IEEE-CYBER

Tianjin, China July 19-23, 2018

PROGRAM

The 8th Annual IEEE International Conference on

Cyber Technology in Automation Control and Intelligent Systems

IEEE

IEEE Robotics & Automation Society

CINGAI

The 8th Annual IEEE International Conference

on CYBER Technology

in Automation, Control, and Intelligent Systems

IEEE-CYBER 2018

Conference Digest

Tianjin, China

July 19 – 23, 2018

IEEE-CYBER 2018 PROCEEDINGS

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The Institute of Electrical and Electronics Engineers, Inc.

Welcome Message

Welcome to the 8th Annual IEEE International Conference on ***CYBER*** Technology in Automation, Control, and Intelligent Systems. The IEEE-CYBER is a key international conference (financially sponsored by IEEE Robotics & Automation Society and technically sponsored by Nankai University, Hebei University of Technology, and K.C.Wong Education Foundation) focusing on advanced research areas related to cyber physical systems, control/automation, robotics, internet of things and sensor networks. This year, the IEEE-CYBER conference will be held from July 19 to July 23 in Tianjin, China, with the spirit of bringing together researchers and engineers from around the world to present their latest research findings, accomplishments, innovations, and visions in the related fields.

With 419 paper submissions from 13 countries or regions, 304 papers have been selected for presentation at the conference after going through a rigorous review process. The technical program of the IEEE-CYBER 2018 consists of 7 plenary talks, 3 keynote talks, 42 technical sessions organized into six parallel tracks, and 4 separated poster sessions. The goal of IEEE-CYBER 2018 is to create an opportunity for participants to present their latest research results to an international audience. Moreover, networking with other researchers has always been a cornerstone of the IEEE-CYBER conference series, and several networking activities have been scheduled during IEEE- CYBER 2018, including welcome reception, banquet, and farewell reception. We hope IEEE-CYBER 2018 will be a valuable, memorable and exciting platform for people to exchange ideas and information, identify new research interests, establish collaborations, make friends, and find new opportunities for their career.

IEEE-CYBER 2018 will give out three technical awards: *Best Conference Paper Award*, *Best Student Paper Award*, and *Best Poster Award*. The nominated papers are arranged in separate sessions for presentation, which is convenient for those who specially want to attend the presentations from the nominees.

We greatly appreciate Nankai University, Hebei University of Technology, and K.C.Wong Education Foundation for their strong support to the organization of this conference. In addition, we would like to express our deepest gratitude to the great contributions from the Program Committee members, the Organizing Committee members, local staff, and student volunteers. The IEEE-CYBER 2018 would not have been possible without your commitment and efforts. Last but not least, our heartfelt thanks go to the authors, the reviewers, the conference participants, and the sponsors. It is your participation and contribution that will make IEEE-CYBER 2018 unique, enjoyable, and successful.

Besides enjoying the technical programs and networking activities during the conference, we highly suggest you spend some time in enjoying the city of Tianjin.

Finally, we wish you a wonderful and joyful stay in Tianjin, China!

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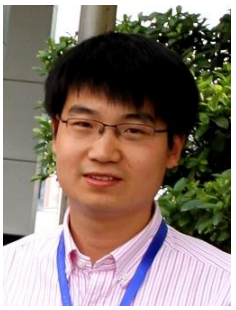

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We acknowledge the support of the following sponsors to the 8th Annual IEEE International Conference on CYBER Technology in Automation, Control, and Intelligent Systems (IEEE-CYBER 2018).

General Information

Conference Date and Venue

Date: July 19 - 23, 2018

Venue: Hyatt Regency Tianjin East
126 Weiguo Road, Hedong District, Tianjin, China, 300161

Registration Desk

July 19 (Thursday)	14:00 - 18:00	Lobby, 1F
July 20 (Friday)	08:00 - 18:00	Lobby, 1F
July 21 (Saturday)	08:00 - 18:00	Lobby, 1F
July 22 (Sunday)	08:00 - 17:00	Lobby, 1F

Conference Events

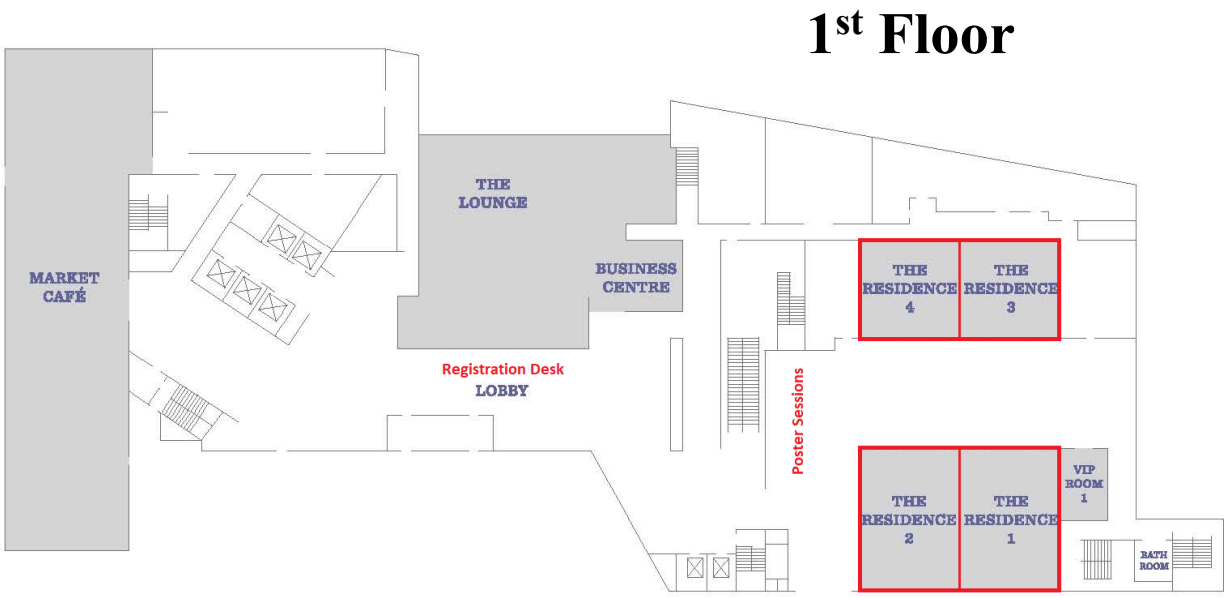
Welcome Reception	July 19 (Thursday)	18:30 - 20:00	Market Café, 1F
Dinner	July 20 (Friday)	18:30 - 20:00	Market Café, 1F
Conference Banquet	July 21 (Saturday)	18:30 - 21:30	Grand Ballroom, 2F
Farewell Dinner	July 22 (Sunday)	18:30 - 20:00	Market Café, 1F

Conference Lunches

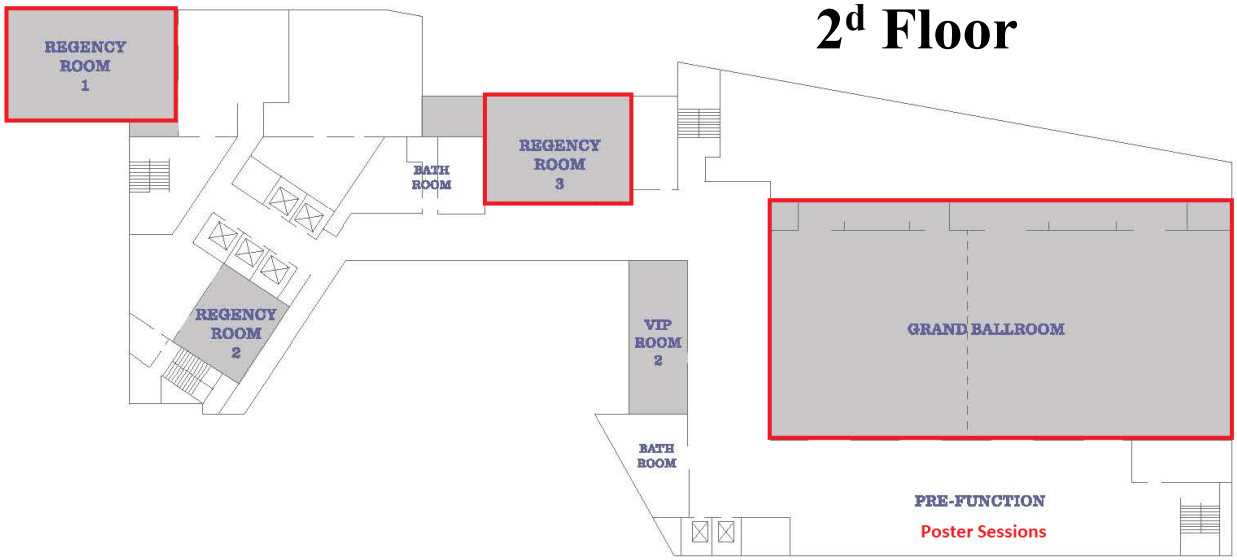
July 20 (Friday)	12:00 - 13:30	Market Café, 1F / Wok in the Garden, 3F
July 21 (Saturday)	12:00 - 13:30	Market Café, 1F / Wok in the Garden, 3F
July 22 (Sunday)	12:00 - 13:30	Market Café, 1F

Floor Map- Hyatt Regency Tianjin East

1st Floor (Registration Desk, Workshop, Oral Sessions, Poster Sessions, Coffee Breaks, Welcome Reception, Farewell Dinner and Lunches)



2nd Ffloor (Plenary Talks, KeynoteTalks, Forum, Oral Sessions, Poster Sessions, Coffee Breaks and Conference Banquet)



Official Language

The official language of the conference is English.
All presentations, including discussions and paper submissions, shall be made in English.

Conference Attire

Casual attire is generally recommended for the Welcome and Farewell Receptions while a business suit or a white shirt with a neck-tie at all technical sessions and at the Conference Banquet.

Presentation Specifications

In each oral presentation room, one LCD projector and one laptop will be available. The presenters do not need to bring their own laptop. The presenters should prepare Power Point Slides (PPT) to facilitate their presentations. The slides and the presentations must be in English. Please test the slides (in either the provided laptop or your own laptop) before session start to avoid potential format problems caused by different software versions.

Durations for each category of oral presentation are listed below:

Plenary Lectures are scheduled for 45 minutes (including 5 mins Q&A) each.
Keynote Lectures are scheduled for 30 minutes (including 5 mins Q&A) each.
Regular Sessions are scheduled for 15 minutes (including 3 mins Q&A) each.

Poster Specifications

Poster session represents an effective and valuable means for authors to present their research results. It offers an opportunity of meeting with interested attendees for in-depth scientific and technical discussions, and establishing new collaborations. Therefore, it is important that you display your results clearly to attract people who have an interest in your team's research work.

Your poster should cover the KEY POINTS of your paper, which include but not limited to backgrounds, methods, results and conclusions. Make your poster as self-explanatory as possible. This will save your time for discussions and questions with fellow researchers.

Poster Dimensions

- Your poster SHOULD have the following dimensions:
- **Poster Size: A0 Size 33.1 inches (84.1 cm) wide x 46.8 inches (118.9 cm) high.**
- Please note that printing out your submitted full paper in A4 size format is NOT acceptable as a poster.

Poster Contents

- **Title:** The title of your poster should appear at the top with lettering of at least **70 pt** font size). Below the title, place the names of authors and their affiliations.

- **Text:** Text should be readable from five feet away. Use a minimum font size of **18 pt**. Keep the text brief. Try to use text to introduce the study, explain visuals and direct viewers' attention to significant data trends and relationships portrayed in the visuals, state and explain the interpretations that follow from the data. It is also a good idea to put future research plans or questions for discussion with viewers in your text.

- **Figures:** Each figure should have a brief title. Figures should be numbered consecutively according to the order in which they are first mentioned in the text. Try to use color figures rather than only black and white text to make your poster attractive and highlight the important technical content of your paper. Make sure that the text and the visuals are integrated.

Transportation to/from Tianjin Binhai International Airport

Hyatt Regency Tianjin East forms part of the fast-developing commercial hub connecting downtown Tianjin and the booming business district of Tianjin Binhai New Area. The convenient location is just 20 minutes from Tianjin Binhai International Airport and 10 minutes from the historic heart of Tianjin, with easy access to the Tianjin Economic Development Area (TEDA), Dongli, Beichen, Wuqing and Xiqing industrial zones. It is also close to Tianjin Line 2 Metro Station and Tianjin Main Railway Station, a regular stop for high-speed train services from around China, including the Tianjin-Beijing line that takes just 28 minutes to reach the Chinese capital.

Tianjin Binhai International Airport is located in Zhanggui Zhuang, Dongli District, about 13 kilometers (about 8 miles) away from the downtown area.

With easy access to the express highway linking to the airport and industrial zones, the hotel is within 20 minutes of the airport and 10 minutes of downtown.

a. Beijing Capital International Airport: 120 km (2 hours by car)
b. Tianjin Binhai International Airport: 13 km (20 minutes by car)
c. Tianjin Train Station: 4.5 km (14 minutes by car)
d. Subway Station: Jingjiang Road Station, Line 2

For more information, please contact the Hotel Concierge at +86 22 2457 1234.

About Tianjin

Tianjin, one of China's four municipalities directly under the Central Government, is the largest opening coastal city in North China, one of the National Famous Historical and Cultural Cities in China, as well as a member of the first group of the outstanding tourist cities of China.

Tianjin is located in northeast part of the North China Plain and the center of Bohai-Rim, bordering the Bohai Sea in the east, leaning against the Yanshan Mountain in the north. It is only 120 kilometers from Beijing in the northwest. Tianjin covers an area of 11,760 square kilometers, with a 153-kilometer-long coastline and a total municipal population of 12,280,000. Tianjin is rich in tourism resources. There are many types of attractions in Tianjin, including mountains, rivers, lakes, sea, springs, and wetlands. Tianjin plays a prominent role in China's modern history and can be viewed as an epitome of modern history of China. The blend of Chinese and Western cultures forms Tianjin's distinctive human resources.

Tianjin will gradually transform into an eco-city, an international port city as well as an economic center in North China. As a modern metropolis with a long history, profound cultural background and distinctive natural resources, Tianjin will keep the city environment clean and beautiful, highlight the characteristics of the city and provide tourists with complete facilities and better services.

Climate

Tianjin has four distinct seasons and a dry climate, with summer temperatures in July ranging from 20ºC to 37ºC (68ºF to 98ºF) and winter temperatures in January from -5ºC to 10ºC (23ºF to 50ºF).

Currency

Renminbi (CNY). Major credit cards (Visa, MasterCard, and American Express) and travelers cheques are commonly accepted.

Local Time

The standard time zone is **UTC/GMT +8**.

Electricity

The electrical system is 220V (50 Hz). Travelers with shavers, computers, and other personal electronics are advised to carry a travel Universal adaptor.

Plenary Talks

Plenary Talk 1: Friday, July 20, 2018
09:15-10:00, Grand Ballroom, Second Floor
Session Chair: Yongchun Fang, Nankai University

The Tri-Co (Coexisting-Cooperative-Cognitive) Robots

Han Ding

Professor
School of Mechanical Science and Engineering
Huazhong University of Science & Technology, China

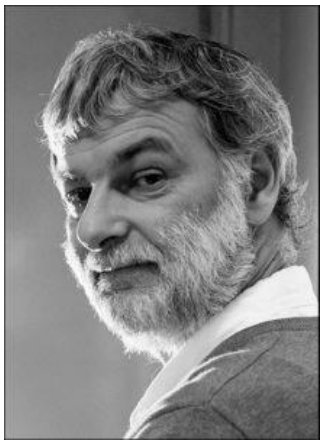
Abstract:

Tri-Co Robots (Coexisting-Cooperative-Cognitive Robots) are those that can naturally interact and collaborate with the environment, including humans as well as other robots, and adapt to new situations. This will all be achieved through state-of-the-art machine learning, control and planning algorithms. Key characteristics of Tri-Co Robots are: plastic and dexterity, multi-modal perception, and working autonomously and collaboratively. This talk will introduce the current research activities of robotics in China, especially the Tri-Robot Research Plan of NSFC (National Natural Science Foundation of China). It will discuss the primary scientific challenges and key scientific problems of the plan, mainly focusing on mechanism, perception and control. The talk will also forecast China's expected breakthroughs and goals in Tri-Co robot research. Finally, the talk will present recent research results of our group and discuss current and future challenges.

Biography:

Prof. Han Ding received his Ph.D. degree in Mechatronics from Huazhong University of Science & Technology in 1989. Supported by the Alexander von Humboldt Foundation, he worked at University of Stuttgart, Germany in 1993. He obtained the National Distinguished Youth Scientific Fund in 1997 and was awarded the "Cheung Kong" Chair Professor at Shanghai Jiao Tong University in 2001. He was elected a member of Chinese Academy of Sciences in 2013. Prof. Ding has long dedicated himself to research in the field of robotics and digital manufacturing, and has successfully combined both technologies. He published three academic books and more than 300 journal papers, and licensed more than 60 patents in China. Prof. Ding acted as an Associate Editor (2003-2007) and as an Editor (2011-) of IEEE Transactions on Automation Science and Engineering. He was also a Technical Editor of IEEE/ASME Trans. on Mechatronics from 2010 to 2014. Currently, he is a Senior Editor of IEEE Robotics and Automation Letters. He is also the Co-founder of the IEEE International Conference on Intelligent Robotics and Applications.

Plenary Talk 2: Friday, July 20, 2018
10:00-10:45, Grand Ballroom, Second Floor
Session Chair: Xin Zhao, Nankai University



Geometric and End-to-end Visual Servoing

François Chaumette

Rainbow group
Inria, Univ Rennes, CNRS, IRISA
Rennes, France

Abstract: As for humans and most animals, vision is a crucial sense for a robot to interact within its environment. Vision-based robot motion control, also named visual servoing, is a general approach to close the perception-action loop. It has given rise to an incredible amount of research and successful applications from the creation of the fields of robotics and computer vision several decades ago. The aim of this talk is to provide a comprehensive state of the art on the basic concepts, methodologies, and applications. In a first part, the traditional approach based on geometric visual features, such as image points, image moments, or camera-object pose will be described. The more recent end-to-end approach that directly uses the image content without any image tracking nor matching process will be also considered, providing a link to CNN modern methods that use the same inputs.

Biography:

François Chaumette, IEEE Fellow, is an Inria senior research scientist at IRISA in Rennes, France, where he lead the Lagadic group since 2004. He received the M.Sc. (eng.) degree from "Ecole Nationale Supérieure de Mécanique", Nantes, in 1987 and a Ph.D. in computer science from the University of Rennes in 1990. His research interests lie in the area of robot vision, mainly visual servoing and active perception. He has published over 250 journal or conference papers, with the 2002 Best IEEE Transactions on Robotics and Automation Paper Award. He has served on the technical program committee of the main conferences in computer vision (ECCV, CVPR, ICCV) and robotics (ICRA, IROS, RSS). He has been Associate Editor of the IEEE Transactions on Robotics (2001-2005) and is currently in the Editorial Board of the Int. Journal of Robotics Research, Funding Senior Editor of the IEEE Robotics and Automation Letters, and Senior Editor of the IEEE Transactions on Robotics. He is currently an elected member of the IEEE Robotics and Automation Administrative Committee.

Plenary Talk 3: Friday, July 20, 2018
11:15-12:00, Grand Ballroom, Second Floor
Session Chair: Peng Yang, Hebei University of Technology

Leader-follower Formation Algorithms with Collision Avoidance for Two-wheeled Mobile Robots

Krzysztof Kozlowski

Professor
Institute of Control and Robotics
Poznan University of Technology, Poland

Abstract:

Multiple mobile robot control became intensively investigated area of robotics in the last few years. This is due to a wide range of applications and the availability of technologies supporting the development of mobile robotics. Designing effective control algorithms remains currently the most challenging problem.

Regardless of the main purpose of the application, one of the basic problems is formation motion control. There are three classes of solutions: virtual structure, behavioral approach and leader-following methods. In this paper a review of leader-follower methods for the multiple differentially driven mobile platforms is presented. The goal is to tracking desired trajectory by the formation. In this approach only one robot called leader knows the desired trajectory. The others form a queue. For each of them control problem reduces to the task of maintaining a constant (predefined) distance from the predecessor.

Most of the algorithms known from the literature assume that initial configuration of robots ensures that collisions cannot occur. In presented methods collision avoidance behavior is part of the algorithm. Initial configurations may be 'difficult', that minds that during the process of forming the queue robots can get close to each other, but the collision will not occur, which is guaranteed by the algorithm.
In the paper the proof of stability of the closed-loop system is given in presence of obstacles for different kind of control algorithms. The proposed algorithms are new and are supported by extensive numerical simulations.

Biography:

Professor K. Kozlowski received the M.Sc. degree in electrical engineering from Poznan University of Technology (PUT), Poland, and the Ph.D. degree in control engineering from PUT in 1979, where he currently holds full professor position in robotics and automation. In 1993, he was a Fulbright scholar with Jet Propulsion Laboratory, Pasadena, USA. He founded and serves as a chairman of a new Institute of Automation and Control established on May 1, 2017 at Poznan University of Technology.

He teaches and conducts research in the area of modeling and control of industrial and mobile robots. His research interests include multi-agent systems, identification and various robotics applications. His research publications include more than 140 conference papers and more than 65 papers published in national and international journals. He is an author of the book titled Modelling and Identification in Robotics (Springer-Verlag, 1998).

He was an Associate Editor for the IEEE Transactions on Control Systems Technology (1999-2008), for the IEEE Robotics and Automation Magazine (1998-2002), for the Journal of Intelligent and Robotic Systems (2005-2010) and for the International Journal of Applied Mathematics and Computer Science (1999-2017), IEEE Conference Editorial Board, Conference on Decision and Control (CDC) and American Control Conference (ACC) since 1999 till now. He was the member of the Administrative Committee, IEEE Robotics and Automation Society 2000-2002, 2004-2005 and the member of the Board of Directors, IEEE Control Systems Society, 2003-2004. He serves as the chair of the IEEE Robotics and Automation Chapter, Polish Section, 2000-2008 and 2014-2019.

He conducted 39 different research scientific projects as supervisor (26) and as principal investigator (13) granted by national research institutions and 2 international research agencies.

Plenary Talk 4: Saturday, July 21, 2018
08:30-09:15, Grand Ballroom, Second Floor
Session Chair: Jingtai Liu, Nankai University

Cross-modal Learning of Intelligent Robot Systems

Jianwei Zhang

Professor
Institute TAMS (Technical Aspects of Multimodal Systems)
Department of Informatics
University of Hamburg, Germany

Abstract:

It is a long-term goal of AI research to understand the complex neural, cognitive and computational mechanisms of cross-modal learning and to use this understanding for (1) enhancing human performance, and (2) improving the performance of artificial systems. The term cross-modal learning refers to the synergistic synthesis of information from multiple sensory modalities such that the learning that occurs within any individual sensory modality can be enhanced with information from one or more other modalities. Cross-modal learning is crucial for human understanding of the world, and examples are ubiquitous, such as: learning to grasp and manipulate objects; learning to walk; learning to read and write; learning to understand language and its referents; etc. In all these examples, visual, auditory, somatosensory or other modalities have to be integrated, and learning must be cross-modal. In fact, the broad range of acquired human skills are cross-modal, and many of the most advanced human capabilities, such as those involved in social cognition, require learning from the richest combinations of cross-modal information.In a dynamic and changing world, a robust and effective robot system must have adaptive behaviors, incrementally learnable skills and a high-level conceptual understanding of the world it inhabits, as well as planning capabilities for autonomous operations. Future intelligent robot systems will benefit from the recent research on neurocognitive models in processing cross-modal data, exploiting synergy, integrating high-level knowledge and learning, etc. I will first introduce cross-modal learning issues of intelligent robots. Then I will present our investigation and experiments on synergy technique which uses fewer parameters to govern the high DOF of robot movement. The third part of my talk will demonstrate how an intelligent system like a robot can evolve its model as a result of learning from experiences; and how such a model allows a robot to better understand new situations by integration of knowledge, planning and learning.

Biography:

Jianwei Zhang is professor and director of TAMS, Department of Informatics, University of Hamburg, Germany. He received both his Bachelor of Engineering (1986, with distinction) and Master of Engineering (1989) at the Department of Computer Science of Tsinghua University, Beijing, China, his PhD (1994) at the Institute of Real-Time Computer Systems and Robotics, Department of Computer Science, University of Karlsruhe, Germany, and Habilitation (2000) at the Faculty of Technology, University of Bielefeld, Germany. His research interests are sensor fusion, intelligent robotics and multimodal machine learning, cognitive computing of Industry4.0, etc. In these areas he has published about 300 journal and conference papers, technical reports, four book chapters and three research monographs. He holds 40+ patents on intelligent components and systems. He is the coordinator of the DFG/NSFC Transregional Collaborative Research Centre SFB/TRR169 “Crossmodal Learning” and several EU robotics projects. He has received multiple best paper awards. He is the General Chairs of IEEE MFI 2012, IEEE/RSJ IROS 2015, and the International Symposium of Human-Centered Robotics and Systems 2018. Jianwei Zhang is life-long Academician of Academy of Sciences in Hamburg.

Plenary Talk 5: Saturday, July 21, 2018
09:15-10:00, Grand Ballroom, Second Floor
Session Chair: Heping Chen, Texas State University

Towards More Flexible Calibrations for Visual Sensing and Tracking

Youfu Li

Professor
Department of Mechanical Engineering
City University of Hong Kong, Hong Kong, China

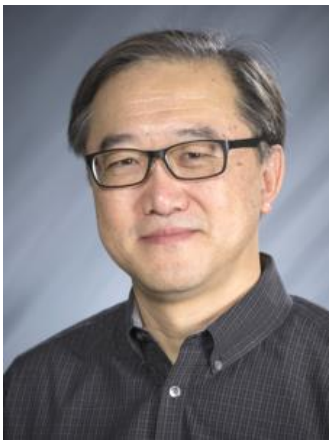
Abstract:

Visual sensing is important to many engineering applications including tracking for robotics. In this talk, I will present our research in visual sensing and tracking focusing on the issues in the calibration. For robotic applications, visual sensing in 3D is often needed, but the calibration remains tedious and inflexible with traditional approach. To this end, we have investigated the relevant issues for different visual sensing systems. A flexible calibration method desires the vision system parameters to be recalibrated automatically or with less operator interference whenever the configuration of the system is changed, but practically this is often hard to achieve. Various attempts were made in our previous works to enhance the flexibility in the visual sensing calibration. I will present some them including the work on omni-directional visual sensing and tracking. Another case to present is that of gaze tracking where the issues in the parallax errors and the tedious calibration procedures are addressed with our new calibration method developed.

Biography:

You-Fu Li received the B.S. and M.S. degrees in electrical engineering from Harbin Institute of Technology, China. He obtained the PhD degree in robotics from the Department of Engineering Science, University of Oxford in 1993. From 1993 to 1995 he was a research staff in the Department of Computer Science at the University of Wales, Aberystwyth, UK. He joined City University of Hong Kong in 1995 and is currently a professor in the Department of Mechanical Engineering. His research interests include robot sensing, robot vision, and visual tracking. In these areas, he has received many awards including a Second Prize of Natural Science Research Award by the Ministry of Education of China, for the work on "Active 3D Computer Vision", and IEEE Sensors Journal Best Paper Award by IEEE Sensors Council. He has served as an Associate Editor for IEEE Transactions on Automation Science and Engineering (T-ASE), Associate Editor for IEEE Robotics and Automation Magazine (RAM), Editor for CEB, IEEE International Conference on Robotics and Automation (ICRA), and Guest Editor for IEEE Robotics and Automation Magazine (RAM).

Plenary Talk 6: Sunday, July 22, 2018
08:30-09:15, Grand Ballroom, Second Floor
Session Chair: Xiang Chen, University of Windsor



Making of a Microresonator-based Sensor –Dynamics, Feedback and Functional Printing

George Chiu

Professor
School of Mechanical Engineering,
Purdue University, USA

Abstract:

Vibration-based sensing using microelectromechanical systems (MEMS) have shown promise in mass detection across numerous application spaces. To date, many such vibration-based sensing modalities have relied upon monitoring shifts in the natural frequency to detect structural changes which are attributable to the chemical or biological species that are being detected. This approach often carries significant signal processing expense, due to the presence of electronics such as precision phase locked loops or lock-in amplifiers, when high sensitivities are required. Bifurcation-based sensing modalities, in contrast, can produce changes in response amplitude with high sensitivity to structural change. However, low fabrication yield is a key consideration. In this talk, we will introduce the design and implementation of a tunable, Duffing-like electronic resonator. It was realized via nonlinear feedback electronics on a quartz crystal tuning fork as the device platform. The system in this manifestation used collocated sensing and actuation, along with readily available electronic components, to realize the desired behavior, creating a nonlinear resonator from a linear one. A novel method, leveraging inkjet technology, is used to functionalize the sensors and characterizes the spatial mass sensitivity of microresonators. Experimental validations will also be presented.

