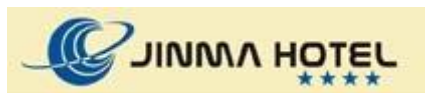


CONFERENCE ABSTRACTS

**International Conference on Robotics, Control and Automation Engineering
(RCAE 2018)**

**International Conference on Advanced Mechanical and Electrical Engineering
(AMEE 2018)**

Beijing, China
December 26-28, 2018

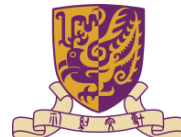


Jinma Hotel

Building A, Golden Tower, 38 Xueqing Road, Beijing, China

Web: <http://www.jmdjd.com.cn/>

Supported by



Published by



Table of Contents

Welcome Address.....	3
Organizing Committee.....	4
Local Information.....	6
Instructions for Oral & Poster Presentations.....	7
Introduction of Keynote Speakers.....	8
Quick Glance of Oral Presentations	11
Session 1.....	13
Session 2.....	18
Posters.....	23
Listeners	30
Optional Visit	31
Author Index.....	32

Daily Schedule of Events

Dec. 26th, 2018

Registration | 10:00am-16:00pm

Hotel Lobby

 **Venue: Jinma Hotel**

Staff: Ms. Tina Wong & Ms. Jennifer Luo

Note: *Collecting conference materials;

*Certificate will not be available at the registration desk until you finish the presentation at the conference day (except the listeners and poster presenters);

*Accommodation is not provided, and it's suggested to make an early reservation.

Morning | 9:00am-11:50am

Conference Room 3

Opening Remarks

Prof. Bin Zi, Hefei University of Technology, China

9:00-9:05

Chair – Prof. Huafeng Ding, China University of Geosciences, China

Keynote Speech I

Prof. Beom Hee Lee, Seoul National University, South Korea

Title: Multi-Robot Collision Avoidance and Applications

9:05-9:50

Keynote Speech II

Prof. Xiaqing Wen, Kyushu Institute of Technology, Japan

Title: LSI Testing: A Core Technology to a Successful Semiconductor Industry

9:50-10:35

Coffee Break & Group Photo



10:35-11:05

Keynote Speech III

Prof. Yifei Chen, China Agricultural University, China

Title: The Different of Smart Agriculture (SA) and Intelligent Agriculture (IA) & Each Key Technologies

11:05-11:50

Lunch | Jin Shilin Restaurant



12:00-13:00

Afternoon | 13:15pm-17:50pm

Conference Room 3

Session 1

Robot Design and Automation Control Technology

13:15-15:30

Coffee Break & Posters



15:30-15:50

Session 2

Electronic Power and Energy Engineering

15:50-17:50

Dinner | Jin Shilin Restaurant



18:00-19:30

Dec. 28th, 2018

One Day Visit | 7:00am-17:00pm

*This is optional choice and not included in registration fee.

Note: Conference Room 3 is on 3rd floor

Jin Shilin Restaurant is on 2nd floor

Welcome Address

We are delighted to welcome you to RCAE 2018 & AMEE 2018 conference, which will be held at Beijing, China, from December 26-28, 2018.

After several rounds review procedure, the program committee accepted those papers to be published in conference proceedings. We wish to express our sincere appreciation to all the individuals who have contributed to RCAE 2018 & AMEE 2018 in various ways. Special thanks are extended to our colleagues in program committee for their thorough review of all the submissions, which is vital to the success of the conference, and also to the members in the organizing committee and the volunteers who had dedicated their time and efforts in planning, promoting, organizing and helping the conference. Last but not least, our special thanks go to keynote speakers Prof. Beom Hee Lee, Seoul National University, South Korea, Prof. Xiaoqing Wen, Kyushu Institute of Technology, Japan and Prof. Yifei Chen, China Agricultural University, China for all the kind and patient support and assistance they offered to our whole conference procedure. Without their support, our conference could not be prepared so smoothly, thanks again.

One best presentation will be selected from each session, evaluated from: Originality; Applicability; Technical Merit; PPT; English. The best one will be announced and awarded the certificate at the end of each Session.

Beijing, formerly romanized as Peking, is the capital of the People's Republic of China, the world's third most populous city proper, and most populous capital city. The city, located in northern China, is governed as a municipality under the direct administration of central government with 16 urban, suburban, and rural districts. It is an important world capital and global power city, and one of the world's leading centers for politics, economy and business, finance, education, culture, innovation and technology, architecture, language, and diplomacy.

We wish you a enjoyable visit in Beijing!

RCAE 18 & AMEE 18
Conference Organizing Committee

Organizing Committee

Advisory Chairs

Xiaoqing Wen, Kyushu Institute of Technology, Japan
Beom Hee Lee, Seoul National University, South Korea

Conference Chairs

Bin Zi, Hefei University of Technology, China
Huafeng Ding, China University of Geosciences
Haitao Liu, Tianjin University, China

Program Chairs

Yifei Chen, China Agriculture University, China
Chunzhan Yu, Beijing Forestry University, China
Toshihisa Funabashi, University of the Ryukyus, Japan

Technical Committee

Song Aiguo, Southeast University, China
Gheorghe-Daniel Andreescu, Universitatea Politehnica Timisoara, Romania
Wan Zuha b. Wan Hasan, Universiti Putra Malaysia
Mohammad Hamiruce b. Marhaban, Universiti Putra Malaysia
Ishak b. Aris, Universiti Putra Malaysia
Madya Dr. Samsul Bahari b. Mohd. Noor, Universiti Putra Malaysia
Mohamed Arezki Mellal, M'Hamed Bougara University, Algeria
Haibo Zhao, Tongling University, China
Joel P. Ilao, De La Salle University, Philippines
Shuquan Wang, Chinese Academy of Sciences, China
Ying Chih Lai, National Cheng Kung University, Taiwan
Yousef Moh. Abueejela, College of Electronic Technology, Libya
Man Yongkui, Northeastern University, China
Mona N. Eskander, Electronics Research Institute(ERI), Egypt
Adam Cholewa, Silesian University of Technology, Poland
Shengwei Yu, Purdue University, USA

Haldun M. Ozaktas, Bilkent University, Turkey

Nouby Ghazaly, South valley University, Egypt

Nopparat Seemuang, King Mongkut's University of Technology North Bangkok, Thailand

Huang Weimin, NTU, Singapore

Yong Xu, Army Engineering University, China

Thananchai Leephakpreeda, Thammasat University, Thailand

Hugo Miguel Silva, University of Minho Guimarães, Portugal

Martin Stava, Brno University of Technology, Czech Republic

Emese Gincsiné Szádeczky-Kardoss, Budapest University of Technology and Economics,
Hungary

Local Information

Conference Venue



Jinma Hotel

Building A, Golden Tower, 38 Xueqing Road, Beijing, China

Web: <http://www.jmdjd.com.cn/>

Time

UTC/GMT+8

Weather

The Weather Situation of Beijing in December

Average daily minimum temperature

-9°C

Average daily highest temperature

-1°C

Emergency

Police emergency phone: 110

Emergency center: 120

Fire Alarm: 119

Beijing Tourism Bureau: 010-85157015

Transportation

Three high-speed rail lines

The Beijing-Tianjin Intercity Railway; the Beijing-Shanghai High-Speed Railway; and the Beijing-Guangzhou High-Speed Railway.

