co-occurrence Information on the Verb Concepts*  
Takashi Ogata, Jumpei Ono (Iwate Prefectural University, Japan)
- OS13-4 *A Viewing Experiment on the Effects of Advertising Story*  
Yoji Kawamura (Kinki University, Japan)

##### **13:00-14:30 GS3 Reinforcement Learning Systems & Genetic Programming (6)**

**Chair: Kunikazu Kobayashi** (Aichi Prefectural University, Japan)

- GS3-1 *Examination of Robotic Aerospace Engines Maintenance Supported by Augmented Reality through Cloud Manufacturing*  
Mosab Alrashed, Yaser Yadekar, John Ahmet Erkoyuncu, Yifan Zhao (Cranfield University, UK)

- GS3-2 *Unit Layout Design Supporting System of Cell Assembly Machine Using Two Robots by Reinforcement Learning*  
Yusaku Ikai, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)
- GS3-3 *Virtual Input Parts Decision System of Job-Shop Production Line by using GA with ON / OFF Gene*  
Junji Ito, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)
- GS3-4 *An Evolutionary Algorithm for Making Decision Graphs for Classification Problems*  
Shingo Mabu, Masanao Obayashi, Takashi Kuremoto (Yamaguchi University, Japan)
- GS3-5 *Improvement of Computational Efficiency of UPF by Automatic Adjustment of the Number of Particles*  
Kenta Hidaka, Takuo Suzuki, Kunikazu Kobayashi (Aichi Prefectural University, Japan)
- GS3-6 *Multi Objective Evolutionary Algorithms for Association Rule Mining: Advances and Challenges*  
Aswini Kumar Patra (North Eastern Regional Institute of Science & Technology, India)

## RoomB4

### 9:10-9:55 OS9 Modern Approaches of MOT and Corporate Strategy (3)

**Chair: Takao Ito** (Hiroshima University, Japan)

**Co-Chair: Seigo Matsuno** (National Institute of Technology, Ube College, Japan)

- OS9-1 *A Study on the Structural Hole of Patent Applicant Network in R&D Management*  
Iori Nakaoka<sup>1</sup>, Yousin Park<sup>2</sup>, Yun-ju Chen<sup>3</sup> (<sup>1</sup>National Institute of Technology, Ube College, <sup>2</sup>Prefectural University of Hiroshima, <sup>3</sup>Shiga University, Japan)
- OS9-2 *The TCE-RBV framework for information systems outsourcing: Empirical testing using survey data in Japan*  
<sup>1</sup>Seigo Matsuno, <sup>2</sup>Tsutomu Ito, <sup>1</sup>Yasuo Uchida, <sup>3</sup>Yoshiki Mikami, <sup>4</sup>Takao Ito  
(<sup>1</sup>National Institute of Technology, Ube College, <sup>2</sup>Hino Motors, Ltd., <sup>3</sup>Nagaoka University of Technology, <sup>4</sup>Hiroshima University, Japan)
- OS9-3 *Momentum and its Implications in Corporate Management*  
Tsutomu Ito<sup>1</sup>, Takao Ito<sup>1</sup>, Rajiv Mehta<sup>2</sup>, Sakamoto Makoto<sup>3</sup>, Katsuhiko Takahashi<sup>1</sup>,  
Katsumi Morikawa<sup>1</sup> (<sup>1</sup>Hiroshima University, <sup>3</sup>Miyazaki University, Japan) (<sup>2</sup>New Jersey Institute of Technology, USA)

### 10:10-11:25 OS7 Image Analysis and Content Security (5)

**Chair: Yasunari Yoshitomi** (Kyoto Prefectural University, Japan)

**Co-Chair: Masayoshi Tabuse** (Kyoto Prefectural University, Japan)



- OS7-1 *A Method for Secure Communication Using a Discrete Wavelet Transform for Sound Data*  
Yuji Tsuda<sup>1</sup>, Kouhei Nishimura<sup>2</sup>, Haruka Oyaizu<sup>3</sup>, Yasunari Yoshitomi<sup>2</sup>, Taro Asada<sup>2</sup>, Masayoshi Tabuse<sup>2</sup> (<sup>1</sup>Software Service, Inc., <sup>2</sup>Kyoto Prefectural University, <sup>3</sup>NHK Media Technology, Inc., Japan)
- OS7-2 *An Authentication Method Using a Discrete Wavelet Transform for a Recaptured Video*  
Ren Fujii, Yasunari Yoshitomi, Taro Asada, Masayoshi Tabuse  
(Kyoto Prefectural University, Japan)
- OS7-3 *A System for Facial Expression Analysis of a Person While Using Video Phone*  
Taro Asada, Yasunari Yoshitomi, Ryota Kato, Masayoshi Tabuse, Jin Narumoto  
(Kyoto Prefectural University, Japan)
- OS7-4 *Emotion Recognition of a Speaker Using Facial Expression Intensity of Thermal Image and Utterance Time*  
Yuuki Oka<sup>1</sup>, Yasunari Yoshitomi<sup>2</sup>, Taro Asada<sup>2</sup>, Masayoshi Tabuse<sup>2</sup>  
(<sup>1</sup>NTT DATA Financial Solutions Corp. <sup>2</sup>Kyoto Prefectural University, Japan)
- OS7-5 *Estimation of Learners' Subjective Difficulty in e-Learning Using Thermal Image Processing*  
Yuki Yoshimitsu, Masayoshi Tabuse (Kyoto Prefectural University, Japan)

## PS abstracts

### PS1 Disrupting the Industry with Play

Henrik Hautop Lund (Technical University of Denmark, Denmark)

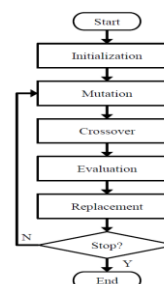
Decades of research into intelligent, playful technology and user-friendly man-machine interfaces has provided important insight into the creation of robotic systems and intelligent interactive systems which are much more user-friendly, safer and cheaper than what appeared possible merely a decade or two ago. This is significantly disrupting the industry in several market sectors. This paper describes the components of the playware and embodied artificial intelligence research that has led to disruption in the industrial robotics sector, and which points to the next disruption of the health care sector. This includes playful robotics, LEGO robots for kids, minimal robot systems, user-friendly, behavior-based, biomimetic, modular robotics and intelligent systems. The insight into these components and the use in synthesis for designing robots and intelligent systems allows anybody, anywhere, anytime to use these systems, providing an unforeseen flexibility into the sectors, which become disrupted with these systems.



### PS2 A Study on Differential Evolution Using BetaCOBL, B<sup>3</sup>R, and TPBO

So-Youn Park, Ju-Jang Lee (KAIST, South Korea)

New parameters are defined to use a beta distribution without limitation and two beta utilizations to control the search magnitude of thstacte algorithm are proposed: one for adding randomness to OBL (BetaCOBL) and the other for individual distribution-oriented reproduction (B<sup>3</sup>R). BetaCOBL and B<sup>3</sup>R are developed into DE embedding BetaCOBL (BetaCODE) and two-phase B<sup>3</sup>R optimization (TPBO) respectively. The proposed algorithms are tested on various test functions and two real world applications and compared with other algorithms with respect to the performance criteria. The results indicate that the proposed algorithms outperform or perform comparatively to the comparison group especially in terms of solution accuracy and reliability.



## IS abstracts

### IS1 Redefining robot based technologies for elderly people assistance: a survey.

Luigi Pagliarini<sup>1,2</sup>, Henrik Hautop Lund<sup>1</sup>

(<sup>1</sup> Technical University of Denmark, Denmark, <sup>2</sup> Academy of Fine Arts of Macerata, Italy)

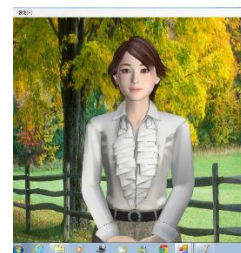
We analyse the state of the art of hi-tech and robot based technologies in terms of Assistive Technology for all patients and, in particular, elderly people assistance and everyday activities aid. By focusing on different aspects and characteristics (such as *playfulness, invasiveness, learning-speed, efficiency, short and long-term effect, active vs. passive, etc.*) we show the most important existing examples, and highlight all the factors that might help researchers when developing technologies for elderly care. Decades of research have not yet declared what the optimal HMI is, in such context. Since there is an urgent need to clarify how various technologies can be a goal or an approach for preventive, rehabilitative and assistive interaction, we try to make a first step towards a redefinition of Robotics Assistive Technology.



### IS2 Affective Human Computer Interaction

Kaoru Sumi (Future University Hakodate, Japan)

This talk introduces a study of spoken dialogue agent systems using emotional expressions as affective human computer interaction. The paper describes an experiment investigating the effect that the expression and words of the agent have on people, introduces a spoken agent for customer services using expressive facial expressions and a spoken agent for mental care using expressive facial expressions and positive psychology as application systems for affective human computer interaction, and presents a discussion and a conclusion.



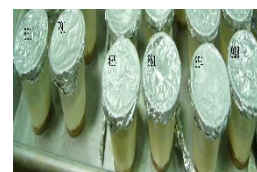
## OS abstracts

### OS1 Artificial Life and Quality Enhancement of Life (6)

#### OS1-1 The development of new products of pineapple cheesecakes

Sheu-Der Wu<sup>1</sup>, Hung-Wen Su<sup>2</sup> (<sup>1</sup>Cheng Shiu University, <sup>2</sup>Far East University, Taiwan)

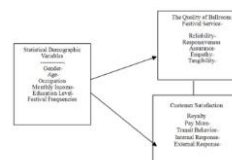
We are in view of the product - pineapple cheesecakes newly developed for this study, the questionnaire answers proposed by consumers after sensory evaluations find the most popular flavor with 27% recipe proportion of pineapple chops added. Furthermore, after pineapples are added into cheesecakes, a new flavor has emerged in cheesecakes yet reduces the oily taste without sacrificing its original flavor and nutrient value. In the experiment of formal sensory evaluation, genders, ages, occupations, incomes and purchase intention are served as factors to analyze consumers' preference to pineapple cheesecakes. Research results after investigation finds the strongest acceptability is the samples of pineapple cheesecakes added with 27% pineapple chops. The least acceptability happens to the samples of pineapple cheesecakes added with 27% pineapple jams. After analysis, it is found the overall acceptability is high but the purchase intention is low revealing a higher preference to cheesecakes added with pineapple chops.



## OS1-2 The study on ballroom service quality to affect customer satisfaction

Hsiu-Min Lin , Yang Wu, Jei-Fu Ho (Far East University, Taiwan)

For hoteliers, customer expectations and the real performance of service probably existed in perceptive variance between the emphasized details and satisfaction to bring about the gaps of service quality. As such, it naturally caused customer unsatisfied with service quality to lose their patronage. As it is found from research results, service quality exerted positive influence on demographic variables. If it was available to improve the service quality and the expectations to customer satisfaction, then it was naturally available to enhance the repeated purchase intention of customers. In 10 dimensions cited in this research, after researching analysis, "tangibles" was satisfied by customers the most. If providers could keep the satisfaction always, then it was naturally available to enhance the first image in customers' mind. Additionally, "external response" scored the least and provides should improve their own service quality by focusing on the parts highly emphasized by customers. Furthermore, more emphasis should be placed on the opinions of customers to win their trust and avoid external complaint lodged by customers without losing the source of customers. The excellency or inferiority of service quality would directly affect customer satisfaction. If providers were planning for sustainable business management, excellent service quality was imperatively required. As such, it was just available to win the trust from customers under the fiercely competitive business climate with the goal of sustainable business management achievable.

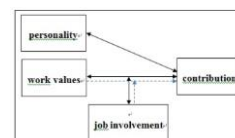


## OS1-3 The relationship between employees' personality traits, work values and job involvement with the contribution to their companies – For the micro food service industry

Hsiu-Chen Chung<sup>1</sup>, Chiou-Lan Chien<sup>1</sup>, Lung-Chi Tsai<sup>2</sup>

(<sup>1</sup>Tainan University of Technology, <sup>2</sup>Southern Taiwan University of Science and Technology, Taiwan)

The purpose of the study is to discover the influence between the employee's (for whom who works in the micro food industry) personality, work values and job involvement to the contribution and dedication. Research sample focus on the snack bar in night market, bakery stores and the micro food industries' employees or owners from Taizhong, Changhua, Yunlin, Jiayi and Tainan cities. We send 450 questionnaires, the effective questionnaires are 333, and the percentage of effective retrieve of the questionnaire is 87.63%. After using reliability analysis, correlation analysis, one-way analysis of variance (ANOVA), independent, work values and personality can forecast prediction the employee's contribution and dedication very precisely; in addition, we find out that job involvement has a very clear effects between work values and job contribution.



## OS1-4 Consumer's acceptance to the new product- pineapple jam as example

Shang-Hui Li, Jei-Fu Ho (Far East University, Taiwan)

Based on the health and environmental considerations, consumers paid their more attention to the pursuit of natural ingredient. In other words, a safe and non-toxic diet is the basic consideration for the consumers. More consumers pay more attention on natural foods; they gradually change their eating habits. In recent years, many food safety events such as tainted milk, clenbuterol, poison starch, plasticizers etc. have been reported. Consumers tend to buy natural foods, less chemical additives and security food as the primary concern. This study attempts to take the natural pineapple jam as the major structure. And try to add dates and plum into pineapple jam instead of any artificial additives, and enhance the taste level. Meanwhile, different flavors could derive from the natural products according to the pineapple jam proportion of different formulations. The study expects to be able to create the pineapple jam which is not the same as made by the market products. The study selected 150 consumers of Tainan area to be tested of preferences of sensory evaluation, and SPSS 12.0 statistical software was used as the data analysis of the outcomes of the study. The result found among 123 valid questionnaires. The original flavor pineapple jam in its appearance, aroma, stiffness, acidity, sweetness and overall acceptability can be accepted by most consumers and there are significant differences with other products. Consumer also showed their strongest willingness to buy the original flavor pineapple jam and there are significant differences with other products.

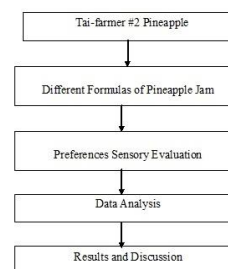
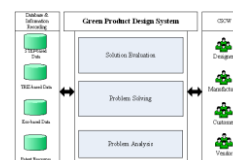


Chart 1. Pineapple Jam Test Flowchart

## OS1-5 Development of an innovative design process for green products

Ming-Chieh Wang (Far East University, Taiwan)

We are Under the growing trend of environmental protection, many different eco-design methods have been proposed, at the same time, there are many TRIZ tools used to support these processes. In this study, we proposed an innovative design process for green products. This process includes three frameworks-collaborative design, innovative design environment, and the green product design system. Collaborative design framework aims to assist the designer and their upstream and downstream partners to combine their ideas by CSCW tools. The innovative design environment includes data layer, information layer, and knowledge layer, analyzed through the data exchange, information sharing and decision making during the design process. The green product design system was consists of the problem analysis, problem solving, and solution evaluation used to assist the design process with collaborative coordination and information recording. This construct integrating the design ideas, knowledge exchange, problem solving and feedback for the green product design process.



## OS1-6 Research on Nail Art 3D Design with Different Materials -- A Case Study of the Tang Dynasty Style

Mei-Yin Lee, Kung-Yu Liu, Sih-Jie Guan and Jei-Fu Ho (Far East University, Taiwan, ROC)

Women in Tang Dynasty, China (618 A.D.-907 A.D.) had concerned with beauty. They had painted color in their nails in addition to emphasis on clothing and makeup. Tang's costumes had blended the diverse characteristics of northern ethnic groups. Meanwhile a variety of engineering methods had been used such as embroidery, painting, printing, wearing gems and gemstones. Floral patterns had been appeared in large numbers in clothing, accessories and poetry. This study has tried to build the Tang Dynasty decorative painting technique or way of painting reappeared on modern nail art and to make the nail painting presents the different faces. After collecting a lot of relevant documents and experimenting many combinations of different materials, such as sculpture, super-light clay, foam paper, popsicle sticks, and Styrofoam, many hand-made stereoscopic flowers, such as peony, rose, plum etc., with painting have been made. Hence different from the past nail art, beautiful pieces of finger nail with the mood of Tang Dynasty poetry are presented. Furthermore, this study has investigated whether the stereoscopic nail art design with different materials could be promoted to the daily nail decoration to enhance the quality of life.