Biography:

George T.-C. Chiu is the Assistant Dean for Global Engineering Programs and Partnerships in the College of Engineering and a Professor in the School of Mechanical Engineering with courtesy appointments in the School of Electrical and Computer Engineering and the Department of Psychological Sciences at Purdue University. Dr. Chiu received the B.S. degree in Mechanical Engineering from the National Taiwan University in 1985 and the M.S. and Ph.D. degrees from the University of California at Berkeley, in 1990 and 1994, respectively. Before joining Purdue, he worked for the Hewlett-Packard Company, designing inkjet printer and multi-function devices. Between 2011 and 2014, he served as the Program Director for the Control Systems Program of the US National Science Foundation. Dr. Chiu's current research interests are mechatronics and dynamic systems and control with applications to digital printing and imaging systems, digital fabrications, human motor control and robotics, motion and vibration perception and control. He received the 2012 NSF Director's Collaboration Award, the 2010 IEEE Transactions on Control System Technology Outstanding Paper Award and the Purdue University College of Engineering 2016 Faculty Engagement/Service Excellence Award and 2010 Team Excellence Award. Professor Chiu is the current Editor-in-Chief for the IEEE/ASME Transactions on Mechatronics. He served on the Executive Committee of the ASME Dynamical Systems and Control Division from 2007 to 2015 and was the Chair of the division between 2013-14. He is a Fellow of ASME and the Society for Imaging Science and Technology (IS&T) and a senior member of IEEE.

Plenary Talk 7: Sunday, July 22, 2018
09:15-10:00, Grand Ballroom, Second Floor
Session Chair: Zhidong Wang, Chiba Institute of Technology

Mutli-Scale Robotic System — From Large Scale Cellular Robot to Small Scale Robots

Toshio Fukuda

Professor
Beijing Institute of Technology, China

Abstract:

This lecture is an overview of the Multi-scale robotics, based on the Cellular Robotics System, which is the basic concept of the emergence of intelligence in the multi-scale way from Cell Level to the Organizational Level, proposed more than 30 years ago. It consists of many elements how the system can be structured from the individual to the group/society levels in analogy with the biological system. It covers with the wide range of challenging topics: Then I mainly focus on medical robots and bio cell manipulation and cell assembly and refer to applied areas for the future hybrid cyborg and bionic system to improve the quality of life of human.

Biography:

Toshio Fukuda graduated from Waseda University, Tokyo, Japan in 1971 and received the Master of Engineering degree and the Doctor of Engineering degree both from the University of Tokyo, in 1973 and 1977, respectively. He studied at Graduate School of Yale University in 1973-1975. He joined the National Mechanical Engineering Laboratory in Japan in 1977, the Science University of Tokyo in 1982, and then joined Department of Mechanical Engineering, Nagoya University, Japan in 1989. He worked at University of Stuttgart, as Humboldt Fellow in 1979-1981.

He is Professor Emeritus of Nagoya University. Department of Micro and Nano-Systems Engineering and Professor of Meijo University as well as Beijing Institute of Technology.

He is mainly engaging in the research fields of intelligent robotic system, micro and nano robotics, bio-robotic system, and technical diagnosis and error recovery system.

He was the President of IEEE Robotics and Automation Society (1998-1999), Director of the IEEE Division X, Systems and Control (2001-2002), the Founding President of IEEE Nanotechnology Council (2002-2005), Region 10 Director (2013-2014) and Director of Division X, Systems and Control (2017-2018). He was Editor-in-Chief of IEEE/ASME Trans. Mechatronics (2000-2002).

He was the Founding General Chair of IEEE International Conference on Intelligent Robots and Systems (IROS) held in Tokyo (1988). He was Founding Chair of the IEEE Workshop on Advanced Robotics Technology and Social Impacts (ARSO, 2005), Founding Chair of the IEEE Workshop on System Integration International (SII, 2008), Founding Chair of the International Symposium on Micro-Nano Mechatronics and Human Science (MHS, 1990-2012).

He has received many awards such as IEEE Eugene Mittelmann Achievement Award (1997), IEEE Third Millennium Medal (2000) , Humboldt Research Prize (2003), IEEE Robotics and Automation Pioneer Award (2004), IEEE Transaction Automation Science and Engineering Googol Best New Application Paper Award (2007), George Saridis Leadership Award in Robotics and Automation (2009), IEEE Robotics and Automation Technical Field Award (2010). He received the IROS Harashima Award for Innovative Technologies (2011), Friendship Award of Liaoning Province PR China (2012), Friendship Award from Chinese Government (2014), JSME Achievement Award (2015), IROS Distinguished Service Award (2015) and Honor of Medal with the Purple Ribbon from Japanese Government (2015). Award from Automation Foundation (2016).

IEEE Fellow (1995). SICE Fellow (1995). JSME Fellow (2002), RSJ Fellow (2004), VRSJ Fellow (2011) and member of Science Council of Japan (2008-2014), Academy of Engineering of Japan (2013-), and Foreign member of Chinese Academy of Sciences (2017).

Keynote Talk

Keynote Talk 1: Sunday, July 22, 2018
10:30-11:00, Grand Ballroom, Second Floor
Session Chair: Xuebo Zhang, Nankai University

Robust Coordination of Networked Multi-Robot Systems

Guoqiang Hu

Associate Professor
School of Electrical & Electronic Engineering
Nanyang Technological University, Singapore

Abstract:

Man-made multi-robot systems have been advancing apace with the help of high-performance hardware and computational technologies. Despite the high-performance computing, communication, sensing, and power devices used in these systems, their effectiveness in uncertain environments appears to still fall behind the natural systems such as a swarm of ants, a flock of birds, or a team of wolves. One of the challenges in multi-robot coordination is the lack of effective distributed algorithms and designs that enable the robots to work cooperatively and safely in uncertain environments. This talk will present some recent research results on distributed algorithms and robust control methods for multi-robot coordination. The research on this topic has a wide range of potential engineering applications, including surveillance and search, intelligent transportation, environment monitoring, unmanned exploration of dangerous areas, and deployment and scheduling of sensor networks.

Biography:

Guoqiang Hu joined the School of Electrical and Electronic Engineering at Nanyang Technological University, Singapore in 2011, and is currently a tenured Associate Professor and the Director of the Centre for System Intelligence and Efficiency (EXQUISITUS). He was an Assistant Professor at Kansas State University from 2008 to 2011. He received the B.Eng. degree in Automation from University of Science and Technology of China in 2002, the M.Phil. degree in Automation and Computer-Aided Engineering from the Chinese University of Hong Kong in 2004, and the Ph.D. degree in Mechanical Engineering from University of Florida in 2007. His research interests include distributed control, optimization and games with applications to intelligent energy and robotic systems.
Dr. Hu was a recipient of the Best Paper in Automation Award in the 14th IEEE International Conference on Information and Automation, and a recipient of the Best Paper Award (Guan Zhao-Zhi Award) in the 36th Chinese Control Conference. He serves as Associate Editor for IEEE Transactions on Control Systems Technology, Technical Editor for IEEE/ASME Transactions on Mechatronics, Associate Editor for IEEE Transactions on Automation Science and Engineering, and Subject Editor for International Journal of Robust and Nonlinear Control. He serves as General Chair for ICARCV 2018, General Co-Chair for IEEE ICCA 2018, and Program Co-Chair for IEEE IECON 2020.

Keynote Talk 2: Sunday, July 22, 2018
11:00-11:30, Grand Ballroom, Second Floor
Session Chair: Long Cheng, Institute of Automation, CAS

Laser-Based 3D Scene Modeling and Understanding for Autonomous Robots in Large-Scale Open Environments

Yan Zhuang

Professor
School of Control Science and Engineering
Dalian University of Technology, China

Abstract:

Since recent advancement of computing and 3D laser scanning technologies, autonomous robots such as UGVs and UAVs are soon ready to serve us in large-scale urban scenes, natural scenes and post-disaster environments. These robots can perform unstructured scene reconstruction, semantic map building and long-term navigating autonomously in dynamic and open environments, and therefore will play an important role in our life. This talk briefly overviews the key challenges and opportunities in laser-based 3D scene modeling and understanding robotic systems towards real-world applications with UGVs and UAVs. In particular, the recent development of modeling algorithms and scene understanding frameworks for outdoor security robots, driverless car, patrol quadrotors at Dalian University of Technology are introduced, and some preliminary results are demonstrated via videos.

Biography:

Yan Zhuang is a Professor in School of Control Science and Engineering at Dalian University of Technology, China, leading the Intelligent Robotics Lab (DUT Robotics Lab). His research interests include mobile robot 3D environment perception and mapping, outdoor scene understanding and machine learning in robotics. He has published over 60 papers in journals and conferences in these areas including IEEE Transactions and Journal, IEEE ICRA, IEEE IROS, and received best paper award in WCICA2006. He has been a chair or committee member for many international conferences such as IEEE ICSSE, CYBER, ROBIO and WCICA. Intelligent robotic products developed by DUT Robotics Lab won the "Excellent Product Award" of China Hi-Tech Fair in 2010, 2016 and 2017. His lab has provided 1 stack and 7 packages to ROS.org, and also published several 3D point clouds processing algorithms in Point Cloud Library (PCL). He currently serves as the member of Robotics Professional Committee of CAA and council member of Liaoning Association for Artificial intelligence.

Keynote Talk 3: Sunday, July 22, 2018
11:30-12:00, Grand Ballroom, Second Floor
Session Chair: Lianqing Liu, Shenyang Institute of Automation, CAS

Intelligent Robot for Large-scale Equipment Manufacturing

Jing Xu

Associate Professor
Lab of Robotics and Automation
Department of Mechanical Engineering
Tsinghua University, China

Abstract:

Industrial robot has achieved many successes in automotive manufacturing industry, where the robot performance depends on repeatability. However, it is still a challenge for large-scale structure in 10 priority sectors in "Made in China 2025", where the part is always much bigger than the robot workspace. The reason is that the inevitable deformation cause by large scale and heavy weight would result in difference from CAD model. Therefore, the offline programming method from CAD model used in automotive manufacturing industry would fail. To improve robot accuracy, real-time 3D sensing, online path planning, and intelligent control methods are introduced in this talk. The proposed methods have been successfully applied in drilling, assembly, spray, and quality inspection in manufacturing industry, resulting in quality and efficiency improvement.

Biography:

Jing Xu is currently an associate professor in the Department of Mechanical Engineering, Tsinghua University, China. His research focuses on 3D perception and control for industrial robot. He has been involved in several Chinese National Projects regarding quality inspection robot for specular surface, assembly robot for large-scale structure, 3D printing robot for complex shape, 3D perception for robot navigation under the support of NSFC and MOST. He has published over 100 peer-reviewed journal and conference papers, co-authored 4 book chapters, over 20 issued patents. He serves as guest editor for Journal of Sensors and as the organizing committee member of IEEE ROBIO and so on. He also received two Best Conference Paper Awards in recent years.

Workshop: Advanced Theory and Technologies in Intelligent Automation

Thursday, July 19, 2018
The Residence 1, First Floor
Session Chair: Yongchun Fang, Nankai University

14:10-14:50

Unmanned Vehicles: from Automated Driving to Autonomous Driving

Jianru Xue
Professor
Institute of Artificial Intelligence and Robotics
Xi'an Jiaotong University, China

Abstract: Unmanned vehicles are well known disruptive technologies, and gain more and more attention ranging from academia, enterprise, to government. However, autonomous driving and automated driving are two different stages of the unmanned vehicle technologies, and there is still a huge gap between them. The aim of this talk is to provide a comprehensive state of the art on the basic concepts, methodologies, and technologies of autonomous driving. Firstly, the traditional automated driving technologies will be described. Secondly, challenging problems in the field of autonomous driving are presented as well as the latest progress we have made. Finally, demonstrations of our unmanned vehicles autonomous driving in real urban scene will be presented, along with our future work.

Biography: Jianru Xue, Phd, Professor, Changjiang Scholar. He got his BS degree from Xian University of Technology in 1994, and both MS and PhD degrees from Xi'an Jiaotong University in 1999 and 2003, respectively. He joined the Institute of Artificial Intelligence and Robotics at Xi'an Jiaotong University, Xi'an, China, since 1996, where he currently is a full professor. He had worked in FujiXerox, Tokyo, Japan, from 2002 to 2003, and visited University of California, Los Angeles, from 2008 to 2009. His research interests include computer vision and pattern recognition, visual scene understanding and motion control for intelligent vehicles, and machine learning. He and his team are winner of IEEE ITSS Institute Lead Award in 2014. He and his students won the best application paper award in Asian Conference on Computer Vision 2012. He is co-author of the book Statistical Learning and Pattern Analysis approaches to Image and Video Processing，published by Springer-verlag in 2009. He has published 100+ papers in top cited journals and conferences including IEEE TPAMI, IEEE TIP, IEEE TSMCB, ICCV, ECCV, ACM MM, ICPR, etc. He had severed as organization chair or co-chair of several international conferences including VALSE2012, VLPR2011, VLPR2010, ACCV2010, VSMM2006, and so on. He also served on the technical program committee of peer-reviewed conferences ICME, ACCV, ICPR, IVS, etc.

14:50-15:30

Model Predictive Control: From Theory to Vehicle Applications

Hong Chen
Professor
State Key Laboratory of Automotive Simulation and Control
Jilin University, China

Abstract: Model predictive control (MPC) is used in a variety of industrial application over the last three decades. The reasons for its success are, on the one hand, its capability to directly incorporate constraints, and on the other hand, the intuitive way to address control problems. The main purpose of this talk is to provide the state of the art of model predictive control, and its application to vehicle control. In the first part, the basic idea of MPC, MPC with guaranteed nominal stability, inherent robustness of MPC, and an efficient robust MPC scheme will be introduced, respectively. Then, fast MPC for real-time automobile control using low-cost hardware will be considered, providing two technical routes of reducing computational effort. The third part focuses on some aspects of applying MPC to automotive systems through some selected examples including MPC-based ecological-driving and energy management strategies.

Biography: Chen Hong has been a professor in Jilin University, Changchun, China since 1999, where she currently serves as a Tang Aoqing professor and as the director of the State Key Laboratory of Automotive Simulation and Control. She received the B.S. and M.S. degrees in Process Control from Zhejiang University, Zhejiang, China, in 1983 and 1986, respectively, and the Ph.D. degree in System Dynamics and Control Engineering from the University of Stuttgart, Stuttgart, Germany, in 1997. Her current research interests include model predictive control, nonlinear control and applications in mechatronic systems focusing on automotive systems.

15:30-16:10

Some Challenges in Machine Vision Applications

Shengyong Chen
Professor
Tianjin University of Technology, China

Abstract: This talk presents the recent developments and challenges of machine vision, including object localization, segmentation, recognition, reconstruction, representation, feature extraction, target tracking, pattern analysis, etc. The questions in the presentation are summarized to include: Where is the object? Who is who? What is meaningful? What represents the object? What happen? All problems have been studied for tens of years and all have significant progress. All, however, are still open to seek better solutions. Variety of examples and videos are shown in the talk.

Biography: Shengyong Chen received the Ph.D. degree in computer vision from City University of Hong Kong, Hong Kong, in 2003. He worked as a guest research at University of Hamburg, Germany, where he received a fellowship from the Alexander von Humboldt Foundation in 2006. He was a visiting professor at Imperial College London, from 2008 to 2009. He is currently a Professor in Tianjin University of Technology and Zhejiang University of Technology. Dr. Chen is an IET Fellow and an IEEE senior member. His research interests include computer vision, image processing, and robotics. He received the National Outstanding Youth Foundation Award of NSFC. He has published over 100 scientific papers in international journals, five of which received Best Paper Awards from IEEE and IET societies.

16:20-17:00

Intelligent Perception and Decision-making of USVs, Based on the Memory Forming and Cognition Process of Brain

Shaorong Xie

Professor
Shanghai University, China

Abstract: The intelligent perception and automatic control problem of USVs in the complex dynamic marine environment consists of object recognition, situation awareness and autonomous decision, and it is characterized by two attributes: 1) incomplete information, 2) uncertainty information. To address the above problem, a general and innovative architecture based on the memory forming and cognition process of brain is recommended. In the architecture, the functions of memory modules and their relationships in brain memory cognitive process, and the selective attention and cross-perception mechanisms have inspired the development of intelligent perception and decision-making techniques. Based on this architecture, we also have proposed the framework of situation awareness, task allocation and cooperative control. This research is expected to provide important support for the USV applications in the area of submarine survey, marine monitoring, etc.

Biography: Prof. Shaorong Xie is Associate Dean of School of Computer Engineering and Science, Director of Engineering Research Center of Marine Intelligent Unmanned System Equipment of the Ministry of Education, and Associate Dean of Unmanned Surface Vehicle Engineering Research Institute at Shanghai University. She received her Ph.D. from the Institute of Intelligent Machines, Tianjin University and the Institute of Robotics and Information Automation, Nankai University in 2001. She was a postdoctoral fellow at the University of Toronto in Canada, a visiting professor at Tokyo Institute of Technology in Japan, and a visiting professor at New Mexico State University in the United States. Her main research areas are intelligent and autonomous robots, including unmanned surface vehicle technology, cooperative control technology of multi-autonomous robots, and intelligent systems. She was selected as a leading talent in Shanghai, Shanghai outstanding academic leader, and other talent plans. Among the awards Prof. Xie has received are: the first national team of Huang Danni-style teachers, the National Able Women Achievement Medal, Best Professor Award in Shanghai, Distinguished Young Scholar by the National Science Foundation of China, Young Scientist Award from the Chinese Society of Automation, Shanghai Science and Technology Elite Nomination, the second prize of national technology invention, the first prize of Shanghai science and technology advances, and the first prize of Shanghai technological invention.

17:00-17:40

Intelligent Construction

Bin He

Professor
Group of Intelligent Detection and Computing Perception
College of Electronics and Information Engineering
Tongji University, China

Abstract: The automation technologies have promoted the improvement of productivity in various industrial fields. However, in the field of civil engineering, the automatic detection technology and robot technology are still lagging behind other fields. Aiming at the automation technologies and methods in the manufacturing field, here will talk about the automation technologies, robotics and information technologies that will change the civil engineering in the future, and propose other related technologies for future intelligent constructions through some construction examples.

Biography: Bin He is a Professor at College of Electronics and Information Engineering of Tongji University, Shanghai, China. He has been with the Group of Intelligent Detection and Computing Perception since 2003. He received the B.S. degree in engineering machinery from Jilin University, Changchun, China, in 1996, and the Ph.D. degree in mechanical and electronic control engineering from Zhejiang University, Hangzhou, China, in 2001. Between 2001 and 2003, he held postdoctoral research appointments with The State Key Lab of Fluid Power Transmission and Control, Zhejiang University. He has published 100 papers and authorized over 20 patents of innovation. His current research interests include intelligent robot and intelligent construction, and etc. He is an Associate Editor of Neurocomputing (2012-).

Forum of Artificial Intelligence (AI), Robotics, and Cyber Systems

Saturday, July 21, 2018
Grand Ballroom, Second Floor
Session Chair: Jianwei Zhang, University of Hamburg, Germany

Artificial Intelligence (AI) including deep learning techniques achieves remarkable progress and successful applications in areas such as object classification, speech recognition, AlphaGoZero, and so on. Advanced robotics and cyber systems are also paid significant attention in recent years. In this context, this forum aims to provide novel viewpoints by leading experts with different backgrounds covering artificial intelligence, advanced robotics, autonomous vehicles, vision, and cyber systems. By discussion, it is expected that some potential and promising future research directions can be concluded for both the academic and industrial communities.

Deep Imitation Reinforcement Learning for Complex Decision-making Tasks

Xin Xu
Professor
Director of the Institute of Unmanned Systems
National University of Defense Technology, China.

Abstract: This talk will present a deep imitation reinforcement learning scheme for complex sequential decision-making tasks which include autonomous driving and playing video games, etc. Human expert data will be used to realize deep imitation learning at first. And Deep reinforcement learning algorithms are integrated with the policy obtained by deep imitation learning for better performance both in terms of learning speed and policy quality. Some experimental results will be provided to show the effectiveness of the proposed scheme.

Exploration and Practice of Autonomous Vehicle

Youchun Xu
Professor
Academy of Military Transportation, China

Abstract: This talk will Introduce the technical research and the practice of the autonomous vehicle in the field of the autonomous vehicle in the past 20 years, and the prospects for future development.

Neural Interface, Intelligent Prosthetics and Rehabilitation Robotics

Jiping He
Professor
Beijing Institute Technology, China

Abstract: Integrating neuroscience into the design principles of robotics development is the current trend so that human desire and intention are intimately interfaced into the control of robotic systems. Strokes, Parkinson's, multiple Sclerosis et al neural degenerative diseases and spinal cord injury as well as other traumatic injuries, furthermore, recent rapid growth in diabetic population needs our attention on diabetic foots due to high rate of eventual amputation. All these lead to high demand of rehabilitation robots and artificial limbs. These highly human-machine interface systems demand new breakthrough in safe, reliable and durable information exchange with human neural system. Where to get the most relevant information from human and machine and how to transfer the information? How to make these highly personalized yet capable flexible system economically affordable and profitable requires creative thinking and collaboration among government agencies, science technology research society and manufactory communities.

Design of the Service Robot based on its Representation Space

Jianbo Su
Professor
Shanghai Jiao Tong University, China

Abstract: SLAM and robot interactions are investigated for versatile service in unstructured environments. The representation space is proposed and the optimal strategy for task realization is evolved. Different tasks are demonstrated within the proposef strategy.

Technical Tour to Nankai University

Institute of Robotics & Automatic Information Systems
（Tianjin Key Laboratory of Intelligent Robotics）

Date: July 23 (Monday)
Price: Free of Charge (Maximum 90 persons)
Time: 9:00-12:00

If you are interested in this activity, please sign up at the registration desk before 12:00 July 22 and **gather before 9:00 of July 23 (Mon) on the 1st floor of Hyatt Regency Tianjin East Hotel.**

The Institute of Robotics & Automatic Information System (IRAIS) was founded in spring 1998 within the College of Information Technical Science of Nankai University, which was established back in 1971 as one of the earliest in China. In 1985, Nankai initiated robotics research and established the Artificial Intelligence and Robotics Laboratory, one of the pioneer robotics laboratories in China. Over the years, the Lab gradually expanded and transferred into the Institute of Robotics & Automatic Information System. It has been awarded with multiple titles, namely an open laboratory on robotics in the National High Technology Research and Development Program (863 Program) of China in 1990, Tianjin Key Laboratory of Intelligent Robotics in 2013, National Education Center for Virtual Simulation in 2015, and Tianjin International Cooperation Base in 2016. Subsequently on May 11, 2018, the research works of the institute and the education programmes of the department were united together, and became the base for the new College of Artificial Intelligence of Nankai.

Through decades of persistent academic pursuit, IRAIS has gained recognition in multiple robotics research fields. It now has research directions spanning from large-scale aerospace down to micro/nano technologies, from industry robots to cell manipulation, from missile guidance to surgical navigation, etc. The first robot controller of China was developed in IRAIS, the micro-manipulation robotic system of IRAIS was awarded National Award for Technological Invention, and multiple research works of IRAIS have been successfully commercialized, such as the automated overhead crane system, and the large-scale 3D sculpture-painting robot.

IRAIS currently holds a young and highly qualified team. Steering vision from senior professors and energetic dedication of young faculties have brought synergy and broadened the research horizon. Through collaboration with groups inside and outside Nankai, we apply control methods and techniques to tackle emerging challenges in other engineering and science fields of biology, medicine, physics, mathematics, etc., and have extended our research beyond disciplinary.

IRAIS's Cutting-Edge Research：

- The emphasis on fusion of control science and engineering excites ample theoretical and experimental research opportunities at the forefront of this field and its interdisciplinary applications.
- Advanced Robotics: trajectory planning, robot vision and vision based SLAM, multi-robot scheduling, human-robot interaction and coordination, as well as their applications in industrial, service, rehabilitation and surgical robotics.
- Micro/Nano Systems: cell micro-manipulation, high-aspect-ratio micro-fabrication, soft material nano-fabrication, superhydrophobic surface manufacture, AFM-based nano-scale manipulation and characterization, and nano-positioning.
- Complex Systems and Control: theory and application of the chaotic system, complex dynamical networks, modeling and control of multi-agent systems.

- Optimization and Applications: guidance and control, underactuated systems and control, medical and process engineering, modern logistics, bioinformatics.

The technical tour will visit the following Laboratories:

- Rehabilitation and Assistive Robotics Laboratory
- Wearable Bio-Monitoring System Lab
- Bio-Inspired Robotics Lab
- Micro Manipulation System Lab
- Micro/Nano Positioning & 3D Bio-printing Lab
- Micro/Nano Fabrication Lab
- Micro/Nano Systems Control Lab
- Medical Robotics Lab
- Underactuated Systems Lab
- Mobile & Flying Robotics Lab
- Field & Aerial Robotics Lab
- Service Robots Lab
- Industrial Robotics Lab
- VR-AR and Robotic Simulation Lab
- Bio-system Modeling & Simulation Lab
- Human-Robot Interactive Gait Lab

IEEE-CYBER 2018 Conference Program

July 19 (Thursday)	
14:00-17:40	**Workshop on Advanced Theory and Technologies in Intelligent Automation** (The Residence 1) **Speakers: Prof. Jianru Xue, Prof. Hong Chen, Prof. Shengyong Chen, Prof. Shaorong Xie, Prof. Bin He**
18:30-20:00	***Welcome Reception*** *(Market Café, 1F)*

July 20 (Friday)

	The Residence 1	The Residence 2	The Residence 3	The Residence 4	Regency Room 3	Regency Room 1
08:50-09:15	**Opening Ceremony**					
09:15-10:00	Plenary Talk 1 ***The Tri-Co (Coexisting-Cooperative-Cognitive) Robots*** ***Han Ding, Huazhong University of Science & Technology, China*** (Grand Ballroom)					
10:00-10:45	Plenary Talk 2 ***Geometric and End-to-end Visual Servoing*** ***François Chaumette, IRISA, France*** (Grand Ballroom)					
10:45-11:15	*Coffee Break* (Prefunction Area, 2F)			*FrPoA-* ***Poster Session 1*** (Prefunction Area, 2F) *(103,108,129,138,225,448,332,156,470, 261,398,464,405,395,428,161,309,177)*		
11:15-12:00	Plenary Talk 3 ***Leader-follower Formation Algorithms with Collision Avoidance for Two-wheeled Mobile Robots*** (Grand Ballroom) ***Krzysztof Kozlowski, Poznan University of Technology, Poland***					
12:00-13:20	***Lunch*** *(Market Café, 1F/ Wok in the Garden, 3F)*					
13:20-14:50	FrA1- **Stochastic Control** (152,172,226,229, 231,325,367)	FrA2- **Active Robot Perception** (210,219,272,275, 344,347,352)	FrA3- **Simultaneous Localization and Mapping** (279,328,201,232, 249,250,194)	FrA4- **Visual Servo Control** (253,155,164,165, 179,291,357)	FrA5- **Cyber Robotics** (361,406,450,480, 137,336)	FrA6- **Best Paper Session** (105,262, 311, 477, 462, 199,)
14:50-15:05				FrPoB-**Poster Session 2** (Foyer, 1F) (175,276,115,385,409,463,438,451,159, 410,176,193,315,178,420,351,348,441)		
15:05-15:20	*Coffee Break* (Foyer, 1F)					
15:20-16:50	FrB1- **Modeling and Control of Piezoelectric Actuators** (128,215,230,433, 257,435)	FrB2- **Space Robotics** (242,243,281,282, 294,360)	FrB3- **Surgical Robotics** (255,368,310,383, 407,457)	FrB4- **Cyber Physical Systems** (475,217,212,466, 187)	FrB5- **Specialized Robot** (111,139,259,412, 476,209)	FrB6- **Best Student Paper Session** (366,381,374,283, 240,481)
17:00-18:15	FrC1- **System Modeling** (248,532,148,149)	FrC2- **Micro and Nano Manipulation Robotics** (416,474,422,483)	FrC3- **Bio & Smart Sensing** (228,274,300,394)	FrC4- **Intelligent Surveillance and Detection** (531,338,296,478)	FrC5- **Unmanned Aerial Vehicle** (154,264,269,411, 459)	
18:30-20:00	***Dinner*** *(Market Café, 1F)*					