Main railway stations

The Beijing Railway Station; the Beijing West Railway Station; the Beijing South Railway Station; the Beijing North Railway Station.

Primary airport

The Beijing Capital International Airport (IATA: PEK)

Public transit

22 lines subways, 1,000 public bus and trolleybus lines.

Taxi

Usually registered taxis have yellowish brown as basic hue, with another color of Prussian blue, hunter green, white, umber, tyrian purple, rufous, or sea green.



Instructions for Oral & Poster Presentations

Oral Presentations

- **Timing:** a maximum of 15 minutes total, including speaking time and discussion. Please make sure your presentation is well timed. Please keep in mind that the program is full and that the speaker after you would like their allocated time available to them.
Please arrive at the designated conference room 15 minutes earlier, in case some authors are not able to make the presentation on time.
- You can use USB flash drive (memory stick) and make sure you scanned viruses in your own computer. Each speaker is required to meet her / his session chair in the corresponding session rooms 10 minutes before the session starts and copy the slide file (PPT or PDF) to the computer.
- It is suggested that you email a copy of your presentation to your personal inbox as a backup. If for some reason the files can't be accessed from your flash drive, you will be able to download them to the computer from your email.
- Please note that each session room will be equipped with a LCD projector, screen, point device, microphone, and a laptop with general presentation software such as Microsoft Power Point and Adobe Reader. Please make sure that your files are compatible and readable with our operation system by using commonly used fronts and symbols. If you plan to use your own computer, please try the connection and make sure it works before your presentation.
- Videos: If your Power Point files contain videos please make sure that they are well formatted and connected to the main files.

Poster Presentations

- Maximum poster size is 60 CM X 80CM.
- Posters are required to be condensed and attractive. The characters should be large enough so that they are visible from 1 meter apart.
- Please note that during your poster session, the author should stay by your poster paper to explain and discuss your paper with visiting delegates.

Dress Code

- Please wear formal clothes or national characteristics of clothing

Keynote Speakers

Prof. Beom Hee Lee (Fellow of IEEE & ICROS)

Seoul National University, South Korea



Biography: Professor Beom Hee Lee received his B.S. and M.S. degrees in Electronics Engineering from Seoul National University, Seoul, Korea in 1978 and 1980, respectively, and his Ph.D. degree in Computer, Information, and Control Engineering from the University of Michigan, Ann Arbor, Michigan, USA in 1985. From 1985 to 1987, he was with the School of Electrical Engineering at Purdue University, West Lafayette, IN, USA, as an Assistant Professor. He joined Seoul National University (SNU) in 1987, where he is currently a Professor at

the Department of Electrical and Computer Engineering and the Director of the Robotics and Intelligent Systems Lab at SNU. In 2001, he was the Program Chairman of the IEEE International Conference on Robotics and Automation (ICRA) in Seoul, Korea. Since 2004, he has been a Fellow of the IEEE Robotics and Automation Society, and he is in charge of IEEE Robotics and Automation Korea Chapter as the chairman since 1995. He was the President of the Automation and Systems Research Institute (ASRI) in SNU during 2004-2006, and the Dean of Information Technology in SNU. He has served the Korea Robotics Society (KROS) as the president in 2009. He was also in charge of the Board of Directors of the Korea Institute of Patent Information (KIPI) as the chairman. He has published over 670 technical journal and conference papers mainly in the field of Robotics and Automation. His current interest includes multi-robot systems and applications, Multi-robot collision avoidance, Multi-robot SLAM problems and Underwater robotics.

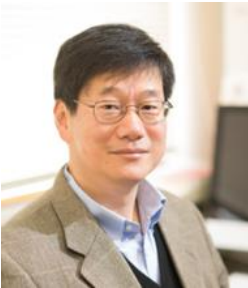
Title: Multi-Robot Collision Avoidance and Applications

Nowadays, multi-robot operations are acknowledged as a common practice in industry for various tasks. State of the Art of Multi-Robot Systems are described in the first statement. Multi-robot research issues are then discussed in terms of the operational strategies: centralized, distributed, and mixed operational schemes. Next, we show that one of the main issues in multi-robot operation is the problem of collision avoidance. We also show the importance of the collision avoidance problem in multi-robot operations. For multi-robot collision avoidance, a special tool, called the collision map, is introduced and applied to the problem of multi-robot collision avoidance.

More deep analysis and investigation are presented for an application of the collision map. Various types of collision maps are then introduced with several possible applications. Also, robot path modification is viewed in terms of collision avoidance using the concept of collision map. Various applications using the collision map are presented for a problem of 100 multi-robot operations, a stealth intruder intercept scheme, and efficient multiple cleaning robots operation. Especially, the load balancing in multiple cleaning robots are realized using the collision map. Finally, future applications using multi-robot systems are briefly discussed.