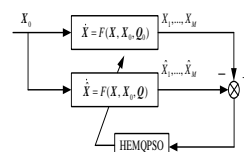


## OS2 Intelligence Control System and Artificial Life (6)

### OS2-1 Modified Quantum Particle Swarm Optimization for Chaos Synchronization

Ching-I Lee, Chia-Nan Ko (Nan Kai University of Technology, Taiwan)

In this study, a modified quantum-behaved particle swarm optimization (MQPSO) based on hybrid evolution (HEMQPSO) approach is proposed to synchronize chaotic systems, in which the proposed HEMQPSO algorithm combines the conceptions of genetic algorithm (GA) and adaptive annealing learning algorithm with the MQPSO algorithm to search optimal solutions. Simulation results are illustrated to verify the performance of chaos synchronization using the proposed HEMQPSO approach. From the numerical simulations and comparisons with other extant evolutionary methods in chaotic systems, the validity and superiority of the HEMQPSO approach are verified.

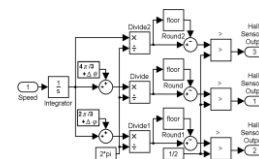


### OS2-2 A Simulation Model of Hall Sensor Misalignment in BLDC Motors

Chung-Wen Hung, Chu-Lin Hsu

(National Yunlin University of Science & Technology, Taiwan)

A simulation model of Hall sensor misalignment in BLDC motors is proposed in this paper. The Hall sensor is popularly used in brushless DC motor to decide commutate and rotational speed. However, the accuracy of Hall sensor position is limited in most of BLDC motors, and it is lack of suitable simulation model for Hall Sensor installation misalignment. The details of simulation model are discussed in this paper, and simulation results are also provided to show the model workable.





### OS2-3 Using Multi-Target Tracking and Identification TLD Algorithm for Intelligent Mobile Robot

Jr Hung Guo, Kuo-Hsien Hsia, Kuo-Lan Su  
(National Yunlin University of Science & Technology, Taiwan)

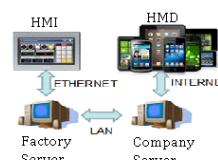
Image algorithms used herein are Tracking-Learning-Detection (TLD) and Speed UP Robust Features (SURF). TLD is used for target tracking and SURF is used to identify targets. We use zoning identification, with the use of statistical probability to strengthen the efficiency of TLD and SURF. With such a method, the efficiency of image identification and target tracking can be enhanced so that the robot can simultaneously track and identify multiple targets.



### OS2-4 Handheld Mobile Devices for Remote Monitoring of Factory

Bing-Gang, Jhong, Jian-Sing, Hu, Mei-Yung, Chen  
(National Taiwan Normal University, Taiwan)

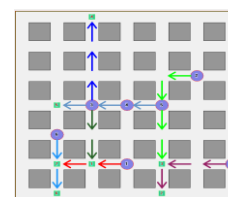
In this paper, a handheld mobile device system is presented for remote monitoring of the factory to short the downtime of machines and recovery more quickly. The human-computer interaction of the system is developed by GP-Por EX, and operates by using commercial or free distal APP combining with sign-in-website of the company. The way for the program linked can be linked with multi-way links, such as long-distance link (3G/4G or Wi-Fi wireless INTERNET), medium distance (LAN) and short distance (ETHERNET) and can be chosen in the company portal page. With supplemented Internet browser program for remote monitoring, the distal end operator or the person in charge can confirm the machine condition through the distal end of the server, port, user name and password settings. Therefore, the operational efficiency and system transparency can be improved with the handheld mobile devices for remote monitoring system.



### OS2-5 Task Assignment and Checking Process for Pattern Reformation on a Square Grid Plane

Kuo-Hsien Hsia<sup>1</sup>, Bo-Yi Li, Kuo-Lan Su  
(<sup>1</sup>Far-East University, National Yunlin University of Science & Technology, Taiwan)

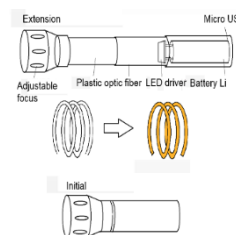
Pattern reformation problem on a grid plane is an interesting problem. Suppose there is a group of mobile robots on a square grid plane with the number of robots equaling to the number of columns/rows of the grid plane. The mobile robots are initially in a certain formation and they are commanded to change to another formation as soon as possible. Any one of them has to prevent himself from colliding with others during the moving of reformation process. In this paper, we will provide a systematic process on task assignment of route programming for the pattern reformation problem on a square grid plane. We will also provide a checking process to check if the suggested program is really good or not.



## OS2-6 The Design of a Multifunctional Acousto-Optical Device With a Mobile Power Pack

Yi-Yu Lu, Wen-Bin Lin, Zheng-Ying Li (Far-East University, Taiwan)

This study presents details of a multifunctional acousto-optic warning device that recently obtained a patent in Taiwan. The device comprises three subsystems, which are RGB LEDs, warning system and mobile power pack. This device has multiple functions, including as a traffic baton, camping light, glow sticks and for women's security at night. The tube body of the device is adjustable, and can extend to 1.5 times its length. The design is both functional and practical, and it is also energy efficient due to the use of polymer optical fiber and a lithium battery. Since this device also has a USB charge and discharge function, it can also work as a mobile power pack.

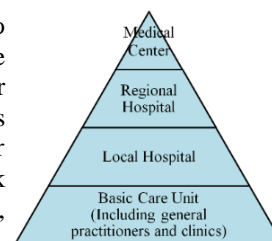


## OS3 Construction Engineering and Management (6)

### OS3-1 Discussion on Factors Influencing the Performance of Hospital Renovation Engineering Taking one Medical Center in Taiwan as Example

Wen-Lung Lin, Yan-Chyuan Shiau, Ting-Chi Lai, Chen-Chung Liu (Chung Hua University, Taiwan)

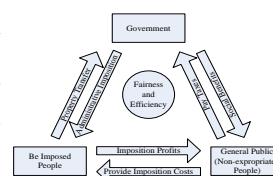
Renovation engineering is conducted to create the high-quality medical environment to meet the public's medical demands. The subjects of this study were to investigate the renovation engineering case of four hospital areas in Mackay Memorial Medical Center in Taiwan. 50 factors influencing the engineering performance were concluded in this study. The rank of each factor's influencing severity and influencing performance in four stages for hospital renovation engineering was summarized. The factors' severity rank influencing the performance in the four stages were planning and design stage, construction management stage, bidding stage and case acceptance and closing stage. The conclusions and suggestions of this study can be used as reference for future hospital renovation projects.



### OS3-2 Discussion on Land Expropriation Compensation System

Hung-Chi Liu, Yan-Chyuan Shiau, Yao-Shan Huang, Chen-Chung Liu (Chung Hua University, Taiwan)

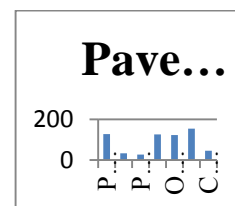
Land expropriation is a necessary means for the public construction of country. Usually some appropriate compensation was paid to imposed people. How land expropriation should be compensated in accordance with the spirit of the Constitution for governments to protect people's property rights have been explored in this study. The study results show that the public in Taiwan is rather satisfied with the current land expropriation at the land market value. "Estimation of land value by real-estate estimators" and "Compensation based on values listed on the Actual Price Registration" are much accepted by the public. It is also suggested that the existing land expropriation compensation shall adjust to meet the public wish to reduce incidences of struggles and improve administrative proficiency.



### OS3-3 Study on User Satisfaction of Pick Areas for Elementary Schools – Using Nanyang Elementary School in Taichung City as Example

Chun-Feng Chang, Yan-Chyuan Shiau, Kuan-Yin Chen (Chung Hua University, Taiwan)

Most of the campus accidents happen on the way between school and home, and most of the locations are close to their homes or schools. The elementary school children have low autonomy and they are mainly picked by parents. This study has investigated the user satisfaction of pick areas for elementary schools and their improvement requirements. Questionnaire is adopted to discuss user satisfaction of the school environment. The improvement strategies for pick areas were inspected for different various backgrounds. The research results have showed that overall satisfaction ranges from general to satisfaction. Some useful suggestions are proposed. These suggestions can be served as reference for schools and educational organizations to establish an unimpeded pick area for a safe school commuting environment.



### OS3-4 Study on User Satisfaction in Sport Site Facilities for Senior Students of Elementary Schools in Taichung City

Pei-Ling Lin, Yan-Chyuan Shiau, Ling-Lin Chang (Chung Hua University, Taiwan)

In Taiwan, obesity rate of children and adolescents is 26.8% and physical fitness also falls behind the neighboring Asian countries. This study has discussed senior students' actual use and satisfaction towards school sport field facilities in elementary schools of Taichung City. This study adopted questionnaire method and senior students in elementary schools of Taichung City were used as research subjects which were sampled with stratified cluster sampling method. The obtained data were analyzed by descriptive statistics, Chi-square test, T test, one-way ANOVA, and Pearson product-moment correlation. It is expected to provide reference for relevant personnel so as to provide the ideal campus sports environment.



### OS3-5 The Establishment of the Sustainability Performance Indicators for Wetland Ecological Project: Using Construction Inspection Phase as Example

Ching-Mei Miao, Yan-Chyuan Shiau, Chen-Chung Liu, Jen-Kuo Chang (Chung Hua University, Taiwan)

Taiwan's government has invested considerable material, human resources and money to build many artificial by using ecological engineering methods. The critical success factors of sustainable performance indicator (SPI) were investigated in this research. A wetland water purification project of a stream in Hsinchu was used as an example in this paper. The experiment information was integrated as feedback to correct the index library. The measurement from test results verifies the SPI from sample project case in some facet is consistent with the results of current inspection system. Adopting the SPI integrated from this study can quickly detect the sustainability of the construction project and dramatically reduce labor inspection and costs. The research result can be served as reference for the sustainable development of ecological engineering achievements.



### OS3-6 Development of Type Control Guidelines for the Old Town District of Hsinchu City

Yi-Yin Tsai (Chung Hua University, Taiwan)

The study employed the concept of "Building Type Control" to establish the hierarchy model and design guideline for the urban regeneration process. GIS was used to efficiently manage database and map out the building environmental features to serve as a visual reference tool. Existing building regulations and urban design policies set out by the government were reviewed to set out limitation and ultimate vision for the study district, three type control zonings were set out with type control design guidelines respectively. Results of the study can serve as a sufficient reference tool to assist design decision making in the urban regeneration process.



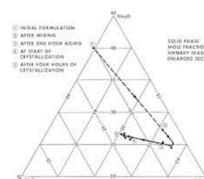


## OS4 Construction Technology and Management (5)

### OS4-1 Study on the Promotion of Steel Slags Recycling in Taiwan

Shu-Chen Chang, Ching-Jung Chang (Chung Hua University, Taiwan)

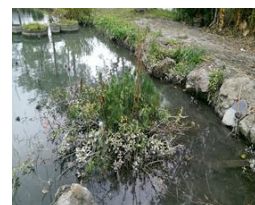
The fast development of global economy makes the great development of industry, causes the excess development and abuse of natural resources, and causes the resources depletion gradually. So the topic of waste reuse has already become an energy strategy paid more attention the worldwide research units and governments day by day. The construction industry uses a large amount of concrete, and its basic materials are the fine and coarse aggregates and cement, which are taken from sandstone mining and limestone calcining, and they will be exploited excessively and destroy the environment. This study tries to use the industrial waste to replace the aggregates and cement in concrete, and use them suitably in accordance with their different properties.



### OS4-2 The Research on the Utilization of Green Building Ecological Index Group in Campus Environment – Taking of Elementary Schools at Houli District, Taichung City as Example

Ching-Jung Chang, Yung- Feng Hsu, Chun-Hsien Chen (Chung Hua University, Taiwan)

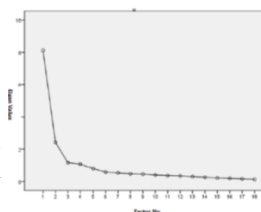
Due to overexploitation of the earth, the mankind causes the phenomena such as the climate anomaly, ozone layer depletion, forest disappearance, species extinction, ocean pollution, debris flow, global warming and sea level rise etc. Therefore every country in the world begins to launch the comprehensive environmental protection action of earth. This research took elementary schools at Houli District, Taichung City as study subjects, based on “Green Building Assessment Manual” announced by official authority, and conducted “ecological index group” assessment. Through field investigation, analyzed and compared three assessment indices of “biodiversity”, “greening amount” and “base water preservation”, and provided recommendation of improvement, in order to raise the ecological environment of campus. It is hoped there should have appropriate contribution for the planning of similar school or environment in the future.



### OS4-3 The Assessment and Research on the Reconstruction of Enclosing Wall into Open Type in Elementary School Campus – Taking of Erlin Township, Changhua County as Example

Ching-Jung Chang, Chia-Chen Li, I-Chen Wu (Chung Hua University, Taiwan)

In recent years, Taiwan government has pursued the open campus by reconstructing the enclosing wall of campus into the friendly fence or dismantling the enclosing wall directly, let the community residents participate in the school space together. So the government subsidizes the funds and encourages the school to reconstruct or remove the enclosing wall. Because the change for the type and height of enclosing wall, the teachers and parents have the doubt for the security of students in the campus. This research conducted the regional investigation for the school teachers, students and parents against the friendly fence and security opinion of open campus. It hopes to provide the reference for the reconstruction and design of enclosing wall in Elementary School campus by the government authority in the future.



#### **OS4-4 The Study and Analysis on the Reuse and Transformation Strategy of Tile Kiln Space – Taking of San-He Tile Kiln as Example**

Ching-Jung Chang, Hsiao-Yu Lin, Ying-Yu Su (Chung Hua University, Taiwan)

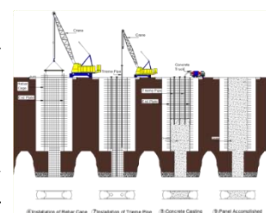
Because the new technology was introduced and the abundant use of concrete and steel products, the tile kiln industry was declined gradually in Taiwan. This paper attempts to review a successful case of kiln space reuse that has good culture assets preservation and combines cultural and creative industry. This research selects San-He Tile Kiln as the study subject. The questionnaire for investigating the visitors on different requirement was designed through interviewing the kiln owners and experts in advance and collating the interview information systematically. The Principal Component Analysis simplified the questionnaire variables to become the aspects of appeal. This research hopes to provide the operation reference to the civilian tile kiln owners or the other related space reuse sector.



#### **OS4-5 The Research on the Influence of Economic Benefit for High-Rise Buildings Constructed by Different Excavation Method – Taking of Residence Buildings at New Taipei City as Example**

Ching-Jung Chang, Cheng-Min Yang, Hsiu-Hsiung Hsu (Chung Hua University, Taiwan)

Every domestic big construction company hunted the land for development aggressively, in order to get the priority of obtaining the profit. The selection of excavation method has great relative relationship on the construction speed of structure, influence of adjacent building, acquisition of use license and delivery of house. This research adopted diverse excavation methods used by the constructor to analyze the advantage and disadvantage, construction period difference, and construction cost prediction etc. Finally, the results are compiled and contrasted to verify the relative relationship of excavation method on the difference of construction period, and cost etc. The purpose of this research is expected to provide the developer to select suitable excavation method effectively to reach the highest benefit of delivering the finished house.

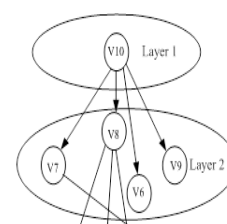


#### **OS5 Advanced Control Systems (6)**

##### **OS5-1 Socialized Multi-Agent System Rendezvous via Networks of Networks**

Yunzhong Song, Ziyi Fu, Fuzhong Wang (Henan Polytechnic University, P.R. China)

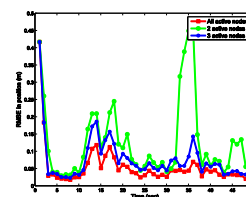
Networks of networks paradigm was introduced to explore rendezvous problems of leader-follower multi-agent system, where rendezvous actors were categorized into target object, leader agents, informed follower agents and isolated follower agents, respectively. Three humanized system inspired strategies were investigated. Results demonstrated that democracy strategy could fulfill rendezvous task in expenses with a long convergent time and autarchy democracy could come to targeted object quickly with risk of failing in rendezvous, while mixed strategy cared about both of convergent speed and utmost task, would take autarchy strategy when connections were available for follower agents, while democracy rules had to be used if the connections were not possible.