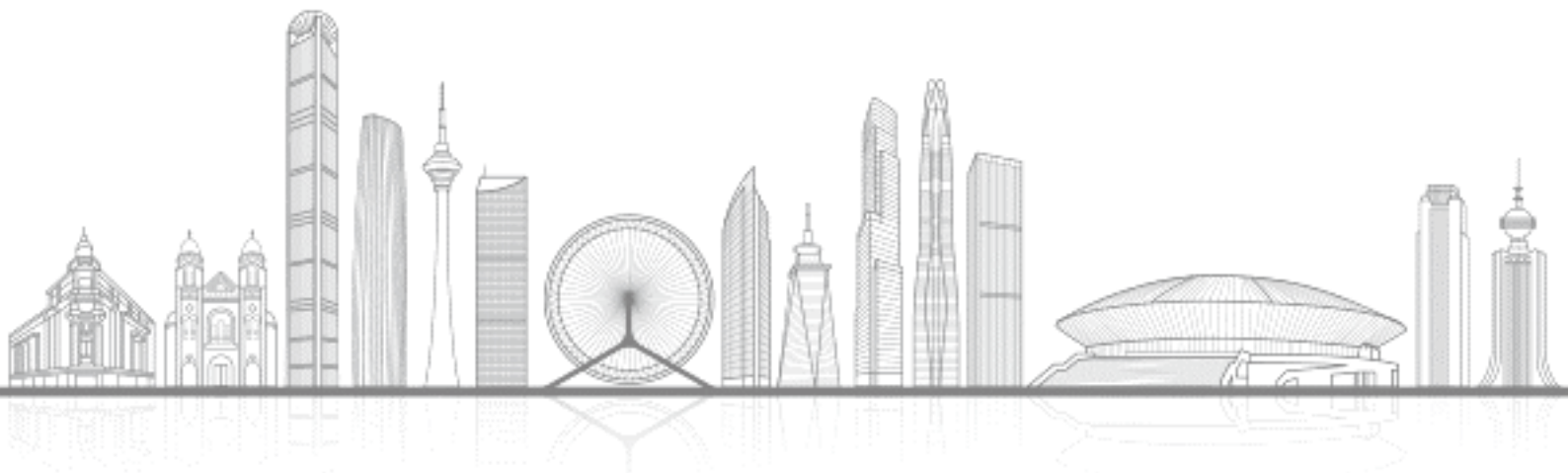
July 21 (Saturday)				
	The Residence 1	The Residence 2	The Residence 3	The Residence 4
08:30-09:15	Plenary Talk 4 ***Cross-modal Learning of Intelligent Robot Systems*** ***Jianwei Zhang, University of Hamburg, Germany*** (Grand Ballroom)			
09:15-10:00	Plenary Talk 5 ***Towards More Flexible Calibrations for Visual Sensing and Tracking*** ***Youfu Li, City University of Hong Kong, Hong Kong, China*** (Grand Ballroom)			
10:00-10:30	*Coffee Break* (Prefunction Area, 2F)		*SaPoA-* ***Poster Session 3*** (Prefunction Area, 2F) *(131,135,101,109,145,147,364,399,434, 308,442,461,529,151,356,358,365,112)*	
10:30-12:00	**Forum of Artificial Intelligence (AI), Robotics, and Cyber Systems** (Grand Ballroom)			
12:00-13:20	***Lunch*** *(Market Café, 1F/ Wok in the Garden, 3F)*			
13:20-14:50	SaA1- **Human Abilities and Robotic Assistance 1** (306,134,203,319,465,307)	SaA2- **Mobile Robot 1** (120,170,186,460,387)	SaA3- **Advanced Control of Mechatronic Systems 1** (184,195,207,443,244,200)	SaA4- **Multi-Agents and Networked Systems 1** (110,126,218,114,334,349)
14:50-15:20	*Coffee Break* (Foyer, 1F)		SaPoB-**Poster Session 4** (Foyer, 1F) (163,171,227,247,286,468,208,104,180,181, 192,205,221,241,375,141,484,271,485,486)	
15:20-16:50	SaB1- **Human Abilities and Robotic Assistance 2** (216,482,239,359,313,404)	SaB2- **Mobile Robot 2** (122,127,528,206,273,302)	SaB3- **Advanced Control of Mechatronic Systems 2** (268,301,289,391,265,479)	SaB4- **Multi-Agents and Networked Systems 2** (125,173,339,380,118,144)
17:00-18:15	SaC1- **Human Abilities and Robotic Assistance 3** (146,290,224,304,130,444)	SaC2- **Mobile Robot 3** (346,354,408)	SaC3- **Automation in Space/Flying Robots** (157,158,326,329,222)	SaC4- **Multi-agent Systems and Evolutionary Game Theory** (113,277,299,414,369)
18:30-21:30	***Banquet and Award Presentation*** *(Grand Ballroom)*			

July 22 (Sunday)				
	The Residence 1	The Residence 2	The Residence 3	The Residence 4
08:30-09:15	Plenary Talk 6 ***Making of a Microresonator-based Sensor –Dynamics, Feedback and Functional Printing*** (Grand Ballroom) ***George Chiu, Purdue University, USA***			
09:15-10:00	Plenary Talk 7 ***Mutli-Scale Robotic System— From Large Scale Cellular Robot to Small Scale Robots*** (Grand Ballroom) ***Toshio Fukuda, Beijing Institute of Technology, China***			
10:00-10:30	*Coffee Break* (Prefunction Area, 2F)			
10:30-11:00	Keynote Talk 1 ***Robust Coordination of Networked Multi-Robot Systems*** (Grand Ballroom) **Guoqiang Hu, Nanyang Technological University, Singapore**			
11:00-11:30	Keynote Talk 2 ***Laser-Based 3D Scene Modeling and Understanding for Autonomous Robots in Large-Scale Open Environments*** **Yan Zhuang, Dalian University of Technology, China** (Grand Ballroom)			
11:30-12:00	Keynote Talk 3 ***Intelligent Robot for Large-scale Equipment Manufacturing*** (Grand Ballroom) **Jing Xu, Tsinghua University, China**			
12:00-13:20	***Lunch*** *(Market Café, 1F)*			
13:20-14:50	SuA1- **Sliding Mode Control and Mechatronics 1** (107,183,188,254,267,370)	SuA2- **Connected and Automated Vehicles 1** (143,202,234,236,305,317)	SuA3- **Power Systems 1** (182,213,220,278,337,417)	SuA4- **Robotic Vision** (185,401,376,413,454,136)
14:50-15:20	*Coffee Break* (Foyer, 1F)			
15:20-16:50	SuB1- **Sliding Mode Control and Mechatronics 2** (371,431,440,233,343,453)	SuB2- **Connected and Automated Vehicles 2** (318,345,372,373,400,430)	SuB3- **Power Systems 2** (323,324,320,153,190,396)	SuB4- **Automation in Real-world Applications** (362,415,419,527,473,191)
17:00-18:15	SuC1- **Robot Control and Planning** (198,378,472,533,295)	SuC2- **Medical Robotics and Systems** (150,252,263,284,403)	SuC3- **Power Systems 3** (166,214,246,330,342)	SuC4- **Structural Analysis and Evolutionary Dynamics of Complex Systems** (297,321,327,340,287)
18:30-20:00	**Farewell Dinner** *(Market Café, 1F)*			

July 23 (Monday)	
09:00-12:00	**Technical Tour** **Institute of Robotics & Automatic Information Systems, Nankai University**

Technical Sessions

July 20th, 2018



FrPoA Poster Session 1

Session Chairs: Xiao Liang and Donyang Bie

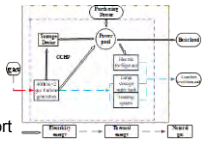
Room : PREFUNCTION, 10:45-11:15, Friday, July 20, 2018

FrPoA(1) 10:45-11:15

Optimization for Commercial Building Energy Management of Multi-energy Fusion

Changbao Xu and Bin Liu
Electric Power Research Institute of Guizhou Power Grid Co., Ltd., China
Dezhi Wang and Tao Yu
School of Electric Power, South China University of Technology, China
(dezhi_3701@sina.com)

- This paper proposed the optimization for commercial building energy management of multi-energy fusion, which has the characteristics of multi energy fusion, and considers the coordination strategy of CCHP and energy storage devices under the commercial TOU mechanism. Building comfort and energy costs are considered as the optimization objective functions. Finally, GWO has been used to solve this optimization problem.



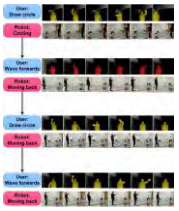
Framework of CBEM

FrPoA(2) 10:45-11:15

Real-Time Human-Robot Interaction for a Service Robot Based on 3D Human Activity Recognition and Human-mimicking Decision Mechanism

Kang Li, Jinting Wu, Xiaoguang Zhao and Min Tan
State Key Laboratory of Management and Control for Complex Systems,
Institute of Automation, Chinese Academy of Sciences

- This paper describes the development of a real-time Human-Robot Interaction (HRI) system for a service robot based on 3D human activity recognition and human-mimicking decision mechanism.
- The Human-Robot Interactive (HRI) system, which allows one person to interact with a service robot using natural body language, collects sequences of 3D skeleton joints comprising rich human movement information about the user via Microsoft Kinect.
- The framework of the overall system is established on the Robot Operating System.



Interaction between robot and user

FrPoA(3) 10:45-11:15

Attack Detection in Cyber-Physical Systems Using Particle Filter: An Illustration on Three-Tank System

Hongyang Li and Xiao He
Department of Automation, Tsinghua University, China
Yufeng Zhang and Wenyuan Guan
CSSC Systems Engineering Research Institute,
Oceanic Intelligent Technology Innovation Center, China

Bullet Point

- A problem of cyber attack detection is researched for three-tank system;
- The attack detection method based on particle filter is utilized to detect the attack;
- Three types of attacks are considered in this paper.

Physical map of three-tank system

FrPoA(4) 10:45-11:15

Learning Jumping Skills from Human with a Fast Reinforcement Learning Framework

Yiqun Kuang, Shanren Wang, Bibei Sun,
Jiasheng Hao and Hong Cheng
Center For Robotics, University of Electronic Science and Technology of China,
Chengdu, China

- This approach adopts guided policy search (GPS) to accelerate learning jumping from human demonstrations.
- Human samples captured by Kinect and then normalized to keep consistency.
- The algorithms are tested on "HopL" platform which contains three DoFs.
- Experiments demonstrated the robot can learn to jump well within a few iterations.

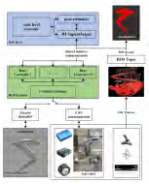


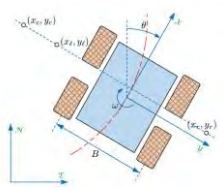
Fig.1 Framework of the system

FrPoA(5) 10:45-11:15

Terrain Vision Aided Online Estimation of Instantaneous Centres of Rotation for Skid-Steering Mobile Robot

Wenjun Lv, Ji Chang, Yu Kang, and Zerui Li
Department of Automation, University of Science and Technology of China, China
Yun-Bo Zhao
College of Information Engineering, Zhejiang University of Technology, China

- We propose an online estimation method to acquire the robot's instantaneous centres of rotation (ICRs).
- The sensor system is composed of two incremental encoders, a GPS-compass unit, and a camera.
- The robot's ICRs can be estimated by using terrain adaptive innovation-based extended Kalman filter.

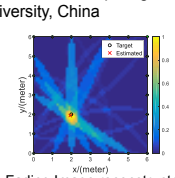


FrPoA(6) 10:45-11:15

CYBER 2018 Digest
Backprojection and Integration for the Multi-Scale Spatial Model in Radio Tomographic Imaging

Jiaju Tan and Xin Zhao
Institute of Robotics and Automatic Information System,
Nankai University, Tianjin, China
Longwen Yang, Xuemei Guo and Guoli Wang
Key Laboratory of Machine Intelligence and Advanced Computing,
Ministry of Education, Sun Yat-sen University, China

- Multi-Scale model reflects the heterogeneous detectability of RF links
- Fading Image can be regarded as the weighted combination of the contribution of RF links
- Backprojection Imaging by RF links utilizes the multi-scale information
- Integration of the multi-modal images obtains the fine-grained image



Fading Image reconstructed by Backprojection and Integration

FrPoA Poster Session 1 (con't)

Session Chairs: Xiao Liang and Donyang Bie

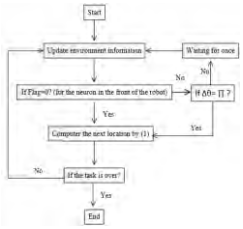
Room : PREFUNCTION, 10:45-11:15, Friday, July 20, 2018

FrPoA_2(7) 10:45−11:15

Complete Coverage Path Planning Based on Bioinspired Neural Network and Pedestrian Location Prediction

Chunyu Yang, Member, IEEE, Yaohan Tang, Linna Zhou, and Xiaoping Ma
China University of Mining and Technology

In this paper, a pedestrian location prediction based complete coverage path planning approach is presented, which integrates biologically inspired neural network, location prediction algorithm and pedestrian avoidance strategy.



FrPoA_2(8) 10:45−11:15

A Novel Image Classification Method Based on Bag-of-Words Framework

Yi Liu[1], Ming Yu[1], Cuihong Xue[2], Yueqiang Yang[3]
[1] School of Artificial Intelligence, Hebei University of Technology
[2] Technical College for the Deaf, Tianjin University of Technology
[3] Information Technology Department of Tianjin City Commercial Bank

In this paper, an improved image classification method is proposed within the Bag-of-Words framework. At the feature-extraction stage, one single-scale SIFT feature and HOG feature are extracted from the densely sampled patches, which are further fused into a combined low complexity feature. At the visual word allocation stage, a new allocation technique is proposed, which no longer assigns a visual word totally to one certain visual word in the codebook that has the nearest distance to the visual word to be assigned. Experiments on Caltech-101 and 15-Scene datasets show that the proposed method can obtain a higher AR than the traditional methods.

FrPoA_2(9) 10:45−11:15

A Novel SLAM Method Using Wi-Fi Signal Strength and RGB-D Images

Shaokun Yang, Qinxuan Sun, Xingliang Dong and Jing Yuan
College of Computer and Control Engineering, Nankai University, China

- Fusion of Wi-Fi signal strength and RGB-D images is addressed based on the extended Kalman filter.
- Motion estimation and loop-closure detection of the robot are achieved based on multi-sensor fusion.
- Map of the environment is obtained by the graph optimization algorithm.

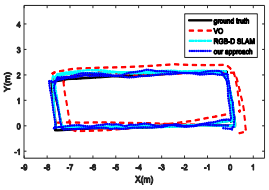


Fig.1. The localization results.

FrPoA_2(10) 10:45−11:15

Multiple Baggage Identification Algorithm Based on Point Cloud Density Clustering

Qing-ji Gao and Quan Zhao and Li-ping Deng
Robotics institute, Civil Aviation University Of China,China

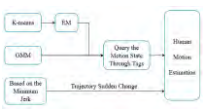
- Focuse on the detection and discrimination of multiple pieces of baggage based on 3D point cloud data
- Determine the number of bags based on point cloud density clustering
- Based on the actual data of passengers in the airport for experimental verification

FrPoA_2(11) 10:45−11:15

Real-time Human Motion Estimation for Human Robot Collaboration

Jie Kang, Yanan Zhang and Hengle Ren
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences
University of Chinese Academy of Sciences
Kai Jia, Fang Xu and Fengshan Zou
Shenyang SIASUN Robot & Automation Co., LTD., China

- Clustering by gaussian mixture model
- Query the motion state through tags
- Motion estimation based on the minimum jerk in the case of sudden change of trajectory
- The experimental results show that the presented framework can make an accurate prediction



Real-time motion estimation framework

FrPoA_2(12) 10:45−11:15

Recovery method for missing sensor data in multi-sensor based walking recognition system

Cheche Xie, Sheng Bi , Min Dong* and Yongfa Li
School of Computer Science&Engineering,
South China University of Technology, China

- This paper presents Multi-source Denoising Autoencoder (MSDA) for filling missing sensor data in walking recognition system.
- The embedding of MSDA that can predict the features for missing sensor data is used to train the walking recognition classifier.
- Experimental results show that the MSDA can effectively reduce FRR and FAR in walking recognition for missing sensor data

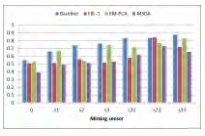


Figure1 The sum of FRR and FAR in walking recognition for missing sensor data

FrPoA Poster Session 1 (con't)

Session Chairs: Xiao Liang and Donyang Bie

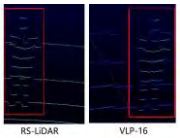
Room : PREFUNCTION, 10:45-11:15, Friday, July 20, 2018

FrPoA_3(13) 10:45-11:15

CYBER 2018 Digest Template Characterization of a RS-LiDAR for 3D Perception

Zhe Wang, Yang Liu, Qinghai Liao, Haoyang Ye, Ming Liu
Robotics and Multi-Perception Lab, HKUST, China
Lujia Wang
Cloud Computing Lab, SIAT, China

1.This paper presents the characteristics of RSLiDAR
2. Provides a set of evaluations to analyze the characterizations and performances of LiDARs sensors.
3. Analyzes multiple properties,such as drift effects, distance effects, color effects and sensor orientation effects



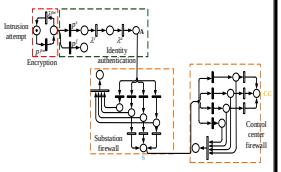
Common scenes etection of RS-liDAR and VLP-16

FrPoA_3(14) 10:45-11:15

A Malicious Attack Modeling Method for Source-Grid-Load System Based on Petri Net

Jie Fan, Lei Wei, Wei Li, Quan Yuan, Mengya Li, Yi Tang
the Global Energy Interconnection Research Institute co. Ltd.

- Modeling of independent safety protection device and security protection mechanism
- The attack mode contains false data injection attack (FDIA), denial of service (DoS) and fake command attack
- The SGL system malicious attack model considers the layered and partitioned architecture of the SGL system and the required permissions for different attack modes



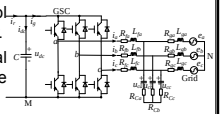
The Petri net model of FDIA in production and control area

FrPoA_3(15) 10:45-11:15

Full-order Terminal Sliding-Mode Control for LCL Type Grid-Side Converter

Xuemei Zheng and Xinrui Chang Ruobo Chen, Yangman Li
Liguo Wang, Yong Feng
Electrical Engineering, Harbin Institute of Technology , China

- This paper investigates the robust control strategies for the LCL type grid-side converter.
- The voltage outer loop adopts the traditional voltage vector orientation control to stabilize the DC side voltage.
- The current inner loop is designed in the synchronous rotating coordinate system, and adopts full-order sliding mode control strategy.
- Finally, the simulation results validate the proposed method.



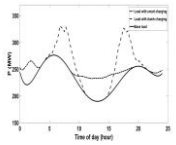
Wind energy conversion system.

FrPoA_3(16) 10:45-11:15

Smart Charging Strategy for EV Loads Based on Peak-load Shifting

Longchuan Yue and Yu Kang, and Jiahu Qin
Department of Automation, University
of Science and Technology of China, China

- An optimization model with the objective function of maximizing the valley load is built.
- A smart charging strategy is proposed based on the optimization model.
- The effectiveness of the strategy is verified by the case studies.

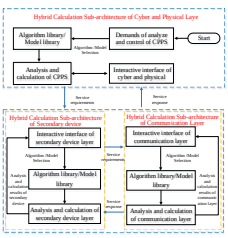


FrPoA_3(17) 10:45-11:15

Hybrid Calculation Architecture of Cyber Physical Power System Based On Correlative Characteristic Matrix Model

Manli Li, Ming Ni, Yusheng Xue, Xuetong Chen and Weidong Ding
NARI Group Corporation (State Grid Electric Power Research Institute), China

- Three sub-architectures: hybrid calculation sub-architectures of communication network, secondary device network and decision-making layer
- each sub-architecture contains model, hybrid calculation algorithms and data interaction interface
- The hybrid calculation architecture can simplify the complex CPPS model, and realize the analysis, calculate and the optimal control of CPPS.



calculation Architecture of CPPS

FrPoA_3(18) 10:45-11:15

Single Force-Guided Precision Peg-in-Hole Search of Cylindrical Part with Small Length/Diameter Ratio

Bin Zhou, Mingqiang Pan, Jizhu Liu, and Yangjun Wang
School of Mechanical and Electric Engineering, Soochow University, China

- Precise positioning for valve spool of precision solenoid valve in automatic assembly
- Utilize adaptive deformation of flexible manipulator and combine with high-frequency one-axis force sensor
- Create a motion control algorithm based on the force decay during search phase
- Mating parts diameter 20mm, radial clearance 6μm, success ratio 94.2%

FrA1 Stochastic Control

Session Chairs: Yuanhua Ni and Bingchang Wang

Room : THE RESIDENCE 1, 13:20-15:05, Friday, July 20, 2018

FrA1(1) 13:20-13:35

H2/H∞ Control for Continuous-Time Infinite Markov Jump Systems: Infinite Horizon Case

Liu Yueying, Hou Ting (ht_math@sina.com)
Shandong University of Science and Technology

In this paper, the infinite horizon H2/H∞ control problem is studied for a class of stochastic differential equations (SDEs) with infinite Markov jumps and multiplicative noise. The jumping parameters are modelled as a continuous-time, infinite-state Markov chain. Stochastic bounded real lemma (SBRL) is analyzed in terms of coupled algebraic Riccati equations (CAREs) for the considered system. Further, based on SBRL, a necessary and sufficient condition is presented for the existence of the mixed H2/H∞ control by means of the solvability of the CAREs.

FrA1(2) 13:35-13:50

The topology structure of leader-follower MASs for optimal cost control

Shuai Liu Zhijian Ji and Haisheng Yu
College of Automation and Electrical Engineering ,
Qingdao University , China
Ting Hou
College of Mathematics and Systems Science ,
Shandong University of Science and Technology , China

- Based on LQR theory for hybrid weighted leader-follower multi-agent systems(MASs).
- The optimal topological structure corresponding to be a (an uneven) hybrid weighted star structure.
- The exchange of information among followers will increase the cost of system control.

FrA1(3) 13:50-14:05

An overview of recent progress in the study of convergence rates of SA consensus algorithms

Huaibin Tang
School of Microelectronics, Shandong University,
Jinan 250100, P. R. China.
Academy of Mathematics and Systems Science, CAS,
Beijing 100190, P. R. China
Tao Li
Shanghai Key Laboratory of Pure Mathematics and
Mathematical Practice, Department of Mathematics, East China Normal University,
Shanghai 200241, P. R. China

For the consensus problem with stochastic communication noises, the stochastic approximation type algorithm is one effective method to reduce the impact of the noise. This paper reviews some main results in the study of convergence rates of the stochastic approximation consensus algorithms with communication noises, which is one of the most important tasks to optimize the performance of the algorithm. After the review,a short discussion is included to propose several potential research topics for further investigations.

FrA1(4) 14:05-14:20

Exponential Stabilization for Ito Stochastic Systems with Multiple Input Delays

Juanjuan Xu Huanshui Zhang

School of Control Science and Engineering, Shandong University

Firstly, we reduce the original system to a pseudo delay-free system by defining a new state.

Secondly, we consider the finite-horizon optimization problem of minimizing the linear quadratic cost functionfree system by defining a new state.

Finally, we have the necessary and sufficient conditions for the mean-square stabilization for system.

FrA1(5) 14:20-14:35

Linear Quadratic Mean Field Games: Open-loop Solutions

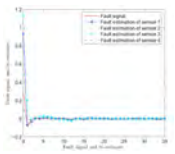
Bing-Chang Wang, Dan-Dan Pang
School of Control Science and Engineering, Shandong University,
Jinan, China
School of Information and Electrical Engineering, Shandong Jianzhu University,
Jinan, China
pangdandan@sdjzu.edu.cn

FrA1(6) 14:35-14:50

Distributed Fault Estimation for A Class of Time-varying Systems over Sensor Networks with Switching Topologies and Randomly Occurring Uncertainties

Xianye Bu, Hongyu Gao, Jianling Chen, Qinjiang Sun and HongliDong
Institute of Complex Systems and Advanced Control, Northeast Petroleum University, Daqing.
CNOOC (China) Co., Ltd. Tianjin branch, Tianjin.

- The sensor networks model which contains switching topologies is proposed in fault estimator design.
- The raised algorithm handled by RLMIs is suitable for online execution.
- The randomly occurring uncertainties is introduced in the target systems.



Fault signal and its estimate.

FrA1 Stochastic Control (con't)

Session Chairs: Yuanhua Ni and Bingchang Wang

Room : THE RESIDENCE 1, 13:20-15:05, Friday, July 20, 2018

FrA1_2(7) 14:50-15:05

Time-Inconsistent Stochastic Optimal Control

Yuan-Hua Ni
College of Computer and Control Engineering, Nankai University, China

- Standard optimal control problems are all time-consistent.
- The non-exponential discounting and the nonlinear appearance of conditional expectation will ruin the time-consistency.
- Open-loop equilibrium control and feedback equilibrium strategy of time-inconsistent optimal control problems are clarified.

FrA2 Active Robot Perception

Session Chairs: Yuanlong Yu and Peng An

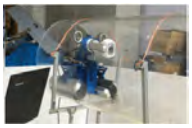
Room : THE RESIDENCE 2, 13:20-15:05, Friday, July 20, 2018

FrA2(1) 13:20-13:35

A Novel Pipeline Inspection Robot with Two Angle-changeable Crawler Drive Modules

mingxue cai and mingjie dong
the State Key Laboratory of Management and Control for Complex Systems,Instituteof Automation, Chinese Academy of Sciences
the State Key Laboratory of Virtual Reality Technology and System, Beihang University

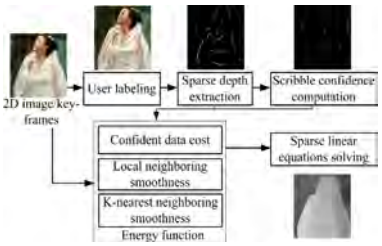
- Modular crawler drive module
- Adapt to big range of diameter of pipeline
- move throw the elbow pipeline



Pipeline inspection robot
With two Angle-changeable
Crawler Drive Modules

FrA2(2) 13:35-13:50

Error-Tolerant Interactive 2D-to-3D Conversion Using Local Consistency



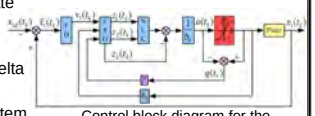
Jiahai Chen, Hongxing Yuan, and Jiatao Song
Ningbo University of Technology

FrA2(3) 13:50-14:05

Active Disturbance Rejection Control for a Nonlinear System Subject to Actuator Saturation

Yang Yu and Yuan Yuan
School of Astronautics, Northwestern Polytechnical University, China
Huaping Liu
Department of Computer Science and Technology, Tsinghua University, China

- Delta-domain ESO with anti-windup compensator is introduced to estimate error states and nonlinearity.
- ESO-based composite controller is developed to control the nonlinear delta operator system.
- Stabilizations of estimation error system and overall control system are guaranteened in delta domain.



Control block diagram for the nonlinear system

FrA2(4) 14:05-14:20

The Research on Place Recognition of Unmanned Vehicles

Xinyu Zhang, Mo Zhou, Yi Huang
State Key Laboratory of Automotive Safety and Energy, Tsinghua University, China
Huaping Liu
State Key Laboratory of Intelligent Technology and Systems, Tsinghua University, China

- Visual-based Place Recognition

underlying features → high-level features → deep learning (i.e. hybrid network architecture)

- Laser-based Place Recognition

two-dimensional range finders / three-dimensional LIDAR

- Multimodal and Cross-modal Place Recognition

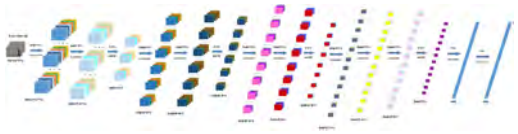
fusion /joint representation of vision and LIDAR

FrA2(5) 14:20-14:35

Event Recognition based on 3D Convolutional Networks

Rong Chen, Yuanlong Yu and ZhiYong Huang
College of Mathematics and Computer Science, FuZhou University, FuZhou,

- A approach that learns spatiotemporal features based on spatio-temporal neural networks.
- The network follow the way that contacting two continuous convolutional layers to instead of a convolutional layer which its kernel size is bigger through synthetical consideration.
- The experiment results show that the model has better classification ability than hand-crafted feature extraction algorithm, we also compares the model with different depth neural networks, and further proves the superiority of the model.

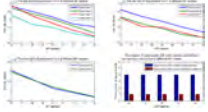


FrA2(6) 14:35-14:50

Study on the Effects of Multi-Agent Application in WLAN Planning Optimization Problem

Xiaohuo Xu, You Zheng, Tailong Shi, Peng An and Jiahai Chen
Ningbo University of Technology, China
Dandan Fang
Ningbo Academy of Smart City Development, China

- Describe a mathematical WLAN model for the large-scale planning problems.
- Give a multi-agent optimization algorithm based on distributed artificial intelligence.
- Compared with the published optimization algorithm by the experiments with the large-scale WLAN scene.
- Focuse on the performance of the algorithm with different AP radio parameters in depth.



Comparisons of experimental results

FrA2 Active Robot Perception (con't)

Session Chairs: Yuanlong Yu and Peng An

Room : THE RESIDENCE 2, 13:20-15:05, Friday, July 20, 2018

FrA2_2(7) 14:50-15:05

Recognition and classification of coal sample composition using KSVD

Min Jiang, Zhenghao Xi, and Yilun Liu
Department of electronic and electrical engineering , Shanghai University Of Engineering Science, Shanghai, China.

Abstract—In order to solve the problem of coal sample images classification, this paper proposes a new method which includes a pre-processing of coal sample images and an advanced KSVD algorithm. The KSVD algorithm includes sparse coding (find sparse coefficient x) and dictionary update (find dictionary D), then we get an adaptive dictionary iteratively. Finally, we use SVM to solve the problem of coal sample images classification. For the classification of coal samples with no obvious features, the algorithm of this paper has been shown to be effective. Experiments show that the proposed algorithm has good stability and accuracy in classification of coal sample images.

FrA3 Simultaneous Localization and Mapping

Session Chairs: Yong Liu and Yan Zhuang

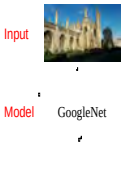
Room : THE RESIDENCE 3, 13:20-15:05, Friday, July 20, 2018

FrA3(1) 13:20-13:35

Euler angles based loss function for camera localization with deep learning

Qiang Fang, Kuang Zhao, Dengqing Tang, Zhengyuan Zhou,Yong Zhou, Tianjiang Hu and Han Zhou
College of Intelligence Science and Engineering, National University of Defense Technology, China

- This paper concentrates on loss function design for camera localization with deep learning.
- Complicated parameter selection is avoided by exploring the euler angles as the orientation representation in the camera pose regressor.
- Results show that the proposed approach has comparable translation accuracy and better orientation accuracy against the pre-existing PoseNet.