Prof. Xiaoqing Wen (Fellow of IEEE)

Kyushu Institute of Technology, Japan



Biography: Xiaoqing WEN (wen@cse.kyutech.ac.jp) received a B.E. degree from Tsinghua University, China, in 1986, a M.E. degree from Hiroshima University, Japan, in 1990, and a Ph.D. degree from Osaka University, Japan, in 1993. From 1993 to 1997, he was a Lecturer at Akita University, Japan. He was a Visiting Researcher at University of Wisconsin, Madison, USA, from October 1995 to March 1996. He worked at SynTest Technologies, Inc., USA, from 1998 to 2003 and served as its Vice President and Chief Technology Officer. In 2004, he

joined Kyushu Institute of Technology, Japan, where he is currently a Professor and Chair of Department of Creative Informatics. He is a Co-Founder/Co-Chair of the Technical Activity Committee on Power-Aware Testing under the Test Technology Technical Council of the IEEE Computer Society. He is serving as Associate Editors for IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems as well as IEEE Transactions on Very Large Scale Integration Systems. He co-authored and co-edited two widely-referred books: “VLSI Test Principles and Architectures: Design for Testability” and “Power-Aware Testing and Test Strategies for Low Power Devices”. His research interests include design, test, and diagnosis of VLSI circuits. He holds 43 U.S. Patents and 14 Japan Patents. He received the 2008 Society Best Paper Award from the Information Systems Society of Institute of Electronics, Information and Communication Engineers for his pioneering work on mitigating capture power in at-speed scan testing of low-power VLSI circuits. He was elevated to a Fellow of IEEE in 2012 for contributions to testing of integrated circuits. (Homepage: <http://aries3a.cse.kyutech.ac.jp/~wen/>)

Title: LSI Testing: A Core Technology to a Successful Semiconductor Industry

The semiconductor industry is exposed to shrinking feature sizes, growing circuit complexity, increasing clock speeds, and decreasing power supply voltages. In addition to significant impact on LSI design and manufacturing, these factors also have a profound impact on LST testing, a complex process for separating defective chips from defect-free ones. The major challenges to LSI testing are low test quality, high test cost, and excessive test power. These challenges have led to new chances of innovations in LSI testing, characterized by cell-aware test generation, test compression, and power-aware testing. This talk will review these challenges and chances. Furthermore, this talk will reveal the role of LSI testing in the semiconductor business chain, so as to explain why LSI testing is a core technology to a successful semiconductor industry.

Prof. Yifei Chen

China Agricultural University, China



Biography: He was born in Beijing, China. He received the B.S.E.E. degree from Dept. of Electrical Engineering of Beijing Agricultural Mechanization College in 1984, and the M.Phil (S. of Mang.) degrees in management engineering and applied science from Bei Hang University in 1991, the M.S. degree in control theory and control engineering from Beijing Agricultural Engineering University in 1994. Since graduation in 1984, he still works as the researcher and teacher in collage of Electronic & Electrical Power Eng. of Beijing Agricultural Engineering University which was renamed as China Agriculture University later. After holding the position in the university, he studied further in control theory class by IFCA in Tongji University at Shang Hai in 1995, where he currently holds the academic positions in research. In 1998, he is as associate Professor at College of Information and Electrical Engineering in China Agriculture University.

Prof. Yifei Chen has published extensively in control systems, control engineering, and mechanical control, including 3 books, 4 edited volumes, over 80 journal articles and book chapters, and over 30 international conference publications. He is currently the Editor-in-Chief of IJCCE, and member of editorial and advisory boards of several domestic journals in control, networks, and applied agricultural control engineering. He is a senior member of China Agricultural Engineering Association, a member of China Intelligent Automation Committee as well as a member of IEEE.

Prof. Yifei Chen has received several awards and recognitions over the years, among which are the Outstanding Paper Award of Chinese Science and Technology Association of China (2008); Outstanding Paper Award in ICINIS (2009), and Post Paper and Lecture Prize (2011) of WEC2011 Society (UN) in Switzerland; Outstanding Teacher Award (2005/2010) of China Agriculture University; Outstanding post graduation Director Award (2008/2009/2010/2012/2013)of China Agriculture University; Honorary Director Award for M.S. outstanding paper (2010) of China Agriculture University.

Title: The Different of Smart Agriculture (SA) and Intelligent Agriculture (IA) & Each Key Technologies

Based on different meaning between words of “Smart” and “Intelligent” , describing the different of Smart Agriculture(SA) and Intelligent Agriculture(IA) as well as each development background. The speech presents the main viewpoint on key technologies such as intelligent control and cloud computing etc, and give the application with combination of SA and IA in modern agriculture engineering.

Quick Glance of Oral Presentations

Session I—Robot Design and Automation Control Technology
Conference Room 3 | 13:15-15:30

AE005-A	Hybrid Fault-tolerant Control System
AE002	Development and Composition of Robot Architecture in Dynamic Environment
AE007	The Effect of Redundant Degrees of Freedom on Manipulator's Kinematic Characteristics
AE010	Map Registration of Lidar-based 2D NDT Map and Vision-based 3D NDT Map with Known Initial Robot Poses
AE018	Experimental Research and Numerical Simulation of Natural Convection
AE024	Providing an Aperiodicity of Transient Process in a Interval Control System on a Base of Pole Domination Principle
AE0016	Modeling of Anisotropy Influence on Thickness Distribution of Deep Drawing Sheet
AE023	A Method of Traffic Light Status Recognition Based on Deep Learning
AE0026	Towards the Regulation of Robotics and AI

Session II—Electronic Power and Energy Engineering
Conference Room 3 | 15:50-17:50

AE1002	An Integrated Sensor System for Prosthetic Socket Design
AE0008	A Novel Design of 100GHz Silicon-Based CMOS Injection Locked VCO
AE0009	Research on Joint Bidding Mechanism of Cascade Hydropower
AE0017	Optimal Deployment of DG and DSTATCOM in Distribution System using Swarm Intelligent Techniques
AE0019	Energy Flow Analysis of Combined Natural Gas and Electric System Using Multi-Balanced Buses Power Flow Calculation
AE0024	A Commercial Inverter Applying for Solar Pump in Agriculture Plant Case Study in South of Thailand
AE0025	The Model of Solar Power Plant Efficiency Improvement: A Case Study in Lampang, Thailand
AE2003	Modified Beta MPPT Method in Photovoltaic System

Afternoon, December 27th, 2018

Session I—Robot Design and Automation Control Technology

Session Chair: Assoc. Prof. Wei Xu, University of Surrey, UK

Venue: Conference Room 3 | Time:13:15-15:30

Note:

- * The certification of Oral Presentations will be awarded after each presentation.
- * For the Best Presentation of each session, it is encouraged to award to student author prior at the end of each session.
- *To show the respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session, the scheduled time for presentations might be changed due to unexpected situations, please come as early as you could.
- *Session Photo will be taken at the end of the session.