## OS5-2 Global sensor selection for maneuvering target tracking in clutter

Wenling Li, Yingmin Jia (Beihang University, P.R. China.)

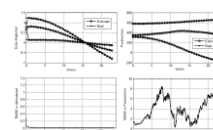
In this paper, we consider the problem of sensor selection for maneuvering target tracking in clutter. By utilizing the global knowledge of all sensors locations, a cost function that minimizes the expected filtered mean square localization error is developed to select a given number of active sensors. As the cost function is derived based on the decentralized structure, we investigate how to derive the decentralized fusion formula by applying EKF and PDA technique so that the clutter information can be combined into the cost function. By minimizing the cost function, a sensor selection scheme is proposed based on the 'add one sensor node at a time' strategy. Simulations are provided to illustrate the effectiveness of the proposed approach.



## OS5-3 Attitude/Position Estimation of Rigid-Body using Inertial and Vision Sensors

Shihao Sun, Yingmin Jia (Beihang University, P.R. China)

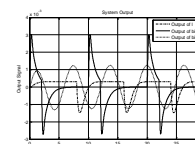
This paper is concerned with the attitude and position estimation of a rigid-body using inertial and vision sensors. By employing the Newton-Euler method, a kinematic model is developed for the rigid-body by treating the inertial measurements as inputs. Based on the coordinate transformation, a nonlinear visual observation model is proposed by using the image coordinates of feature points as observations. Then the unscented Kalman filter (UKF) is utilized to estimate the attitude and position recursively. Simulation results are provided to show the effectiveness of the proposed algorithm.



## OS5-4 Modeling and Control of a Suspended Gravity Compensation System with the Rigid-Flexible Coupling

Jiao Jia, Yingmin Jia, Shihao Sun (Beihang University, P.R. China)

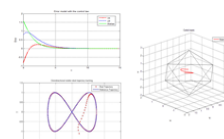
In this paper, the suspension gravity compensation system (SGCS) is modeled and the corresponding controller is designed. The system is a servo platform consisting of three sub-systems by which a micro-gravity environment can be established. The system model is deduced based on Lagrange equation. The system state variables are classified in two parts based on their physical meaning and the model dimensions are reduced on the classification. A PID controller is designed based on the feedback linearization. The simulation results show the effectiveness of the proposed method.



## OS5-5 Trajectory Tracking Control for Omnidirectional Mobile Robots with Input Constraints

Wenhao Zheng, Yingmin Jia (Beihang University, P.R. China)

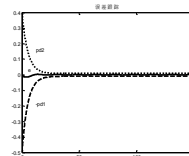
In this paper, a trajectory tracking controller based on kinematics for omnidirectional mobile robots with input constraints is presented. The tracking error model with the control law is proved to be global asymptotic stability by Lyapunov stability theory. The input limits can be described as an octahedron in three-dimensional space, so that a spatial vector analysis method is proposed to design time-varying feedback parameters to limit robot inputs. Simulation results show the feasibility and effectiveness of the control strategy.



## OS5-6 Parameters Tuning Approach for Prescribed Performance Function Based Active Disturbance Rejection Control

Wei Wei, Bo Liang, Weijun Su  
(Beijing Technology and Business University, P.R. China)

Active disturbance rejection control (ADRC) is a control approach which needs less information of the controlled plants/processes. However, there are many parameters in the nonlinear functions utilized in ADRC, such parameters make the tuning of ADRC be a challenge. Prescribed performance function based ADRC is proposed and the tuning approach is studied in this paper. Some typical controlled plants are taken in the simulations. Numerical results are presented to support the proposed control approach and its tuning method.

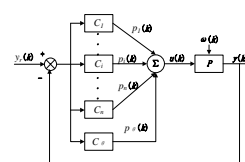


## OS6 Intelligent Control (6)

### OS6-1 Adaptive Control of Discrete-Time Systems Using Multiple Fixed and One Adaptive Identification Models

Zhang Yuzhen, Li Qing, Zhang Weicun (University of Science and Technology Beijing, P. R. China)

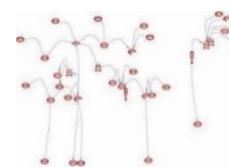
The adaptive control of a linear time-invariant discrete-time system using multiple models is considered in this paper. Based on the prediction errors of a finite number of fixed and one adaptive identification models, a new weighting algorithm is proposed for improving system performance. The principal contributions of the paper are the proofs of global stability and the convergence of the overall system. Computer simulation results are included to complement the theoretical results.



### OS6-2 Adaptive Polynomial Regression and Its Applications to Gene Selection of Rat Liver Regeneration

Juntao Li, Yimin Cao, Xiaoyu Wang, Cunshuan Xu (Henan Normal University, P.R. China)

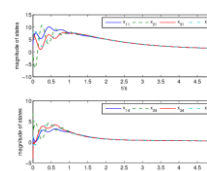
This paper proposes an adaptive polynomial regression by incorporating the multi-class adaptive elastic net penalty into polynomial likelihood loss. The adaptive polynomial regression was proved to adaptively select the relevant genes in groups in performing multi-class classification. The proposed method was successfully applied to the gene expression data for rat liver regeneration and the relevant genes were selected. The pathway relationships among the selected genes were also provided to verify their biological rationality.



### OS6-3 Adaptive Consensus via Dynamic Output Feedback for Lipschitz Nonlinear Multi-Agent Systems

Lin Li, Heyang Wang (University of Shanghai for Science and Technology, P.R. China)

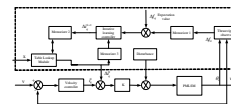
This paper deals with the consensus problem via dynamic output feedback for multi-agent systems with fixed topologies. The agents are described by Lipschitz nonlinear systems. Under the assumption that the states of the multiple agents are unmeasured, and only output information of each agent can be obtained from its neighbor agents. Based on the graph and Lyapunov theory, a distributed adaptive consensus algorithm via dynamic output feedback is proposed, in which the coupling weights between adjacent agents are time-varying and satisfy some designed adaptive laws. Provided examples are included to demonstrate the effectiveness of our proposed consensus algorithm.



### OS6-4 Iterative Learning based Thrust Ripple Suppression for PMLSM

Caixia Gao, Fuzhong Wang, Ziyi Fu (Henan Polytechnic University, P.R. China)

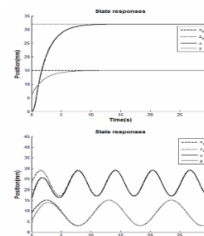
To solve problem of thrust ripple of multi-segment primary Permanent Magnet Linear Synchronous Motor (PMLSM), a control strategy combining fuzzy PID, which was based on velocity regulation and iterative learning algorithm, which was based on current compensation was proposed to deal with thrust ripple in advance. Through investigation of thrust ripple of PMLSM, mapping relationship between thrust ripple and motor critical parameters has been established, then thrust ripple suppression model for multi-segment primary Permanent Magnet Linear Synchronous Motor was available, and control law can be made possible. Results show that, thrust ripple was less than 1% under different position; strong suppression of thrust ripple caused by periodic disturbance could also be inhibited.



### OS6-5 Adaptive Sliding Mode Control for A 2-DOF Magnetic Levitation System with Uncertain Parameters

Meng Duan, Yingmin Jia (Beihang University, P.R. China)

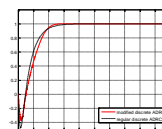
This paper investigates the stability control for a 2 degrees of freedom magnetic levitation system with both parameters uncertainty and external disturbance. This system includes one magnet and two coils, the magnet which levitated by two coils can only move through x-axis and z-axis. The electromagnetic forces between the magnet and coils are obtained by numerical calculation that brings uncertain parameter of input to the system dynamical model. To this end, an adaptive sliding mode controller is proposed. The system stability and robustness are proved by the Lyapunov stability theory. Simulation results are presented to verify the effectiveness of the proposed control strategy.



### OS6-6 Undershoot Reduction in Discrete-Time ADRC of NMP Plant by Parameters Optimization

Tong Wu, Weicun Zhang (University of Science and Technology Beijing, P.R. China)

Undershoot phenomena caused by unstable zeros of non-minimum-phase (NMP) plant is difficult to deal with in active disturbance rejection control (ADRC). This paper proposes a new method to reduce undershoot by optimizing the controller parameters of discrete-time ADRC system. Simulation results are given to verify the effectiveness of the proposed scheme.

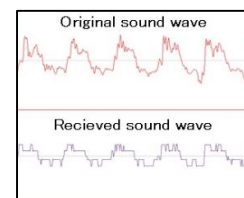


## OS7 Image Analysis and Content Security (5)

### OS7-1 A Method for Secure Communication Using a Discrete Wavelet Transform for Sound Data

Yuji Tsuda<sup>1</sup>, Kouhei Nishimura<sup>2</sup>, Haruka Oyaizu<sup>3</sup>, Yasunari Yoshitomi<sup>2</sup>, Taro Asada<sup>2</sup>, Masayoshi Tabuse<sup>2</sup>  
(<sup>1</sup>Software Service, Inc., <sup>2</sup>Kyoto Prefectural University, <sup>3</sup>NHK Media Technology Inc., Japan)

We developed a method for secure communication using a discrete wavelet transform for sound data. Two users must have one piece of music before communicating each other. The music is beforehand transformed into a code using the scaling coefficients obtained from a discrete wavelet transform. The sound data are transformed into another code using the same method as that for the music. The information on the difference between these two codes is sent from one user to the other. The user can produce the sound similar to the original sound using an inverse discrete wavelet transform with the code made from the music, the information on the difference between these two codes, and values of zero for all wavelet coefficients. The voice produced by the proposed method was audible.





### OS7-2 An Authentication Method Using a Discrete Wavelet Transform for a Recaptured Video

Ren Fujii, Yasunari Yoshitomi, Taro Asada, Masayoshi Tabuse (Kyoto Prefectural University, Japan)

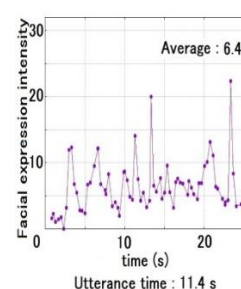
Recently, several digital watermarking techniques have been proposed for hiding data in the frequency domain of moving image files to protect their copyrights. In this study, we developed an authentication method for a recaptured video by using the previously proposed method using a discrete wavelet transform for a static image and a method for selecting several frames in the moving image. In contrast to digital watermarking, no additional information is inserted into the original moving image by the newly proposed method. The experimental results show that the proposed method has a good performance for authentication.



### OS7-3 A System for Facial Expression Analysis of a Person While Using Video Phone

Taro Asada, Yasunari Yoshitomi, Ryota Kato, Masayoshi Tabuse, Jin Narumoto (Kyoto Prefectural University, Japan)

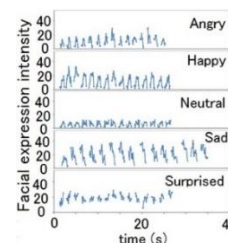
We developed a wireless local area network system, consisting of two personal computers and one router, where a module for analyzing facial expressions of a person while speaking with another person using a phone video is equipped in a personal computer in front of a subject and is controlled by an operator using another personal computer in the system. In the module, a function for determining the reference frame and locally searching the mouth-part area with the most appropriate position for each frame to be analyzed is contained. The video saved in the personal computer in front of the subject is analyzed using image processing software (OpenCV) and the previously proposed feature parameter (facial expression intensity), which is measured for the mouth-part area. The experimental result shows the usefulness of the proposed system.



### OS7-4 Emotion Recognition of a Speaker Using Facial Expression Intensity of Thermal Image and Utterance Time

Yuuki Oka<sup>1</sup>, Yasunari Yoshitomi<sup>2</sup>, Taro Asada<sup>2</sup>, Masayoshi Tabuse<sup>2</sup> (<sup>1</sup>NTT DATA Financial Solutions Corp., <sup>2</sup>Kyoto Prefectural University, Japan)

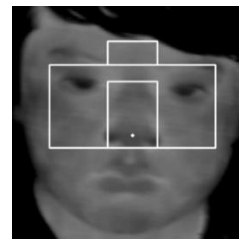
We previously proposed a method for recognizing human emotion. A video is analyzed by thermal image processing and the feature parameter of facial expression, which is extracted in the area of the mouth and jaw. The facial expression intensity, defined as the norm of the difference vector between the feature vector of the neutral facial expression and that of the observed one, is measured. The standardized mean value of facial expression intensity for a major cluster, and the standardized mean value of time at utterance for a major cluster are used for recognizing human emotion. In this study, the emotions of one subject were discriminable with 76.5% accuracy in speaking each of 23 kinds of utterances with exhibiting each of the five intentional emotions of "angry," "happy," "neutral," "sad," and "surprised."



## OS7-5 Estimation of Learners' Subjective Difficulty in e-Learning Using Thermal Image Processing

Yuki Yoshimitsu, Masayoshi Tabuse (Kyoto Prefectural Univ., Japan)

In recent years, e-learning has been utilized as a learning system in many schools. In a conventional class, a teacher teaches learners face-to-face, so that a teacher observes facial expressions and posture change of learners and estimates learners' subjective difficulty of the lecture. On the other hand, e-learning is usually utilized in the self-study. A learner learns a teaching material using a computer by oneself, so that a teacher can't observe the state of the learner. It is difficult for a teacher to estimate learners' subjective difficulty. Therefore, we propose a learners' subjective difficulty estimation system. This system captures the face of a learner in e-learning with a thermal camera. It extracts the face region, measures the temperature changes of the nose region and the forehead region of the learner, and estimates the subjective difficulty of the learner based on the temperature changes.

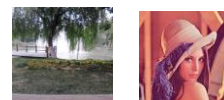


## OS8 Image, Circuit and Control (9)

### OS 8-1 Image Encryption Implementation Based on fractional-order Chen System

Hongyan Jia, Qinghe Wang (Tianjin University of Science and Technology, P.R. China)

In this paper, based on the fractional-order Chen system, a kind of double encryption algorithm method is adopted to realize the image encryption. The method mainly refers to the transformation of the pixel position and the transformation of pixel value. The effectiveness of the double encryption method is verified by encryption and decryption of a typical image. The experimental results show that this method not only has the ideal effect of image encryption and decryption, but also possesses a better guarantee on the image security. That is, this encryption method is practical and feasible.



### OS 8-2 Mobile Camera based Motion Segmentation by Image Resizing

Chunyu Yu (Syracuse University, USA)

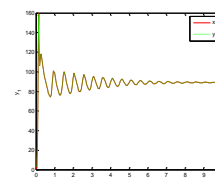
The need of detecting moving object like human and vehicle by mobile camera is increasing in commerce and industry. In this paper, an image-resize methodology which can abstract motion segmentation and detect moving object from moving background is proposed. First, edges images are computed. Then movement vector between frame images are computed and the relative background motion is compensated. By adjusting the parameters of resize algorithm, human liked object or vehicle liked object can be segmented separately and the segmentation can be used for further detection. Experiments have been performed under three different environments for human detection and vehicle detection.



### OS 8-3 Synchronization of the fractional-order permanent magnet synchronous motor

Xue Wei, Li Xue (Tianjin University of Science and Technology, P.R. China)

In this paper, the synchronization of the fractional-order permanent magnet synchronous motor is investigated. The presented control scheme is simple and flexible, and it is suitable both for design and for implementation in practice. According to the stability theory of fractional-order linear system, adopting the linearization by feedback method, a nonlinear feedback controller to implement the synchronization of the drive system and the response system is designed. The numerical simulation results coincide with that of theoretical analysis, which can further demonstrate the feasibility and effectiveness of the proposed synchronization scheme.

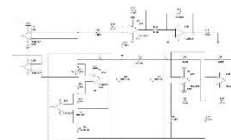


Variation of  $x_1$  and  $y_1$

## OS 8-4 Analog Circuit Implementation and Full State Observation of Chua's Circuit

Hong Niu, Dongchen Tan, Yongjun Wu  
(Tianjin University of Science and Technology, P.R. China)

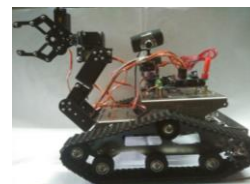
In this paper, an inductance simulator and a nonlinear resistor, which are constructed by operational amplifiers and resistors, are applied to complete the analog circuit implementation of Chua's circuit as well as improve the accuracy of circuit parameters. For the observation of all variables, the state variable  $z$ , which represents the product of the linear resistance and the inductor current in Chua's circuit, should be observed even if it is not an actual measurable physical quantity. It is found that  $z$  can be obtained via scaling of the voltage of the resistor in the inductance simulator. The real chaotic curves generated from the analog Chua's circuit are displayed on the oscilloscope clearly and correctly.