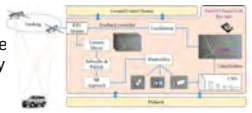


FrA3(2) 13:35-13:50

Onboard smart surveillance for micro-UAV swarm: an experimental study

Kuang Zhao and Zhengyuan Zhou
College of Intelligence Science and Engineering,
National University of Defense Technology, China

- Use saliency detection to extract ROI regions from UAV Imagery
- Use shallow CNN network to classify the regions into pre-trained vehicle category
- This approach can identify ground vehicles in about up to 14 fps on small UAV computing platform



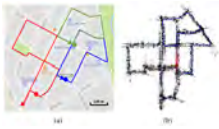
System architecture overview.

FrA3(3) 13:50-14:05

Distributed monocular multi-robot SLAM

Xieyuanli Chen, Huimin Lu, Junhao Xiao and Hui Zhang
Department of Automation, National University of Defense Technology, China

- A distributed multi-robot SLAM based on the robust monocular SLAM is proposed, by which a team of robots can cooperatively map the large-scale environment with high efficiency.
- A relative pose calculation and map merging method is proposed, by which the monocular multi-robot SLAM can be realized without any prior knowledge and large map overlaps.
- Extensive experiments have been conducted and the experimental results show that the proposed distributed monocular multi-robot SLAM system can be used in outdoor large-scale environments.



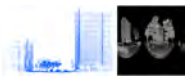
The mapping result of the proposed method. (a) shows the corresponding Google map of this experiment environment, (b) shows the global map obtained by the proposed distributed monocular multi-robot SLAM

FrA3(4) 14:05-14:20

A Novel Image Model of Point Clouds and Its Application in Place Recognition

Fengkui Cao, Fei Yan, Yufeng Gu, Chao Ding
Yan Zhuang and Wei Wang
School of Control Science and Engineering, Dalian University of Technology, China

- To present a novel panoramic image model of scattered point clouds
- To achieve laser-based place recognition using visual methods
- Experiments executed on three datasets show the validity and efficiency of the proposed method



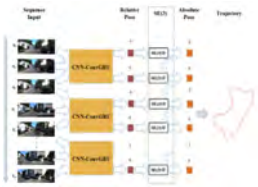
An exampling point cloud and its image model

FrA3(5) 14:20-14:35

Visual Ego-motion Estimation by Learning

Liang Liu, Linjian Zhang, Yong Liu
Institute of Cyber-systems and Control, Zhejiang University, China

- A learning based monocular camera ego-motion estimation methods.
- Memory module captures the long-term motion feature in the consecutive image pairs
- The model doesn't matter with the optical flow or other flow-like subspace



FrA3(6) 14:35-14:50

Mobile Robot Localization Using Wireless Sensor Based Landmark and Particle Filter

Haotian Chen, Biao Zhang, Guang Liu and Fengchi Sun
College of Software,Nankai University, China

- A localization scheme is proposed based on particle filter and the wireless sensor landmark system
- Take the fusion distance from ultrasonic ranging and radio frequency ranging as observation information
- The observation information is used in probabilistic perception model to update particle's weight

FrA3 Simultaneous Localization and Mapping (con't)

Session Chairs: Yong Liu and Yan Zhuang

Room : THE RESIDENCE 3, 13:20-15:05, Friday, July 20, 2018

FrA3_2(7) 14:50-15:05

An Experiment Implementation of Outdoor Formation Flight

Hongkai Ye, Jiangcheng Zhu, Zhepei Wang, Chao Xu
College of Control Science and Engineering, Zhejiang University, P. R. China

- A formation platform consists of quadrotors, communication link and ground control station
- An unified frame of reference to eliminate the effect of GPS error
- Both static and dynamic errors are considered to determine the minimal margin between agents
- Jonker-Volgenant and RVO algorithm used to generate control input

Experiment of formation of 12 quadrotors

FrA4 Visual Servo Control

Session Chairs: Jian Chen and Baoquan Li

Room : THE RESIDENCE 4, 13:20-15:05, Friday, July 20, 2018

FrA4(1) 13:20-13:35

Partially Calibrated Camera based Pose Estimation of Mobile Robots With Application to Visual Tracking

Yang Li, Jian Chen*, Kaixiang Zhang, and Xinfang Zhang
College of Control Science and Engineering,
Zhejiang University, Hangzhou, China

- A new method for relative pose estimation with a monocular camera
- Partially calibrated camera with uncertainty of focal-length
- Works with both coplanar and non-planar scenes
- Visual trajectory tracking

Visual Tracking Platform

FrA4(2) 13:35-13:50

A Review of Intelligent Control Algorithms Applied to Robot Motion Control

Qian Zhang and Fei Tong
College of Internet of Things, Hohai University, China
Xiaoying Sun
College of Mechanical and Electrical, Hohai University, China
Hua Chen
Mathematics and Physics Department, Hohai University, China.

- Single control strategies have been used for motion control and path tracing of robot
- Hybrid control methods also have an essential role to play in robot control
- Future trends in control of robot

FrA4(3) 13:50-14:05

Fractional Order Visual Servo Control For Fillet Seam Tracking

Weipeng Liu and Haojie Zhang
School of Control Sciences and Engineering, Hebei University of Technology, Tianjin 300130, China
Hebei Control Engineering Technology Research Center, Tianjin 300130, China

- A visual system with laser structured light is developed to measure the deviation
- A decoupling visual detection model is presented to gain approximately uncoupled relationship
- the fractional-order $PI^{\lambda}D^{\mu}$ controller is designed to improve the adjustment range and the control ability

Block diagram of visual servo control system based on fractional-order PID

FrA4(4) 14:05-14:20

A Review of Robot Control with Visual Servoing

Xiaoying Sun and Xiaojun Zhu
College of Mechanical and Electrical, Hohai University, China
Qian Zhan
College of Internet of Things, Hohai University, China
Hua Chen
Mathematics and Physics Department，Hohai University，China

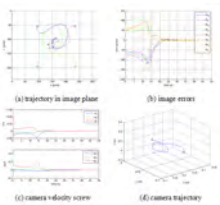
- Robot vision control systems are classified from different angles and play important roles
- Position-based visual servo system, image-based visual servo system is focused onThe future of robot vision servo research

FrA4(5) 14:20-14:35

Visual Servoing Controller Design with T-S Fuzzy Model and Parallel Distributed Compensation

T. T Wang and Y. D Zhang
Mechanical and Electrical Engineering, Hohai University, China
J. F Cui
Electrical and Control Engineering, North University, China

- A visual servoing controller based on Takagi-Sugeno (T-S) fuzzy model and parallel distributed compensation (PDC) is proposed.
- This approach avoids the inverse of the image Jacobian matrix and no image singular problem.
- The feasible solutions of LMIs ensure the closed-loop asymptotic stability of the visual servoing system.
- The system input constraints according to the actuator mechanical limitations can be handled.



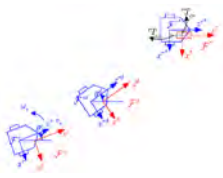
Simulation results

FrA4(6) 14:35-14:50

Uncalibrated Visual Servo Tracking control of Mobile Robots

Yu Qiu, Baoquan Li and Wuxi Shi
the School of Electrical Engineering and Automation, Tianjin Polytechnic University, China

- To handle the challenge introduced by the uncalibrated translation camera-to-robot parameters, a novel visual servo tracking scheme is designed for wheeled mobile robots.
- The homography decomposition method is used to get the current pose and the desired pose of the robot
- Simulation results are provided to demonstrate the effectiveness of the proposed strategy



FrA4 Visual Servo Control (con't)

Session Chairs: Jian Chen and Baoquan Li

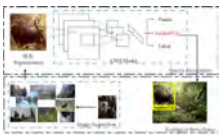
Room : THE RESIDENCE 4, 13:20-15:05, Friday, July 20, 2018

FrA4_2(7) 14:50-15:05

CNN based Wildlife Recognition with Super-pixel Segmentation for Ecological Surveillance

Yulin Song, Hongpeng Wang, Fulai Xu and Jingtai Liu
Tianjin Key Laboratory of Intelligent Robotics, Nankai University, China
Sheng Li
School of Life Sciences, Peking University, China

- Propose an effective combination on the challenging low-resolution camera-trap imagery dataset.
- Prove it's effective to apply super-pixel segmentation into image size normalization.
- Collected and annotated a standard camera-trap dataset of 14 common wildlife species.



FrA5 Cyber Robotics

Session Chairs: Qi Song and Zhi Han

Room : REGENCY ROOM 3, 13:20-14:50, Friday, July 20, 2018

FrA5(1) 13:20-13:35

Robot Learning by Demonstration Interaction System Based on Multiple Information

Fei Wang Huan Qi Yunwen Huang Xingqun Zhou, Yucheng Long
Faculty of Robot Sci. & Eng., Northeastern University, China

- This paper proposes an interactive robot learning system, which uses wearable sensors that can detect surface electromyography signals (sEMG) and inertial information.
- By introduction of Programming by Demonstration (PBD), as a priori knowledge of the crawling operation, the convergence speed and learning efficiency of the reinforcement learning process are obviously superior to the traditional Q learning algorithm.

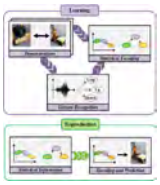


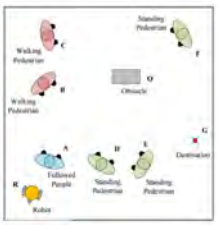
Figure Learning and reproduction phase

FrA5(2) 13:35-13:50

Evaluation of Human Comfortable Following Model for Service Robots

Yue Sun *, Lei Sun and Jingtai Liu
Institute of Robotics and Automatic Information System and Tianjin Key Laboratory of Intelligent Robotics, Nankai University, China

- The necessary of future motion expectation and natural interaction for human following.
- An intelligent following system based on user comfortable feeling and human factors.
- A comprehensive performance evaluation index of human following system.
- The proposed model considering human comfort performs better than traditional human following model.



Human Comfort Following Behavior

FrA5(3) 13:50-14:05

An MDP-based Task Allocation Model for A Class of Uncertain Human-Machine System

Meng Ge
State Key Lab of Rail Traffic Control & Safety, and Electronic and Information Engineering school, Beijing Jiaotong University, China
Qi Song WeiNing Fang
State Key Lab of Rail Traffic Control &Safety, Beijing Jiaotong University, China.

This paper proposes a model representing the task-operator allocation process for SSU-HMS, which not only considering the task uncertainty, but also considering the heterogeneity of human operators, the results of numerical simulations and experimental verification on MATB platform have verified the efficacy of the proposed method.

FrA5(4) 14:05-14:20

Switch Unit (SU): A Novel Type of Unit for the Activation Function

Xiuyi Yang
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, University of Chinese Academy of Sciences
Zhi Han, Yandong Tang, Jianda Han
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences

- This new units have comparable generalization ability as ReLU
- It have no suffering from gradient diminishing problem

Switch unit network

FrA5(5) 14:20-14:35

Adaptive Sliding Mode Observer-Based Force Feedback Control for Nonlinear Bilateral Teleoperators

Yunpeng Zhao, Kuo Li and Changchun Hua
The Institute of Electrical Engineering, Yanshan University, China

- An improved adaptive sliding mode observer to estimate the external force
- The transparency of the system is improved by the designed force feedback control
- The allowable maximal transmission delays can be obtained by solving the specific LMI conditions

FrA5(6) 14:35-14:50

Gravity Compensation of KUKA LBR IIWA through Fast Robot Interface

Che Hou, Yiwen Zhao, Guoli Song
the State Key Laboratory of Robotics, Shenyang Institute of Automation, the Chinese Academy of Sciences (CAS), Shenyang,China.
Junchen Wang, School of Mechanical Engineering & Automation, Beihang University, Beijing, China.

- Torque control on the KUKA LBR IIWA by Fast Robot Interface(FRI)
- Gravity compensation for the direct teching task
- Gravity parameter identification of KUKA LBR IIWA

FrA6 Best Paper Session

Session Chairs: Jizhong Xiao and Qining Wang

Room : REGENCY ROOM 1, 13:20-14:50, Friday, July 20, 2018

FrA6(1) 13:20-13:35

Design, Fabrication, and Analysis of a Sensorized Soft Robotic Gripper

Jawad Mehmood Butt, Hesheng Wang and Radan Khan
Department of Automation, Shanghai Jiao Tong University, China

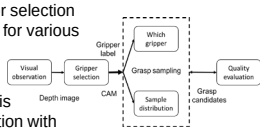
- Design, fabrication and analysis of human inspired soft robotic gripper with haptic and position feedback
- Characterization of sensors is performed to validate the experimental results
- The rigid as well as fragile object are grasped
- The future of soft robotics is to entertain multi-modal perception and our work is one of the early presentation of the future

FrA6(2) 13:35-13:50

A Cross Complementarity Method for Simultaneous End-effector Selection and Grasp Planning

Liang Ji, Hongxiang Yu, Yue Wang and Rong Xiong
State key Laboratory of Industrial Control and Technology, Zhejiang University
Jiafan Zhang
ABB Corporate Research China, Shanghai

- We propose a method of end-effector selection and robust graspable point selection for various objects.
- A cross complementarity framework is proposed for graspable region selection with suitable end-effector
- Predict the grasp affordance of all end-effectors given the depth image by fully convolutional networks
- A grasp sampling method that takes full advantage of the global information

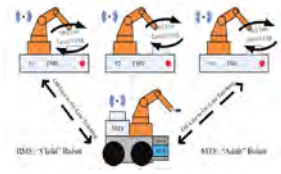


FrA6(3) 13:50-14:05

Robot Teaching and Learning Based on "Adult" and "Child" Robot Concept

Qi Hong[1], Lianqing Liu[2], Hongtai Cheng[3] and Heping Chen[4]
1. Shenzhen Institute of Information Technology; 2.Shenyang Institute of Automation
3. Northeast University; 4. Texas State University, USA

- Safety and robustness are critical issues in robotic manufacturing.
- An "Adult" and "Child" robot concept is proposed to deal with these two issues. An "Adult" robot can teach a "Child" robot to make corrections. The "Child" robot can adapt to uncertainties.
- Experimental platforms were developed. Preliminary results are quite promising.



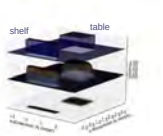
Proposed "Adult" and "Child" Robotic System

FrA6(4) 14:05-14:20

World Modeling for Robots using a Contextual Object-based Representation of the Environment

M. Hiller, F. Particke, C. Hofmann, H. Bey and J. Thielecke
Institute for Information Technology,
Friedrich-Alexander University Erlangen-Nürnberg, Germany

- **Semantic** and **Object-Based** Environment Modeling for Mobile Platforms (**CORE**)
- Consistent Mapping in **Static and Dynamic** Scenarios
- Incorporation of Associated **Uncertainties** by Using a **Probabilistic Approach**
- Object **Semantics as Basis for Inference** of Missing Data



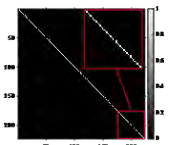
Probabilistic, Semantic & Object-Based World Model

FrA6(5) 14:20-14:35

Image-Sequence-Based Mobile Robot Localization

Xingliang Dong, Jing Yuan and Qinxuan Sun
College of Computer and Control Engineering, Nankai University, China.
Fengchi Sun and Yalou Huang
College of Software, Nankai University, China.

- The places in environments are modeled by different image sequences according to the spatial density.
- Using an image sequence to represent a place can overcome the disadvantages of using a single frame image.
- The complete and stable features of each image sequence are learned from the LSTM.



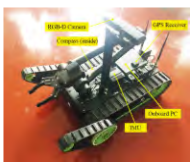
Localization results of the proposed algorithm

FrA6(6) 14:35-14:50

Outdoor Navigation of a Mobile Robot by Following GPS Waypoints and Local Pedestrian Lane

Jiatong Bao and Aiguo Song
School of Instrument Science and Engineering, Southeast University, China
Xiaomei Yao and Hongru Tang
School of Hydraulic, Energy and Power Engineering, Yangzhou University, China

- Through moving toward the GPS coordinates of the waypoints sequentially, the robot could be piloted to the destination in a global and coarse-grained navigation manner.
- A simple vision-based lane following method is proposed to control the robot to move safely on the pedestrian lane in a local and fine-grained navigation manner.
- Elementary blind test results on the campus environments have shown the effectiveness of the proposed method.



FrPoB Poster Session 2

Session Chairs: Xiao Liang and Donyang Bie

Room : FOYER, 1/F, 14:50-15:20, Friday, July 20, 2018

FrPoB(1) 14:50-15:20

A Dynamic Decision-Making Approach for Cyber-Risk Reduction in Critical Infrastructure

Qianxiang Zhu, Yue Zhao, Li Fei, Chujie Zhou
School of Automation, Huazhong university of Science and Technology, China

- Characteristics of Critical infrastructure (CI) include cyber-physical interaction and stations interdependence.
- A dynamic decision-making approach for cybersecurity protection of CI is provided based CI characteristics.
- Optimal defense strategy is selected with considering resource constraint and cyber-risk assessment.

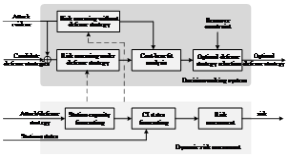


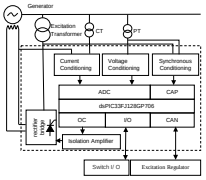
Figure 1. Architecture of dynamic decision-making

FrPoB(2) 14:50-15:20

Research on Intelligent Excitation Cubicle Based on dsPIC

Xiujuan Bao and Tao Zhang
College of Computer and Control Engineering, Nankai University, China
Shanyou Lou
College of Engineering, Yantai Nanshan University, China

- This paper focuses on the principle and function of the intelligent detection and control modules in the intelligent excitation cubicle
- the necessary hardware circuits of the excitation cubicle are provided
- A software program is compiled by mixed programming of C language and dsPIC assembly language



System principle diagram

FrPoB(3) 14:50-15:20

Iterative Learning Control for Singular Systems with Fixed Initial Shift

Ya Zhu, Panpan Gu, Senping Tian and Xiangyang Li
School of Automation Science and Engineering, South China University of Technology, China

Abstract: The iterative learning control problem for a class of discrete singular systems with fixed initial shift is studied. Based on the nonsingular transformation method, the considered discrete singular systems are transformed into the difference-algebraic systems, then an iterative learning control algorithm is proposed and the corresponding state limiting trajectory is presented. It is shown that the algorithm can guarantee that the system state converges uniformly to the state limiting trajectory. Furthermore, the initial rectifying strategy is applied to the discrete singular systems for eliminating the effect of the fixed initial shift. Under the action of the initial rectifying strategy, the system state can converge to the desired state trajectory over all the discrete time points within the prespecified finite time interval. Finally, an example is given to illustrate the effectiveness of the proposed method.

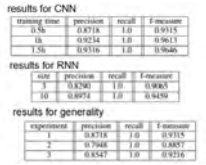
Index Terms: Discrete singular systems, iterative learning control, fixed initial shift.

FrPoB(4) 14:50-15:20

Key Frame Extraction of Assembly Process Based on Deep Learning

Minghui Zhao, Xian Guo, Xuebo Zhang
Institute of Robotics and Automatic Information Systems, Nankai University, Tianjin, China

- We proposed two methods of key frame extraction of assembly based on CNN and RNN.
- The identification accuracy for different data sets can reach more than 88%.
- The method has a good accuracy as well as generality.



FrPoB(5) 14:50-15:20

Contact State Classification in Industrial Robotic Assembly Tasks Based on Extreme Learning Machine

Sisi Zhang,Qi Jiang,Yibin Li,Fengming Li,Rui Song

School of Control Science and Engineering, Shandong University Jinan, 250061, China

In industrial robotic assembly process, the work surrounding environment is generally described by Contact State (CS). In this paper, to solve the problem of contact state recognition, contact state classification based on Extreme Learning Machine (ELM) is proposed in industrial robotic assembly process and extended the neural network to kernel learning. ELM is superior to accuracy and speed of classification, owing to node generation being independent of training data, ELM with kernel (ELM-kernel), based on the basic classifier ELM, is applied to classify contact state of the complex assembly process. Results have shown that contact state can be recognized by the proposed classification method and the performance of ELM kernel is better than ELM. So that more accurate information of contact states can be provided for the robot favoring the assembly tasks.

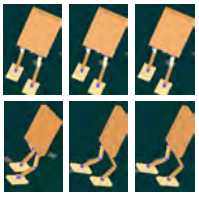
FrPoB(6) 14:50-15:20

A Reinforcement Learning Method for Humanoid Robot Walking

Yunda Liu[1], Sheng Bi[1], Min Dong[1], Yingjie Zhang[1], Jiangcheng Chen[2] and Jialiang Huang

1:South China University of Technology, Guangzhou, Guangdong 510006 China
2:Shenzhen Academy of Robotics, Shenzhen, Guangdong 518000 China

- In this paper, we describe a model-free reinforcement learning method for gait controlling of humanoid robots, which combines Q-learning with Radial Basis Function Network.
- The approach is applied to the controllers on hip joints of humanoid robots that receives sensory data and constantly adjusts the outputs of steering engines on hip joints.



FrPoB Poster Session 2 (con't)

Session Chairs: Xiao Liang and Donyang Bie

Room : FOYER, 1/F, 14:50-15:20, Friday, July 20, 2018

FrPoB_2(7) 14:50-15:20

Facial expression recognition based on deep convolutional neural network

Kejun Wang, Jing Chen, Xinyi Zhang, Liying Sun
Harbin Engineering University, College of Automation, Harbin 150001, China
wangkejun@hrbeu.edu.cn

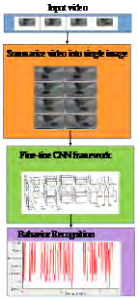
In interpersonal communication, facial expressions serve as an important way for people to communicate with each other. Through small changes of the face, people can express a variety of emotions. However, the existing facial expression recognition technology has the disadvantages of low recognition rate, slow speed and poor generalization. Based on these problems, we propose a new facial expression recognition method which uses the convolutional network based on convolution block to realize the recognition of facial expression. Firstly, we expand the existing expression database to effectively improve the generalization performance of training samples and solver other issues such as single background; Secondly, for the convolution block in convolutional neural network, multi-layer small convolution kernels are mostly used instead of large convolution kernel .This not only reduces the parameters and improves the practical application of convenience, but also makes the network more sensitive to image details and more significant recognition effect. In this paper, we use three different methods to experiment on 12 expressions. The above method has the obvious advantage that the error rate of expression recognition is reduced to 13.7%. The experimental results show that the proposed method has a good recognition rate and training speed, which has a certain promotion effect and reference value for more accurate facial expression recognition in the future.

FrPoB_2(8) 14:50-15:20

Mouse Behavior Recognition Based on Convolution Neural Network

Shanshan Zhou and Lin Xu
Institute of Robotics and Automatic Information System,
Nankai University, China

- **Mouse behavior** recognition has an important role in basic and clinical neuroscience.
- This paper **summarizes videos into single images** and develops a 2D CNN model to analyze mouse behavior by using these images as model inputs.
- Seven behaviors, including **drinking, eating, grooming, hanging, rearing, walking and micromovements of the head** are able to be classified by our model.
- The method is simple but powerful because of **utilizing 2D CNN models directly on video data.**



FrPoB_2(9) 14:50-15:20

A Semi-Supervised Learning Method using Deep Conv-Deconv Network and Robust-KSH for Image Retrieval

Yi Li[1,2], Mingyang Wan[1] and Bin Xie[1,2]
1.Information Science and Engineering, Central South University, China
2.Mobile Health Ministry of Education - China Mobile Joint Laboratory, Xiangya Hospital Central South University, China

- A semi-supervised learning method with deep Conv-Deconv network and Robust-KSH is proposed for image retrieval
- Deep Conv-Deconv network is an unsupervised learning method based on encoder-decoder structure
- Robust-KSH is more robust and less computational complexity than Supervised Hash with Kernels

FrPoB_2(10) 14:50-15:20

Modeling Contact State of Industrial Robotic Assembly using Support Vector Regression

Fengming Li, Qi Jiang, Yibin Li, Meng Wei, Rui Song

School of Control Science and Engineering, Shandong University
Jinan, 250061, China

In industrial robotic assembly process, the work surrounding environment is generally described by contact state when vision-based systems fail for occluded parts. To address the problem of contact state recognition, the paper proposes an assembly process modeling method based on Support Vector Regression (SVR) and Particle Swarm Optimal (PSO), which constructs a model by mapping the relationship between assembly contact state and robotic executive action. The model of SVR, whose parameters is optimized by PSO, used to predict the next motion of robot. The effectiveness and accuracy of the hybrid model based on SVR and PSO are further demonstrated by experiments using fasten-assembly of circuit breaker in low-voltage apparatus automotive assembly. The results show that the proposed model is capable of modeling the complex assembly process of low-voltage apparatus to construct the assembly rule base and lay the foundation for improving the flexibility and rapidity of small assembly.

FrPoB_2(11) 14:50-15:20

Grasp Planning for Multi-fingered Hand in Blind Grasping

Xiubo Xu, Yongyao Li, Ming Cong and Dong Liu
Institute of Mechanical Engineering, Dalian University of Techonology, China
Yu Du
Department of Mechanical Engineering, University of British Columbia, Canada

- A method of blind grasping is provided, with force sensors and given geometric information.
- Grasping Positions are firstly determined, then the force is calculated.
- The final grasping may reach the maximum stability and minimum force.

Grasping an Object
Resulting from the Method

FrPoB_2(12) 14:50-15:20

Fast Consensus Seeking in First Order Multi-Agent Systems with Antagonistic Interactions*

Jijun Qu and Zhijian Ji
Institute of Complexity Science, College of Automation and Electrical Engineering, Qingdao University, China

- We study the variation of the convergence rate when a superposition system is joined.
- When there is an eigenvector x of λ_2 satisfying $\tilde{L}x \neq 0$, the multiplicity of λ_2 is changed
- By using the equality of eigenvalues, the situation of how the convergence rate changes is analyzed.

FrPoB Poster Session2 (con't)

Session Chairs: Xiao Liang and Donyang Bie

Room : FOYER, 1/F, 14:50-15:20, Friday, July 20, 2018

FrPoB_3(13) 14:50−15:20

The Application of digital flexible intelligent manufacturing system in machine manufacturing industry

Yefeng Liu, Yuan Zhao, Lin Tao, Kexue Zhao, Kangju Li
(1. Liaoning Key Laboratory of Information Physics Fusion and Intelligent Manufacturing for Grade CNC Machine, Fushun 113122; 2. College of Mechanical and Vehicle Engineering, Shenyang Institute of Technology, Fushun 113122 Liaoning, China)

- The digital workshop refers to the manufacturing resources, operation and product as the core. On the reality existing manufacturing systems, the digital data of product design in the digital environment, by computer simulation and optimization of virtual manufacturing in the production process.
- This paper constructs the physical structure of the whole system and gives the detailed design of workshop management and control system, intelligent logistics system, three flexible digital processing unit.
- By sensors, radio frequency identification (RFID) device operation, need to monitor, connection, interactive tools, materials, logistics trolley, machine tools, gages real-time workshop, and information of all kinds of logistics process and processing needs, flexible intelligent manufacturing system of digital form and the combination of Internet and build a local workshop net.

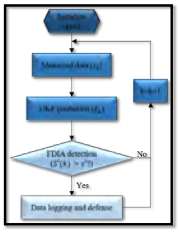
Figure 1. The Application of digital flexible intelligent manufacturing system in machine manufacturing industry

FrPoB_3(14) 14:50−15:20

Detecting False Data by CUSUM Algorithm Synergy with UKF

LIU Zhongxi, HUANG Manyun, WEI Zhinong and SUN Guoqiang
College of Energy and Electrical Engineering, Hohai University, China
NI Ming, LI Manli
NARI Group Corporation, State Grid Electric Power Research Institute, China

- Bad Data Detection (BDD) is vulnerable to false data injection attacks.
- We propose an improved cusum algorithm to detect false data injection attack.
- The algorithm also synergy with the Unscented Kalman Filter(UKF).
- The proposed algorithm tested on IEEE-14 systems successfully.



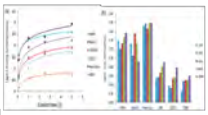
Program flow

FrPoB_3(15) 14:50−15:20

Quantifying cell-fibronectin adhesion forces by AFM single-cell force spectroscopy

Dan Dang[1, 2], Xiaofei Liu[2], Mi Li[3], Bin Liu[3]*
1 College of mechanical engineering, Northeastern University, Shenyang
2 Medical equipment College, Shenyang Pharmaceutical University, Shenyang
3 State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang

- The advent of atomic force microscopy (AFM) provides a powerful tool for investigating the physical behaviors of single native cells with nanometer spatial resolution. By attaching individual cells onto the cantilever of AFM, cellular adhesion forces can be quantified, and this technique is called single-cell force spectroscopy (SCFS). In this work, we used AFM-based SCFS to detect adhesion forces between different cells (including cancerous cells and normal cells) and fibronectin, which improves our understanding of cellular adhesion behaviors.