AE005-A

Time: 13:15-13:30

Hybrid Fault-tolerant Control System

Dr. Ye Yuan, Shuiting Ding, Xiaofeng Liu
Beihang University, China

In this paper a hybrid fault-tolerant control system is presented to complete fault-tolerant regulation function during the situation of coexisting faults. In this fault-tolerant control system, the fault estimation process and the following fault-tolerant regulation process is combined into one process, which means the time cost of fault-tolerant control process can be shorten, and the performance of the fault-tolerant control system will be improved. The fault-tolerant controller in this system is able to adjust its structure to adapt to different fault situations. The proposed approach is applied to the nonlinear aeroengine model. According to the simulation results, the hybrid fault-tolerant control system is able to estimate the variations of faults and minimize the influence of faults at the same time when the sensor faults and actuator faults coexist.

AE002

Time: 13:30-13:45

Development and Composition of Robot Architecture in Dynamic Environment

Ms. Juan Chen, DianXi Shi
National University of Defense Technology, China

Robots occupy an increasingly important position in life. The design and

execution of a plan will be a challenge when performing tasks in a complex and dynamic environment. To understand the layers of architecture and design a framework with a higher degree of autonomy, it is necessary to understand the development and Key technology of the architecture. Based on the author's understanding of the reading materials, this paper summarizes the history of the robot architecture development, analyzes the problems and solutions encountered in the past, lays the foundation for the understanding of the architecture. After that, the focus is on the FSM (finite-state machine) and BT (behavior tree) methods what are commonly used in the architecture. The aerostack is used as an example to help the readers understand the modules and layers of the architecture better.

AE007

Time: 13:45-14:00

The Effect of Redundant Degrees of Freedom on Manipulator's Kinematic Characteristics

Mr. Qinjuan XU, Qiang ZHAN, Xiujie CAO
Robotics Institute, BUAA

In order to verify the necessity and effectiveness of redundant degrees of freedom (DOF) of anthropomorphic manipulators, the effects of redundant DOFs on manipulator's kinematic characteristics are quantitatively studied. Firstly, the manipulator configurations with 6, 7 and 8 DOFs as well as optimal position and posture structure are introduced. Kinematic models of the three manipulators with the same maximum working radius, the same joint motion range are established. Workspace, Jacobian condition number and manipulability of the three manipulators are obtained respectively through numerical simulations, and their kinematic characteristics are analyzed from three aspects. Then, the distribution of relative manipulation capabilities in the workspaces and the optimal workspace of the three manipulators are obtained based on the concept of global relative manipulability. Through comparing and analysis, the effects of redundant DOFs on workspace, movement flexibility and manipulability of manipulators are obtained, which can provide theoretical basis for the configuration design of anthropomorphic manipulators.



AE010

Time: 14:00-14:15

Map Registration of Lidar-based 2D NDT Map and Vision-based 3D NDT Map with Known Initial Robot Poses

Mr. Hyunki Hong, Beomhee Lee
Seoul National University, Korea

This paper focuses on the multi-robot mapping, especially the collaboration

of vision- and 2D lidar-mounted robots with known initial poses. Since the scale of the map built by a single vision sensor is hardly the same to the real world scale, the scale should be estimated to register the 2D map built by 2D lidar and 3D map built by a vision sensor. In this paper, we propose a method of converting maps into NDT maps to rapidly register the two maps in multiple resolutions based on minimizing the modified objective function of distribution-to-distribution normal distributions transform (NDT-D2D). Instead of scaling the 3D map, the proposed method updates the 2D map within optimization. In the experiment, we showed the registration of 2D NDT map built by gmapping with 2D lidar and 3D NDT map built by direct sparse odometry (DSO) with vision sensor. As a result, the runtime was 0.041 second, and the error of the estimated scale was 18.0%.



AE018

Time: 14:15-14:30

Experimental Research and Numerical Simulation of Natural Convection

Mr. Zhiqiang Jia, Qite Wang
China Academy of Electronic Science, China

This paper mainly introduces the study that use particle image velocimetry (PIV) technique to measure the natural convection flow field in a cabinet. In order to simulate the natural convection flow, a square cabinet is built, and different boundary temperatures are set to generate natural convection. The research shows that the experimental results measured by the PIV technology are close to the results of computational fluid dynamics (CFD) numerical simulation. This verifies the accuracy of the test technique and numerical simulation. Furthermore, the measurement technologies of PIV and PLIF(planar laser induced fluorescence) will contribute to in-depth study on natural convective flow phenomena

AE024

Time: 14:30-14:45

Providing an Aperiodicity of Transient Process in a Interval Control System on a Base of Pole Domination Principle

Ms. Tatiana Ezangina, Sergey Gayvoronskiy, Ivan Khozhaev
National Research Tomsk Polytechnic University, Russia

The paper is dedicated to a problem of parametric synthesis of a controller, providing an aperiodicity of transient processes in control system with interval parametric uncertainty. The synthesis method is based on a pole domination principle and decomposing a characteristic polynomial in two parts: dominant and unrestricted ones. Roots of dominant polynomial determine an interval of a real dominant pole. In order to place a dominant pole according to desired control quality, a set of coefficient polytope vertices, whose images are ends of the dominant pole interval, was found. In

order to place unrestricted poles, conditions of their allocation on a left side from a desired allocation area border were developed on a base of a coefficients approach. The research resulted in a method of a robust linear controller parametric synthesis. An example of the method application was provided.



AE0016

Time: 14:45-15:00

Modeling of anisotropy influence on thickness distribution of deep drawing sheet

Ms. Kenza Bouchaâla, Elhachmi Essadiqi, Mohamed Mada, Mohamad Fathi Ghanameh, Mustapha Faqir, Mohammed Meziane
Université Internationale de Rabat, Morocco.

In the current paper, numerical results of cylindrical cup drawing of aluminum-lithium sheets using the commercial FE software ABAQUS/EXPLICIT are presented. This software permits investigating physical models of real procedures putting singular emphasis on geometrical non-linearities produced by large deformations, material properties and complex conditions. Numerical simulation using Finite Element Methods (FEM) offers the ability of analyzing the feasibility of a process, allowing the benefit of saving time and reducing costs by comparison with traditional methods. The 2090 T3 aluminum-lithium alloy was studied with the focus on the influencing plastic anisotropy that affect the final predicted part. The results illustrate that anisotropy influence the thickness variation, and a comparison between anisotropic and isotropic yield was discussed.