## OS 8-5 Research on visualizational rescue robot

YuanLi Yue, Fengzhi Dai, Qijia Kang, Pengfei Xie  
(Tianjin University of Science and Technology, P.R. China)

Aimed at the shortcomings of the low efficiency and the limitation of the search and rescue robot, this paper presents a visualizational search and rescue robot based on Arduino platform. The infrared detector for searching human body is used to detect life, and the camera can transmit the information back to the mobile phone or computer terminal in real-time. The track wheel improves the capability of shuttle and over obstacle, and can easily cope with complex terrain. The mounded manipulator can complete many missions, such as clean up the road block and deliver essential supplies to small space. It can replace humans to carry out the task into the dangerous environment and search-and-rescue person into the confined space.



## OS 8-6 Development of training instrument for upper limb muscle rehabilitation

Qijia Kang, Fengzhi Dai, Yuanli Yue, Bo Liu, Hongtao Zhang  
(Tianjin University of Science and Technology, P.R. China)

This equipment can work in multiple degrees. By the single joint and composite motion, it imitates human upper limb movement. Composite motion can be multiple degrees of freedom, so that the equipment can fit with the physiological structure of human body well. Upper limb strength can be recovered efficiently and the muscle contraction can also be well preserved as expected. Obtaining vibration module, it enhances the effect of recovering. Wireless transceiver module makes the wireless monitoring and data wireless transmission be a feasible way. It is connected with the computer, and the recover information of patients could be gathered, analyzed and recorded in computer as well. Date can also be transmitted by the internet, so as to offer the recover information to medical institution.

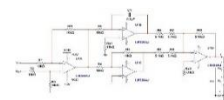




### OS 8-7 Design and Analog Circuit Implementation of a Dynamic Feedback Control System Based on RLC Series Circuit

Hong Niu, Yongjun Wu, Dongchen Tan (Tianjin University of Science and Technology,)

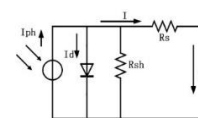
The purpose of this paper is to verify that a dynamic feedback control system can be realized by a simple small analog circuit. A normal RLC series circuit, which is an electrical two-order circuit only consisting of one resistor, one inductor and one capacitor, is taken as the controlled object, and the voltage of the capacitor is taken as the output of the system. The engineering design method of regulator in DC drive control system is applied to design the dynamic feedback compensator, so that the output of the system can track the given input, and the system is stabilized and has expected performance. The simulation results of the theoretical model and the corresponding results of the real analog circuit implementation are given in the paper to illustrate that the circuit can accomplish the tracking function of dynamic feedback control system.



### OS 8-8 Maximal power point tracking technology for the solar photovoltaic battery based on model predictive control

Xia Zhao, Huailin Zhao (Shanghai Institute of Technology, P.R. China)

The solar photovoltaic battery is a new type of renewable distributed energy. Its output power is directly affected by light intensity and the temperature, and its voltage-current characteristic has the obvious nonlinear feature. In order to improve the energy conversion efficiency of the photovoltaic system, it's very significant to study the effective control algorithm's realization on the maximal power point tracking (MPPT) control. A new MPPT technology based on model predictive control (MPC) is proposed. The proposed method is developed to control the output current of a boost converter in order to extract the maximal solar power from the photovoltaic panel.



### OS 8-9 Analysis and unidirectionally coupled synchronization of a novel chaotic system

Li Xue, Xue Wei (Tianjin University of Science and Technology, P.R. China)

In this paper, a new three-dimensional autonomous chaotic system is proposed. By means of theoretical analysis and numerical simulation, some basic dynamical properties, such as equilibrium points, fractal dimension, Lyapunov exponent spectrum and chaotic dynamical behaviors of the new chaotic system are investigated. The obtained results show clearly that this system is a new chaotic system. Furthermore, based on Lyapunov stability theory of the system, we observe unidirectionally coupled synchronization of the new three-dimensional chaotic system through designing the appropriate coupling coefficient. Results of numerical simulation illustrate the effectiveness of the presented synchronization scheme.

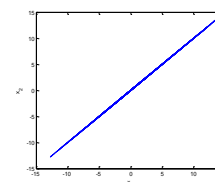


Fig.curve of state variable  $(x_1, y_1)$

## OS9 Modern approaches of MOT and Corporate Strategy (3)

### OS9-1 A Study on the Structural Hole of Patent Applicant Network in R&D Management

<sup>1</sup>Iori Nakaoka, <sup>2</sup>Yousin Park, <sup>3</sup>Yun-ju Chen (<sup>1</sup>National Institute of Technology, Ube College, <sup>2</sup>Prefectural University of Hiroshima, <sup>3</sup>Shiga University, Japan)

The arrangement of R&D staff refers to the issue of the linkage between structural holes in a network (Burt, 2003). In order to examine the linkages between multiple R&D projects in a company, we use the patent information as the index of R&D capability and examine our propositions by social network analysis. In this paper we focus on top-shared companies in Japanese cosmetics industry, and suppose that these companies keep their market shares due to their smoothly changes of business fields to cope with the threat of new entrants from other industries. The analysis in this paper include: 1) calculate the betweenness centrality, and create heat-maps to visualize the change of the betweenness centrality, 2) examine the structure hole.

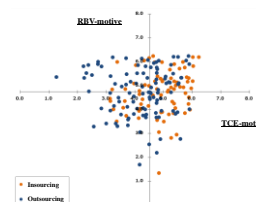


### OS9-2 The TCE-RBV framework for information systems outsourcing: Empirical testing using survey data in Japan

Seigo Matsuno<sup>1</sup>, Tsutomu Ito<sup>2</sup>, Yasuo Uchida<sup>1</sup>, Y. Mikami<sup>3</sup>, Takao Ito<sup>4</sup>

(<sup>1</sup>National Institute of Technology, Ube College, <sup>2</sup>Hino Motors, Ltd., <sup>3</sup>Nagaoka University of Technology, <sup>4</sup>Hiroshima University, Japan)

This paper investigates the factors that influence the motives of make-or-buy decisions on information systems from the viewpoints of Transaction Cost Economics (TCE) and the Resource-based View (RBV). Using our original questionnaire survey data carried out in 2007 targeting Japanese firms, we analyze the relationships between the recognition related to the role of their information systems and the pattern of their make-or-buy decisions. As a result, we make it clear that there are two cases in which TCE-motive and RBV-motive are complement or contradict with each other. And in latter case, TCE-motive tends to dominate over RBV-motive. Finally, The implications for theory and practice are discussed.



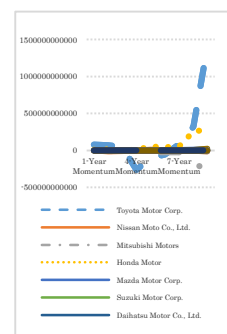
### OS9-3 Momentum and its Implications in Corporate Management

Tsutomu Ito<sup>1</sup>, Takao Ito<sup>1</sup>, Rajiv Mehta<sup>2</sup>, Sakamoto Makoto<sup>3</sup>, Katsuhiko Takahashi<sup>1</sup>, Katsumi Morikawa<sup>1</sup>

(<sup>1</sup>Hiroshima University <sup>3</sup>Miyazaki University, Japan)

(<sup>2</sup>New Jersey Institute of Technology, USA)

In contrasting conventional theses with current strategic theories, discussions on momentum, an important concepts, have been sparse, although in the context of current management strategies the pivotal nature of momentum recently has been operationalized and discussed in research on marketing, and finance. The current manuscript reviews the literature associated with corporate strategy, and proposes a new approach of acceleration to measure momentum based on limited cycle theory. Thus, this research manuscript makes a contribution to extant thought by: (1) Defining momentum, (2) Discussing the nature of the relationship between momentum to its external environment, and company scale, 3) Ascertaining the momentum period, and 4) Proposing a four-cell model composed of momentum and company scales for judging a firm position. Additionally, the relationship between momentum and the impact of the 2007-2008 financial crises is addressed. Based on the findings, the study limitations are identified and directions for further research are suggested.

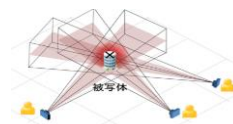


## OS10 Reality Mining (3)

### OS10-1 Fast collective photographic subject detection without pixels by an assumption about a shot and its elevation angle

Sora Tanioka, Masao Kubo, Hiroshi Sato  
(National Defense Academy of Japan, Japan)

In this paper, we propose a collective intelligence to discover photographic subjects without pixel information. A collection of information about shooting, for example, EXIF, Geotag, and Tiff which is automatically attached into a digital photograph is only used for this detection. So far we have to use a large number of such the not-pixel information for this task because the original model of taking a photo is not efficient. In this paper, we estimate the improvement of the performance to discover subject if there is a relation between a shot and its elevation angle of the camera.



### OS10-2 Evaluation of a safety map generated from a collection of difference of Individuals

Masao Kubo, Dang Viet-Chau, Hiroshi Sato, Akira Namatame  
(National Defense Academy of Japan, Japan)

In this paper, we propose a collective intelligence approach to generate safety maps of road environment from a collection of logs of vehicle behavior recorded by drivers' smartphone. Usually a general collective intelligence uses the average of the data and it is difficult to apply it for complex problems. This paper proposes a reasonable method for generation of safety maps to evaluate the difference of the behavior. The accuracy of the map is evaluated by official accident record



### OS10-3 Endeavor to adopt GIS data on evacuation decision making model

<sup>1</sup>Saori Iwanaga, <sup>2</sup>Akira Namatame  
(<sup>1</sup>Japan Coast Guard Academy, <sup>2</sup>National Defense Academy of Japan, Japan)

By Multi Agent Simulation: MAS, we focused on contagion of evacuation decision making on real map assuming that not all people evacuate at the time of disaster. Then, we found that for contagion of evacuation decision making, local neighborhood is needed and connection of sub network is needed. But, there we faced on difficulty of obtaining realistic population data on map, because Census Bureau data consists of not position data but numbers and properties. In this paper, we attempt to use geographic information system GIS data and population data, then we simulate of population with heterogeneous agents and their decision making.



## OS11 Kansei Engineering and Application (4)

### OS11-1 Automated Multiple-Brightness Peak Image Processing Method Using Curvature and Variance Estimation

<sup>1</sup>Yusuke Kawakami, <sup>2</sup>Tetsuo Hattori, <sup>2</sup>Yoshiro Imai, <sup>2</sup>Kazuaki Ando, <sup>2</sup>Yo Horikawa (<sup>1</sup>DynaxT Co., Ltd., <sup>2</sup>Kagawa University, Japan) <sup>3</sup>R. P. C. Janaka Rajapakse (<sup>3</sup>Tainan National University of the Arts, Taiwan)

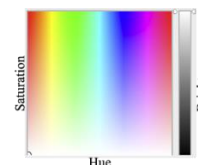
This paper describes the improvement method for the image which have multiple-brightness peak using Histogram Matching based on the Gaussian Distribution (HMGD). The previous papers, we have illustrated that the HMGD is an automated image processing method for improve feeling impression better, through the comparative investigation results of feeling impression among the original image, Histogram Equalization image, and HMGD image. However, the multiple-brightness peak images have been hard to improve using the previous HMGD. In this paper, we propose the processing method of HMGD to correspond image which have multiple-brightness peak, using curvature computation and variance estimation.



## OS11-2 Histogram Matching Based on Gaussian Distribution on the HSB Color System

<sup>1</sup>Yusuke Kawakami, <sup>2</sup>Tetsuo Hattori, <sup>2</sup>Yoshiro Imai, <sup>2</sup>Kazuaki Ando, <sup>2</sup>Yo Horikawa (<sup>1</sup>DynaxT Co., Ltd., <sup>2</sup>Kagawa University, Japan) <sup>3</sup>R. P. C. Janaka Rajapakse (<sup>3</sup>Tainan National University of the Arts, Taiwan)

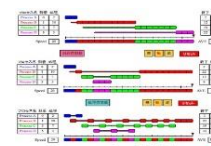
This paper proposes Histogram Matching based on Gaussian Distribution (HMGD) processing on the HSB color system which is close to the human visual property. In the previous paper, we have proposed HMGD processing on the brightness axis which is calculated from RGB color system. And we have considered that HSB color system is more suitable for HMGD processing, because it contains brightness axis. In this paper, we describe how to transform the color image from RGB color system into HSB color system first. Second, we describe that the principal of HMGD on this color system. And then, we also explain how to re-transform HSB color system to RGB color system.



## OS11-3 Quantitative Evaluation of Flash-based Educational Visualizing Simulator

Kei Takeichi, Yoshiro Imai, Kazuaki Ando, Yusuke Kawakami, Tetsuo Hattori  
(Kagawa University, Japan)

A Flash-based simulator of CPU scheduling has been developed and utilized for educational visualization in the class of university lecture. We have designed and implemented it with Flash-based scripting language in order to execute it as a stand-alone application as well as in various browsing environment such as Microsoft IE, Google Chrome and/or FireFox (Mozilla). Based on questionnaire for our simulator in the lecture, its quantitative evaluation has been carried out by means of statistical analysis. Our report describes overview of our Flash-based simulator and the results of the above quantitative evaluation.



## OS11-4 Relation between Optimal Stopping Solution and NSPR for Structural Change Point Detection Problem

Tetsuo Hattori, Yoshihide Koyama, Yoshiro Imai, Yo Horikawa, Hiromichi Kawano<sup>1</sup>  
(Kagawa University, <sup>1</sup>NTT advanced technology Company Ltd, Japan)

Previously, we have proposed a novel method using New Sequential Probability Ratio (NSPR) for the structural change point detection (SCPD) of ongoing time series data instead of using SPRT (Sequential Probability Ratio Test). Moreover, we have formulated the SCPD problem in time series data as an Optimal Stopping one using the concept of DP (Dynamic Programming) and also have shown the solution theorem in the form of Inequality. In this paper, we discuss the relation between the solution of Optimal Stopping and NSPR for the SCPD Problem.

*Optimal Solution*

$$a < (A + a) \cdot P(\bar{S}_n | S^{n-1})$$

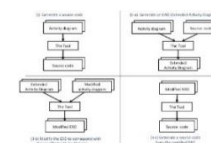
$$NSPR = \frac{P(H_1 | S^n)}{P(H_0 | S^n)} < \frac{\left(\frac{A}{A+a}\right)^{-R}}{R_c - \left(\frac{A}{A+a}\right)}$$

## OS12 Advanced Research on Computer Science and Information Processing (4)

### OS12-1 Development of a Tool to Keep Consistency between a Model and a Source Code in Software Development Using MDA.

Yuuki Kikkawa<sup>1</sup>, Tetsuro Katayama<sup>1</sup>, Yoshihiro Kita<sup>2</sup>, Hisaaki Yamaba<sup>1</sup>, Kentaro Aburada<sup>3</sup>,  
Naonobu Okazaki<sup>1</sup> (<sup>1</sup>University of Miyazaki, <sup>2</sup>Tokyo University of Technology,  
<sup>3</sup>Oita National College of Technology, Japan)

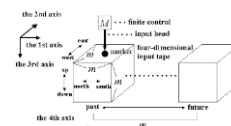
This study improves efficiency of software development using MDA. This paper develops the tool that keeps consistency between a model and a source code in software development using MDA. The tool has two functions: (i) Generating a source code and (ii) Keeping consistency between a model and a source code. Inputs of (ii) are an unmodified activity diagram, the modified activity diagram, and the source code including the detail specification. An output of (ii) is a source code which is consistent with the modified activity diagram and includes the detail specification. In executing (ii), the tool generates EAD (Extended Activity Diagram) as intermediate data.