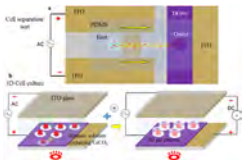
Statistical results of the detachment forces of six different types of cell lines measured by single-cell force spectroscopy.

FrPoB_3(16) 14:50−15:20

Extracellular-controlled Separation and 3D Cell Culture by Using Opto-electrokinetic

Yang Liu, Rong Tan, Yajing Shen*
Department of Mechanical and Biomedical Engineering, City University of Hong Kong, China

- A controllable manipulation based on AC E-Field combined with DC E-Field in an opto-electrokinetics chip
- The arbitrary microstructures are dynamically synthesized in a microfluidic device
- An organic photoconductive chip is developed as an electrode coating the TiOPc on ITO glass

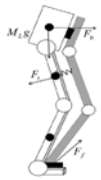


FrPoB_3(17) 14:50−15:20

Hybrid Control for Human-Powered Augmentation Exoskeleton

Qiming Chen, Hong Cheng, Wenqin Shen, Rui Huang, Xinhua Chen
Center for Robotics, University of Electronic Science and Technology of China Chengdu, China

- In the proposed hybrid control strategy, swing leg and stance leg are controlled separately.
- Zero-force control strategy is employed to swing leg to shadow the motion of pilots.
- Zero-load control strategy is employed to stance leg to reduce the gravity of load.
- A system named HUALEX is designed and the efficiency of hybrid control is demonstrated.



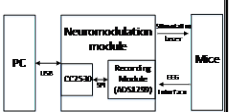
The model of human-exoskeleton.

FrPoB_3(18) 14:50−15:20

Closed-Loop Neuromodulation System for Epilepsy Based on Optogenetics

Yang Zhao and Lin Xu
Institute of Robotics and Automatic Information System, Nankai University, China

- **Neuromodulation** based on **optogenetic** is more developed toward intelligent and closed-loop control.
- The system composes of a laser, light stimulation-electric recording neural **interface**, neural signal recording module and control software.
- The change of EEG corresponds to the effect of applying **optogenetic** in the experimental body.
- Using **closed-loop** feedback of electrical and optical signals to determine the better **optogenetic** parameters.



Block diagram of the system

FrB1 Modeling and Control of Piezoelectric Actuators

Session Chairs: Yonghong Tan and Long Cheng

Room : THE RESIDENCE 1, 15:20-16:50, Friday, July 20, 2018

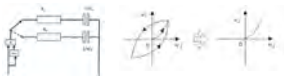
FrB1(1) 15:20-15:35

Nonlinear Robust Control of Positioning Stage Using Piezoelectric Actuator

Ruili Dong
College of Information Science and Technology
Donghua University
Shanghai, China

Yonghong Tan
College of Information, Mechanical and Electrical Engineering
Shaghai Normal University
Shanghai, China

In this paper, an equivalent circuit based model is applied to describe the behavior of piezo-actuator. The constructed equivalent circuit based model has a much simpler structure to describe the behavior of piezo-actuator than the other kind of models. Then, the positioning stage is described by a sandwich model with hysteresis. In this sandwich model, both driving amplifier and flexure hinge are described by linear dynamic submodels, respectively. Afterwards, the modeling procedure of the positioning stage using piezo-actuator is implemented by applying a two-step identification strategy. With the obtained sandwich model with hysteresis, a nonlinear robust control strategy is proposed. The robust stability analysis is also presented.

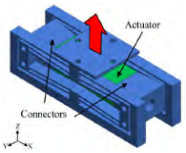


FrB1(2) 15:35-15:50

Design of a Compact 1-DOF Piezo-Driven Flexure Stage for Vertical Micro/Nano-Positioning

Zeyi Wu and Qingsong Xu
Department of Electromechanical Engineering, University of Macau, Macao, China

- A new compact 1-DOF compliant stage driven by a piezoelectric actuator is designed for micro/nano-positioning in vertical direction
- An orthogonal compound bridge-type displacement amplifier is introduced for compact design
- Design variables are optimized by multi-objective genetic algorithm
- FEA simulation results indicate that the stage provides the motion range of 181.18 μm and supports the maximum load of about 80 N

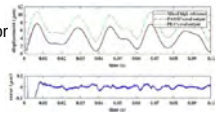


FrB1(3) 15:50-16:05

A Model Predictive Controller for Piezoelectric-Actuated Stick-Slip Devices

Long Cheng
State Key Lab. of Management and Control for Complex Systems
Institute of Automation, Chinese Academy of Sciences

- A model predictive controller is proposed for piezoelectric-actuated stick-slip devices.
- An adaptive TS fuzzy model is constructed for modeling the input-output relationship of the device.
- A prototype of such a device has been designed.
- Experimental results show that the control error is less than 0.2um for the 100Hz periodical reference.



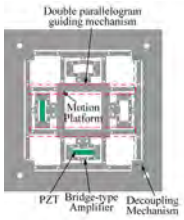
Tracking control performance under the proposed controller

FrB1(4) 16:05-16:20

Characteristics of a Decoupled 2-DOF Nano-positioning Stage

Fujun Wang*, Zhichen Huo, Yanling Tian, and Dawei Zhang
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University,

- A novel 2-DOF nano-positioning stage with compact configuration and new bridge type amplifier.
- The analytical model based on Euler-Bernoulli beam theory is established to analyze the characteristics of positioning stage.
- Finite element analysis is conducted and the results indicate that the proposed positioning stage has the amplification ratio of 5.9, as well as the input stiffness of 24.9 N/μm.



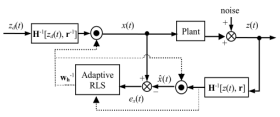
Schematic diagram of 2-DOF nano-positioning stage

FrB1(5) 16:20-16:35

Hysteresis Compensation of Piezoelectric Actuator Using Direct Inverse Modeling and Adaptive Recursive Least Squares Method

Rurui Jia and Yanding Qin
Institute of Robotics and Automatic Information System, Nankai University, China

- Direct inverse modeling (DIM) approach is adopted to construct the inverse hysteresis model without inversion calculation.
- Adaptive recursive least squares is integrated into DIM to dynamically update the parameters of the hysteresis compensator.
- Ease of use is guaranteed as the on-site fine tuning is eliminated.
- Experimental verifications are conducted on tracking of smooth and non-smooth trajectories.



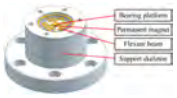
The integration of DIM and adaptive RLS

FrB1(6) 16:35-16:50

A Symmetry Flexure Structure and Its Application in Micro/Nano Newton Force Generation

Chongkai Zhou, Yanling Tian, Fujun Wang, Dawei Zhang
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education,Tianjin University,Tianjin 300350, China

- A symmetry flexure structure and its application in micro/nano Newton force generation is presented.
- Based on the electromagnetic actuator, a novel mechanical system for micro/nano Newton force generation is designed.
- The stiffness of thin beams are calculated and the Lorentz force is theoretically modeled. And then, the suspension mechanism is simulated by Finite Element Analysis (FEA).



The schematic diagram of the electromagnetic actuator

FrB2 Space Robotics

Session Chairs: Fan Zhang and Zhonghua Hu

Room : THE RESIDENCE 2, 15:20-16:50, Friday, July 20, 2018

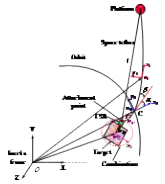
FrB2(1) 15:20-15:35

Inertia Parameters Identification and Control of Post-capture Combination by Tethered Space Robot

Yingbo Lu, Panfeng Huang, and Zhongjie Meng

School of Astronautics, Northwestern Polytechnical University, China

- Post-capture combination's full three attitude angles are considered in the dynamic model
- Linear regression form is constructed for combination's physical parameters identification
- Recursive least squares is employed to obtain the combination's physical parameters.



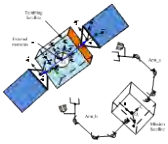
TSR System configuration

FrB2(2) 15:35-15:50

A Trajectory Planning Method for Rapid Capturing an Unknown Space Tumbling Target

Jianqing Peng, Wenfu Xu*, Senior Member, IEEE, Zhonghua Hu,
Harbin Institute of Technology, Shenzhen
Bin Liang
Tsinghua University, Beijing

- The kinematics of a dual-arm space robot system is introduced.
- The attitude dynamic equations of the tumbling target are derived and the motion characteristics of a space tumbling target is analyzed.
- An efficient trajectory planning method for rapid capturing of a space tumbling target is introduced.
- Two typical simulation cases are discussed.



The model of a space tumbling target capturing

FrB2(3) 15:50-16:05

Collision Free Path Planning for Multi-Section Continuum Manipulators Based on A Modal Method

Xingyao Yu, Xueqian Wang, Deshan Meng, Houde Liu
Graduate School at Shenzhen, Tsinghua University, China
Bin Liang
Department of Automation, Tsinghua Universit and Research Institute of Tsinghua University in Shenzhen, China

- Modify classical modal method to make it applicable for continuum manipulators' constant curvature kinematics.
- Use modal functions to generate a backbone curve that captures macro geometric features and meets tip position constraints.
- Treat one section as variable length link in fitness process.
- Implement "repelling" strategy to avoid obstacles and track pre-defined path.

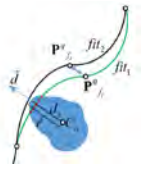


Fig. 1. Obstacle avoidance strategy.

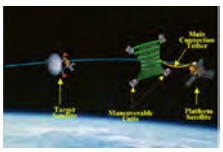
FrB2(4) 16:05-16:20

Trajectory Tracking Control for an Tethered Space Net Robot

Fan Zhang, and Panfeng Huang, *Senior Member, IEEE*

Research Center for Intelligent Robotics,
School of Astronautics,
Northwestern Polytechnical University

- Tethered space net robot is considered as a promising solution for on-orbiting debris capture and removal.
- A modified hierarchical adaptive super-twisting sliding mode control scheme is proposed.
- The desired trajectory can be tracked steadily and efficiently by employing the proposed control scheme.

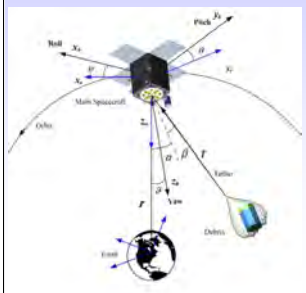


FrB2(5) 16:20-16:35

Attitude Stabilization of Spacecraft Perturbed by Tether-Captured Debris

Zhai Guang, Bi Xingzi, Zheng Heming

Beijing Institute of Technology, Aerospace Engineering School.



Attitude dynamics of platform are derived by involving the libration tether.

Nonlinear disturbance observer based on gyros measurements is developed to estimate the libration disturbance on the platform.

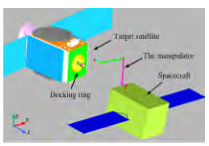
Adaptive attitude control scheme is proposed by combining the disturbance observer and a PD controller.

FrB2(6) 16:35-16:50

Impedance Control for Stabilizing the Coupled System during Tumbling Target Capturing

Zhonghua Hu, Lei Yan, Wenfu Xu*, Senior Member, IEEE and Jianqing Peng
Harbin Institute of Technology, Shenzhen, 518055, China

- Dynamics modeling of tumbling satellite and space robot
- Control strategy for capturing tumbling target
- Simulation study and conclusion



The model of simulation

FrB3 Surgical Robotics

Session Chairs: Zhijiang Du and Yu Dai

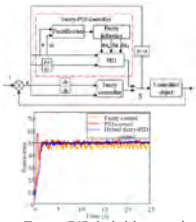
Room : THE RESIDENCE 3, 15:20-16:50, Friday, July 20, 2018

FrB3(1) 15:20-15:35

Fuzzy-PID Hybrid Control Strategy for Pneumatic Driven Surgical Robot

Yi Fu[1,2], Baoliang Zhao[1], Ying Hu[1], Shoubin Liu[2], Youhui Qian[3], Yanhui Wan[3]
[1]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China
[2]Harbin Institute of Technology at Shenzhen, China
[3]The Second People's Hospital of Shenzhen，China

- Robotic systems for Magnetic Resonance Imaging (MRI) guided interventional surgery are highly demanding.
- Pneumatic system is one of the most commonly used driving modes in MRI environment.
- Due to the nonlinearity, hysteresis and gas compressibility, it is a common problem for the position control of pneumatic system.
- This paper proposes a fuzzy-PID hybrid control algorithm which has the advantage of low overshoot, high accuracy and high adaptability.



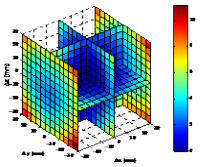
Fuzzy-PID hybrid control strategy

FrB3(2) 15:35-15:50

Real-time Error Compensation Strategy Based on BP Neural Network for Master-Slave Control

Jiafu Yi, Zhijiang Du, Hongjian Yu*, Shaodong Li and Wenlong Yang
State Key Laboratory of Robotics and Systems, Harbin Institute of Technology, Harbin, Heilongjiang, China

- The mapping between small increment in Cartesian space and joint space is established.
- A real-time error compensation strategy based on neural network is proposed.
- The simulation based on 3-degree of freedom (3-DOF) master-slave system is carried out



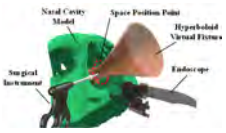
Following error of master manipulator before compensation (mm)

FrB3(3) 15:50-16:05

Automatic Tracking Motion Based on Flexible Forbidden Virtual Fixtures Design in Robot Assisted Nasal Surgery

Qingwen Zheng, Yucheng He, Xiaozhi Qi, Peng Zhang, Suiping Tan, Bing Li
Harbin Institute of Technology at Shenzhen
Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences

- A new security motion control model for different nasal cavity shapes is proposed.
- Flexible forbidden virtual fixture based on hyperboloid can effectively constraint the spatial movement of robot.
- The tracking motion control strategy based on VFs can completely liberate the doctor's hands.
- Great design of human-machine interaction with input filter improves efficiency of robot.



Robot automatic tracking motion based on the design of virtual fixtures

FrB3(4) 16:05-16:20

Needle Intervention Robot-Assisted Driving System with Augmented Haptic Force Feedback Facility

Xiangzhan Kong, Xingguang Duan, Amjad Ali Syed, Yonggui Wang and Ping Li

Beijing Advanced Innovation Center for Intelligent Robots and Systems,
Beijing Institute of Technology, Beijing, China

- This research presents novel table-mounted 4-DOFs surgical robot on slave side to achieve required position and orientation, through which the surgical needle can be inserted and extracted with augmented force feedback facility.
- Surgical results in beef and chicken are slightly different due to the difference in tissue physical properties

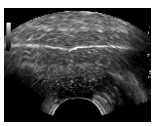
Experimental setup of needle driving force feedback

FrB3(5) 16:20-16:35

A Fast Automatic Segmentation Method Based on Improved Hammer Elastic Registration

Jiawen Yan, Bo Pan, and Yili Fu
State Key laboratory of robotics and system,
Harbin Institute of Technology, China

- An automatic pre-extraction method is proposed based on elastic registration
- Improved Hammer algorithm is exerted to realize elastic registration between ultrasound images with and without instrument
- The difference of deformed image and image with instrument is made to obtain the instrument contour



Elastic deformed ultrasound image

FrB3(6) 16:35-16:50

Disturbance Observer based Sliding Mode Control for Robot-assisted Minimally Invasive Surgical System with Stochastic Time Delay

Ai Dong and Zhiyuan Yan and Zhijiang Du
State Key Laboratory of Robotics and System, Harbin Institute of Technology, Harbin, China

- Disturbance observer is proposed to acquire the slave-environment interaction force information
- Projection based gradient estimator is employed to online estimate the unknown environmental parameters
- A novel communication architecture is designed that works under varying stochastic time delay
- Sliding mode control is utilized to make the tracking error as small as possible

Slave manipulator for RMIS

FrB4 Cyber Physical Systems

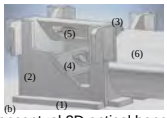
Session Chairs: Guanglie Zhang and Xian Guo

Room : THE RESIDENCE 4, 15:20-16:35, Friday, July 20, 2018

FrB4(1) 15:20-15:35

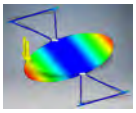
Simulation results of uniaxial micromirrors with conic-backside and V-arm flexures for scanner and display applications

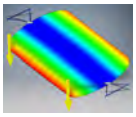
Winston SUN, Shaodong ZHAN, Yihang QIU, Jianmin HU, Guanglie ZHANG
Shenzhen Academy of Robotics, Shenzhen, China
wsun@szarobots.com



Conceptual 3D optical bench

Preliminary experimental setup


Circular micromirror for fast axis

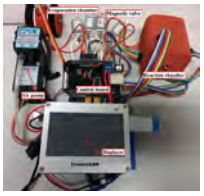

Rounded-rectangular micromirror for slow axis

FrB4(2) 15:35-15:50

A Fast Method for Chinese Liquor Recognition

Hui-Rang Hou, Ying-Jie Liu and Qing-Hao Meng
School of Electrical and Information Engineering, Tianjin University, China

- To solve recognition issue of Chinese liquors , a novel liquor recognition method (coding method) is proposed in this paper. Use Arial 28pt font in bold face for the title
- Ten gas sensors were used in our e-nose system. Based on the multi-sensors, the coding method is proposed.
- Our proposed method have been verified by the classification of five kinds of liquors and the true-fake liquor recognition.


Experimental system.

FrB4(3) 15:50-16:05

Robust Diagnosability and Robust Prognosability of Discrete-Event Systems Revisited

Xiang Yin, and Shaoyuan Li

Department of Automation and Key Laboratory of System Control and Information Processing, Shanghai Jiao Tong University, Shanghai 200240, China.

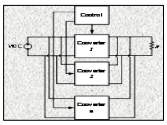
- New approaches for the verification of robust diagnosability and robust prognosability in DES.
- The complexity of the proposed algorithms are polynomial in both the number of states and the number of possible models.

FrB4(4) 16:05-16:20

Sliding Mode Based Current Sharing Control of Parallel Cuk DC-DC Converters

Yangfei Feng
College of Automation, Chongqing University, China
(e-mail:291606143fyf@gmail.com)
Rui Ling
College of Automation, Chongqing University, China

- A sliding mode based current-sharing control approach.
- Achieving the current-sharing control for the parallel cuk dc-dc converters
- Sliding mode voltage and current controls
- The converter with the presented control has the advantages of good dynamic performance and robustness.



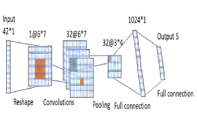
The parallel Converter

FrB4(5) 16:20-16:35

Hybrid Intrusion Detection Method Based on K-means and CNN for Smart Home

Kaijian Liu，Zhen Fan，Meiqin Liu and Senlin Zhang
College of Electrical Engineering, Zhejiang University, China

- An active and hybrid method
- Establish rule base to detect intrusion with K-means and PCA
- Specify type of intrusion based on a CNN model
- Adopt SMOTE and under-sampling techniques to reduce missing report rate



CNN architecture specialized for smart home system intrusion detection

FrB5 Specialized Robot

Session Chairs: Heping Chen and Ning Sun

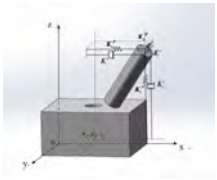
Room : REGENCY ROOM 3, 15:20-16:50, Friday, July 20, 2018

FrB5(1) 15:20-15:35

Robot Learning from Human Demonstration of Peg-in-Hole Task

Peng Wang, Jinxin Zhu, Wei Feng, Yongsheng Ou
Shenzhen Institutes of Advanced Technology, CAS

- Introduced a learning framework for peg-in-hole assembly tasks in which robots learn assembly skills from human demonstrations.
- By using GMM to encode demonstration information, the robot learns stiffness changes, rather than manually adjusting the stiffness of the model.

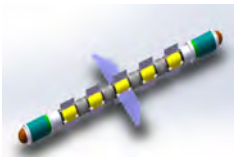


FrB5(2) 15:35-15:50

Gliding Control of Underwater Gliding Snake-like Robot based on Reinforcement Learning

Xiao-lu Zhang
College of Information Science and Engineering,Northeastern University ,China
Bin Li,Jian Chang and Jing-ge Tang
State Key Laboratory of Robotics,Shenyang Institute of Automation Chinese Academy of Sciences, China

- The control of the gliding action of underwater gliding snake-like robot is mainly studied
- A modified Monte Carlo policy gradient algorithm using pre-processed neural network is proposed
- The POMDP problem due to the complex environment and structure of the robot is relieved



FrB5(3) 15:50-16:05

An Energy Optimal Foot Trajectory for the Hydraulic Actuated Quadruped Robot

Kun Yang, Lelai Zhou, Xuewen Rong and Yibin Li
Control Science and Engineering department, Shandong University, China

- An energy model including mechanical power and the heat rate was established.
- The dynamic equation of the single leg model was obtained using Lagrangian method.
- An Energy Optimal Foot Trajectory based on Fourier series was proposed.
- The energy consumption was compared with a foot trajectory based on the cubic spline interpolation.

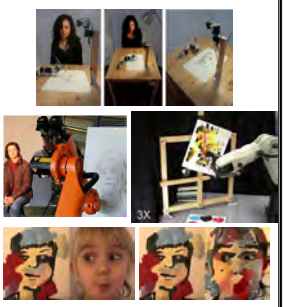
Simplified model of the right-front leg of the robot

FrB5(4) 16:05-16:20

A Review of Robotic Drawing

Dongmeng Yu, Heping Chen
Shenzhen Academy of Robotics, Shenzhen, China.

- Based on the number of colors in the final works, drawing robots are divided into mono-color drawing robot and multi-color drawing robot.
- Image processing provides a way to compare aimed drawing/color with current drawing/color, to define whether the drawing is finished or not.
- Style transfer gives a method for robots to create new paintings by combining the content with style of different pictures.
- The future trends of robotic drawing is becoming faster, more humanized and more creative.



FrB5(5) 16:20-16:35

Event-based Planning and Control for Teleoperation of Hot Line Work Robot

Yang Wang, Xiaoming Mai
Department of Artificial Intelligence and Robotics, The Guangdong Electric Power Research Institute of Guangdong Power Grid Corporation, Guangzhou, China
Jiangcheng Chen, Sheng Bi, Yu Cheng, Ning Xi
Department of Industrial and Manufacturing Systems Engineering, The University of Hong Kong, Pokfulam, Hong Kong SAR

- A HLWR prototype consists of a joystick and a robot arm is established.
- An event-based planning and control method for the teleoperation of a HLWR is proposed and tested.
- Fusion of manual operation and automatic operation is realized.
- Manual-automatic fusion control enable the HLWR to cope with some unexpected events during its working.

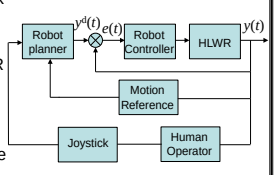


Figure The block diagram of the commands fusion scheme

FrB5(6) 16:35-16:50

Study on Fault Diagnosis of Coal Planer Based on Factor Space

Limin Zhang, Chenguang Guo,
School of Mechanical Engineering, Liaoning Technical University, China
Xinghui Zhang, Weixun Li
School of Information Technology Engineering, Tianjin University of Technology and Education, China
Weixun Li
School of Science, Tianjin University of Technology and Education, China
Haitao Gao
School of Electrical and Electronic Engineering, Anhui Science and Technology University, China

- Coal planer often break down because of poor working environment.
- Fault diagnosis problem of coal planer is studied based on the theory of factors space.
- Fault diagnosis of coal planer is described through its symptom factors set together, through factor analysis, got the fault type.

FrB6 Best Student Paper Session

Session Chairs: Tao Liu and Juanjuan Zhang

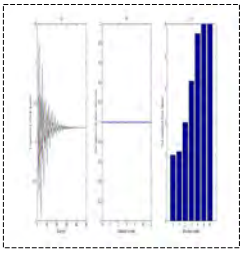
Room : REGENCY ROOM 1, 15:20-16:50, Friday, July 20, 2019

FrB6(1) 15:20-15:35

Attack-state Estimation for Cyber-Physical Systems: A GraphTheory Perspective

Wentao Zhang, Zhiqiang Zuo and Yijing Wang
School of Electrical and Information Engineering, Tianjin University, Tianjin, P. R. China

- The attacked state recovery problem by virtue of the graph theory perspective is studied.
- Some new results are induced, as well as some comparisons are given in contrast with the existing results.
- Numerical examples are presented to show the efficiency of the derived theoretical results.



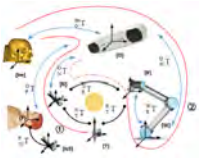
FrB6(2) 15:35-15:50

FrB6(3) 15:50-16:05

Space Registration and Experiment of Craniotomy Robot

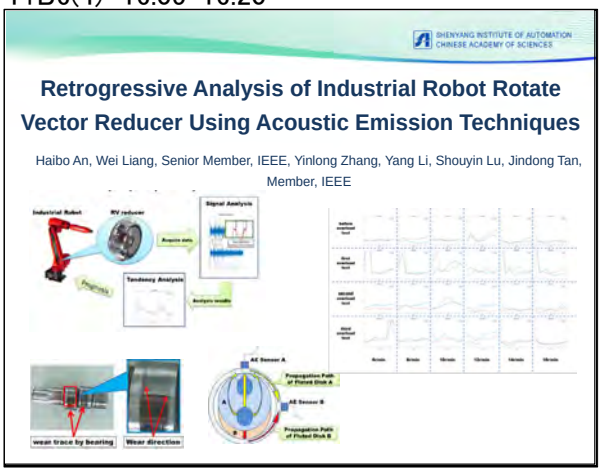
Tengfei Cui and Xingguang Duan* and Dingqiang Han and Anji Ma and Huanyu Tian
Intelligent Robotics Institute, Beijing Institute of Technology, China
Email:ctflychina@163.com

In view of the characteristics of high complexity and high risk of craniotomy, a robotic system of intelligent human craniotomy was developed. This paper mainly expounds the registration scheme of robot, operating tool and skull coordinate system in the craniotomy robot system, and carries out the cranial model test. Experimental results show that the registration accuracy of the spatial registration scheme is high, and it is feasible to meet the needs of the craniotomy system.



Craniotomy robot navigation system

FrB6(4) 16:05-16:20



FrB6(5) 16:20-16:35

Deep learning for manipulator visual positioning

H.Cheng, J. Xin, Y.M.Yao, D.Liu
Information and control department,Xi'an University of Technology, China
Y.M. Zhang
Mechanical and Industrial Engineering department, Concordia University,Canada

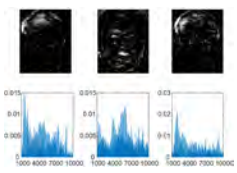
Abstract: Visual servoing is an important issue in the field of robotics. Meanwhile, it is a challenging problem in the field of robot visual servoing that enables the robot to position an unknown object only using the current image feature, without having to known any model information about the object before positioning it. So we apply deep learning to the robotics control and propose a manipulator visual positioning method based on deep learning. The positioning process is as follows: Firstly, we use a well-trained object detection network based on deep learning to classify and detect objects, and obtain the class label and location information of all the object in the first frame image ,which is captured by the camera mounted on the robot; Then, user randomly selects object to be manipulated through human-computer interaction according to the result of recognition and detection , and the object's class label and location information is also acquired by manipulator robotics control system. In the sequence of subsequent images, robotics control system can detect the object to be manipulated using the selected object class label information and well-trained object detection network; Finally, we can calculate the current image features, that is 2D image pixel coordinates of the object to be manipulated. On this basis, we design the visual sliding mode controller to control the manipulator to position the unknown object randomly selected by the user in the first frame image. Experimental results show that our manipulator visual positioning method can position an unknown object without having to known any model information about the object prior to the positioning task execution, and it is an effective manipulator visual positioning on unknown object method.

FrB6(6) 16:35-16:50

Content-based Compressive Sensing

Congjian Li, Yu Cheng, Zhiyong Sun, Ping He, Sheng Bi and Ning Xi, Fellow, IEEE
Department of Industrial and Manufacturing Systems Engineering, The University of Hong Kong, Hong Kong, China

- Propose an approach to sensing signals based on the content information
- The sensing rate is reduced and the sparsity requirement of signals is not necessary
- Experiments are conducted to compare the reconstruction quality



Content-based sensing element and distribution

FrC1 System Modeling

Session Chairs: Fujun Wang and Mingzhu Sun

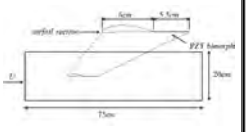
Room : THE RESIDENCE 1, 17:00-18:00, Friday, July 20, 2019

FrC1(1) 17:00-17:15

Development of an Airfoil-Based Aeroelastic Energy Harvester driven by Alternating Airflow

Shenyu Liu, Fei Fei, Changcheng Wu, Min Yang, Dehua Yang
Institute of Automation, Nanjing University of Aeronautics and Astronautics, China

- Aeroelastic energy harvester (EH) is developed to support wireless sensor nodes
- Two kinds of airfoil model (NACA6412 and NACA23012) are tested for airflow-structure coupling
- Maximum voltage 4.60V and 9.12V can be reached in wind tunnel experiments



Schematic diagram of wind tunnel experiments

FrC1(2) 17:15-17:30

Virtual Keyboard Based on MEMS Sensors and Fusion of Accelerometer and Gyroscope

Chao Lian, Haifang Wang, Yuliang Zhao*, et al.
Control Engeering Dept, Northeastern University at Qinhuangdao, China

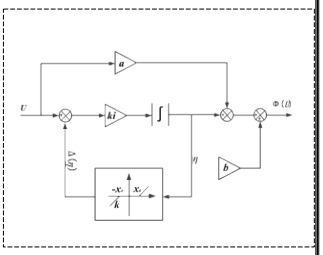
- The attitude angle and accelerometer data were extracted for the keystroke recognition.
- KNN classifier is applied and shows a higher recognition accuracy than other classifiers.
- The best recognition correct rate of two sensors on one hand is 94%.