AE023

Time: 15:00-15:15

A method of traffic light status recognition based on deep learning

Ms. Xin Yuan Wang, Tao Jiang, Yu Rui Xie
Chengdu University of Information Technology, China

Traffic light recognition plays an important role in the field of intelligent vehicles for safe driving. Driving with intelligent vehicles has been demonstrated as a trend for the following years. However, numbers of difficulties are currently existing in traffic light recognition, such as, the appearance of traffic light, illumination, and the bad weather, etc. By showing the potential challenges in traffic light recognition, this paper introduces a real-time traffic light status recognition method based on the combination of YOLOv3 and a lightweight Convolutional Neural Network (CNN). YOLOv3 performs traffic light ROI detection, the lightweight CNN is responsible for classifying traffic light status.

Two alternative methods are compared with this paper's method. We present

an extensive evaluation on the BDDV dataset. Experimental results show that our method reach both high accuracy (98%) and less time consumption.

AE026

Time: 15:15-15:30

Towards the regulation of robotics and AI

Dr. Andrey Neznamov

Dentons, Robolow Institute, Russia

The development of robotics is accompanied by a whole range of thorny legal issues. A kind of “roboLaw” is emerging in the work of scholars and the legislative acts of various countries. There are first legislative acts in China and Korea, European Union and precise countries like Estonia and German. In this article, we examine a number of regulatory aspects: the levels at which regulation is implemented. The work also contains a brief overview of self-regulation and ethical norms, laws, development strategies and concepts, standards and international acts. Additionally, selected provisions of the Model convention on robotics and artificial intellect are described.

Session II—Electronic Power and Energy Engineering

Session Chair: Assoc. Prof. Vijay S. Kale, Dept. of Electrical Engineering, V.N.I.T.,
Nagpur, India

Venue: Conference Room 3 | Time:15:50-17:50

Note:

- * The certification of Oral Presentations will be awarded after each presentation.
- * For the Best Presentation of each session, it is encouraged to award to student author prior at the end of each session.
- *To show the respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session, the scheduled time for presentations might be changed due to unexpected situations, please come as early as you could.
- *Session Photo will be taken at the end of the session.

AE1002

Time: 15:50-16:05

An integrated sensor system for prosthetic socket design

Dr. W. Xu, A. van Heesewij, M Tayler, X Zhu, L. Lorenzelli, A. S. Haidar and J. Gao, Nikolaos Arapkoules
University of Surrey, UK

Prosthetic socket is an interface to attach a prosthesis to the residual limb of an amputee. The comfort of the amputee relies on the socket as the body weight of the amputee, during walking, running or climbing, is loaded to the residual limb via the socket. Currently a prosthetic socket is designed using a trial and error method by a prosthetist who needs to be well trained. In order to optimize the design of the socket for the lower limb amputees, an integrated sensors system was developed. This paper presents an integrated tri-axial force sensor system for the design of the prosthetic socket.

AE0008

Time: 16:05-16:20

A Novel Design of 100GHz Silicon-Based CMOS Injection Locked VCO

Mr. Fei Zhao, Yong Xu, Ying Lin, Yuanliang Wu
Army Engineering University, China

A 100GHz fundamental mode injection locked voltage controlled oscillator (ILVCO) is proposed to provide a lower phase noise frequency generator based on a clean reference frequency. The circuit is designed in a custom 65nm CMOS process with a self-designed inductor by HFSS and VCO power is 2.1mW under 1.2V supply voltage. Using a lower phase noise reference frequency, the ILVCO prototype generates about 100GHz central frequency with phase noise of

-119dBc/Hz@1MHz, and the tuning range of fundamental output frequency is 93-109GHz.



AE0009

Time: 16:20-16:35

Research on Joint Bidding Mechanism of Cascade Hydropower

Lei Liu, Gangyi Zhu, Jun Li, Xiaolu Li and **Mr. Chengpeng Tang**
North China Electric Power University, China

There is a strong coupling relationship between cascade hydropower stations. If stations participate in the electricity market jointly, it will be advantageous to optimize the allocation of resources in the whole cascade and to maximize the economic and social benefits of the basin. In this process, the benefit balance mechanism is the basis and key of cascade union. Two ways of forming a union for cascade hydropower stations were proposed, cascade hydropower alliance and agency mechanism. Based on the idea of balanced account in the electricity market and the relevant theory of game theory, this paper designed a "benefit balance mechanism based on negotiation process". First of all, it compensated for damaged power station. And then it simulated the negotiation process among the members of cascade union, rationally determined the distribution scheme of benefit, shared benefit of joint operation among the power stations. Finally, the numerical study results illustrated the effectiveness of the proposed mechanism.

AE0017

Time: 16:35-16:50

Optimal deployment of DG and DSTATCOM in distribution system using swarm intelligent techniques

Srinivas Nagaballi and **Dr. Vijay S. Kale**
Electrical Engineering Department, VNIT Nagpur, Maharashtra, India

Power distribution system delivers the electrical power to the end-users. While doing this, it experiences some issues related to power loss, voltage profile, stability, power quality, reliability etc. Dynamic control of the power supply in Radial Distribution System (RDS) is possible by introducing Distributed Generation (DG) and Distribution Static Compensator (DSTATCOM). Benefits of integrating DG and DSTATCOM in RDS include improvement in voltage profile, voltage stability, reliability, power quality, harmonic mitigation and reduction in active as well as reactive power losses. DG and DSTATCOM are beneficial to RDS if they are placed optimally. This paper presents a method to improve voltage profile and reduce losses in RDS. In this paper, a recent nature inspired optimization method called Modified Variant of Grey Wolf Optimizer (MVGWO) has been utilized for optimal location and sizing of DG and DSTATCOM in RDS. The simulation results are compared with the existing method of Particle Swarm Optimization (PSO). Simulation results are obtained using MATLAB software.

The efficacy of MVGWO algorithm is illustrated with two test systems i.e. 33-bus and 69-bus RDS.



AE0019

Time: 16:50-17:05

Energy Flow Analysis of Combined Natural Gas and Electric System Using the multi-balanced buses power flow calculation

Hong-bo Wang, Bin Wang, Qing-shuang Guan, **Mr. Hao-tian Ding**, Xin Chen
North China Electric Power University, China

The electric-gas interconnection will be one of the main forms of the combined energy system in the future, its characteristic analysis and optimization operation are based on power flow calculation. In face of the problem of its power flow calculation, such as many types of nodes, large matrix dimension, relatively high algorithm requirements. To address this issue, an energy flow analysis method is developed in this paper, which is based on multi-balanced buses power flow calculation and loop iteration between the power grid and gas grid. The algorithm contains two layers of loops, the external loop mainly solves the problem of strong coupling, Internal loop mainly solve the divided solution of power grid and gas grid. The solution of the gas grid, which is based on the Newton mesh node method, consider the general scene, including multi-gas source, compressor and gas compressor. In order to process multi-engine problems, the calculation of power grid adopts multi-balanced node power flow algorithm. This method can start iterate separately from the gas grid or power grid. In the end, the method in this paper can be tested by simulation and comparison.