### OS12-2 Necessary spaces for seven-way four-dimensional Turing machines to simulate four-dimensional one-marker automata

Makoto Nagatomo<sup>1</sup>, Shinnosuke Yano<sup>1</sup>, Makoto Sakamoto<sup>1</sup>, Satoshi Ikeda<sup>1</sup>, Takao Ito<sup>2</sup>,  
 Tsutomu Ito<sup>2</sup>, Yasuo Uchida<sup>3</sup>, Tsunehiro Yoshinaga<sup>4</sup>, Hiroshi Furutani<sup>1</sup> (<sup>1</sup>University of Miyazaki,  
<sup>2</sup>Hiroshima University, <sup>3</sup>Ube National College of Technology, <sup>4</sup>Tokuyama College of Technology, Japan)

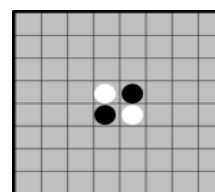
We think that recently, due to the advances in many application areas such as motion image processing, computer animation, and so on, it is very useful for analyzing computational complexity of multi-dimensional information processing to explicate the properties of four-dimensional automata, i.e., three-dimensional automata with the time axis. As far as we know, there is no investigation about four-dimensional automata. Then, in 2002, we first introduced four-dimensional finite automata in the world. In 2003, we investigated four-dimensional alternating Turing machines. In 2015, we show the sufficient spaces for four-dimensional Turing machines to simulate four-dimensional one-marker automata. In this paper, we continue the investigations, and deal with the necessary spaces for four-dimensional Turing machines to simulate four-dimensional one-marker automata.



### OS12-3 Analysis for 4×12 board of Othello

Yuki Takeshita<sup>1</sup>, Satoshi Ikeda<sup>1</sup>, Makoto Sakamoto<sup>1</sup>, Takao Ito<sup>2</sup>  
 (<sup>1</sup>Miyazaki University, <sup>2</sup>Hiroshima University, Japan)

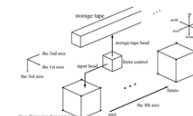
More than 20 years has passed since J. Feinstein (1993) found that a perfect play on 6×6 board of Othello gives a 16-20 win for the second player. A computer Othello surpasses a much more human now. However, standard 8×8 board remain unsolved. In our previous paper, we were able to obtain the perfect plays on 6×6 board and 4×10 board. In this paper, we challenge the unsolved problem of 4×12 board by dividing it into about 150 small problem.



### OS12-4 A space lower-bound technique for four-dimensional alternating Turing machines

Makoto Nagatomo<sup>1</sup>, Shinnosuke Yano<sup>1</sup>, Makoto Sakamoto<sup>1</sup>, Satoshi Ikeda<sup>1</sup>, Takao Ito<sup>2</sup>,  
 Tsutomu Ito<sup>2</sup>, Yasuo Uchida<sup>3</sup>, Tsunehiro Yoshinaga<sup>4</sup>, Hiroshi Furutani<sup>1</sup> (<sup>1</sup>University of Miyazaki,  
<sup>2</sup>Hiroshima University, <sup>3</sup>Ube National College of Technology, <sup>4</sup>Tokuyama College of Technology, Japan)

Alternating Turing machines were introduced in 1981 as a generalization of nondeterministic Turing machines and as a mechanism to model parallel computation. On the other hand, we have no enough techniques which we can show that some concrete four-dimensional language is not accepted by any space-bounded four-dimensional alternating Turing machines. The main purpose of this paper is to present a technique which we can show that some four-dimensional language is not accepted by any space-bounded four-dimensional alternating Turing machines. Concretely speaking, we show that the set of all four-dimensional input tapes over {0,1}, which each top half part is equal to each bottom half part, is not accepted by any L(m) space-bounded four-dimensional alternating Turing machines for any function L(m) smaller than log m.



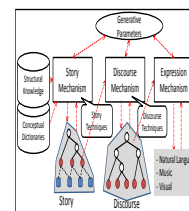


## OS 13 Automatic Generation, Creation, and Production of Narrative Contents (4)

### OS13-1 Automatic Generation, Creativity, and Production of Narrative Contents

Takashi Ogata (Iwate Prefectural University, Japan)

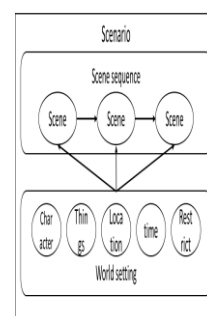
According to the concept of this organized session, in this presentation, we will consider the study of automatic narrative or story generation as a research field of artificial intelligence in the following levels: generation, creation, and production. At first, we study the technologies of narrative or story generation systems based on mainly artificial intelligence and cognitive science. Next, the artistic and aesthetic problems of narrative creation are considered in the relationships with the technologies and systems of narrative generation. Further, issues toward organizational or social narrative production are presented. These survey and discussion will be done based on some topics in this session relating to a game and advertising systems and our integrated narrative generation system.



### OS13-2 A Design Plan of a Game System including an Automatic Narrative Generation Mechanism: The Entire Structure and the World Settings

Jumpei Ono, Takashi Ogata (Iwate Prefectural University, Japan)

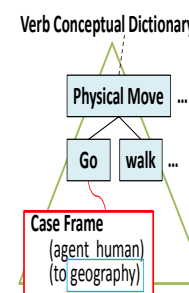
We present a plan of a narrative generation system based on a scenario generation method in tabletop role-playing games (TRPGs). It uses an integrated narrative generation system (INGGS) that synthesizes various narrative generation mechanisms. A TRPG is an analog game in which one or more player (PL) play each role as characters in a framework of narrative by the game master (GM). A PL promotes the development of scenes, and, as a result, a narrative is completed. In particular, we concentrate on the “world setting” that has a role of rules or constricts in narrative and consists of components defined by its rule and the stage setting of the narrative. In the ordinary use, a GM sets a basic world setting to guide generation through the interaction between PLs. We consider preliminarily prepared scripts corresponding to various world settings in addition to the detailed mechanism for the use it.



### OS13-3 A Way for using the Verb Conceptual Dictionary in an Integrated Narrative Generation System: Focusing on the use of Co-occurrence Information on the Verb Concepts

Takashi Ogata, Jumpei Ono (Iwate Prefectural University, Japan)

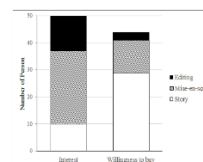
This paper presents a way for selecting verb concepts based on the analysis of co-occurrence information of verb words in the data of modern Japanese novels (“Aozora Bunko”). The proposed method will be incorporated into some mechanisms in an integrated narrative generation system (INGGS) that synthesizes various mechanisms for narrative generation that we have been developing. We show an overview of INGS, in particular the mechanism relating to the proposed method in this paper. In the verb conceptual dictionary, as verb concepts of a variety of difficulty or understandability are mixed, the objective in this paper is to adjust the usage by using co-occurrence information on verb concepts. Our hypothesis is that the original concepts of co-occurrence and the resulted concepts have a proportional relation. We will investigate it by incorporating the mechanism into the INGS.



## OS13-4 A Viewing Experiment on the Effects of Advertising Story

Yoji Kawamura (Kinki University, Japan)

This research lays out the conception and functions of developed Commercial Film Production Support System (CFPSS). The research then explains the results of a viewing experiment that utilized CFPSS. In this experiment where commercial films of beer were utilized, the following findings were obtained: in inducing interest, the evaluation of image type of advertising story is high; in stimulating willingness to buy, the evaluation of provider type is high; and mise-en-scène or editing attracts interest and the advertising story associated with product function and the supporting production and distribution stimulates willingness to buy. These findings gradually clarify the following creative know-how of the creator; to attract consumer interests by focusing on the stories of consumer situations in case consumers do not aware or understand their products or services; to arouse their willingness to buy by focusing on the products and stories of their acceptance and effects in case consumers have a certain level of understanding and interests in products or services.



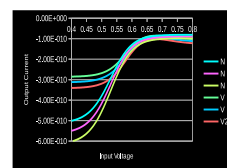
## GS abstracts

### GS1 Neuromorphic Systems (5)

#### GS1-1 Compensating Temperature-Dependent Characteristics of a Subthreshold-MOSFET Analog Silicon Neuron

Ethan Green, Takashi Kohno (The University of Tokyo, Japan)

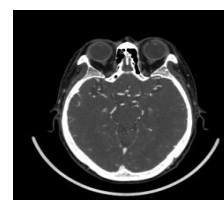
Analog silicon neurons are neuro-mimetic VLSI (very-large-scale-integrated) circuits that replicate the electrophysiological behavior of animal nerve tissue. These circuits send and receive spike trains in continuous time and require minimal power. This research focuses on the temperature sensitivity of a subthreshold-MOSFET silicon neuron. Subthreshold operation of CMOS transistors allows for low power consumption and desirable current-voltage characteristics, but is also drastically sensitive to temperature changes. This critical issue must be addressed before these circuits can be implemented into massive networks to develop future technologies, which could include neuromorphic computers, artificial brains, brain-machine-interfaces, and ultra-low power computing platforms.



#### GS1-2 Medical image analysis of brain X-ray CT images by deep GMDH-type neural network

Tadashi Kondo, Junji Ueno, Shoichiro Takao (Tokushima University, Japan)

In this study, the deep Group Method of Data Handling (GMDH)-type neural network is applied to medical image analysis of brain X-ray CT images. The deep GMDH-type neural network algorithm can automatically organize the deep neural network architecture which has many hidden layers, using the heuristic self-organization method which is a type of evolutionary computations. This algorithm is applied to the medical image analysis of brain X-ray CT images. The deep neural network is automatically organized from brain X-ray CT images and recognizes and extracts the brain, bone and blood vessels regions in the brain images.



### GS1-3 Medical image diagnosis of lung cancer by deep feedback GMDH-type neural network

Tadashi Kondo, Junji Ueno, Shoichiro Takao (Tokushima University, Japan)

The deep feedback Group Method of Data Handling (GMDH)-type neural network is applied to the medical image diagnosis of lung cancer. The deep feedback GMDH-type neural network has feedback loops and the complexity of the neural network architecture is increased by feedback loop calculations. Each feedback loop is constructed with the three layers which are the input, hidden and output layers. This deep feedback GMDH-type neural network is applied to the medical image diagnosis of lung cancer and the deep neural network which can recognize and extract the lung cancer and blood vessel regions, is automatically organized from the chest X-ray CT images.



### GS1-4 Feature Linking by Synchronized Response in Chaotic Cellular Neural Network for Visual Stimulus of Moving Objects

Akihiro Yamaguchi<sup>1</sup>, Satoshi Arakane<sup>1</sup>, Masao Kubo<sup>2</sup>

(<sup>1</sup>Fukuoka Institute of Technology, <sup>2</sup>National Defense Academy of Japan, Japan)

A feature linking mechanism by the synchronized response of neural assemblies was studied for the chaotic cellular neural network (Chaotic-CNN). The Chaotic-CNN consists of chaotic spike response neurons that show the chaotic inter-spike-interval dynamics. In our scheme of feature linking, the features of the target objects are linked by the synchronized spike responses that are characterized by the temporal chaotic pattern of spike sequence. In this paper, we analyzed the synchronized spike responses that are invoked by the visual stimulus of moving bars. As a result, neural assemblies have higher correlation for the visual stimulus of moving two bars with the same direction (Fig.1 (a)) than the opposite direction (Fig.1 (b)). Then we discussed a possibility of feature linking by the chaotic synchronized response in the view point of neural coding.

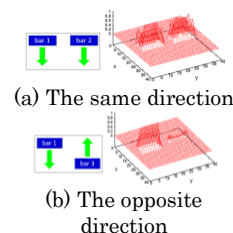
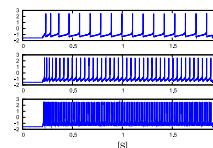


Fig.1 Correlation of neural assemblies

### GS1-5 An FPGA-based cortical and thalamic silicon neuronal network.

Takuya Nanami, Takashi Kohno (The University of Tokyo, Japan)

A DSSN model is a neuron model which is designed to be implemented efficiently by digital arithmetic circuit. In our previous study, we expanded this model to support the neuronal activities of cortical and thalamic neurons. They are regular spiking, fast spiking, intrinsically bursting and low-threshold spike. In this paper, we report our implementation of the expanded DSSN model and kinetic-model-based silicon synapses on a Xilinx / Spartan -6 LX45 FPGA. Here, synaptic efficacy was stored in block RAMs. The DSP modules integrated on the FPGA chip were utilized to facilitate efficiency in implementation of multiplication in the DSSN model.





## GS2 Pattern Recognition & Image Processing (6)

### GS2-1 An accurate method for the extraction of structured light stripe

Jiwu Wang<sup>1</sup>, Yaodong Li<sup>1</sup>, Zhijing Jian<sup>1</sup>, Sugisaka Masanori<sup>2</sup>  
(<sup>1</sup>Beijing Jiaotong University, P.R. China), (<sup>2</sup>Alife Robotics Corporation Ltd, Japan)

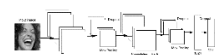
In order to obtain the highest measurement accuracy in the On-line measurement of rail profile with a line structured light based on machine vision, the extraction of structured light stripe is a necessary step. An accurate extraction method is proposed for the structural light stripe extraction in practical applications. The noise in the captured image can be removed with region segmentation method. The structured light stripe is separated and extracted accurately based on the characteristics of the structure light stripe in the binary image. The method was verified in laboratory conditions. Experiment results show that the method can effectively solve the problem of real-time and accurate extraction of structured light stripe.



### GS2-2 Feature Acquisition From Facial Expression Image Using Convolutional Neural Networks

Taiki Nishime, Satoshi Endo, Koji Yamada, Naruaki Toma, Yuhei Akamine  
(University of The Ryukyus, Japan)

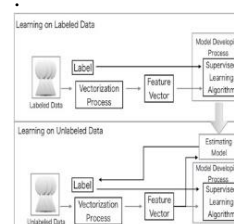
In this study, we carried out the emotion acquisition from facial expression image using a Deep Neural Networks(DNN). Emotions we focused on are "happiness", "sadness", "surprise", "anger", "disgust", "fear" and "neutral". By using Convolutional Neural Networks(CNN) approaches, we have obtained an average emotion recognition score of 58%; two emotions (happiness, surprise) recognition score was about 70%. This result was the same tendency as preliminary experiment of human recognition. From CNN model after training, specific unit were confirmed to be learning the feature about happiness. The results corroborate that CNNs work effectively for learning facial expression about happiness, surprise representations.



### GS2-3 Estimating Age on Twitter Using Self-Training Semi-Supervised SVM

Tatsuyuki Iju, Satoshi Endo, Koji Yamada, Naruaki Toma, Yuhei Akamine  
(University of The Ryukyus, Japan)

Most recent researches for estimating Twitter user's latent attributes are concerned with making attribute estimator from only user tweets with one's profile known, that is, ground truth data. However, it tends to be high cost to collect enough amount of ground truth data to provide estimator. In our study, we employ SVM with self-training, with words in tweets used as features, in order to reduce the cost of collecting data. We carry out some parameter surveys to investigate how these parameters affect performance of classifier. We utilize predict-probability of LIBSVM package as a threshold to determine which of unlabeled users to be labeled during self-training. At last, we evaluate the classifier for parameters which are found to be the best on parameter surveys.



## **GS2-4 Interactive musical editing system to support human errors and offer personal preferences for an automatic piano**

Kenji Tsunenari, Eiji Hayashi (Kyushu Institute of Technology, Japan)

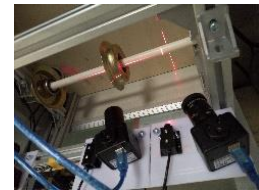
Recently, electronic musical instruments are achieving progress for development of electronics and seen everywhere. However, their sound quality and ambience are inferior to real musical instruments. Therefore, we developed automatic piano by using grand piano. Pre-edit is needed to play music in the manner of a live pianist. In the case of piano music, there are often 1000 or more notes in the score of even a short piece of music, requiring that an editor spend a huge amount of time to accurately simulate the emotionally expressive performance of a highly skilled pianist. Therefore, we have developed an interactive musical editing system that utilizes a database to edit music more efficiently.



## **GS2-5 Geometric parameters measurement of wheel tread based on line structured light**

Jiwu Wang<sup>1</sup>, Zhijing Jian<sup>1</sup>, Yaodong Li<sup>1</sup>, Chao Yang<sup>1</sup>, Sugisaka Masanori<sup>2</sup>  
(<sup>1</sup>Beijing Jiaotong University, China), (<sup>2</sup>Alife Robotics Corporation Ltd, Japan)

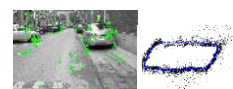
The positioning precision is important in the processing of geometric parameters measurement technology of wheel tread. In this paper, a new method with non-contact measurement based on line structured light is given to solve this problem. Here traditional mechanical locating method is used as a rough reference. Moreover, some digital image processing techniques are developed for each of the key dimensions of measurement. According to the feature points (particularly, the key points that have not been worn) and lines extracted effectively on the wheel tread, precise positioning is realized. In this paper, the experiments show that the proposed method is feasible and excellent to design and implement non-contact measurement of the wheel tread, wheel flange thickness and rim width. It also ensures the accuracy of positioning and analyses the factors of measurement error.