FrC1(3) 17:30-17:45

A dynamic hysteresis model for MR dampers based on particle swarm optimization

Xinlong Zhao , Wen Qin, Shuangjiang Wu and Haipeng Pan
School of Mechanical Engineering and Automation, Zhejiang Sci-Tech University, China

- A new parametric model of MR damper is proposed based on dynamic hysteresis elements.
- As the damping force of MR dampers is related both velocity v and current I, the inclusion of current is used to enhance the performance of the proposed model.
- M-PSO algorithm is developed to estimate the parameters.

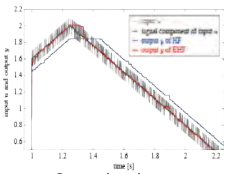


FrC1(4) 17:45-18:00

An Enhanced Hysteresis Filtering for Removing Impulsive Noise

S. Jin[1], S. Guo[2], Y. Jin[1], X. Wang[1] and X. Xiong[3]
[1] School of Engineering, Yanbian University, China
[2] School of Mechanical Engineering, Hebei University of Technology, China
[3] School of Mechanical Engineering and Automation, Harbin Institute of Technology Shenzhen Graduate School, China

- An enhanced hysteresis filter (EHF) for Removing Impulsive Noise is proposed.
- The backward Euler discretization is used for discretizing an algorithm of the filter.
- The proposed filter suppresses impulsive noise effectively, while producing smaller phase lag than conventional hysteresis filter (HF).



Comparison between EHF and HF

FrC2 Micro and Nano Manipulation Robotics

Session Chairs: Guanglie Zhang and Yanding Qin

Room : THE RESIDENCE 2, 17:00-18:00, Friday, July 20, 2018

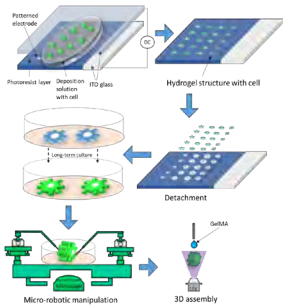
FrC2(1) 17:00-17:15

Construction of 3D micro-tissue based on electrodeposition and robotic manipulation

Zhiqiang Zheng, Huaping Wang*, Qing Shi, Jianing Li, Juan Cui, Tao Sun, Qiang Huang, and Toshio Fukuda

School of Mechatronical Engineering
Beijing Institute of Technology
Beijing, China

In this paper, a novel 3D cell laden microstructure assembly method was proposed, which is based on the rail-guided micromanipulation system and GelMA initial fixation method.

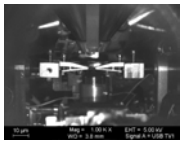


FrC2(2) 17:15-17:30

Trans-scale Measurement Method For Graphene Materials Inside Scanning Electron Microscope

Donglei Chen, Zhan Yang, Tao Chen, Lining Sun and Toshio Fukuda
Jiangsu Provincial Key Laboratory of Advanced Robotics & Collaborative Innovation Center of Suzhou Nano Science and Technology, Soochow University, Suzhou 215123, China

- The graphene material was fixed on the golden gripper.
- The graphene can be stretched by controlling the nanomanupulation inside the SEM.
- In the experiments, the stretched surface structure in nanoscale of the graphene was observed and the electrical characteristic was tested.
- The effective measurement method which combined macroscopic with microscopic has important practical significance.



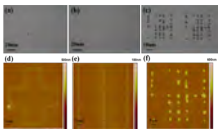
The nanorobotics manipulation system in the SEM

FrC2(3) 17:30-17:45

Patterning Micro-nano Structures Based on Tip-assisted Electrohydrodynamic Jet Printing

Wuhao Zou, Haibo Yu, Peilin Zhou, Yangdong Wen and Lianqing Liu
The State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, China

- Tip-assisted EHD printing achieves greater printing resolution of high-viscosity materials
- Smaller patterns can be printed without a finer nozzle
- Micro-nano patterning structures smaller than the nozzle inner diameter can be printed



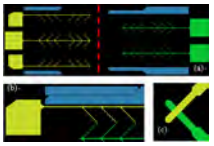
Pattern experimental results of tip-assisted EHD-printing

FrC2(4) 17:45-18:00

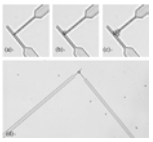
A Low-Cost Dielectrophoretic Chip with 3D Overlapping Electrodes for Cell Trapping Applications

Zhi LI[1], Yihang QIU[2], Winston SUN[2], Jianmin HU[2], Shaodong ZHAN[2], Guanglie ZHANG[2] *
[1] College of Computer Science and Software Engineering, Shenzhen University, China
[2] Shenzhen Academy of Robotics, China.

- A low-cost DEP chip with 3D overlapping electrodes for cell trapping was designed.
- A simplified model of the DEP chip assembly was constructed using 3D CAD software to simulate the effect.
- A real DEP chip was assembled and experiments showed that particles are trapped only at the upper-lower electrode overlapping region and nowhere else.



DEP chip design layout



Capturing experiment for 5 μm electrode tips

FrC3 Bio & Smart Sensing

Session Chairs: Wenli Zhou and Han Zhang

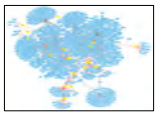
Room : THE RESIDENCE 3, 17:00-18:00, Friday, July 20, 2018

FrC3(1) 17:00-17:15

Prioritizing congenital heart disease genes from transcriptome and interactome via PageRank

Haixia Shang and Zhi-Ping Liu
School of Control Science anf Engineering,Shandong University, China

- Construction of PPI network
- Calculation of weight based on mutual information
- Weighted PageRank Algorithm
- Rank of genes in the PPI network



PPI Network

FrC3(2) 17:15-17:30

A MAC Controller Design for Zigbee and WiFi Hybrid Network Based on FPGA

Wenyue Liu, Zheng Chen, Guosheng Luo, Gang Li, Shuo Wu, Wenli Zhou*
School of Optical and Electronic Information, Huazhong University of Science and Technology, China

- A MAC controller design on Xilinx xc7z020 working in Zigbee/WiFi mode
- Support the priority-based flow control and dynamic channel access opportunity adjustment
- Functionally simulated with self built loopback test platform using Vivado simulator

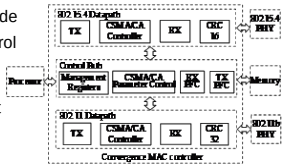


Figure 1. Architecture of the convergence MAC controller

FrC3(3) 17:30-17:45

Research on Pulse Wave Diagnostic System Based on Flexible Electron

Jian Yang, Junjun Chen, Lihua Liang

Figure 1 Measuring pulse signal with flexible sensor

A pulse wave diagnosis system is obtained by cloud data processing.

Continuous pulse wave data was measured by the flexible wearable device, and the data was transmitted to the cloud by the lower device. The obtained pulse wave signal data was denoised by the wavelet decomposition method. The tensor was used to obtain the label-free tensor group and represent the data such as "main peak wave", "tidal wave" and "double pulsation" in the pulse wave. The data was clustered using the density-based clustering method.

Volunteers were grouped according to the clustering result, and the common physical condition characteristics were determined according to the physical condition of the volunteers in the same group to obtain each group of labels.

A complete collection of pulse wave signals can be obtained under the existing electronic equipment monitoring. It will be easily to collect more than 100,000 pulse waves in one day, and more feature points and clustering results can be collected compared with the original study. The results indicate that the labels and heart health are closely related.

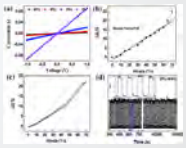


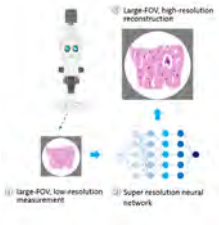
Figure 2 Graphene/Copper Nanowire Flexible Sensor
(a) Volt-ampere characteristic curve (b) Relationship between strain and resistance
(c) Rupture curves during loading and unloading (d) 1000 cycles of loading and unloading curves

FrC3(4) 17:45-18:00

Deeping Learning for Super-Resolution Biomedical Imaging

Hao Zhang and Peng Fei
SOEI, Huazhong University of Science and Technology, China

- Combine deep learning with wide-field microscopy to achieve single image super-resolution under a large field-of-view
- Computationally overcome the general challenge of high-throughput, high-resolution microscopy
- Introduce no changes to the setup of the conventional wide-field microscope.



FrC4 Intelligent Surveillance and Detection

Session Chairs: Jizhong Xiao and Hongpeng Wang

Room : THE RESIDENCE 4, 17:00-18:00, Friday, July 20, 2018

FrC4(1) 17:00-17:15

Accurate Recognition of Volleyball Motion Based on Fusion of MEMS Inertial Measurement Unit and Video Analytic

Kaiqiao Peng, Yuliang Zhao*, Xiaopeng Sha, Wenqian Ma
School of Control Engineering , Northeastern University at Qinhuangdao, China
Yufan Wang and Wen j. Li*
Department of Mechanical and Biomedical Eng., City University of Hong Kong

- Volleyball skill were assessed utilizing MEMS Inertial Measurement Unit (IMU) data and recorded videos.
- Six key characteristics of spiking motion were extracted to evaluate players of 3 different levels.
- One player's 12 trails of spike were recognized by neural network with 89.6% recognition rate.

FrC4(2) 17:15-17:30

Foreground Extraction of Surveillance Video under Complex Background

Yue Yu and Hong Pan
Xinde Li
School of Automation, Southeast University, China

- Present a novel foreground object extraction method based on an improved ViBe algorithm
- Use a median filter to reduce false detections
- Apply grayscale projection algorithm to stabilize the image for video clips with camera jitter

Foreground Object Extraction on Videos in Background of Water surface

FrC4(3) 17:30-17:45

Smart Surveillance: a Nature Ecological Intelligent Surveillance System with Robotic Observation Cameras and Environment Factors Sensors

Jinchao Zhu, Hongpeng Wang, Danhua Han, Jingtai Liu
1 Institute of Robotics and Automatic Information System, Nankai University, Tianjin
2 Tianjin Key Laboratory of Intelligent Robotics, Tianjin

- Our EIS system consists of environment factors sensors and robotic observation cameras.
- Robotic pan-tilt-zoom cameras detect wildlife and sequentially track them actively according to their rarity.
- Several such stations form a smart surveillance system to detect wildlife and monitor environment factors.

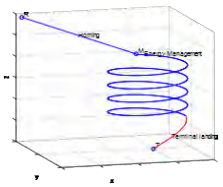
Illustration of nature ecological intelligent surveillance system

FrC4(4) 17:45-18:00

Real-time Trajectory Planning for Autonomous Parafoil in Obstacle-Rich Environment

Bingbing Li, Jianda Han, Jizhong Xiao*
State Key Laboratory of Robotics, Shenyang Institute of Automation
The City College, City University of New York

- Introduction of Parafoil System
- Guidance strategy
- Three-phases landing
- Terminal landing
- Simulation results



FrC5 Unmanned Aerial Vehicle

Session Chairs: Bin Xian and Xiao Liang

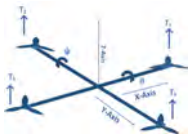
Room : REGENCY ROOM 3, 17:00-18:15, Friday, July 20, 2018

FrC5(1) 17:00-17:15

Attitude Tracking Control of Quadrotor with Disturbances using Sliding Mode Method

Nigar Ahmed and Mou Chen
College of Automation,
Nanjing University of Aeronautics and Astronautics,
Nanjing, China

- Nonlinear tracking control strategies using sliding mode control Techniques
- Development of control scheme in Continuous time (CT) and Discrete time (DT) domain
- DT model of Quadrotor is obtained using approximation of discrete time equivalent model (ADEM)
- Criteria for matched disturbance rejection.



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FrC5(2) 17:15-17:30

Paper Title: Robust Control Design for The Quadrotor UAV with A Suspended Payload

Author: Sen Yang, and Bin Xian*
Affiliation: School of Electrical and Information Engineering,
Tianjin University
Tianjin 300072, P.R.China
E-mail: xbin@tju.edu.cn

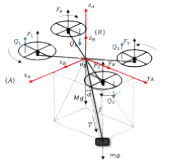
Abstract: In this article, the problem of the trajectory tracking control for the system of the quadrotor UAV with a suspended load is studied. By employing the backstepping technology, the virtual control law is designed to track the target trajectory of the position of the quadrotor. And for the swing angle of the suspended load, a RISE(robust integral of the sign of the error)-based controller is proposed. The stability of the closed loop system is proved via Lyapunov stability theory. Finally, the performance of the proposed control strategy is shown via simulation results.

FrC5(3) 17:30-17:45

PSO-Optimized Fuzzy Control for Four-Rotor Unmanned Aerial Vehicle with Suspended Load

Peili Du, Jian Huang and Dongrui Wu
Key Laboratory of Ministry of Education for Image Processing and Intelligent Control, Huazhong University of Science and Technology, China
Feng Ding
School of Computer Science, South-Central University for Nationalities, China

- A three-dimensional dynamic model for this system is established.
- A fuzzy controller optimized by PSO algorithm is applied to the UAV's stability control and the suspended load's anti-swing control.
- An experimental platform was built, the design of the controller is verified by simulation and experiment



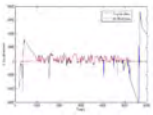
Model of the system in three-dimensional space

FrC5(4) 17:45-18:00

An Autonomous Pose Estimation Method of MAV Based on Monocular Camera and Markers

Juntong Qi and Xianyu Guan
School of Electrical and Information Engineering, Tianjin University, China
Mingming Wang
the EFY intelligent control Co. Ltd, Tianjin, China

- ROS-based pose estimation method.
- Marker confirmed by Expert System .
- A new marker recognition strategy



Increased positioning accuracy after adding Expert System to confirm marker

FrC5(5) 18:00-18:15

Displacement-based Formation Control with Phase Synchronization in a Time-Invariant Flow Field

Qianyun Yao, Shirong Liu, Na Huang
School of Automation, Hangzhou Dianzi University, China

- We study formation control for constant-speed unicycle-type agents in a time-invariant flow field.
- Lyapunov-based design of displacement formation control approach was described.
- A combination of formation shape and phase control in a time-invariant flow field was reached.
- The validity of the proposed algorithms is confirmed by theoretical derivation and numerical simulation.

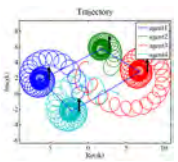
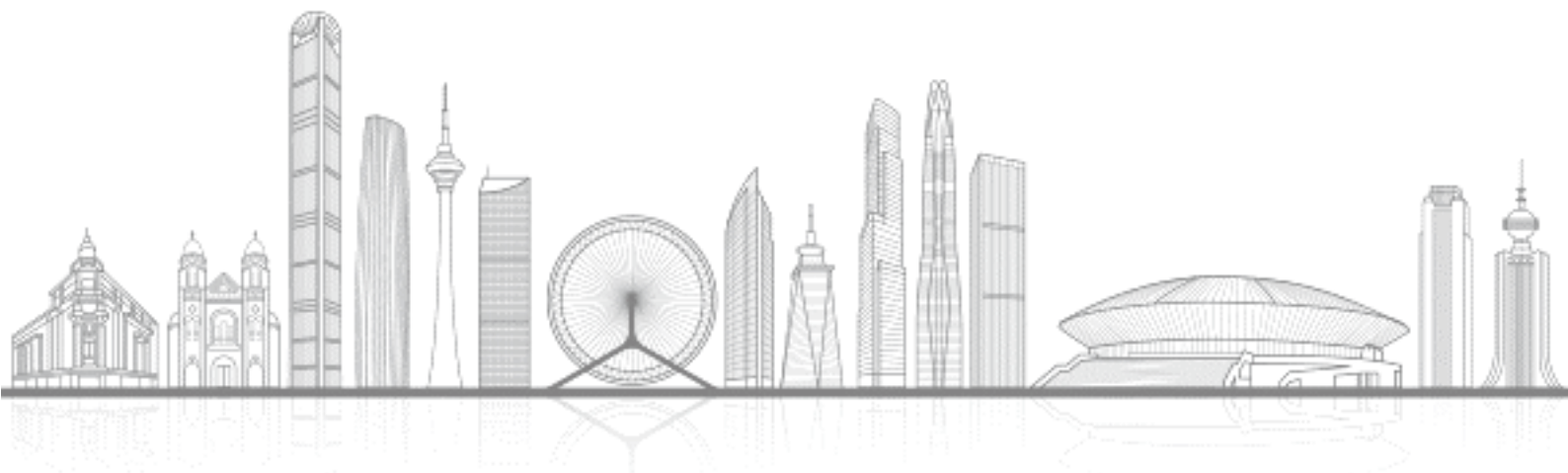


Figure 1 The trajectory and convergence of a four-agent group with phase control and displacement-based formation in a uniform flow field.

Technical Sessions

July 21st, 2018



SaPoA Poster Session 3

Session Chairs: Ning Sun and Xuebo Zhang

Room : PREFUNCTION, 10:00-10:30, Saturday, July 21, 2018

SaPoA(1) 10:00−10:30

Parameter Self-turning Fuzzy PID Controller Design for Atomic Force Microscopy in Z-axis

Yinan Wu and Yongchun Fang
Institute of Robotics and Automatic Information System
Tianjin Key Laboratory of Intelligent Robotics
Nankai University, Tianjin, China

- This paper proposes a parameter self-turning fuzzy PID controller in z-axis to replace the PID controller with fixed parameter, which improves the control effect;
- We design the type and the distribution of the membership degree functions for both inputs and outputs;
- Furthermore, the fuzzy inference is achieved to produce the outputs;
- Simulation results verify the good performance of this proposed fuzzy controller.

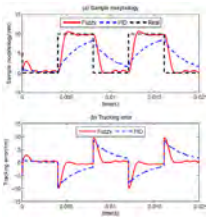


Figure: Simulation results

SaPoA(2) 10:00−10:30

Real time Writing Reproduction by Robot Arm

Dezhou Zhang, Jianxin Chen, Ming Zhang, Hui Ji
Key Lab of Broadband Wireless Communication and Sensor Network Technology, Nanjing University of Posts and Telecommunications, Ministry of Education, Nanjing, China

- Control the robot to write in real time with a 3D camera Kinect
- Dynamic hand tracking algorithm according to deep information with the 3D (Dimension) camera
- N-RPRI real time interpolation algorithm for the robot to let it write continuously

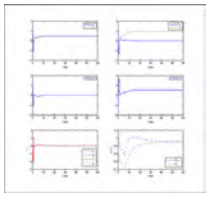
Figure. Hand Motion-based Robot Writing

SaPoA(3) 10:00−10:30

Model Reference Adaptive Control for Time-Delay Systems

Zhengqiang Zhang
School of Engineering, Qufu Normal University,Rizhao 276826, China
Chao Guo
Institute of Automation, Qufu Normal University,Qufu 273165, China

- This paper restudies output feedback MRAC for a class of SISO systems with a known state time-delay
- The general solution in the generalized inverse matrix is used to relax the premise
- A special L-K functional with a adjustable parameter is constructed
- The closed-loop system isstable in the sense that all closed-loop signals are bounded.



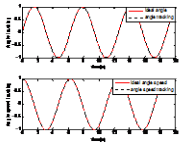
The responses of the closed-loop system

SaPoA(4) 10:00−10:30

Backstepping Control of Flexible Joint Manipulator based on Hyperbolic Tangent Function with Control Input Constraint

Lijun Wang and Qiuyue Shi and Dan Zhang
School of Automation & Electrical Engineering, University of Science and Technology Beijing, China
Jinkun Liu
School of Automation Science and Electrical Engineering, Beihang University, China

- Backstepping control method is used to design the controller of flexible joint manipulator.
- The smooth hyperbolic tangent function is used to approximate the control input constraint model.
- The proposed backstepping controller has good tracking performance under control input constraint and disturbance.



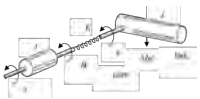
The tracking responses of link angle and angle speed.

SaPoA(5) 10:00−10:30

Adaptive Fault-Tolerant Control for a Flexible Manipulator of Output-Constrained

Lijun Wang, DanZhang, Haifeng Huang and Qiuyue Shi
School of Automation Science and Electrical Engineering, University of Science and Technology Beijing, China
Jinkun Liu
School of Automation Science and Electrical Engineering, Beihang University, China

- Adaptive fault-tolerant control of actuator failure for a flexible manipulator with bounded disturbance is proposed.
- The backstepping technique is selected to design the adaptive fault-tolerant control laws of the flexible manipulator control system, and the stability is guaranteed via the Lyapunov approach.
- Barrier Lyapunov Function is used in the control design to avoid the output constraint violation.



Schematic diagram of single link flexible joint manipulator

SaPoA(6) 10:00−10:30

Research on MPC-based Suspension Control of Wind Maglev Yaw System

Nannan Wang, Bin Cai, Xiaoguang Chu
The Institute of New Energy Technology, College of Engineering
Qufu Normal University,Rizhao, P. R. China.

- A novel maglev yaw system (MYS) is proposed in this paper.
- A suspension control method based on model predictive control (MPC) together with PID is proposed to realize the stable suspension control of the novel maglev yaw system (MYS) at the equilibrium point.
- The control effects via the classical PID control and the proposed MPC together with PID are compared. The simulation results show that the proposed method has a better control effect on the MYS.

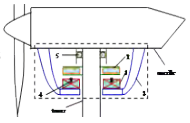


Figure 1 · Structural sketch of maglev yaw system

SaPoA Poster Session 3 (con't)

Session Chairs: Ning Sun and Xuebo Zhang

Room : PREFUNCTION, 10:00-10:30, Saturday, July 21, 2018

SaPoA_2(7) 10:00−10:30

Analytic Solution Study for a 7-DOF Redundant Robot Manipulator

Lei Yang and George Zhang
Shenzhen Academy of Robotics Shenzhen, P. R. China

- A typical redundant manipulator with 7 DOF (degree of freedom) is presented.
- Joint 3 and Joint 5 are not on the same plane.
- An extra constraint is introduced in inverse kinematics.
- The geometric solution was combined with algebraic solution.

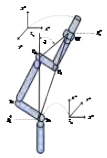


Fig. Chart for Solving δ

SaPoA_2(8) 10:00−10:30

Structure Design and Kinematics Analysis of Omni-directional Mobile Platform

Yan Zhang, Lanshen Guo, Minglu Zhang, Xiaoling Lv
The School of Mechanical Engineering, Hebei University of Technology, Tianjin, China
lxl000418@163.com

In order to achieve the advantages of the robot such as omni-directional movement in a limited space, precise positioning, position adjustment, and so on. The Mecanum omni-directional mobile platform is designed.Through the use of the contents of TRIZ technology innovation method, the functional structure of omnidirectional mobile robot is established. As this platform is used in petroleum, chemical and other hazardous environment inspection, the need for platform explosion-proof design; Then by analyzing the geometric model of Mecanum wheel roller, the roller parameter equation is established, and the finite element simulation analysis of the roller is carried out.Finally, using ADAMS software to simulate the omni-directional mobile robot, through the simulation results, the omni-directional motion of the robot is verified.

SaPoA_2(9) 10:00−10:30

Design of A Predictive Attitude Controller for A Quadrotor Helicopter

Youyuan He, Haokun Wang and Aipeng Jiang
School of Automation, Hangzhou Dianzi University, China

This paper aims to design a predictive controller for a quadrotor helicopter

- System dynamic model is presented based on the Newton Euler formalism and been linearized
- The linear model is augmented to take unmodeled dynamics and/or disturbances into account
- Using unconstrained MPC algorithm to achieve offset-free tracking performance

SaPoA_2(10) 10:00−10:30

Adaptive DSC of a Half-Car Active Suspension Systems with Hydraulic Actuator

Qiang Zeng, Yan-Jun Liu, and Lei Liu
College of Science, Liaoning University of Technology, Jinzhou
Ying Gao
Mathematics and Information Sciences, Tangshan Normal University, Tangshan

- In this paper, an adaptive control scheme for a half-car active suspension systems with hydraulic actuator was proposed. The main contributions can be summarized as follows:
- (1) Dynamic surface control (DSC) technique was introduced into the controller design.
- (2) The control commands was executed by the hydraulic actuator.
- (3) A class of half-car vehicle suspension systems as the main object of research.

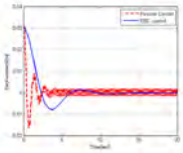


Fig.1 Displacement of the vertical motion

SaPoA_2(11) 10:00−10:30

Modeling of Electrostatic Adhesion Force for Flying and Adhesion Robot

Chengwei Huang and Yong Liu
Nanjing University of Science and Technology, Nanjing University of Science and Technology, China
Yibin Wang
Nanjing Jiaoer Science and Technology Co., Ltd, China

- A novel flying and adhesion robot that capable of carrying a child robot
- Modeling of Electrostatic Adhesion Force
- Simulation and experiment results

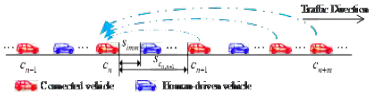
The child robot and the flying and adhesion robot

SaPoA_2(12) 10:00−10:30

Car-following Behavior of Connected Vehicles in a Mixed Traffic Flow: Modeling and Stability Analysis

Lin Liu, Chuanyuan Li and Yongfu Li
College of Automation, Industrial IoT Collaborative Innovation Center, College of Automation, Chongqing University of Posts and Telecommunications, China
Srinivas Peeta and Lei Lin
Lyles School of Civil Engineering, Purdue University, United States of America

- An extended IDM is proposed to capture the car-following behavior of connected vehicles in a mixed traffic flow.
- Stability analyses are performed for the extended IDM in a specific case.
- The results point out different stability conditions for both IDM and extended IDM.



Sketch of car-following in the mixed traffic flow

SaPoA Poster Session 3 (con't)

Session Chairs: Ning Sun and Xuebo Zhang

Room : PREFUNCTION, 10:00-10:30, Saturday, July 21, 2018

SaPoA_3(13) 10:00-10:30

Visual Servoing of Mobile Robot with Setting Desired Pose Arbitrarily

Zhiwei Song, Baoquan Li, and Wuxi Shi
School of Electrical Engineering and Automation,
Tianjin Polytechnic University, P. R. China

- This paper can address visual servoing without prerecorded desired images by a novel strategy.
- The content includes the setting of the feature points and the relationship between coordinate systems.
- Simulation results signify that this control strategy can drive the robot to the arbitrarily set desired poses.

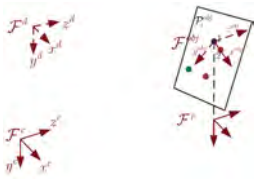


Fig. 1 The coordinate system relationship in visual servoing without desired image.

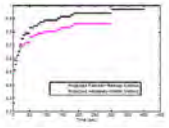
SaPoA_3(14) 10:00-10:30

A rapidly convergent projected Hestenes-Stiefel conjugate gradient algorithm for optimal robust controller of bipedal walking robots

Zhongbo Sun, Yufeng Lian, Shuaishi Liu and Yantao Tian
1.Key Laboratory of Bionic Engineering of Ministry of Education, Jilin University, China 2.Department of Control Engineering, Changchun University of Technology, China

(1) A rapidly convergent projected Hestenes-Stiefel conjugate gradient method is presented and investigated to an optimal robust controller of bipedal walking robots by using a novel design method.

(2) In order to demonstrate the feasibility and effectiveness of the algorithm, we will conduct numerical simulations on the model of 5-link bipedal walking robot.
(3) it is reasonable to infer that the projected Hestenes-Stiefel conjugate gradient approach can be used in real-time systems.



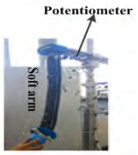
The results of projected Fletcher-Reeves and Hestenes-Stiefel method

SaPoA_3(15) 10:00-10:30

Research on Kinematics Modeling of Soft Manipulator

Ying Zhang, Yao Sun and Lina Hao
School of Mechanical Engineering and Automation,
Northeastern University,
China

- The soft manipulator has the characteristics of large deformability, nonlinearity, strong coupling, time-varying and infinite dimensions, and it is a distributed parameter system.
- The existing kinematics modeling methods of soft manipulator are summarized, and the advantages and limitations of each method are analyzed.
- A pneumatic soft arm with handle is designed.
- The kinematics model of the arm is established, simulated by MATLAB, and proved by experiment.



Drive control process of pneumatic arm

SaPoA_3(16) 10:00-10:30

Research on the Control Method of a Rehabilitation Exoskeleton Robot for Passive Training on Upper-Limbs of Stroke Patients

Zhao Zhirui and Hao Lina
The Institute of Applied Mechanics, Northeastern University, P.C.
Li Xing
The State Key Laboratory of Synthetical Automation for Process Industries, Northeastern University, P.C.