AE0024

Time: 17:05-17:20

A Commercial Inverter Applying for Solar Pump in Agriculture Plant Case Study in South of Thailand

Mr. Pirapong Limprasitwong and Chaiyapon Thongchaisuratkrul
Electrical Engineering, Thailand

This research aims to study an effective way of solar pump for agriculture plant using commercial inverter. The system includes PV solar panel and squirrel cage induction motor (SCI) with centrifugal water pump. The proposed solar pump system is performed in location where has no public electricity system. The place is used for agriculture. The place is in region of southern Thailand. The proposed solar pump system is not used backup battery. The system is controlled by internal-microcontroller of inverter. The control algorithm uses detecting solar voltage by DC-Link inverter and then control frequency suitable. At the plant, public stream is down the hill and storage pond is on the hill. The water is pumped from the stream to storage at the pond. After that it is distributed

to agricultural area through water sprinkler. The solar pump is delivered water automatically from downhill to the pond in every sunny day. From experimental result, it is investigated that the system can run well at frequency of 35-50 Hz with the flow rate of 385-550 l/min. The system consumes maximum power at 7 kW and minimum power at 2.4 kW. Moreover, it is still economical. The return on investment is 23% a year with a yield of 4.3 years comparing with diesel engine pump.



AE0025

Time: 17:20-17:35

The model of solar power plant efficiency improvement: a case study in Lampang, Thailand

Mr. Withawint Srisuriyajan and Chaiyapon Thongchaisuratkrul
Electrical Engineering, Thailand

This research studies the factors influencing the efficiency of solar power plants to form a control system for increasing their performance. The case study is conducted in Lampang province, Thailand. The investigated factors include irradiance, humidity, wind speed, ambient temperature, module temperature and power peak. All the data are analysed correlating with the electric power. The results show that the major factor influencing the solar power plants is irradiance. The efficiency also depends on cleaning or dirty of panel. Therefore, solar power plants efficiency could be improved by periodically cleaning. The decision point of cleaning is analysed. It is used to create the program model. The module temperature influences on the energy generation. If the module temperature increases, the generated energy decreases. On the other hand, humidity, wind speed, ambient temperature and power peak had less significant effect on solar energy generation. After panel cleaning, generated energy is increased about 5.6%-12.7% a month or approximately 6,780 – 15,240 kW-hour per month. Finally, the income per unit is 0.19 USD and the value return is 4.5 times of investment cost.



AE2003

Time: 17:35-17:50

Modified Beta MPPT Method in Photovoltaic System Based on Actual Climatic Data

Mr. Sikander Ali, Sheng Xue Tang, Jian Yu Zhang and Arshad Nawaz
Hebei University of Technology, China

Maximum power point tracking (MPPT) technique is a method which is used in the photovoltaic power system (PVS) to increase the power efficiency. The most important challenges facing conventional MPPT methods are oscillation during steady state and slow power tracking during dynamic state because of getting fixed step size during tracking. The Beta method can handle these challenges

using intermediate parameter "Beta" to get variable step size in transient state. However, for higher efficiency, some of the parameters of this method need to be optimized. The main objective of this research is to minimize oscillation in steady state and to tracks rapidly the maximum power in the transient state. Necessary climatic information such as highest, average irradiance and temperature levels are taken from 1-year climatic data set of Karachi city to set up Beta limits. A PLECS model of the modified beta method with the boost converter is proposed and simulated which shows excellent results.

Posters



AE001

Single Neuron PI Control of PFC AC/DC Converter for On-board Charger

Ms. Yuyan Chen, Yeqin Wang, Wei Ni, Yan Yang, Lu Liu, Xingyue Wang
Nanjing Tech University, China

The AC/DC Boost APFC converter is taken as the main topology to construct the circuit model. In view of the system uncertainty, a power factor correction control system based on single neuron PI control is designed in this paper. In order to verify the effectiveness of the proposed PFC control scheme, a comparative simulation experiment between the proposed control method and double closed-loop PI control method is carried out. The simulation results show that the control system proposed in this paper can allow the input current in phase with the grid voltage and avoid the crossover distortion at the zero crossing point of current. When the load changes within a certain range, the sinusoid of input current can still be guaranteed using single neuron PI control, the power factor is higher and above 0.99, and the total harmonic distortion is smaller. The system has good dynamics and static performance as well as strong adaptability and robustness.



AE006

Photovoltaic Power Supply Control Based on Sliding Mode Current Sharing Strategy and its Application

Ms. Mengtian Shen, Youming Liu, Jian Yang, Xiaoyu Tian, Yougen Chen
State Grid Hunan Electric Power Corporation Limited Maintenance Company, China

To solve the flow control problem of interleaved flyback photovoltaic charging module, this paper established a two-order model of the DC power supply in continuous current mode (CCM), outputting sine wave current by controlling the current of transformer. A novel current sharing strategy based on sliding mode control is proposed. The control algorithm is derived from the Lyapunov function without switching condition, which is convenient and has strong anti-interference ability. The effectiveness of the proposed model and control method is verified by MATLAB/Simulink simulation.

AE009

Attitude Control of a Quadrotor UAV Based on the Block-Pulse Function Approximation

Assoc. Prof. Chin-Hsiung Lee

College of Robotics, Fuzhou Polytechnic, China

Four-rotor UAV is a strong coupling, under-drive system. To solve the attitude control problem of the four-rotor UAV, a robust PID control method is proposed. The dynamic model of four-rotor UAV is established by Newton-Euler equation. Then a PID control method is proposed to realize attitude control. Finally, a digital redesign method based on the block-pulse function approximation is used to reconstruct a hybrid system. The output response of the whole hybrid system can approximate the output response of the analog system. The simulation results verify that the system performance is excellent after digital redesign.