## **GS2-6 Study on the ORB algorithm in the application of Monocular SLAM**

Jiwu Wang<sup>1</sup>, Shunkai Zheng<sup>1</sup>, Masanori Sugisaka<sup>2</sup>  
(<sup>1</sup>Beijing Jiaotong University, P.R. China) (<sup>2</sup>Alife Robotics Corporation Ltd, Japan)

In view of reducing the accumulative error, we perform loop closing (detection + correction) based on PTAM in our Monocular SLAM. As this method relies on extracting natural environment features, we chose ORB algorithm as the feature extraction and matching. We demonstrate that ORB features have enough recognition power to enable place recognition from severe viewpoint change and they are so fast to extract and match (without needing multi-threading or GPU acceleration) that enable real time accurate tracking and mapping. Through outdoor scene experiment, we validate the algorithm performance.

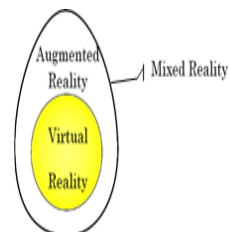


## GS3 Reinforcement Learning System & Genetic Programing (5)

### GS3-1 Examination of Robotic Aerospace Engines Maintenance Supported by Augmented Reality through Cloud Manufacturing

Mosab Alrashed, Yaser Yadekar, John Ahmet Erkoyuncu, Yifan Zhao (Cranfield University, UK)

This Paper aims to develop a demonstration using a mobile device to apply augmented reality to allow remote maintenance activities. This research was focused primarily on the aerospace industry studies as there was a research gap as there are few relevant researches in the manufacturing field and accepted industry needs. The targets were achieved by developing and designing controls in the engineering steps to create the optimum conditions for augmented reality. The design process pursued in four stages: first, research the current practice of using augmented reality remotely in manufacturing maintenance; second, classify maintenance remote assisting problems and weakness in augmented reality; third, design and develop software and hardware, depending on the case study for a prototype solution to remote maintenance enhanced by the augmented reality that can be demonstrated and tested; finally, validate the developed software and demonstration using industrial experts and authentic reports.



### GS3-2 Unit Layout Design Supporting System of Cell Assembly Machine Using Two Robots by Reinforcement Learning

Yusaku Ikai, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)

In this study, we explain the development of Design Supporting System for Cell Assembly Machine System (CAMS) which systemize the decision of the unit layout that compose the assembly machine using two robots. CAMS uses Profit Sharing which is one of the Reinforcement Learning methods, determining each units layout. Profit Sharing is performed by the following flow: (1) The units layout is determined by Roulette Selection, (2) The one cycle work time of the robot is calculated to evaluate the unit layout, (3) If the evaluation is good, the units layout is given rewards. Efficient units layout is decided by the number of regulation times repeating the flow 1-3. We apply CAMS to assembly of the Differential which is automotive parts to verify its validity.



### GS3-3 Virtual Input Parts Decision System of Job-Shop Production Line by using GA with ON / OFF Gene

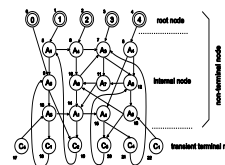
Junji Ito, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)

We propose the simulator to decide the best parts input order. We call this simulator as Virtual Input Parts Decision by ON/OFF Genes (VIPDOG). VIPDOG has 2 configuration systems as follows: 1) The parts order decision system to indicate the parts input and processing orders of a job shop production line. 2) The virtual production system that performs the visualization of the working environments acquired by VIPDOG. The virtual production system can check what will happen in the future and some experienced engineers can discuss the problems to solve them.



### GS3-4 An Evolutionary Algorithm for Making Decision Graphs for Classification Problems Shingo Mabu, Masanao Obayashi, Takashi Kuremoto (Yamaguchi University, Japan)

Classification is one of the major research in pattern recognition and a large number of methods have been proposed such as decision trees, neural networks (NNs), support vector machines (SVMs). In order to easily understand and analyze the reason of the classification results, decision trees are useful comparing to NNs and SVMs although these methods have shown distinguished classification abilities. In this paper, to enhance the classification ability of decision trees, a new evolutionary algorithm for creating decision graphs is proposed, where multi-root nodes, unique genetic operators and majority voting mechanism based on Maximum a posteriori are introduced. In the performance evaluation, it is clarified that the proposed method shows better classification ability than decision trees.



### GS3-5 Improvement of Computational Efficiency of UPF by Automatic Adjustment of the Number of Particles

Kenta Hidaka, Takuo Suzuki, Kunikazu Kobayashi (Aichi Prefectural University, Japan)

In RoboCup Standard Platform League (SPL), the method using unscented particle filter (UPF) has been proposed for self-localization.

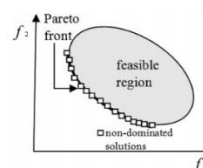
The UPF resolves a problem of particle filter (PF) which cannot be sampled appropriately when the likelihood is too high or low. It is also applicable to the kidnapping problem. The filter can estimate the precise position if the number of particles is large enough but the computational cost may also increase in proportion to the number of particles. In the present paper, we propose an automatic adjustment method for the number of particles in UPF using the variance of distances between the position of a particle and the average position of all the particles and the absolute error between the position of a particle and the correct position of robot. Through computer simulations, we confirmed the improvement of computational efficiency of UPF.



### GS3-6 Multi Objective Evolutionary Algorithms for Association Rule Mining: Advances and Challenges

Aswini Kumar Patra (North Eastern Regional Institute of Science & Technology, India)

Association rule mining, one of the most important and well researched techniques of data mining. The challenge, posed by most of the association rule mining methods, is the amount of time consumed for generating frequent items sets. To overcome this evolutionary algorithms have been used widely. Moreover, apart from support and confidence, there are many other metrics available to measure the quality of association rules. That is the reason why multi-objective approach plays a crucial role. Therefore, two methodologies namely, multi-objective and evolutionary algorithms as a combination proved to be a preferred choice. Though numerous works have been proposed for mining association rules, use of multi-objective evolutionary algorithms are still in its infancy stage. This paper explores the challenges and advances that has been made in this regard in terms of nature of algorithm, encoding mechanism, objective functions and operators.

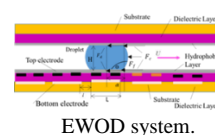


## GS4 Micro-Machine (4)+GS9 Robotics III(4)

### GS4-1 Applying Fuzzy Sliding Mode Control on Electrowetting on Dielectric System

<sup>1</sup>Arsit Boonyaprapasorn, <sup>2</sup>Thavida Maneewarn, <sup>2</sup>Eakkachai Pengwang (<sup>1</sup>Chulachomklao Royal Military Academy, <sup>2</sup>King Mongkut's University of Technology Thonburi, Thailand)

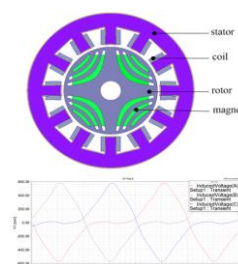
In Lab-on-a-chip (LOC) devices, an electrowetting on dielectric (EWOD) method can be performed to create, cut, mix, and transport droplets. Moreover, the micro assembly process of micro parts can be manipulated by the EWOD system. High accuracy of droplet motion in both applications is required. Based on the simplified model, the feedback control such as sliding mode control can be applied so that the droplet motion can achieve a high accuracy performance under disturbances. However, the sliding mode control often has chattering problem. Thus, in this study, the fuzzy sliding mode control was applied to manipulate the droplet in the EWOD system. The study was conducted via simulation in MATLAB environment. The result showed that the proposed control method could provide an accurate motion control with lower chattering compared to that of classical sliding mode control.



### GS4-2 Development of Micro-Permanent Magnet Synchronous Reluctance Generator for TPMS on Smart Robots

<sup>1</sup>Chun-Chieh Chang, <sup>1</sup>Cheng-Tang Pan, <sup>1</sup>Shao-Yu Wang, <sup>1</sup>An-Yun Yang, <sup>1</sup>Gu-Xuan Lin, <sup>2</sup>Roger Chenglung Lee, <sup>2</sup>Ting-Hung Chung, <sup>1</sup>Yu-Jen Wang (<sup>1</sup>National Sun Yat-sen University, <sup>2</sup>Naroller Electronics, Taiwan)

Synchronous Reluctance Generator (SynRG) is a high-functioning and robust motor with simple structure and low cost. In this study, the rotor was embedded magnet and developed with a miniature size of permanent magnet generators, which can be applied to the tire pressure monitoring system (TPMS) on the smart robots. The SynRG was studied for voltage producing to achieve sufficient power for TPMS. The experiment focuses on the specific winding distribution, such as distributed winding or concentrated winding, and the number of stator slots per phase. On the other hand, the structural design of the generator focuses on the magnet configuration, the rotor structure, and working air gap to optimize the parameters. In addition, the generator was considered with a different rotational speeds and the rotor resistances. High power output, stable voltage waveform, and torque ripple were analyzed to determine the generator. In the selection of the magnetic materials, ferrite magnet was selected which has the advantage of lower-cost. Finite element method (FEM) is used to simulate the magnetic properties of the generator. The optimized design of SynRG in this study was centralized distribution of windings, ratio 12/4 of the slot and pole, 500-1200 rpm of the rotation speed and 5 mm of lamination thickness, 50 mm of outer diameter of the stator. The results indicate that the generating capacity of 2.3 V can be achieved.

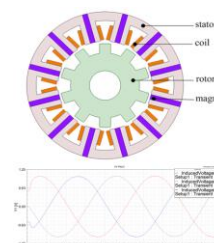




### GS4-3 Study of Micro-Flux-Switching Permanent-Magnet Generator for TPMS on Smart Robots

<sup>1</sup>An-Yun Yang, <sup>1</sup>Cheng-Tang Pan, <sup>1</sup>Shao-Yu Wang, <sup>1</sup>Chun-Chieh Chang, <sup>1</sup>Gu-Xuan Lin, <sup>2</sup>Roger Chenglung Lee, <sup>2</sup>Ting-Hung Chung, <sup>1</sup>Yu-Jen Wang (<sup>1</sup>National Sun Yat-sen University, <sup>2</sup>Naroller Electronics, Taiwan)

Flux-Switching Permanent-Magnet Generator (FSPMG) is of high flux density and high efficiency due to its double salient structures. This study presents a micro FSPMG which can be applied to tire pressure monitoring system (TPMS) on the smart robots. To design a micro FSPMG, we tested the slot-pole ratio to find out an optimal voltage output. This steady rotation generator with high generating capacity and low torque ripple was obtained by optimizing the design of air gap, arc ratio and salient ratio with different rotation speeds. In this paper, we used finite element method (FEM) to simulate the magnetic properties of generator and the voltage output. The magnetic material used in this study was ferrite magnet which has the advantage of lower-cost. The design of FSPMG in this study was ratio 12/10 of the slot and pole, 500-1200 rpm of the rotation speed and 5 mm of lamination thickness, 50 mm of outer diameter of the stator. The results indicate that the generating capacity achieves to 3.4 V where the air gap is the main factor to affect this generator.



### GS4-4 MEMS Microrobot Controlled by Mounted Neural Networks IC with Two Types Actuators

Kei Iwata, Hirozumi Oku, Yuki Okane, Yohei Asano, Masaki Tatani, Yuki Ishihara, Kazuki Sugita, Satohiro Chiba, Satoko Ono, Mizuki Abe, Minami Takato, Ken Saito, Fumio Uchikoba (Nihon University, Japan)

We report the hexapod microrobot controlled by the hardware neural networks. MEMS (Micro Electro Mechanical System) was used for fabrication of the microrobot. Hexapod walking of microrobots that mimics such motion of ants is realized by link mechanisms. Actuators of the robots can be classified as piezoelectric (PZT) type and shape memory alloy (SMA) type. The rotation of PZT actuator is generated by the impact head attached to the piezoelectric element. On the other hand, rotation of SMA actuator is generated by shrinkage of SMA from four directions. The microrobots are controlled by the bare chip IC of hardware neural networks. As the result, PZT type microrobot was realized the walking motion by bare chip IC. Moreover, SMA type microrobot could be systemsral networks. The walking speed was 2.4mm / min and the step width was 0.083mm.

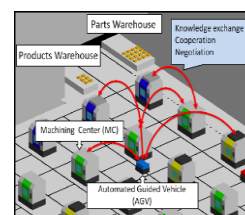


### GS5 Multi-Agents Systems & Visualization

#### GS5-1 Moving Robots Lies and Their Minds with Degree of Confidence in a Decentralized Autonomous FMS

Shizuka Tanaka, Hidehiko Yamamoto, Takayoshi Yamada (Gifu University, Japan)

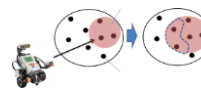
An autonomous decentralized FMS needs to control the entire factory and avoid the route interference of automated guided vehicles (AGVs). To solve this problem, we inserted an arrogant mind and a modest mind into AGVs. Also, in an autonomous decentralized FMS, it is assumed that the information provided by agents is always correct. However, incorrect information can sometimes be sent as a result of machine failures in a real factory. In this study, we define and find this incorrect information as a "lie" of AGV. We propose the method of finding lies and sending the lie information to the AGVs. We also propose a degree of confidence to control the AGV's moving. The result of simulation has shown the number of production was increased. Therefore, it is useful to control behavior by finding AGV's lies and using the degree of confidence.



## GS5-2 Conquest Oriented Robot Knowing Its Own Availability

Sho Yamauchi, Keiji Suzuki (Future University Hakodate, Japan)

Robot is designed for achieving specific task. However, robot is able to do much more things than it is expected by its own hardware. If both human and robot become to be able to know the things robot can do in the place, robot become to deal with variable tasks that are not expected. In this paper, concept of conquest oriented robot is proposed to know its availability systematically and autonomously. Conquest action for the robot that knows its own availability is defined and the thing that conquest oriented robot do is to know, increase and maintain things it can do. Algorithm of conquest oriented robot and its experimental result in simulation field for the first step is shown.

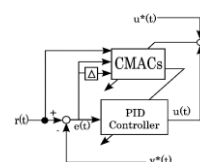


## GS6 Intelligent Control & System Cybernetics

### GS6-1 A Consideration on Feature Extraction for Operation Skill Based on Control Engineering Approach

Kazushige Koiwai<sup>1</sup>, Liao Yantao<sup>1</sup>, Toru Yamamoto<sup>1</sup>,  
Takao Nanjo<sup>2</sup>, Yoichiro Yamazaki<sup>2</sup>, Yoshiaki Fujimoto<sup>2</sup>  
(<sup>1</sup>Hiroshima University, <sup>2</sup>KOBELCO Construction Machinery CO., LTD., Japan)

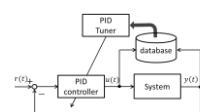
Technologies of automation or manpower-saving are innovated in production fields. However, there are many industrial equipments to need human operation, i.e. construction site. The human-skill optimized by professionals exists in those fields. However, the transfer of skills is not processing in leading countries because of decreasing or aging of professionals. Therefore the quantification of the human-skill is required to transfer those skills. In this study, the human-skill is considered as a kind of controller. It consists of CMAC-PID that is learned by using system outputs and control inputs of operators. CMACs calculate PID parameters, and human-skill is evaluated by trajectories of parameters. As an example, the comparison of operator skills for an excavator will be performed.



### GS6-2 Design of a Data-Driven Control System for a Hydraulic Excavator

Takuya Kinoshita<sup>1</sup>, Yasuhito Oshima<sup>1</sup>, Kazushige Koiwai<sup>1</sup>, Toru Yamamoto<sup>1</sup>,  
Takao Nanjo<sup>2</sup>, Yoichiro Yamazaki<sup>2</sup>, Yoshiaki Fujimoto<sup>2</sup>  
(<sup>1</sup>Hiroshima University, <sup>2</sup>KOBELCO Construction Machinery CO., LTD, Japan)

PID control schemes have been widely used in most industrial systems. However, most systems have nonlinearity and it is difficult to achieve the desired control performance by using fixed PID parameters. The hydraulic excavators have nonlinearity, therefore it is difficult to maintain the desired control performance. In order to overcome such a problem, data-driven PID control scheme based on database has been proposed. Moreover, data-driven scheme has a learning method in off-line by using the closed-loop data. In this paper, data-driven control scheme is applied to a hydraulic excavator in order to get desired control performance. The effectiveness of the proposed scheme is numerically verified by using a simulation example.