- A rehabilitation exoskeleton driven by PAM
- A silding mode anti-interference controller
- passive trainings on upper-limbs

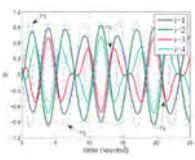
2-DOF upper limb exoskeleton driven by PAM

SaPoA_3(17) 10:00-10:30

Bipartite Containment Tracking With Prescribed Performance of Nonlinear Multi-Agent Systems With Hysteresis Inputs

Tao Yu and Lei Ma
School of Electrical Engineering, Southwest Jiaotong University, China

- Bipartite containment tracking of multi-agent systems with hysteresis constraints is studied
- The interaction network is represented by a signed directed graph
- A distributed low-complexity control law for nonlinear multi-agent systems is proposed
- Both transient and steady state performance of tracking errors are guaranteed



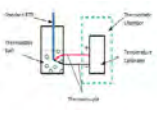
Profiles of the output trajectories

SaPoA_3(18) 10:00-10:30

A calibration method for thermocouple-temperature calibrator based on cold junction compensation

Xu Chen, Li Sun and Yancui Ling
Shanghai Institute of Measurement and Testing Technology, China

- The errors of cold junction compensation at different working temperatures are measured.
- The mathematical model of input and output errors are set up.
- The corresponding input and output errors of calibrator are calculated through utilizing the equations.



Cold junction compensation error measurement system

SaA1 Human Abilities and Robotic Assistance 1

Session Chairs: Tao Liu and Qining Wang

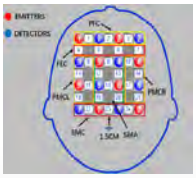
Room : THE RESIDENCE 1, 13:20-14:50, Saturday, July 21, 2018

SaA1(1) 13:20-13:35

Motion Intention Classification of Multi-class Upper Limbs Actions for Brain Machine Interface Applications

Liujin He, Chunguang Li*, Hedian Jin, Jiacheng Xu and Shaolong Kuang
1. Key Laboratory of Robotics and System of Jiangsu Province, School of Mechanical and Electric Engineering, Soochow University, Suzhou, China
2. Collaborative Innovation Center of Suzhou Nano Science and Technology, Suzhou, China

- Functional near-infrared spectroscopy (fNIRs) technology
- Identifying motion Intention of multi-class upper limbs actions
- Signals were decomposed into three frequency bands by wavelet packet.
- ReliefF and genetic algorithms were used to select optimal features.
- LIBSVM method was applied for pattern recognition and the preliminary average recognition rate was 70.6%.



The arrangement of the probes

SaA1(2) 13:35-13:50

Two new indices to assess gait disturbances applied to anterior cruciate ligament reconstructed knees

H. Sobral, A. Paulo Coimbra, M. Crisóstomo
Institute of Systems and Robotics, Electrical and Computer Engineering Department, University of Coimbra, Portugal
J. P. Ferreira, A. Vieira
Institute Superior of Engineering of Coimbra, Quinta da Nora, Portugal
P. Lemos, J. Pinheiro
Physical and Rehabilitation Medicine, University of Coimbra, Portugal
Tao Liu
State Key Laboratory of Fluid Power and Mechatronic Systems, School of Mechanical Engineering, Zhejiang University, China

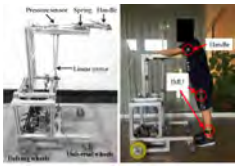
- Two new gait indices – the Normal Gait Index (NGI) and the Abnormal Gait Index (AGI) including a symmetry measurement were developed.
- Each instrumented shoe has 8 force sensors in its sole.
- Gait data from 5 males subjected to the reconstruction of their anterior cruciate ligament 3 or 4 years ago were collected.
- The proposed indices and the graphical representations can be used in a software for real time gait analysis and assess the arthrosis risk.

SaA1(3) 13:50-14:05

Gait Adaptable Human-Robot Interaction System and its Application to a Robotic Walker

Lei Wang and Tao Liu
State Key Laboratory of Fluid Power and Mechatronic Systems, School of Mechanical Engineering, Zhejiang University, China
Jingang Yi
Department of Mechanical and Aerospace Engineering, Rutgers University, USA

- A novel human-robot interaction system for human walking companion and gait adaption was developed.
- Four IMUs attached to human lower limbs were used to detect gait.
- A pressure sensor was used to measure human-robot interaction force.
- With the system, a robotic walker was controlled to accompany human walking.



Human-robot interaction system

SaA1(4) 14:05-14:20

Human Periodic Rebalancing Modelling of a Rider-Bicycle System

Yanhui Wang, Zhiwei Zhou, Guocong Liu, Haofan Pang and Tao Liu
State Key Laboratory of Fluid Power and Mechatronic Systems, School of Mechanical Engineering, Zhejiang University, Hangzhou
João Paulo Ferreira
The institute of Superior of Engineering of Coimbra, Quinta da Nora
Jingang Yi
Department of Mechanical and Aerospace Engineering, Rutgers University, Piscataway

- Rider-bicycle system model describes rider-bicycle dynamics and rider balancing control strategies
- Rider balancing control models with proportional-derivative-like structures including time delays
- Model optimization and system stability analysis

SaA1(5) 14:20-14:35

Motion Understanding Based on Sensor Fusion

Wenxing Li, Fei Wang, Heping Chen, Jianhui Wang, Zhen Zeng, Rongjie Li
Faculty of Robot Sci. & Eng., Northeastern University, China

- This paper focuses on the recognition of arm motion patterns through sEMG signals and inertial sensor information in different assembly modes.
- The comparison experiments show that the hybrid method has significantly improved the accuracy of arm motion pattern recognition compared with SVM or HMM.
- ABB YUMI robot is used to realize human-computer interaction by teaching the robot different movement patterns.

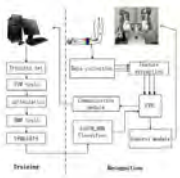


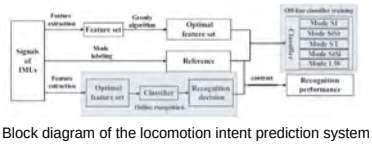
Fig.1. Assembly pattern recognition system

SaA1(6) 14:35-14:50

Real-Time Onboard Human Motion Recognition Based on Inertial Measurement Unit

Xiuhua Liu, Zhihao Zhou and Qining Wang
College of Engineering, Peking University, Beijing 100871, China

- We propose a support vector machine based locomotion intent prediction system using two Inertial Measurement Units (IMUs).
- The prediction system can classify three locomotion modes (level-ground walking, sitting, and standing) in daily life onboard online.
- Average recognition accuracy is 94.25%±0.72%.



Block diagram of the locomotion intent prediction system

SaA2 Mobile Robot 1

Session Chairs: Ming Yue and Chenguang Yang

Room : THE RESIDENCE 2, 13:20-14:35, Saturday, July 21, 2018

SaA2(1) 13:20-13:35

Adaptive leader-follower formation control of wheeled mobile robots via composite techniques

Ruiming Jia, Ming Yue* and Yuan Xu
School of Automotive Engineering, Dalian University of Technology, China

• Objectives:
An excellent anti-disturbance ability of the leader and a desired leader-follower formation;

• Methods:
The model predictive control (MPC) and the adaptive terminal sliding mode control (ATSMC) techniques;

• Results:
The leader and followers appear an excellent stability and the desired formation can be realized.

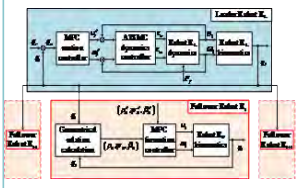


Fig.1. Control structure

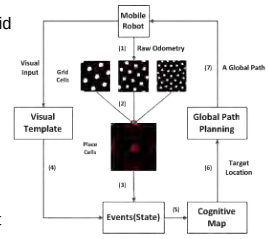
Contributions： Offered an effective composite control strategy included several different techniques for the formation control.

SaA2(2) 13:35-13:50

A biological model for robotic cognitive mapping and global planning

Yingxue Cui, Dong Liu, Qiang Zou, Ming Cong, Haiyun Zhang
School of Mechanical Engineering, Dalian University of Technology, China

- This paper proposes a novel cognitive computation model, which integrates grid cell, place cell and episodic memory.
- And a navigation approach based on episodic memory was proposed. A shortest path can be chosen using events reorganization.
- Experiments performed on a mobile robot show that cognitive maps of the real environment can be efficiently built.
- And the experiment results indicate that the robot can efficiently navigate to target destinations.



SaA2(3) 13:50-14:05

Teleoperation System for Omnidirectional Mobile Robot Based on Shared Control Scheme

Weihao Li, Chenguang Yang and Zhijun Li
College of Automation Science and Engineering,
South China University of Technology, China
Xuebo Zhang
Institute of Robotics and Automatic Information System(IRAIS),
Nankai University, China

- A teleoperation system for omnidirectional mobile robot(TSOMR) is proposed.
- A share control scheme combining potential field method and human control is used.
- The mobile robot's surrounding information is captured by a depth camera.
- Attractive potential field is generated by operator's sEMG signal and repulsive potential field is generated by obstacles.

Teleoperation system for omnidirectional mobile robot

SaA2(4) 14:05-14:20

An autonomous multi-vehicles queue following control system with vision and laser and simulation on ROS

Qi Yang, Shirong Liu
School of Automation, Hangzhou Dianzi University, China

- We study an autonomous vehicle queue following control system based on leader-follower model.
- The wheeled mobile robots obtain information only from laser together with the vision system.
- The effectiveness is validated by simulation experiments through Gazebo simulator of Robot Operating System(ROS).

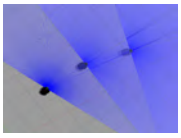


Figure 1 The followers are tracking the leader autonomously.

SaA2(5) 14:20-14:35

Trajectory Tracking Control and Physical Constraints Considered for Omni-directional Wheeled Mobile Robot with Active Casters

Yin Hu, Xuebo Zhang, Peiyao Shen and Yongchun Fang

Contribution and advantages of this paper :

1) Proposing a MPC-based tracking control approach for the OWMR, which solves the problem of guaranteeing the multi-motor coordination and satisfies the physical constraints of the motors;
2) Demonstrating the performance of the MPC controller and comparing with the PID controller by simulation results.

Figure1： The OWMR platform

SaA3 Advanced control of mechatronic systems 1

Session Chairs: Huimin Ouyang and Shengquan Li

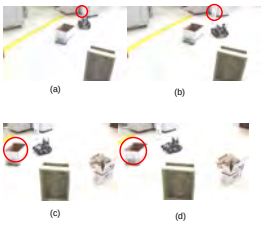
Room : THE RESIDENCE 3, 13:20-14:50, Saturday, July 21, 2018

SaA3(1) 13:20−13:35

Design of an Intelligent Active Obstacle Avoidance Car Based on Rotating Ultrasonic Sensors

Yun Jin, Shengquan Li, Juan Li, Hongbing Sun, Yuanwang Wu
School of Hydraulic, Energy and Power Engineering, Yang Zhou University.
School of Physics and Electronic Electrical Engineering, Huaiyin Normal University, Huaian, China

The design of the automatic obstacle avoidance algorithm is recorded in the car. The trolley was then moved to the test site. In the test experiment, a number of obstacles were randomly set up on the flat ground.
After starting the car, the car avoided most of the obstacles according to the design requirements, and did not appear directly in the following single experiments. Compared with the multi-sensor obstacle avoidance test, when faced with the same obstacle, the car designed in this paper has faster reaction speed and better obstacle avoidance success rate. The following diagram gives a screenshot of a vehicle in which the design algorithm is recorded during the obstacle avoidance test.

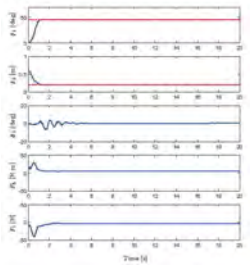


SaA3(2) 13:35−13:50

Positioning and Swing Elimination Control for Offshore Cranes with Sea Wave Disturbances

Tong Yang, Ning Sun*, He Chen, and Yongchun Fang
Institute of Robotics and Automatic Information Systems,
Nankai University, China

- Sliding mode-based control for offshore crane systems
- Boom and rope positioning in finite time
- Rapid payload swing suppression
- Strict stability analysis

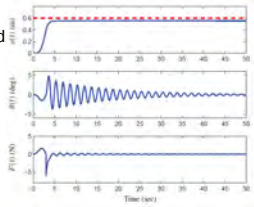


SaA3(3) 13:50−14:05

Emergency Braking Method for Overhead Crane Systems With Safe Limits and Swing Suppression

He Chen, Yongchun Fang, and Ning Sun
Institute of Robotics and Automatic Information System, Nankai University, China

- Emergency braking method for overhead crane systems
- Trolley braking and payload swing suppression
- Safe limit guaranteed
- Rigorous mathematical analysis



SaA3(4) 14:05−14:20

Modeling and Control based on a Force Observer for a Flying-perching Quadrotor

Xi Ye, Yong Liu, Senior Member, IEEE, Chengwei Huang
School of Computer Science and Engineering, Nanjing University of Science a nd Technology, China

- The model of the flying-perching quadrotor when it gets into contact with the environment .
- A force observer based on Lyapunov theorem of stability.
- Simulation results and analysis with consideration of sensor noises .

The structure of the flying-perching quadrotor.

SaA3(5) 14:20−14:35

Neural Network Based Adaptive Feedback Control for Tower Cranes

Hean Hua and Yongchun Fang
Institute of Robotics and Automatic Information System, Nankai University, China

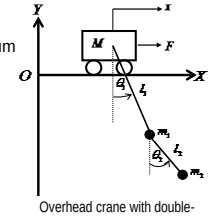
- In this paper, the control problem of 4-DOF tower cranes with friction is studied.
- We have constructed a controller consist of two parts, feedback controller and neural network based adaptive controller.
- We strictly prove the closed loop stability in this paper using Lyapunov stability theorem.

SaA3(6) 14:35−14:50

Novel Sliding Mode Control for Double-pendulum Overhead Cranes

Huimin Ouyang, Guangming Zhang, Lei Mei, Xin Deng,
College of Electrical Engineering and Control Science,
Nanjing Tech University, China

- The nonlinear dynamics of a double-pendulum overhead crane was derived.
- The novel sliding mode controller with nonlinear sliding surface was designed.
- The stability of the whole system was confirmed by Lyapunov technique.
- The proposed method obtained superior robust control performance numerically.



Overhead crane with double-pendulum effect

SaA4 Multi-Agents and Networked Systems 1

Session Chairs: Weisong Zhou and Jianlei Zhang

Room : THE RESIDENCE 4, 13:20-14:50, Saturday, July 21, 2018

SaA4(1) 13:20-13:35

New Stability Criterion for Nonlinearly Perturbed Load Frequency Control Systems With Communication Delays

Pipi Liu, Xianshuang Yao, Yipeng Liu, and Zhanshan Wang
School of Information Science and Engineering,
Northeastern University, China

- A less conservative delay-dependent stability criterion is derived by an augmented LK Functional.
- The derivative of LK functional is bounded tightly by employing a relaxed integral inequality.
- The load perturbation is modeled as a nonlinear norm-bounded function.
- The effectiveness of the theoretical results is proved on the two-area LFC system.

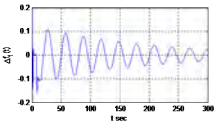


Fig.1 Evolution of frequency deviation for stable system

SaA4(2) 13:35-13:50

Passivity of Coupled Neural Networks with Different Dimensional Nodes

Shanrong Lin, Yanli Huang and Jinliang Wang
School of Computer Science and Software Engineering, Tianjin Polytechnic University, China
Shunyan Ren
School of Mechanical Engineering, Tianjin Polytechnic University, China
Dongfang Liu
Tianjin Tianhang Wisdom Technology Co., Ltd, China

- Two models of coupled different dimensional neural networks with and without coupling delay are presented.
- Several passivity criteria are established for coupled neural networks with different dimensional nodes.
- The passivity of coupled different dimensional neural networks with coupling delay is also analyzed.

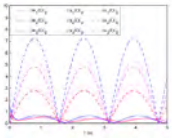


Fig. 1. The norms of $e_i(t)$, $y_i(t)$, $u_i(t)$, i = 1,2,3.

SaA4(3) 13:50-14:05

Adaptive finite-time attitude coordination control for spacecraft formation

Yang Lin, Jianting LYU, Xin Wang and Shangjun Zhang
Heilongjiang Provincial Key Laboratory of the Theory and Computation of Complex Systems, Heilongjiang University, China

- Finite-time attitude coordiantion control problem for spacecraft formation
- The spacecraft attitude synchronization in the presence of external disturbances
- The finite-time attitude synchronization problem for multiple spacecraft system with actuator faults

spacecraft Formation

SaA4(4) 14:05-14:20

Neural Network Cooperative Control of Multi-Manipulator Robots

Yongkun Sun, Wei He and Zichen Yan
the School of Automation and Electrical Engineering, University of Science and Technology Beijing, China
Changyin Sun
the School of Automation, Southeast University, China

- Neural network control is proposed to approximate cooperative model of multiple manipulators with input input saturation.
- Consider there exist unknown disturbances which neural network approximation errors and payloads cause.
- By comparing with PID control and NN, the effectiveness of proposed controllers are verified by simulations.

Dual-manipulator cooperative model

SaA4(5) 14:20-14:35

Exponential ISS analysis of delayed impulsive stochastic CGNNs with time-varying coefficients

Weisong Zhou
College of Science, Chongqing University of Posts and Telecommunications
Zhichun Yang
College of Mathematics, Chongqing Normal University, China

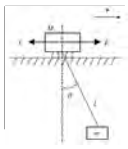
- Abstract: In this paper, we study the exponential input-to-state stability (e-ISS) of the zero solution of impulsive stochastic reaction-diffusion Cohen- Grossberg neural networks with timevarying coefficients and mixed delays. In light of Razumikhin technique and constructing Halanay inequalities, we obtain some sufficient conditions ensuring mean square e-ISS of the zero solution of the derived Cohen-Grossberg neural networks. A numerical example is also discussed to illustrate the efficiency of our results.
- Key words: ISS, CGNNs, time-varying coefficients

SaA4(6) 14:35-14:50

Robust LQR Anti-Swing Control for Quay-Side Crane System with Variable Load

Yougang Sun, Jinchao Lyu, Jin Fang, Zhimin Fu, Dashan Dong
Logistics Engineering College, Shanghai Maritime University, China

- A dynamic model under generalized coordinate system has been built
- A robust LQR state feedback controller is designed base on the standard LQR control and the Lyapunov theory in a variable load system
- The numerical simulation results are included to prove that the presented controller can achieve satisfactory anti-swing and tracking performance with strong robustness against load mass variation



Motion Model of Trolley-load System

SaPoB Poster Session 4

Session Chairs: Ning Sun and Xuebo Zhang

Room : FOYER, 1/F, 14:50-15:20, Saturday, July 21, 2018

SaPoB(1) 14:50-15:20

Modeling Method of Security and Stability Control Device for Intelligent Substation Based on IEC61850

HUANG Ling, WANG JiLin, and TANG Guanjun
NARI Technology co. LTD. China

- Summering traditional SSCD information and interface , and proposing intelligent SSCD information and interface demand;
- Organizing the SSCD's input, output, internal fixed value, alarm, fault, and action logic;
- Building information exchange, data read and write, report, control, replacement, setting and file service model;
- Developing the IEC6180 modeling method and software for SSCD.

Figure 1. PSSC logical node instance diagram

SaPoB(2) 14:50-15:20

Multi-objective Congestion Dispatch in Active Distribution Network with Flexible Charging/Discharging of Electric Vehicle

Chang-Qiang Ding[1] and Chun-Ping Li[2]
[1]School of Electrical Engineering, Dalian University of Technology, China
Bing Liu[2]
[2]State Grid Dalian Electric Power Co, Ltd, China

- Minimizing the charging/discharging cost of EV owners and power generation cost of controllable DGs
- Making full use of EVs' transfer capability of charging and discharging time
- Solving the congestion problem by adjusting the charging/discharging service fee

Line load rate in the ADN in the two modes

SaPoB(3) 14:50-15:20

Research on Meteorological Monitoring and Warning Platform for Typhoon Disaster of Transmission and Distribution Lines

Bin Chen, Shengwen Shu and Xiaojun Guo
Electric Power Research Institute of State Grid Fujian Electric Power Co., Ltd., China
Jinzhong Zhang
Nanjing Upbest Information Technology Co., Ltd., China

- A meteorological monitoring and warning platform was designed;
- The platform integrates the information resources and eliminates the "Isolated Data Island" phenomenon;
- Software component technology and big data mining technology were employed.

Technical framework of platform

SaPoB(4) 14:50-15:20

Development of Efficient Management Platform and Data Interface Module for Photovoltaic Power Station

Jun Yang, Zhengxi Li and Jiatian Gan
(Qinghai Province Key Laboratory of Photovoltaic Grid Connected Power Generation Technology, China)
Jinzhong Zhang
(Nanjing Upbest Information Technology Company, China)

- Efficient management platform and data interface module software system for PV power station is developed
- Software is based on B/S architecture of Java 2 Platform Enterprise Edition (J2EE)
- Hierarchical architecture is designed according to component-based service-oriented architecture(SOA)
- Components and services are built through object-oriented approach based on JAVA.

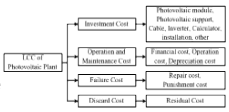
Software interface of efficient management platform

SaPoB(5) 14:50-15:20

Life Cycle Cost Analysis of Photovoltaic Plant Based on Interval Number Theory

Jun Yang, Zhengxi Li and Jiatian Gan
Qinghai Province Key Laboratory of Photovoltaic Grid Connected Power Generation Technology, China
Jinzhong Zhang
Nanjing Upbest Information Technology Company, China

- An LCC model of the photovoltaic plant is established.
- A detailed calculation strategy based on the interval number theory is presented.
- Monte Carlo algorithm is used to simulate the values of PV plants' failure cost.
- The life cycle cost of a 10MW photovoltaic plant is analyzed.



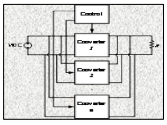
Basic life cycle cost (LCC) framework

SaPoB(6) 14:50-15:20

Sliding Mode Based Current Sharing Control of Parallel Cuk DC-DC Converters

Yangfei Feng
College of Automation, Chongqing University, China
(e-mail:291606143fyf@gmail.com)
Rui Ling
College of Automation, Chongqing University, China

- a sliding mode based current-sharing control approach.
- achieved the current-sharing control for the parallel cuk dc-dc converters
- sliding mode voltage and current control
- converter with the presented control has the advantages of good dynamic performance and robustness.



Multiple Converter structure

SaPoB Poster Session 4 (con't)

Session Chairs: Ning Sun and Xuebo Zhang

Room : FOYER, 1/F, 14:50-15:20, Saturday, July 21, 2018

SaPoB_2(7) 14:50-15:20

Detecting False Data Injection Attacks on Modern Power System Based on Jensen-Shannon Distance

Manyun Huang, Zhinong Wei, Guoqiang Sun, et al;
College of Energy and Electrical Engineering, Hohai University, China.
Ming Ni, Manli Li.
NARI Group Corporation (State Grid Electric Power Research Institute), China.

- A false data injection attack detection method based on the Jensen-Shannon Distance (JSD) is presented to address the false data attack in power systems.
- The distribution of measurement variations under attacks deviates from that under normal working conditions, leading to the deviation of the calculated JSD from the normal value.
- The proposed method proves more stable compared with the state prediction-based false data detection method in Fig. 1.

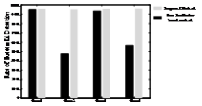


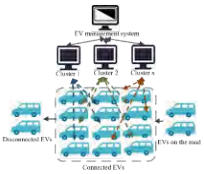
Fig.1. Proposed method compared with the state prediction-based method

SaPoB_2(8) 14:50-15:20

A Real-time Schedule Optimization of Massive Electric Vehicles and Energy Storage System Based on Grey Wolf Optimizer

Bin Liu and Zhukui Tan
Electric Power Research Institute of Guizhou Power Grid Co., Ltd., China
Zhenning Pan, Dezhi Wang and Tao Yu
School of Electric Power, South China University of Technology, China
(scutpanzn@163.com)

- A real-time coordinated schedule model for massive electric vehicles and energy storage system is proposed considering the accurate constrains of each EV and the safe operation of the distribution network. Firstly, the Grey Wolf Optimizer is adapted to calculate the charging/discharging strategy of EV clusters and ESS.Then, allocation algorithm based on energy buffer factor consensus is proposed to make detail strategy for each EV in the cluster considering accurate constrains. The simulation results show that, the model proposed has a great performance on massive EVs and ESS real time scheduling optimization.



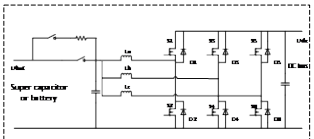
Framework of the proposed model

SaPoB_2(9) 14:50-15:20

Study on Virtual Synchronous Generator with Energy Storage Unit Controlled by Bi-directional DC/DC Converter

Kunyu Ji and Jun Jia
State Grid Jiangsu Taizhou Electric Power Corporation Ltd, Taizhou 225300, China
Weiguo Zhang
ARI Group Corporation, Nanjing 210003, China

- Design a bi-directional DC/DC converter with three-phase interleaving parallel according to analysis results of energy storage requirement.
- EMTDC / PSCAD simulation verifies the feasibility of the overall operation of VSG with energy storage unit.
- Simulation and experimental results verify the correctness and effectiveness of the proposed method and control strategy.



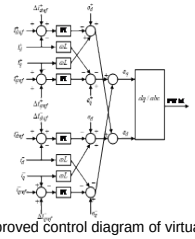
Bi-directional DC/DC converter with three-phase interleaving parallel

SaPoB_2(10) 14:50-15:20

Unbalanced Voltage Improvement Control of Virtual Synchronous Rectifier

Jun Jia and Kunyu Ji
Taizhou Electric Power Supply Company, Jiangsu, China, Taizhou 225300, China
Yongbiao Yang
NARI Group Corporation/State Grid Electric Power Research Institute,
Nanjing 210003, China.

- The virtual synchronous rectifier makes it possible to control the stability of the system by simulating the damping and inertia characteristics of the motor.
- Aiming at the three-phase unbalance problem in distribution network, the control strategy is improved by power analysis to achieve the purpose of stabilizing the DC load voltage.
- Simulation results prove the accuracy and effectiveness of the method.



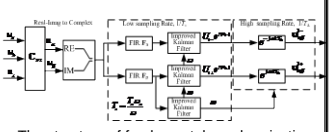
Improved control diagram of virtual synchronous rectifier

SaPoB_2(11) 14:50-15:20

A Novel Grid Voltage Synchronization

Xin Zhou
Dalian Maritime University, China
Hongjun Chen
Harbin Institute of Technology Harbin, China

- The ideal of composite filter in time-domain
- Fast detection for voltage dips premised on satisfying the determination accuracy
- Extremely stability as an open-loop system
- Implementation simplicity



The structure of fundamental synchronization

SaPoB_2(12) 14:50-15:20

Design of Gas Flow Measurement Model for Rectangular Duct in Thermal Power Plant

Yuping BI and Ping WANG
Key Laboratory of Advanced Electrical Engineering and Energy Technology
Tianjin Polytechnic University, Tianjin , China

- The simulation of gas flow in two kinds of duct models is carried out.
- The TES-1340 hot-wire anemometer was used to collect the velocity.
- The velocity table function of the pipe section is obtained by fitting.

Diagram of meshing

SaPoB Poster Session 4 (con't)

Session Chairs: Ning Sun and Xuebo Zhang

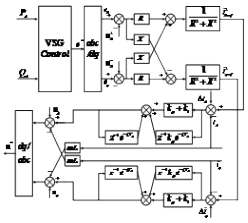
Room : FOYER, 1/F, 14:50-15:20, Saturday, July 21, 2018

SaPoB_3(13) 14:50-15:20

Improvement of Internal Loop Controller for Unbalanced Control System based on Virtual Synchronous Generator

Chaoyun Qin, Dong Liang, Jin Zong
State Grid Jibei Electric Power Co. Ltd., Beijing, China
Xichun Wu, Jun Mei, Bingbing Wang
School of Electrical Engineering, Southeast University, Nanjing, China

- An improvement of internal loop controller combined with VSG balance control is formulated.
- The improved current inner loop PI regulator can realize the difference of the 2 times frequency alternating current component track.
- There is no need to switch current inner loop controller to achieve better VSG balance control effect.



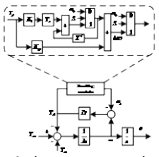
The overall control block diagram of the improved VSG

SaPoB_3(14) 14:50-15:20

A Novel Control Operation Switching Strategy in Virtual Synchronous Generator

Chenyu Zhang
State Grid Jiangsu Electric Power Company Research Institute, China
Huiyu MIAO
School of Electrical Engineering, Southeast University, China

- Switch the distributed generator inverter between VSG control and PQ control according to the requirements
- Propose a VSG operation mode seamless switching control strategy
- Simulation results verify the effectiveness of the strategy
- Output active power, reactive power, current, voltage smooth change



Active power control diagram

SaPoB_3(15) 14:50-15:20

Development of Parallel Restoration Strategy for Chongqing Power System in China

Changcheng Li, Pei Zhang, Yin Xu, Jinghan He and Pinghao Ni
School of Electrical Engineering, Beijing Jiaotong University, China
Li Feng and Fan Mu
State Grid Chongqing Electric Power Company, China

- Considering topology and power flow, a modified label propagation algorithm is applied for network partitioning.
- A near optimal restoration scheme with minimum restoration time is determined by greedy algorithm.
- It helps system operators to develop restoration plans and enhance the system reliability.