AE012

Manipulator Trajectory Planning and Control Method Based on IMU

Mr. Qian Li, Hao Wu, Peng Wang

Institute of Automation, Shandong Academy of Sciences, China

In order to improve the teaching efficiency of the manipulator, a trajectory planning and control method based on inertial measurement unit (IMU) is proposed. Firstly, the data concluding angular velocities, accelerations and magnetic fields are collected based on IMU. Secondly, the posture of the mobile carrier is calculated by synthesizing the information of the 9-axis sensors. Finally, the direction control vector is constructed to realize the end point trajectory control of the manipulator. To verify the effectiveness of this method, a space arc trajectory planning and control simulation for PUMA560 is completed based on Android system and MATLAB Robot Toolbox. The experimental results show that the operator's intention can be accurately converted into a manipulator motion command, and the trajectory control efficiency and accuracy meet the teaching requirements.

AE014

Hardware design of individual soldier mental status monitoring system

Chuanjun Guo, **Dr. Yan Zhang**, Yuan Wang

Harbin Institute of Technology, China

With the development of wireless body area network and sensing technology, the detection of various physiological parameters can be used to analyse the physiological and mental status of individual soldiers. The

study in this paper is to design a set of multi-parameter monitoring system to measure individual soldier status using Wi-Fi wireless communication. The system uses a distributed node to monitor a series of physiological parameters such as electroencephalogram (EEG), electromyography (EMG), electrocardiogram (ECG), breathing and body posture of the soldier. Through the main node DSP, the soldier status is processed and analysed in a comprehensive way. The experiment results demonstrated that the precision, power consumption, reliability of the system could be a good foundation for the analysis of individual soldier status.

AE015

Sleep stage classification based on EEG signal by using EMD and DFA algorithm

Chuanjun Guo, **Dr. Yan Zhang**, Yuan Wang
Harbin Institute of Technology, China

With the increasing pressure of life in the present society, sleep problem has gradually become an important problem that influences most people. Sleep stage monitoring has become a reference standard for evaluating sleep quality, diagnosing sleep disorders and preventing sleep apnea. At present, the commonly used polysomnography sleep stage monitoring method has some shortcomings, such as complicated operation process, huge volume of monitoring equipment, extremely inconvenient measurement process, and the possibility to induce a variety of physiological artifacts interference. In this paper, electroencephalogram (EEG) is adopted to analyze the signal of the brain and thus to classify the sleep stage. Empirical mode decomposition method is used to denoise the EEG signals and the detrended fluctuation analysis (DFA) method is applied to extract the scale characteristics of the EEG. Artificial neural network is further employed to classify the sleep stage. The results show that the proposed method can discriminate different stages during sleep.

AE020

Research on Multi-UAVs Coordinated Coverage Reconnaissance Strategy

Mr. Pang Qiangwei, Hu Yongjiang, Li Wenguang
Army Engineering University Shijiazhuang Campus, China

Two mission modes for solving the problem of multi-UAV (Unmanned Aerial Vehicles) coordinated area coverage reconnaissance are proposed in this paper according to the size of the mission area, which is roughly divided into two steps: area decomposition and mission assignment. When the mission area is large, the area decomposition is transformed into the UAV ground station deployment problem, and two solutions for deploying the ground station are given. When the mission area is small, it is

decomposed into a set of paths to be executed, and then the path set is reassigned to each UAV. Finally, the development trend of multi-UAV coordinated reconnaissance is summarized.

AE20002

Application Analysis of Autonomous Underwater Vehicle in Submarine Cable Detection Operation

Dr. Bin CHEN, Rong LI, Wanjian BAI, Jianxiang LI, Yue ZHOU, Rui GUO¹
State Grid Shandong Electric Power Company;
Shandong Luneng Intelligence Technology Co., LTD., China

The means of construction survey and operation maintenance of submarine cable engineering are scarce, and the effect is not good. In the event of serious faults such as cable breakage, there is no effective mean to locate the breaking point. Combined with the actual needs of submarine cable engineering and the operation characteristics of autonomous underwater vehicle (AUV), the application prospects of AUV in the construction survey, maintenance inspection, and fault detection of submarine cable are analyzed.



AE0010

Real-time Predictive Method for Intelligent Monitoring and Management of Distributed Power Access

Ms. Xing Yahong, Wang Zheng, Zhao Haibo, Shen Zeyuan, Zhang Zhi, Hu Ende and Zhao Xi
Economic and Electrical Research Institute of Shanxi Electrical Power Company of SGCC, China

Currently, existing predictive methods are difficult to adapt to increasingly complex distributed power access and consumption, owing to the rapid growth of distributed accessing power grid scale and the uncertainty of time and space in new energy generation, such as poverty-alleviating photovoltaic (PV) and wind energy. In this paper, a real-time predictive method for intelligent monitoring and management of distributed power access is proposed. Firstly, the Voronoi algorithm is employed to divide the substation power supply area. Then, distributed power saturation is divided into four levels according to the penetration value associated with time matching of the network source and the under-construction capacity. Finally, the distributed power real-time intelligent warning method based on image processing is proposed. And the feasibility of this method was verified through two examples. This innovative partitioning method can overcome the shortcomings of the existing warning methods. Moreover, under the current situation of large-scale photovoltaic poverty alleviation in China, this method also can achieve coordinated optimization between distributed power supply and differentiated regional grid.



AE0015

Research on Microgrid Operation Control Strategy Under the New Power Reform

Dr. Qiang JIN, Weihong YANG, Xiangyu KONG, Dehong LIU, Tao WANG and Jianshi BAI

State Grid Economic and Technological Research Institute Co. Ltd., China

With the market-oriented reform in China's energy field, the operating model of the microgrid has changed. This paper studies the microgrid operation strategy under the new power reform system, and establishes the electricity transaction optimization model of the interconnected microgrid in the power market. The model can coordinate the power generation of each microgrid power component, schedule the amount of energy traded among microgrids in interconnected microgrid system, and optimize the electricity sold by interconnected microgrid systems and other members of the electricity market. Steps using genetic algorithm to solve the operational strategy are given by this paper. To evaluate the performance of proposed method, simulation analysis of multiple microgrids in different operating modes and scenarios is given at the end of the article.