### GS6-3 An Optimization of Spatio-Spectral Filter Bank Design for EEG Signal Classification

Masanao Obayashi, Takuya Geshi, Takashi Kuremoto, Shingo Mabuchi (Yamaguchi University, Japan)

Recently, studies on brain computer interface (BCI) which enables us to operate electronic devices directly using electroencephalogram: EEG signal have been actively done. From knowledge of brain science, in order to distinguish the EEG signals accurately, it plays important role to make an appropriate combination of both optimal selection of EEG sensors and filter bank, due to theory of localization of brain function. From this point of view, Bayesian Spatio Spectral Filter Optimization (BSSFO) has been already proposed. However, the method still has room for improvement in constructing optimal combination mentioned above. We intend to improve BSSFO from the point of them, that is, a modification of a part of the optimization algorithm.



The classification procedure of EEG signal in this paper

### GS7 Robotics I

#### GS7-1 Haptic system with fuzzy controller for extended control of Teleoperation mine detector wheeled robots

Yekkehfallah Majid, Guao Yang, Yuanli Cai, Naebi Ahmad, Zolghadr Javad (Xi'an jiaotong university, P.R. China)

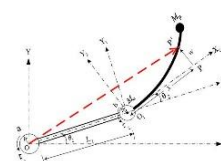
This paper proposes an approach of haptic system and fuzzy logic controller with implementation on teleoperation deminer robot, in order to reduce operator's error through fusion of fuzzy logic controller and haptic system, this approach provides vibrotactile feedback and speed controller corresponding to mine detector sensor and arm status system which are used in robot. This method can uses in all area of teleoperation robotic but we implemented on deminer wheeled robot and for illustrating results of this work we also implemented on MATLAB fuzzy toolbox.



#### GS7-2 Effect of System Parameters and Controlled Torque on the Dynamics of Rigid-Flexible Robotic Manipulator

Sachindra Mahto (North Eastern Regional Institute of Science & Technology, India)

There are several advantages of the flexible robotic system with respect to its counter-part convention system. Conventional robotic systems are heavy and bulky with poor payload to weight ratio; and most of energy is used to overcome the inertia of the system in the engineering applications. As there is significant static deflection due to the loads, it is very difficult to have high position accuracy of the robotic system. Therefore, sometimes some of the links of the conventional robotic system are replaced by the flexible link to have the advantages of the lightweight system. Rigid-flexible robotics systems are the compromise in between of these two systems. Since, one of the link is flexible, its behaviour is highly nonlinear and complex in nature. The dynamics of this system highly depends upon various system parameters viz., length and mass of the links, joint motor mass, payload, hub inertias, etc. A comparative study is also done for different input torque profiles along with the controlled input torques. Results of the comparative study for the effect of variation of the system parameters are very interesting technically.

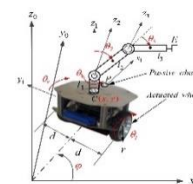




### GS7-3 Modeling of Mobile Manipulator and Adaptive Super-Twisting Backstepping Control

Seong Ik Han, Hyunuk Ha, Jangmyung Lee (Pusan National University, South Korea)

A mobile manipulator with three wheels and three DOF links is modeled by using Euler-Lagrange method and vector orientated constraint conditions. In this modeling process, the conventional complex nonholonomic constraint transformation need not be considered in mobile robot system and then much simpler dynamic model can be obtained. Next, the super-twisting sliding mode control is combined with nonlinear backstepping control to obtain the systematic nonlinear controller design, fast response speed, and improved robustness to uncertainty due to dynamic coupling and disturbance. Simulation and experiment were carried out to prove the effectiveness of the proposed control methodology.



### GS7-4 Self-tuned Local Feedback Gain Based Decentralized Fault Tolerant Control of Reconfigurable Manipulators

Bo Zhao<sup>1</sup>, Bo Dong<sup>2</sup>, Yan Li<sup>2</sup>, Fumitoshi Matsuno<sup>3</sup>, Yuanchun Li<sup>2</sup> (<sup>1</sup>Chinese Academy of Sciences, <sup>2</sup>Changchun University of Technology, P.R. China, <sup>3</sup>Kyoto University, Japan)

This paper investigates the decentralized fault tolerant control (DFTC) scheme based on self-tuned local feedback gain to against partial loss of actuator effectiveness of reconfigurable manipulators. Consider the entire system as a set of interconnected subsystems due to its modularity property, the decentralized control method is proposed by employing two neural networks for the fault-free system. For the subsystem in related failure, the self-tuned local feedback gain is added to the proposed decentralized control method to guarantee the control performance. Finally, a simulation example is provided to demonstrate the effectiveness of the present DFTC scheme.

Fig.1 shows the excellent trajectory tracking performance is derived though the reconfigurable manipulator suffers to actuator failure after  $t=4s$ . The main contributions of this method are: i) The FTC structure is simple since it is no need to be redesigned in the presence of partial loss of actuator effectiveness; ii) The actuator fault can be handled in its local subsystem, it implies that the performance degradation of the faulty subsystem cannot affect the fault-free subsystems.

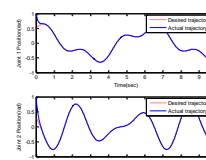


Fig.1 Joint tracking curves with DFTC

### GS7-5 Study on Decentralized Integral Nested Sliding Mode Control for Constrained Reconfigurable Manipulator with Harmonic Drive Transmission

Bo Dong<sup>1</sup>, Zeyu Dong<sup>1</sup>, Bo Zhao<sup>2</sup>, Yan li<sup>1</sup>, Fumitoshi Matsuno<sup>3</sup> and Yuanchun Li<sup>1</sup> (<sup>1</sup>Changchun University of Technology, <sup>2</sup>Chinese Academy of Sciences, P.R. China, <sup>3</sup>Kyoto University, Japan)

This paper addresses the problems of trajectory tracking control of a constrained reconfigurable manipulator with harmonic drive transmission under a decentralized integral nested sliding mode control (INSMC) method, and a high-performance control is achieved without using force/torque sensor. The dynamic model of the constrained reconfigurable manipulator is formulated with a nonlinear harmonic drive model. Based on only local dynamic information of each module, a decentralized integral nested sliding mode control method is proposed to reduce the chattering effect of the controller and compensating the model uncertainties. Finally, simulations are performed for a constrained 2-DOF reconfigurable manipulator to study the effectiveness of the proposed method. Fig. 1 shown that the desired trajectory of robot end-effector can be tracked accurately under the proposed INSMC method.

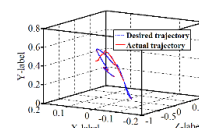
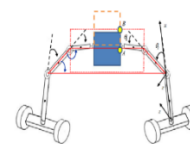


Fig. 1 Trajectory tracking curves of robot end-effector

## GS7-6 A Number of Mobile Manipulator Control for Moving Object by using Cooperative Control

Deok-Su Kim, Dong-Eon Kim, Seong-Ik Han, Jang-Myung Lee  
(Pusan National University, South Korea)

This paper proposes a method of cooperative control of a three mobile manipulator for moving an object. These robots go to desired position independently by using encoder data and inverse kinematics and after arriving in the position, they grasp and lift the object. For the carrying operation, the lifting operation is implemented by using the manipulator mounted on the top of the mobile robots cooperatively. In this system, master-slave mode is used for finding each position of robots and for coordinating among the robots. During the moving operation, a trajectory planning has been kept constantly. The real cooperative carrying motions are implemented to check the possibility of the master-slave mode control based on the mobile manipulator's kinematics



## GS8 Robotics II

### GS8-1 Visual-servo Control of 4-DOF Robot Manipulator for Sorting Moving objects

Longtan Wang, Seon-Woo Kim, Hyun-Wook Ha, Jang-Myung Lee  
(Pusan National University, South Korea)

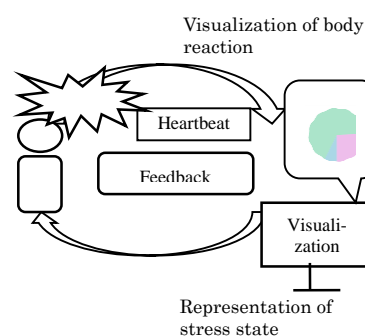
This paper considers the problem of estimating position and determining class of objects on the moving conveyor belt. A 2D camera is utilized to capture the image of moving objects. The control system directly integrates visual data into the servoing process. Objects are recognized by using SURF(Speeded-Up Robust Features) key point detector and FLANN(Fast Library for Approximate Nearest Neighbor) based matcher. Then Rotating calipers algorithm is adopted to estimate the centroid position and orientation of the objects. The proposed system is able to control the robot so that it can approach the desired position and grab the specific object. Experimental result demonstrates that the approach is efficient and reliable



### GS8-2 Self-identification of Mental State and Self-control through Indirect Biofeedback -Indirect Representation and Placebo Effect-

Madoka Takahara, Ivan Tanev, Katsunori Shimohara  
(Doshisha University, Japan)

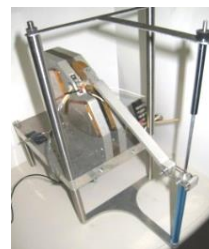
This paper describes a possible new scheme for a user with mental health problems to identify his/her own mental state and control it, not by visiting specialists passively, but by proactively confronting his/her symptoms. For that purpose, the scheme should provide the user with the ability not only to externalize and objectify his or her mental state but also for the user him/herself to control their physiological state. So we propose an indirect biofeedback system that represents physiological information with colors and shapes, and enables the user to grasp his/her inner state and to proactively change and control it through methods of breathing. These methods facilitate the user to control their autonomic nervous system by themselves. Here, we discuss indirect representation and placebo effect.



### **GS8-3 Construction of a sense of force feedback and vision for micro-objects: Recreate the response and a sense of force of objects**

Yusei Ishii, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

Technologies that can accurately perform minute work are now being sought for medical treatment and in the field of manufacturing semiconductors. Such minute work is improved by using micromanipulators, but their operation is difficult because the operator has no sense of force; he or she relies only on sight through a microscope. As a result, a person skilled in the use of this technology is needed for all minute work. For the efficiency of minute work, we used a haptic device and amplified the force feedback from a minute sample.



### **GS8-4 Dynamic Behavior Selection Model based on Emotional States for Conbe-I robot**

Wisanu Jitviriyia, Jiraphan Inthiam, Eiji Hayashi (Kyushu Institute of Technology, Japan)

Currently, the rapid development of non-industrial robots that are designed with artificial intelligence (AI) method to improve the robotics system is to have them imitate human thinking and behavior. Therefore, our works have been focused on studying and investigating the application of brain-inspired technology for developing the conscious behavior robot (Conbe-I). We created the hierarchical structure model, which is called “Consciousness-Based Architecture: CBA” module, but it has limitation in managing and selecting the behavior that only depends on the increase and decrease in the motivation’s level. Consequently, in this paper, we would like to introduce the dynamic behavior selection model based on emotional states, which develops by Self-organizing map learning and Markovian model in order to define the relationship between the behavioral selection and emotional expression model. We confirm the effectiveness of the proposed system with the experimental results.



### **GS8-5 Consideration on a Crawler Robot with Six Legs**

Toyomi Fujita, Taiga Sasaki (Tohoku Institute of Technology, Japan)

In this study, we consider development of a crawler-type mobile robot which is equipped with six legs at its body. This type of robot may have possibilities of both high mobility on rough terrain and working ability with handling such as carrying an object and removing small obstacles in its movement by using the legs as manipulation arms. This paper presents mechanisms and characteristics of this type of robot and some possible hybrid motions in which crawler and legs are used. Several simulations are also performed based on statics to analyze necessary torques for joint of the legs in the motions.

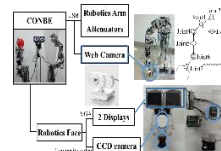


## GS9 Robotics III

### GS9-1 Social Expression of Pet Robot Based on Artificial Consciousness and Biologically Inspired On-line Topological Method

Sakmongkon Chumkamon, Eiji Hayashi (Kyushu Institute of Technology, Japan)

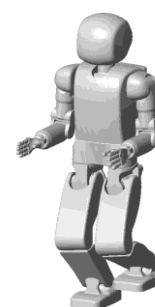
Toward robot becoming friend, the social and natural behavior of the robot is the most needed function for emerging future realistic human-like robot. This paper proposes the topological consciousness based on a pet robot using the artificial neurotransmitter and motivation. Since, the significant is a cross-creature communication to friendly companionship. This system focuses on three points. The first, the organization of the behavior and emotion model regarding the phylogenetic. The second, the robot empathy from human expression. The third, the social interaction by robot expression using biologically inspired topological on-line method for encouragement by its own emotion and the human expression. We believe the artificial consciousness based on complexity level and the robot social expression enhance the user affinity by the demonstration.



### GS9-2 Anthropomorphic robot modelling with virtual height inverted pendulum approach in Simulink: step length and period influence on walking stability.

Ramil Khusainov, Ilya Afanasyev, Evgeni Magid (Innopolis University, Russia)

Humanoid stable walking is a complex task due the high number of degrees of freedom, system nonlinearity and relatively small size of robot footprint. Biped robots tend to fall down as walking speed increases or when the terrain conditions change. This paper presents dynamically stable walking modelling of Russian humanoid AR-601M in Simulink environment with virtual height inverted pendulum model, an effective and simple trajectory generation method based on inverted pendulum model (IPM). This algorithm adjusts height of the center of mass in IPM model to reduce ZMP error and guarantees stable locomotion up to some critical speed. We investigate influence of the step length and step period on walking stability. Maximum torque values in leg joints are estimated in order to verify if such trajectories are attainable by robot motors. We demonstrate that the robot model is capable to achieve significant walking speeds on flat surfaces using this method.



### GS9-3 A low cost genetic algorithm based control scheme for wheelchair control in hospital environment

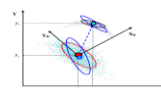
Karam Dad Kallu, Muhammad Jawad Khan, Wang Jie, Min Cheol lee  
(Pusan National University, South Korea)

In this paper, a control strategy to operate a wheelchair in a hospital is proposed to assist patients. The strategy is tested using a mobile robot, that is navigated in a hospital using line following. The mobile robot was operated using both genetic algorithm and A\* algorithm for a thorough comparison of the control scheme. The comparison of the results revealed that genetic algorithm is a better solution in controlling the wheelchair in a hospital environment.



### GS9-4 Simultaneous Localization and Mapping (SLAM) algorithm base on EKF and SPKF. Zolghadr Javad, Yuanli Cai ,Yekkehfallah Majid (Xi'an Jiaotong University, P.R. China)

Simultaneous Localization and Mapping (SLAM) is the problem in which a sensor-enabled mobile robot incrementally builds a map for an unknown environment, while localizing itself within this map. The Kalman Filter's linearized error propagation can result in big errors and instability in the SLAM problem. One approach to reduce this situation is using of iteration in Extended Kalman Filter (EKF) and Sigma Point Kalman Filter (SPKF). We will show that the recapitulate versions of kalman filters can improve the estimation accuracy and robustness of these filters beside of linear error propagation. Simulation results are presented to validate this improvement of state estimate convergence through repetitive linearization of the nonlinear model in EKF and SPKF for SLAM algorithms. Results of this evaluation are introduced by computer simulations and verified by offline implementation of the SLAM algorithm on mobile robot in MRL Robotic Lab. Index Terms— Extended Kalman Filter, Sigma Point Kalman Filter, SLAM, instability, Mobile Robot, Nonlinear Estimation.



### GS10 Poster Sessions (5)

#### GS10-1 Analysis of Postgraduates' Entrance Examination Scores Based on Linear Regression with Dummy Variables

Ning Xiaojun, Huang Ruocheng, Liang Xiaoyi, Ai Dongmei  
(University of Science and Technology Beijing, P.R. China)

Research on the main factors influencing the students' score is a very important part of the student achievement evaluation system. Several factors that have a significant influence on postgraduates' entrance examination score including enrollment category, university category, age, gender, fresh graduate were studied by ANOVA in this paper. Quantitative analysis of the correlation between the discrete variables and admission scores were performed by linear regression with dummy variables and 85% confidence prediction interval of postgraduates' admission scores were obtained. Data support is provided by these results for graduate school enrollment work.

$$\begin{cases} X_{ij} = \mu + \alpha_i + \varepsilon_{ij}, & j = 1, \dots, n_i, i = 1, \dots, r \\ \varepsilon_{ij} \sim N(0, \sigma^2), i.i.d. \\ \sum_{i=1}^r n_i \alpha_i = 0 \end{cases}$$

#### GS10-2 Clinical Evaluation of UR-System 2 for Recovery of Motor Function of Plegic Upper Limb after Stroke

<sup>1</sup>Hirofumi Tanabe, <sup>1</sup>Masahiro Mitsukane, <sup>2</sup>Norihiro Toya, <sup>2</sup>Ryosuke Takeichi, <sup>2</sup>Hitomi Hattori, <sup>2</sup>Yoshifumi Morita, <sup>3</sup>Yoshiaki Takagi, <sup>3</sup>Norio Hasegawa (<sup>1</sup>Shonan University of Medical Sciences, <sup>2</sup>Nagoya Institute of Technology, <sup>3</sup>Sanyo Machine Works, Ltd., Japan)

We developed a new training system UR-System 2 for restoring motor function of the upper limb after stroke in patients with hemiplegia. And then, we conducted clinical evaluation of the therapeutic effect of training with the UR-System 2 in six patients. The UR-System uses Proprioceptive Neuromuscular Facilitation (PNF) to promote muscle strength. In this training, elbow flexion and extension of the supinated forearm were repeated 250 times. As a result of the training, active ranges of motion of elbow extension and supination of the forearm improved after training. Moreover, the modified Ashworth scores for elbow extension and supination of the forearm increased, indicating improvement of spastic paralysis. These results show the immediate therapeutic effect of training with the UR-System 2 for restoring the motor function of the upper limb.





### GS10-3 Knee Android Model Reproducing Internal-External Rotation with Screw-Home Movement of Human Knee

Daichi Yamauchi, Sho Takei, Noritaka Sato, Yoshifumi Morita (Nagoya Institute of Technology, Japan)

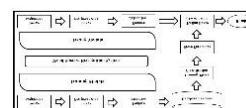
It has been reported that the internal-external rotation during knee extension in human can be classified into three types. In our previous study, we proposed a knee android model (Knee-AM) consisting of a tibia model, a femur model and nylon-cords imitating the ligaments. We found that the Knee-AM can reproduce one type. This paper proposed a Knee-AM that can reproduce another type. This type, to which most of human knee motion belongs, has external rotation occurring at the end of extension, called the screw-home movement (SHM). This type were realized by changing the lengths and the fixing points of the nylon-cords. Moreover, when the anterior cruciate ligament (ACL) was removed from the Knee-AM to imitate ligament injury, the SHM did not occur during extension. The results showed the ACL played an important role for the SHM.



### GS10-4 Wood Species Recognition System based on Improved Basic Grey Level Aura Matrix as feature extractor

<sup>1</sup>Mohd Iz'aan Paiz Zamri, <sup>1</sup>Anis Salwa Mohd Khairuddin, <sup>1</sup>Norrima Mokhtar, <sup>2</sup>Rubiyah Yusof  
(<sup>1</sup>University of Malaya, <sup>2</sup>Universiti Teknologi Malaysia, Malaysia)

An automated wood species recognition system is designed to perform wood inspection at custom checkpoints in order to avoid illegal logging. The system that includes image acquisition, feature extraction and classification is able to classify the 52 wood species. There are 100 images taken from the each wood species is then divided into training and testing samples for classification. In order to differentiate the wood species precisely, an effective feature extractor is necessary to extract the most distinguished features from the wood surface. In this research, an Improved Basic Grey Level Aura Matrix (I-BGLAM) technique is proposed to extract 136 features from the wood image. The technique has smaller feature dimension and is rotational invariant due to the considered significant feature extract from the wood image. Support vector machine (SVM) is used to classify the wood species. The proposed system shows good classification accuracy compared to previous works.



### GS10-5 Evaluation the Performance of a New Quadrotor Model Based on the Arm's Length Variation

Yasameen Kamil N., D. Hazry, Khairunizam Wan, Zuradzman M.Razlan  
(University Malaysia perlis, Malaysia)

The field of UAV has exceptional level of growth; in addition it is predictable to be one of the most prevalent fields of development and research in future. The unmanned aerial vehicle (UAV)- quadrotor widely used as a service robotic in several field. This paper presents a new design of this miniature aerial vehicle in altitude and attitude movements, based on varying the arm's length of quadrotor instead of varying the speed of motors to obtain a rotation around each axes. The length of arms varying are achieved by fixing a stepper motor in each arm of quadrotor to increase or decrease the length of these arms according to controller command for attitude movement. The controller commands are accomplished by designing a PID controller with specific parameters to maintain the stability of the quadrotor in the flight path. A MATLAB software code used to evaluate the simulation results and demonstrate the ability of the proposed design to perform a mission.

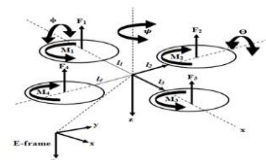


Fig.1 Quadrotor structure

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**PS: Plenary Session IS: Invited Session, OS: Organized Session, GS: General Session,**

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Lund	Henrik	<a href="#">PS1</a>	17/30	Nishime	Taiki	<a href="#">GS2-2</a>	23/54
	Hautop			Nishimura	Kouhei	<a href="#">OS7-1</a>	30/42
		<a href="#">IS1</a>	17/31	Niu	Hong	<a href="#">OS8-4</a>	24/45
						<a href="#">OS8-7</a>	27/46
[M]							
M.Razlan	Zuradzman	<a href="#">GS10-5</a>	21/67	[O]			
Mabu	Shingo	<a href="#">GS3-4</a>	29/57	Obayashi	Masanao	<a href="#">GS3-4</a>	29/57
		<a href="#">GS6-3</a>	27/61			<a href="#">GS6-3</a>	27/61
Magid	Evgeni	<a href="#">GS9-2</a>	22/65	Ogata	Takashi	<a href="#">OS13-1</a>	28/51
Mahto	Sachindra	<a href="#">GS7-2</a>	24/61			<a href="#">OS13-2</a>	28/51
Maneewarn	Thavida	<a href="#">GS4-1</a>	22/58			<a href="#">OS13-3</a>	28/51
Matsuno	Fumitoshi	<a href="#">GS7-4</a>	24/62	Oka	Yuuki	<a href="#">OS7-4</a>	30/43
		<a href="#">GS7-5</a>	25/62	Okane	Yuki	<a href="#">GS4-4</a>	22/59
Matsuno	Seigo	<a href="#">OS9-2</a>	29/47	Okazaki	Naonobu	<a href="#">OS12-1</a>	25/49
Mehta	Rajiv	<a href="#">OS9-3</a>	29/47	Oku	Hirozumi	<a href="#">GS4-4</a>	22/59
Miao	Ching-Mei	<a href="#">OS3-5</a>	21/37	Ono	Jumpei	<a href="#">OS13-2</a>	28/51
Mikami	Y.	<a href="#">OS9-2</a>	29/47			<a href="#">OS13-3</a>	28/51
Mitsukane	Masahiro	<a href="#">GS10-2</a>	20/66	Ono	Satoko	<a href="#">GS4-4</a>	22/59

Oshima	Yasuhito	<a href="#">GS6-2</a>	27/60			<a href="#">OS2-5</a>	19/35
Oyaizu	Haruka	<a href="#">OS7-1</a>	30/42	Su	Weijun	<a href="#">OS5-6</a>	26/41
				Su	Ying-Yu	<a href="#">OS4-4</a>	17/39
				Sugisaka	Masanori	<a href="#">GS2-1</a>	23/54
[P]							
Pagliarini	Luigi	<a href="#">IS1</a>	17/31			<a href="#">GS2-5</a>	23/55
Pan	Cheng-Tang	<a href="#">GS4-2</a>	22/58			<a href="#">GS2-6</a>	23/55
		<a href="#">GS4-3</a>	22/59	Sugita	Kazuki	<a href="#">GS4-4</a>	22/59
Park	So-Youn	<a href="#">PS2</a>	23/30	Sumi	Kaoru	<a href="#">IS-2</a>	23/31
Park	Yousin	<a href="#">OS9-1</a>	29/47	Sun	Shihao	<a href="#">OS5-3</a>	26/40
Patra	Aswini	<a href="#">GS3-6</a>	29/57			<a href="#">OS5-4</a>	26/40
	Kumar			Suzuki	Keiji	<a href="#">GS5-2</a>	27/60
Pengwang	Eakkachai	<a href="#">GS4-1</a>	22/58	Suzuki	Takuo	<a href="#">GS3-5</a>	29/57
[R]				[T]			
Rajapakse	R. P. C.	<a href="#">OS11-1</a>	18/48	Tabuse	Masayoshi	<a href="#">OS7-1</a>	30/42
	Janaka					<a href="#">OS7-2</a>	30/43
		<a href="#">OS11-2</a>	18/49			<a href="#">OS7-3</a>	30/43
						<a href="#">OS7-4</a>	30/43
						<a href="#">OS7-5</a>	30/44
[S]							
Saito	Ken	<a href="#">GS4-4</a>	22/59	Takagi	Yoshiaki	<a href="#">GS10-2</a>	20/66
Sasaki	Taiga	<a href="#">GS8-5</a>	19/64	Takahara	Madoka	<a href="#">GS8-2</a>	19/63
Sakamoto	Makoto	<a href="#">OS9-3</a>	29/47	Takahashi	Katsuhiko	<a href="#">OS9-3</a>	29/47
		<a href="#">OS12-2</a>	26/50	Takao	Shoichiro	<a href="#">GS1-2</a>	20/52
		<a href="#">OS12-3</a>	26/50			<a href="#">GS1-3</a>	20/53
		<a href="#">OS12-4</a>	26/50	Takato	Minami	<a href="#">GS4-4</a>	22/59
Sato	Hiroshi	<a href="#">OS10-1</a>	28/48	Takei	Sho	<a href="#">GS10-3</a>	21/67
		<a href="#">OS10-2</a>	28/48	Takeichi	Kei	<a href="#">OS11-3</a>	18/49
Sato	Noritaka	<a href="#">GS10-3</a>	21/67	Takeichi,	Ryosuke	<a href="#">GS10-2</a>	20/66
Shiau	Yan-Chyuan	<a href="#">OS3-1</a>	21/36	Takeshita	Yuki	<a href="#">OS12-3</a>	26/50
		<a href="#">OS3-2</a>	21/36	Tan	Dongchen	<a href="#">OS8-4</a>	24/45
		<a href="#">OS3-3</a>	21/37			<a href="#">OS8-7</a>	27/46
		<a href="#">OS3-4</a>	21/37	Tanabe	Hirofumi	<a href="#">GS10-2</a>	20/66
		<a href="#">OS3-5</a>	21/37	Tanaka	Shizuka	<a href="#">GS5-1</a>	27/59
Shimohara	Katsunori	<a href="#">GS8-2</a>	19/63	Tanev	Ivan	<a href="#">GS8-2</a>	19/63
Song	Yunzhong	<a href="#">OS5-1</a>	26/39	Tanioka	Sora	<a href="#">OS10-1</a>	28/48
Su	Hung-Wen	<a href="#">OS1-1</a>	19/31	Tatani	Masaki	<a href="#">GS4-4</a>	22/59
Su	Kuo-Lan	<a href="#">OS2-3</a>	18/35	Toma	Naruaki	<a href="#">GS2-2</a>	23/54

Toma	Naruaki	GS2-3	23/54	Wu	Yang	OS1-2	19/32
Toya	Norihiro	GS10-2	20/66	Wu	Yongjun	OS8-4	24/45
Tsai	Lung-Chi	OS1-3	19/32			OS8-7	27/46
Tsai	Yi-Yin	OS3-6	21/37				
Tsuda	Yuji	OS7-1	30/42	[X]			
Tsunenari	Kenji	GS2-4	23/55	Xie	Pengfei	OS8-5	24/45
				Xu	Cunshuan	OS6-2	25/41
[U]				Xue	Li	OS8-3	24/44
Uchida	Yasuo	OS9-2	29/47			OS8-9	27/46
		OS12-2	26/50				
		OS12-4	26/50	[Y]			
Uchikoba	Fumio	GS4-4	22/59	Yadekar	Yaser	GS3-1	28/56
Ueno	Junji	GS1-2	20/52	Yamaba	Hisaaki	OS12-1	25/49
		GS1-3	20/53	Yamada	Koji	GS2-2	23/54
						GS2-3	23/54
[W]				Yamada	Takayoshi	GS3-2	29/56
Wan	Khairunizam	GS10-5	21/67			GS3-3	29/56
Wang	Fuzhong	OS5-1	26/39			GS5-1	27/59
		OS6-4	25/42	Yamaguchi	Akihiro	GS1-4	20/53
Wang	Jiwu	GS2-1	23/54	Yamamoto	Hidehiko	GS3-2	29/56
		GS2-5	23/55			GS3-3	29/56
		GS2-6	23/55			GS5-1	27/59
Wang	Longtan	GS8-1	19/63	Yamamoto	Toru	GS6-1	27/60
Wang	Heyang	OS6-3	25/41			GS6-2	27/60
Wang	Ming-Chieh	OS1-5	20/33	Yamauchi	Daichi	GS10-3	21/67
Wang	Qinghe	OS8-1	24/44	Yamauchi	Sho	GS5-2	27/60
Wang	Shao-Yu	GS4-2	22/58	Yamazaki	Yoichiro	GS6-1	27/60
		GS4-3	22/59			GS6-2	27/60
Wei	Wei	OS5-6	26/41	Yang	An-Yun	GS4-2	22/58
Wang	Xiaoyu	OS6-2	25/41			GS4-3	22/59
Wang	Yu-Jen	GS4-2	22/58	Yang	Chao	GS2-5	23/55
		GS4-3	22/59	Yang	Cheng-Min	OS4-5	17/39
Wei	Xue	OS8-3	24/44	Yano	Shinnosuke	OS12-2	26/50
		OS8-9	27/46			OS12-4	26/50
Wu	I-Chen	OS4-3	17/38	Yantao	Liao	GS6-1	27/60
Wu	Sheu-Der	OS1-1	19/31	Yekkehfallah	Majid	GS7-1	24/61
Wu	Tong	OS6-6	25/42			GS9-4	22/66

Yoshimitsu	Yuki	<a href="#">OS7-5</a>	30/44
Yoshinaga	Tsunehiro	<a href="#">OS12-2</a>	26/50
		<a href="#">OS12-4</a>	26/50
Yoshitomi	Yasunari	<a href="#">OS7-1</a>	30/42
		<a href="#">OS7-2</a>	30/43
		<a href="#">OS7-3</a>	30/43
		<a href="#">OS7-4</a>	30/43
Yu	Chunyu	<a href="#">OS8-2</a>	24/44
Yuanli	Cai	<a href="#">GS7-1</a>	24/61
		<a href="#">GS9-4</a>	22/66
Yue	YuanLi	<a href="#">OS8-5</a>	24/45
		<a href="#">OS8-6</a>	24/45
Yusof	Rubiyah	<a href="#">GS10-4</a>	21/67

[Z]

Zamri	Mohd Iz'aan	<a href="#">GS10-4</a>	21/67
	Paiz		
Zhao	Bo	<a href="#">GS7-4</a>	24/62
		<a href="#">GS7-5</a>	25/62
Zhao	Yifan	<a href="#">GS3-1</a>	28/56
Zhang	Hongtao	<a href="#">OS8-6</a>	24/45
Zhang	Weicun	<a href="#">OS6-1</a>	25/41
		<a href="#">OS6-6</a>	25/42
Zhang	Yuzhen	<a href="#">OS6-1</a>	25/41
Zheng	Shunkai	<a href="#">GS2-6</a>	23/55
Zheng	Wenhao	<a href="#">OS5-5</a>	26/40
Zhao	Xia	<a href="#">OS8-8</a>	27/46
Zhao	Huailin	<a href="#">OS8-8</a>	27/46
Zolghadr	Javad	<a href="#">GS7-1</a>	24/61
		<a href="#">GS9-4</a>	22/66

## Conference Building B



### Select the meeting facility best suited to your needs

Conference Room B1, which may be arranged to seat 226 people in a theater-style setting, can readily serve as a venue for seminars or lectures. There are also six smaller meeting rooms with theater seating for between 49 and 112 people. These rooms are available for a broad panorama of uses, such as academic meetings, business forums or cultural exchange events. Moreover, food and beverage are permitted in all of these areas. With a break room and green room available for event sponsors, these facilities provide the perfect location for small parties and other such events.





Partible conference hall B1



Conference hall B3 and B4 combined



Conference hall B5 and B7 combined



Interpretation service booth equipped

Conference hall B2



Conference hall (single use)