AE0018

Influence of sampled data packet dropout on line differential protection

Nan Yao, Guangwei Shang, Jinfeng Geng, **Mr. Yao Liu**

Electrical Power Research Institute of Henan Electric Power Corporation, China

Switch-centric Ethernet communication is facing two main problems: time delay and data packet dropout. Sampled data may cause packet dropout events due to physical line faults, equipment faults, network congestion and routing errors during transmission over switching Ethernet. According to the number of loss points of sampled data, packet dropout events are divided into four categories: single-point packet dropout, single multi-point packet dropout, multi-interval single-point packet dropout, multi-interval continuous multi-point packet dropout. When the sampled data point is lost, the fundamental wave of the synthesized phasor is smaller than that without dropout. The more the loss, the greater the deviation between the two, which may lead to maloperation and rejection of differential protection. A simulation model is built in PSCAD / EMTDC, and the influence of packet dropout events on differential protection is demonstrated by examples.



AE0027

Research on Campus Landscape Lighting energy Sustainability Based on Emergy Theory

Mr. Junxue Zhang

Southeast University, China

The sustainability assessment of landscape and architectural lighting is a challenging research. This paper uses a new ecological assessment emergy method to evaluate the ecological sustainability of campus lighting design. The research results show that the emergy of architectural lighting occupies the main energy, which is determined by the main function of the campus. Due to students' activities in class, the energy consumption of architectural lighting is much larger than that of campus landscape. The energy value of each luminaire in landscape lighting is at a low level. The three indicators of sustainability are: ELR=2.21; NEYR=2.46; ESI=1.12, indicating that the overall energy consumption of lighting has little impact on the environment, and the relative relationship is relatively harmonious; at the same time, lighting design cannot produce high energy value. The sustainability index for campus lighting was 1.12, which was in a more reasonable state. Based on the perspective of emergy, this article discusses the sustainability of campus landscape and architecture and provides a new idea for the sustainability assessment of lighting design.

AE1001

Flexible DC System Fault Analysis

Mr. Jun Yin, Yuqiang Xue, Lingmin Wu

Fuzhou University, China

With the development of power electronics technology, flexible DC distribution system is getting more attention. The paper introduces the development of the flexible DC distribution system, and analyzes the pole-to-ground fault of the double-ended power supply system. Then it uses the electromagnetic transient simulation software PSCAD/EMTDC to build a model for verification. The calculation results show that in the case of DC-side clamped resistance grounding method, when the system experiences a pole-to-ground fault, the active power does not change.



AE2001

Short-term forecasting of power load in neural network considering the weight of meteorological factors

Mr. Yeting Mao, Wu Zhu
Shanghai University of Electric Power, China

The power grid is the basic service industry of the whole country, which is of great significance to stabilize national security, improve social stability and maintain the normal life of the people. This paper mainly studies the related factors that affects the power load forecasting (meteorological factors), the first analysis of the meteorological information of load, the influence of the sample data to quantify and normalized processing, and on the basis of weight optimization of BP neural network and RBF neural network model is established, with the practical example proves that RBF algorithm to obtain the precision of prediction, has certain use value.



AE2004

Sliding mode observer of BLDC motor drive under DTC scheme with hall signals

Youliang Lu, **Mr. Xiong Xie**
University of Electronic Science and Technology of China

In this paper, sliding mode observation of BLDC motor drives under DTC scheme with hall signals to get the rotor's position is investigated. In the literature, several methods have been proposed for BLDC motor drive to obtain optimum space voltage vector and torque control with minimum torque pulsations. Most methods are complicated and do not consider the hall signals. In this study, a simple and universal approach to achieve torque ripple-free DTC based on stationary reference is presented. This method uses a continuous function to replace conventional symbolic function in the sliding mode observer of back electromotive force to get smooth torque waveform. Moreover, to make the more universal, this method employs the hall signals rather than position encoder. The effectiveness of the introduced scheme is verified through extensive simulation under MATLAB, and the results indicates good speed response is achieved by the BLDC motor.

Listeners



Lis 1

Mr. Kim Hwang-Hee

CONTECHENG Co., Ltd, Republic of Korea



Lis 2

Mr. Lee Jae-Young

CONTECHENG Co., Ltd, Republic of Korea

One Day Visit

December 28, 2018
Beijing, China



Combining both modern and traditional architecture, Beijing is one of the oldest cities in the world, with a rich history dating back three millennia. As the last of the Four Great Ancient Capitals of China, Beijing has been the political center of the country for most of the past eight centuries, and was the largest city in the world by population for much of the second millennium A.D. Encyclopædia Britannica notes that "few cities in the world have served for so long as the political headquarters and cultural center of an area as immense as China."

07:30

- **Downtown to Badaling Great Wall (Around one and a half hours)**

Note: Gathering at 7:00 am in your hotel lobby and the tour guide will contact you last night for details.

09:00

- **Badaling Great Wall (Around two and a half hours, including Cable car)**

Being the ancient military defence project, Great Wall is symbol and proud of China. It shows the Great Wall as it would have looked originally, and it does not look too new. That is another reason of why most travelers choose Badaling Great Wall. There is a Great Wall Museum and Great Wall National Theater close to Badaling Great Wall. The theater offers you a chance to get a full view of the Great Wall of China.



12:00

- **Lunch (Included)**

13:30

- **Ming Tombs (Dingling including)**

Dingling is the tomb of the tenth emperor of the Ming Dynasty and his two empresses. Its underground palace was the first of the underground structures excavated between 1956 and 1957.



15:30

- **Olympic Green (Disband place)**

Beijing Olympic Park is where the 2008 Beijing Olympic Games and Paralympics took place. The park was designed to contain ten venues, the Olympic Village, and other supporting facilities. Afterward, it was transformed into a comprehensive multifunctional activity center for the public.

Author Index

A		Pirapong Limprasitwong	20
Andrey Neznamov	17		
B		Q	
Bin CHEN	26	Qian Li	24
		Qiang JIN	27
		Qinhuan XU	14
C		S	
Chengpeng Tang	19	Sikander Ali	21
Chin-Hsiung Lee	24		
F		T	
Fei Zhao	18	Tatiana Ezangina	15
H		V	
Hao-tian Ding	20	Vijay S. Kale	19
Hyunki Hong	14		
J		W	
Juan Chen	13	W. Xu	18
Jun Yin	28	Withawint Srisuriyajan	21
Junxue Zhang	28		
K		X	
Kenza Bouchaâla	16	Xin Yuan Wang	16
Kim Hwang-Hee	30	Xing Yahong	26
		Xiong Xie	29
L		Y	
Lee Jae-Young	30	Yan Zhang	24/25
		Yao Liu	27
		Ye Yuan	13
M		Yeting Mao	29
Mengtian Shen	23	Yuyan Chen	23
P		Z	
Pang Qiangwei	25	Zhiqiang Jia	15