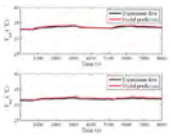
Partitioning scheme of Chongqing power system

SaPoB_3(16) 14:50-15:20

Performance Evaluation of a Heat Pipe Heat Exchanger in Desiccant Regeneration System

Xianhua Ou, Xiongxiong He and Zhongtian Chen
College of Information Engineering, Zhejiang University of Technology,China
Wenjian Cai
School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore

- A dynamic model of HPHE in desiccant regeneration system is developed.
- Only four unknown parameters need to be identified in the proposed model.
- The simple and accurate model can be easy used in engineering application.



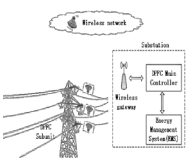
Model validation result

SaPoB_3(17) 14:50-15:20

Architecture design of distributed power flow controller system based on centralized control

Qu Xiaolei, Zhu Kaiyang, Zhu Shijing, and Chen Xiong
NARI Technology Co., Ltd., China

- The distributed power flow controller (DPFC) is a kind of power flow controller consisting of many small single-phase sub-control units installed on the transmission line dispersedly.
- The DPFC is characteristic of light weight, small footprint and low cost.
- This paper proposes a new DPFC system architecture based on distributed installation and centralized control model, and a data interaction architecture based on LORA wireless communication. The paper introduces the software and hardware design scheme of this control system.



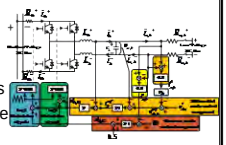
System architecture

SaPoB_3(18) 14:50-15:20

Circulating Currents Suppression Based on Common Mode and Differential Mode Control in DC Distribution Systems

Junwei Chai, Yonggang Peng,
College of Electrical Engineering, Zhejiang University, China
Yanghong Xia and Wei Wei
College of Electrical Engineering, Zhejiang University, China

- The detailed mathematic model of circulating currents among IPOP HBDCs is derived
- Proposes a decentralized control method by using the improved modulation way of HBDCs
- Common mode control is used to suppress the circulating currents within the single HBDC
- Differential mode control is used to suppress the circulating currents among the multiple HBDCs



Control block of the proposed control method for kth HBDC

SaPoB Poster Session 4 (con't)

Session Chairs: Ning Sun and Xuebo Zhang

Room : FOYER, 1/F, 14:50-15:20, Saturday, July 21, 2018

SaPoB_4(19) 14:50-15:20

Mathematical Modeling and Control of the Quad Tilt-rotor UAV

Dawei Shen and Qiang Lu

Hangzhou Dianzi University

The quad tilt-rotor unmanned aerial vehicle (TRUAV) exhibits special application value due to its unique rotor structure. However, it has the complex operating characteristics of both the tension vector control and the air rudder control such that the flight control problem is difficult. In this paper, the theory of classical mechanics is applied to establish the mathematical models of the quad TRUAV in helicopter mode and transition mode . On this basis of the proposed models, the flight attitude controller of the transition mode from the helicopter mode to the airplane mode is designed by the backstepping method. This proposed controller can make the quad TRUAV achieve smooth transition. The simulation results verify the correctness and feasibility of the proposed scheme.

SaPoB_4(20) 14:50-15:20

Event-Triggered Distributed Continuous-Time Optimization Based on Multi-Agent Systems

Min Hu and Qiang Lu

Hangzhou Dianzi University

We have proposed an event-triggered distributed continuoustime optimization algorithm in this paper. Also, we have used the single-integrator dynamic systems and all agent communicate in an undirected communication topology. Our purpose is to reduce the communication resources with each other in the process of making all the agents reach consensus. Based on the algorithms we proposed above, all agents reach consensus through the convex optimization and a great number of communication burdens have been relaxed through the eventtriggered method. Compared with the time-triggered communication, a great number of communication resources have been relaxed. The simulations verify the effectiveness of the above algorithms. In the next, we will study the relative problems about double-integretor dynmaics, discrete time systems using an event-triggered communication scheme.

SaB1 Human Abilities and Robotic Assistance 2

Session Chairs: Xiaodong Zhang and Ningbo Yu

Room : THE RESIDENCE 1, 15:20-16:50, Saturday, July 21, 2018

SaB1(1) 15:20-15:35

IMU-Based Gait Phase Recognition for Stroke Survivors: Preliminary Results

Yu Lou, Rongli Wang, Jingeng Mai, Ninghua Wang, Qining Wang
College of Engineering, Peking University, Beijing 100871, China;
Department of Rehabilitation Medicine, First Hospital,
Peking University, Beijing 100034, China

- We present an inertial measurement unit based gait phase detection system for stroke survivors.
- Features are extracted using a 150ms sliding window and processed by a quadratic discriminant analysis classifier.
- Three stroke survivors were recruited with varying degrees of walking disability to test the system. A recognition accuracy higher than 97% was obtained.

IMU-based gait phase recognition system for stroke survivors

SaB1(2) 15:35-15:50

Sensing and Data Analysis for Assessing Human Balance Ability

Song Wang and Ning Xi, *Fellow, IEEE*
Department of Industrial and Manufacturing Systems Engineering,
The University of Hong Kong, Hong Kong

- This paper presents the development of a novel balance sensor for assessing human balance ability.
- This balance sensor can detect tread force distribution under feet with high resolution.
- Experiment is done to capture tread force distribution variation videos from different human balancing actions.
- 3D convolutional neural network is developed to classify different human actions.

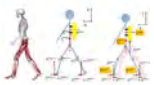
Prototype of balance sensor

SaB1(3) 15:50-16:05

Simulating the effect of ideal load support for walking with heavy loads

Pu Duan and Zhuoping Duan
The State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology, China

- This paper investigated the effect of ideal load support for walking with heavy loads with musculoskeletal model in OpenSim.
- From a theoretical aspect the biological influence of load support exoskeletons on humans was explored.
- Simulation results showed that the ideally applied vertical support force had limited benefit in metabolic cost reduction but possibly more useful in local fatigue relief.

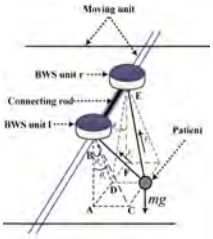


SaB1(4) 16:05-16:20

A Novel Double-Rope BWS System for Locomotion Training of Hemiplegic Patients

Yubo Sun, Peng Zhang, Ningbo Yu *
Institute of Robotics and Automatic Information Systems, Nankai University,
Tianjin Key Laboratory of Intelligent Robotics, Nankai University
Haihe Education Park, Tianjin 300353, China

- Hemiplegic patients after stroke suffer from difficulties to control the left or right side of the body and limbs.
- We designed a novel double-rope body weight support system to provide forward and lateral forces along with the support force against gravity for locomotion training of hemiplegic patients.
- Simulation results promised efficacy of the system design and control strategy.



SaB1(5) 16:20-16:35

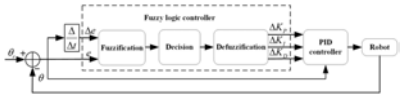
Fuzzy logic based PID control of a 3 DOF lower limb rehabilitation robot

Zhihang Shen, Jie Zhou and Rong Song
School of Engineering, Sun Yat-sen University, China
Jinwu Gao
Department of Control Science and Engineering, Jilin University, China

Method: Fuzzy logic based PID control (FPID).

Experiment: Range of Motion (ROM) training experiments were performed on a 3DOF LLRR.

Result: The tracking error using the FPID controller is 43% less than the conventional one.



Control structure

SaB1(6) 16:35-16:50

Modeling and Simulation of Transporting Elderly Posture of Multifunctional Elderly-Assistant and Walking-Assistant Robot

Khaled Kadry Hamza, Xiaodong Zhang, Xiaoqi Mu., Randolph Odekhe, and Ahmad Bala Alhassan

School of Mechanical Engineering, Shaanxi Key Laboratory of Intelligent Robot, Xi'an Jiaotong University，Xi'an, 710049, China

- an investigation into the modeling and simulation of elderly-assistant and walking-assistant robot of transportation posture using mass-spring-damper concept has been presented.
- The dynamic equations of the model were derived using the Lagrange's equation of motion.
- MATLAB simulations results of the dynamic equations have been performed to study the dynamic behavior of the system.
- The vibration analyses of the robot subjected to a pulse input signal demonstrated that the results will provide useful information for the selection of appropriate control strategy for the person's ride comport.

SaB2 Mobile Robot 2

Session Chairs: Ji Xiang and Baoquan Li

Room : THE RESIDENCE 2, 15:20-16:50, Saturday, July 21, 2018

SaB2(1) 15:20-15:35

Yaw Angle Tracking Control for a quadrotor-like Autonomous Underwater Vehicle Using Global Fast Terminal Sliding Mode Control

Liwei Kou, Ji Xiang and Jingwei Bian
College of Electrical Engineering, Zhejiang University, China
Yanjun Li
School of Information and Electrical Engineering,
Zhejiang University City College, China

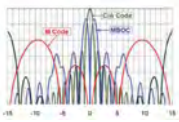
- A quadrotor-like autonomous underwater vehicle is introduced.
- The tracking strategy is based on global fast terminal sliding mode control.
- A wider area is defined explicitly to avoid singularity of the proposed strategy.
- The proposed strategy can surpress the system uncertainties and external disturbances effectively.

SaB2(2) 15:35-15:50

Research on Receiving and Processing of GPS L1C Signals

Meng Zhou, Hong Li, Mingquan Lu
Electronic Engineering, Tsinghua University, China
Jing Li
Navigation ,China Transportation Telecommunications and Information Center, China
Shichen Wang
Anhui Sun Create Electronics Co.,Ltd, China

- The GPS L1C signals are the new civil signals transmitted in the L1 band.
- The pilot channel has higher transmission power, facilitate capturing and tracking of signals.
- Higher precision and better multi-path resistance can be achieved in case of matched receiving.



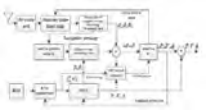
Power spectrum of transmission signals in the GPS L1 band

SaB2(3) 15:50-16:05

Realization of GNSS/INS Tightly Coupled Navigation and Reliability Verification in Intelligent Driving System

Jing LI
School of Computer Science and Engineering, University of Electronic Science and Technology of China, China,
Yue WU
China Transport Telecommunications & Information Center, China

- Vehicle positioning and navigation technology is one of the key technologies of vehicle networking.
- One of the key points of the integrated navigation system isinformation fusion.
- Establish The mathematical model and algorithm of radial basis function neural network and Kalman filter.



structure of ultra-tight integrated navigation system based on RBF neural network

SaB2(4) 16:05-16:20

Application of octree map in robotic environment reconstruction

Yi CHENG， Xiaoyu TONG
School of Electrical Engineering and Automation
Tianjin Polytechnic University,P.R. China

- This paper aiming at resolving the shortcomings of point cloud maps.
- An octree-based 3D reconstruction method is presented.
- The performance of the proposed approach is evaluated with both simulated and real data.
- The experimental results show that the octree map can effectively optimize the reconstruction.

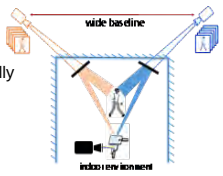
Fig.1 A image resolution is 0.04 of Octree Map

SaB2(5) 16:20-16:35

Monocular Wide Baseline Stereo Measurement Using High-speed Catadioptric System

Shaopeng Hu, Mingjun Jiang, Takeshi Takaki and Idaku Ishii
Department of System Cybernetics, Hiroshima University, Japan

- Wide and adjustable baseline especially in limited space
- Only one camera used as two virtual cameras
- Full image resolution
- Parameters adjusted by ultrafast pan-tilt mirrors



Monocular Wide Baseline Stereo System

SaB2(6) 16:35-16:50

Mobile Robot Odor Source Localization Based on Modified FWA

Yanzi Miao[1], Xiaoping Ma[1], Xin Jin[1]

1. School of Information and Electrical Engineering,
China University of Mining and Technology

2018.07 The 8th Annual IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems

SaB3 Advanced control of mechatronic systems 2

Session Chairs: Dianwei Qian and Yougang Sun

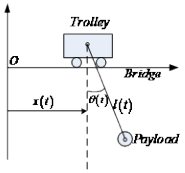
Room : THE RESIDENCE 3, 15:20-16:50, Saturday, July 21, 2018

SaB3(1) 15:20-15:35

Finite-time Trajectory Tracking Control Without Payload-swing Feedback for Overhead Crane Systems Subject to Uncertain Dynamics

Menghua Zhang, Xin Ma, Rui Song, Xuewen Rong, Xincheng Tian, Guohui Tian, Yibin Li
School of Control Science and Engineering,
Shandong University, Jinan, China

- It is robust against uncertain system parameters and external disturbances.
- The trajectory tracking controller can achieve finite-time convergence.
- The designed controller needs no payload-swing feedback.



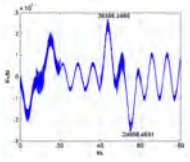
Schematic illusion of an overhead crane

SaB3(2) 15:35-15:50

Research on Elastic Effect of the Frame Excited by Inertia Load of the Trolley

Zhen Qiao
School of Mechanical Engineering Department, Tongji University, China
Yougang Sun and Dashan Dong
Logistics Engineering College, Shanghai Maritime University, China

- A planar three-dimensional dynamic model of container crane and its kinetic equations were presented.
- Design Rules for Cranes fails to estimate the elastic effect of the structure well .
- Inertia loads are magnified beyond estimate because of the vibration of the elastic frame.



Horizontal Reaction Force on Each Leg

SaB3(3) 15:50-16:05

Derivative and Integral Terminal Sliding Mode Control of Uncertain Multiple Robots

Yafei Xi and Dianwei Qian
North China Electric Power Unversity

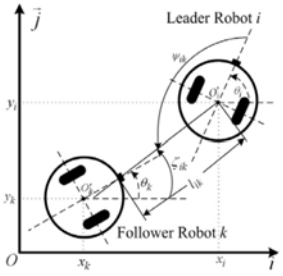
This paper introduces the formal control problem of multi-robot.

The formation model is present.

The derivative-integral terminal sliding mode control law is.

The stability of the control syster analyzed in the sense of Lyapunc

Some simulation results are illustrated.



SaB3(4) 16:05-16:20

A Method of Digitized Implement for IEC Flicker Detection Standard

Haitao Gao
Anhui Science and Technology University, China
Erlin Zhu
Jiangsu University of Technology, China
Shihui Huang
Shenzhen Pluke Intelligent Test Equipment co.,Ltd., China

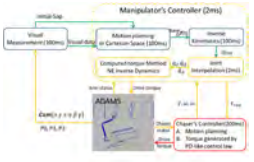
- Measuring the voltage flicker using the digitized method leads to the defect of huge storage data.
- A digitized method based on IEC voltage flicker detection standard is proposed.
- The digitized method improves the detection precision of voltage fluctuation and efficiency of data processing.

SaB3(5) 16:20-16:35

A Motion Planning Method Based Vision Servo for Free-Flying Space Robot Capturing A Tumbling Satellite

Minghe Jin, Guocai Yang, Yechao Liu, Xiaoyu Zhao and Hong Liu
the State Key Laboratory of Robotics and System,
Harbin Institute of Technology, China

- Dynamics of tumbling satellite and capture strategy
- Visual measurement and algorithm of trajectory planning
- The control scheme and simulation verification



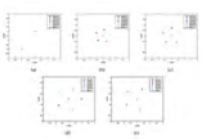
The control scheme of the free-flying space robot

SaB3(6) 16:35-16:50

Distributed Time-varying Formation and Optimization for Uncertain Euler-Lagrange Systems

Chao Sun, Zhi Feng and Guoqiang Hu
School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore

- In this paper, we consider a distributed time-varying formation and optimization problem for a group of robots with uncertain Euler-Lagrange dynamics.
- A distributed penalty based algorithm is proposed to solve the distributed time-varying formation and optimization problem.
- Compared with the existing work, the formation configuration can vary as time evolves.



Applications in a minimum travelled distance problem

SaB4 Multi-Agents and Networked Systems 2

Session Chairs: Jinliang Wang and Youqing Wang

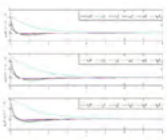
Room : THE RESIDENCE 4, 15:20-16:50, Saturday, July 21, 2018

SaB4(1) 15:20-15:35

Anti-synchronization Analysis and Pinning Control of Coupled Neural Networks with Multiple Weights

Jie Hou, Yanli Huang and Jinliang Wang
School of Computer Science and Software Engineering, Tianjin Polytechnic University, China
Shunyan Ren
School of Mechanical Engineering, Tianjin Polytechnic University, China
Dongfang Liu
Tianjin Tianhang Wisdom Technology Co., Ltd, China

- An anti-synchronization condition of multi-weighted coupled neural networks (MWCNN) is derived.
- An anti-synchronization criterion of MWCNN is established by using pinning adaptive strategy.
- A sufficient condition for achieving the anti-synchronization of MWCNN with coupling delays is also given.
- A pinning anti-synchronization criterion of MWCNN with coupling delays is also obtained.



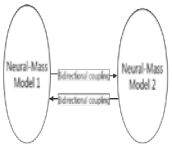
$e_{ij}(t)$, i = 1,2,⋯ ,6, j = 1,2,3.

SaB4(2) 15:35-15:50

Synchronization of Coupled Neural-Mass Models

Ke Ding
School of Information Technology, Jiangxi University of Finance and Economics, Nanchang, 330013, China

- Some synchronization criteria of coupled neural-mass models are derived.
- The adjacency coupling for neural-mass models is investigated.
- Those derived synchronization criteria can be used to study synchronization of neural-mass models with special coupling



Coupled neural-mass models

SaB4(3) 15:50-16:05

Cascaded Control Design for a Stabilized Pan-Tilt Camera Platform on a Quadrotor UAV

Baolu Liu, Jianchuan Guo, Jiahui Rong and Baoquan Li
School of Electrical Engineering and Automation,
Tianjin Polytechnic University, Tianjin

- The Quadrotor UAV carrying a stabilized camera platform can effectively improve the adaptability to environment.
- The optical axis of the camera is stabilized by inertial rate stabilization controller.
- The visual tracking controller achieves the detection and tracking of targets.
- The superiority performance of the proposed cascaded controller is verified by laboratory experiments.

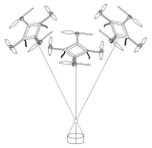
Stabilized camera platform

SaB4(4) 16:05-16:20

A Review on Control Methods for Multi-lift Rotorcraft Systems

Kui Yi[1,2], Yuqing He[1], Jianda Han[1,3], Liying Yang[1] and Feng Gu[1]
[1]Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences
[2]University of Chinese Academy of Sciences
[3]College of Computer and Control Engineering, Nankai University

- Dynamics modeing for Multi-lift Rotorcraft (MLR) systems is briefly outlined.
- Studies of MLR systems are presented in detail, which consist of coordinated control strategies as well as experimental studies.
- The main challenging problems in this field and some development tendencies are discussed.
- Some concluding remarks as well as future work are given.



Multi-lift Rotorcraft Systems

SaB4(5) 16:20-16:35

Dynamic Trajectory Planning of Collaborative Robots in Target Capture Task

Guodong Liu, Yong Jiang and Xiaowei Tan
College of Information Science and Engineering, Northeastern University, Shenyang, China
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, China
liuguodong@sia.cn

In this paper, a new method(APF-RV) for collision avoidance is proposed, which combined APF method with RV method. The core of this algorithm is to deal with dynamic and static obstacles respectively. A new sample approach is used to get the distances between the robot and obstacles in its workspace, which is based on human body identification procedures. These distances are used to generate repelling forces (APF method) or repulsive vectors (RV method) which are processed in order to obtain smooth trajectory that avoid obstacles.. A series of experiments on the UR5 robot and the Kinect sensor confirmed the real-time effectiveness and good performance of the method.

SaB4(6) 16:35-16:50

Minimum-Variance Unbiased Unknown Input and State Estimation for Multi-Agent System with Heterogeneous Unknown Input

Yukun Shi and Changqing Liu
the College of Information Science and Technology, Beijing University of Chemical Technology, China
Xiao Shen and Youqing Wang
the College of Electrical Engineering and Automation, Shandong University of Science and Technology, China

- Homologous and Heterogeneous Unknown Inputs
- Multi-Agent System
- Minimum-Variance Unbiased Estimation

SaC1 Human Abilities and Robotic Assistance 3

Session Chairs: Liang Peng and Guoli Song

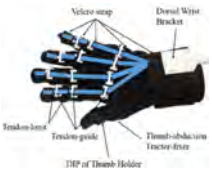
Room : THE RESIDENCE 1, 17:00-18:30, Saturday, July 21, 2018

SaC1(1) 17:00-17:15

A Wearable Bionic Soft Exoskeleton Glove for Stroke Patients

Ziwen Liu Liang Zhao Peng Yu and Lianqing Liu
The State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, China

- The structure design is based on the muscle anatomical model
- Achieve the natural movement patterns of precision grip and power grip
- The motion trajectory correlation between natural motion and device-assisted motion of hand reached 0.97



SaC1(2) 17:15-17:30

Robotic Arm Driven by a Hybrid Gaze-Brain Machine Interface with Continuous Shared Control during Reaching

Yanxin Wang, Junjie Shen, Hong Zeng and Aiguo Song
School of Instrument Science and Engineering, Southeast University, China

- A hybrid Gaze-Brain-robot interface is developed to input user's commands for continuously moving the robotic arm end-effector in 2D space
- We present a dynamical online arbitration between the user command and autonomous robot control
- Experimental results performed on 6 subjects have demonstrated that movements with shared control are safer and more efficient than those without

The proposed shared control system diagram

SaC1(3) 17:30-17:45

Smile Recognition Based on Support Vector Machine and Local Binary Pattern

Zheng Huang, Guoli Song, Yiwen Zhao and Xingang Zhao
Shenyang Institue of Automation, Chinese Academy of Science, China
Jianda Han
College of Computer and Control Engineering,Nankai University, Country

- Machine learning method is used to identify whether a person is smiling or not.
- The recognition system is divided into 4 parts: image processing; human face detection; feature extraction and classification.
- Face detection based on the combination of Haar-like features and Adaboost.
- LBP is used for feature extraction and SVM for classification.
- The accuracy of this system can reach 88.1%.

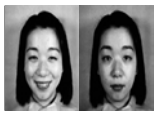


Figure 1 classification of smile

SaC1(4) 17:45-18:00

Physiological response to emotion changes in robot-aided resistance training with cognitive and active force coexistence

Xiang Gao, Linlin Feng, Guozheng Xu, Guojian Huang, Wen Chen

Robotics Information Sensing and Control Institute

Nanjing University of Posts and Telecommunications, Nanjing, China

- This study explores how to extract features of emotional physiological responses only related to cognition.
- The subjects were asked to do the IAPS experiment and rehabilitation resistance training.
- The sEMG signal data in the three target emotional states were analyzed by statistical analysis.

SaC1(5) 18:00-18:15

•An Assessment Method for Upper Limb Rehabilitation Training Using Kinect

Kaizhi Yang, Lina Tong, Rongkai Liu and Bingyang Liu
Mechanical Electronic & Information Engineering, China University of Mining & Technology(Beijing), China
Liang Peng*
Institute of Automation, Chinese Academy of Science, Beijing, China

- Proposes a rehabilitation training assessment method combined with virtual reality technology.
- The DTW algorithm result, the time duration and the amplitude influence the assessment result.
- The system can inform the patients how to modify their motion.

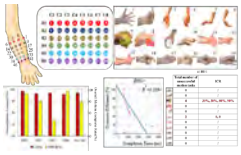
The view of training and assessment

SaC1(6) 18:15-18:30

Real-time Identification Performance of Fine Motor Movements for Traumatic Brain Injured Patients

Xuyan Xing, Oluwarotimi Williams Samuel,Yanjuan Geng, Zeyang Xia, Peng Shang, Guanglin Li
Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China
Xin Guo, Hebei University of Technology, China
Yatao Ouyang, Guangdong Provincial Work Injury Rehabilitation Center, China

- The real-time identification performance of fine motor movements for Traumatic brain injured patients was evaluated.
- The five real-time performance metrics as well as one offline performance metric were presented.
- The real-time performance was found to be related with the specific motor impairment level.



Electrode placement, forearm movements, overall classification accuracy and motion completion rate and the result of BI01

SaC2 Mobile Robot 3

Session Chairs: Qiang Lu and Menggang Li

Room : THE RESIDENCE 2, 17:00-17:45, Saturday, July 21, 2018

SaC2(1) 17:00-17:15

Multiple Resolvable Group Estimation Based on the GLMB Filter with Graph Theory

LIU WEI FENG

HANGZHOU DIANZI UNIVERSITY

SaC2(2) 17:15-17:30

A Localization Method Based on Large Scene Tracking and Target Details Observation about Small Quadruped Robot under Global Vision

Chen Zhang, Yibin Li and Xuewen Rong
The School of Control Science and Engineering, Shandong University, China
Hui Chai
The School of Mechinical Engineering, Shandong University, China
Bo Su
China North Vehicle Research Institute, China

- Fish-eye camera observe large field, guiding long lens camera to aim at the target.
- The QR code on the robot is used to indicate position and posture.
- This system give simultaneously consideration to large scenes observation and high definition of targets details.
- The system has high positioning and orientating accuracy in the experiments.

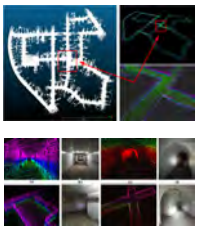
The performance of this system

SaC2(3) 17:30-17:45

Efficient Laser-based SLAM for Coal Mine Rescue Robots

Menggang Li, Hua Zhu, Shaoze You
School of Mechanical and Electrical Engineering
Jiangsu Collaborative Innovation Center of Intelligent Mining Equipment
China University of Mining and Technology, Xuzhou 221008, China

In this paper, we propose a novel real-time 3D SLAM based on Normal Distributed Transform (NDT) which also take pose graph optimization and loop closure to further improve the consistency of mapping. We innovatively extract the floors and walls as plane nodes to construct constraints, in addition to applying pose nodes from the lidar odometry. Edges of the graph are constructed by the observation constraints between pose nodes and plain nodes. A simple and effective loop detection method is used via odometry-based in conjunction with appearance-based approach to build a global consistent map.



SaC3 Automation in Space/Flying Robots

Session Chairs: Yizhai Zhang and Lianqing Liu

Room : THE RESIDENCE 3, 17:00-18:15, Saturday, July 21, 2018

SaC3(1) 17:00-17:15

Control system design of Spacecraft Mechanical Ground Support Equipment automatic storage system

Yang Yu, Hao Fu, Tiecheng Qiu, Zhe Wang
Beijing Institute of Spacecraft Environment Engineering, China

- The Control system select Omron PLC as the main controller for centralized control.
- The system has a total of 273 input points, 147 output points.
- System has multiple photoelectric and travel switches safety sensors.
- System's human-computer interaction control interface is easy to operate.

System appearance

SaC3(2) 17:15-17:30

Neural Adaptive Fault-Tolerant Control for Attitude Tracking of Spacecraft

Pengcheng Wang and Chenliang Wang
School of Automation Science and Electrical Engineering,Beihang University, China
Qinglei Hu and Bing Zhu
School of Automation Science and Electrical Engineering,Beihang University, China

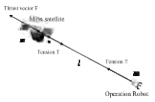
- This paper investigates the problem of attitude tracking control with prescribed tracking performance for a spacecraft exposed to unknown inertial matrix and actuator failure.
- Neural Network, Fault-Tolerant, Prescribed Tracking Performance

SaC3(3) 17:30-17:45

Closed-loop Optimal Control of Tethered Robot during Nonplanar Orbital Transfer

Liang Sun, Ming Chen, Guowei Zhao and Wei Xu
School of Asronautics, Beihang University, China

- Nonlinear equations are derived that describe the motion of the tethered robot system.
- The open-loop controller and an optimal feedback controller in closed-formed are proposed.
- The performance of the controllers is verified via the numerical simulation.



Typical Tethered Robot System

SaC3(4) 17:45-18:00

Vibration Control of Flexible Appendages in Space Tether Tugging System

Guowei Zhao,Wei Xu, Liang Sun and Ming Chen
School of Astronautics, Beihang University, Beijing, China
Dejin Li
China Electronics Technology Group Corporation No.10 Research Institute, Chengdu, China

- An input shaping control strategy suitable for rope combination
- Suppress vibration of flexible accessories during satellite orbit transfer
- The vibration of flexible appendages can be effectively avoided after input shaper

SaC3(5) 18:00-18:15

An Open Source Framework Based Unmanned All-Terrain Vehicle(U-ATV) for Wild Patrol and Surveillance

Mingyue Zhu, Hongpeng Wang, Pengpeng Li,and Jingtai Liu
Institute of Robotics and Automatic Information System, Nankai University, China

- unmanned all-terrain vehicle
- opensource framework
- cross-platform

The Schematic of U-ATV for patrol and surveillance

SaC4 Multi-agent systems and evolutionary game theory

Session Chairs: Dongmei Xie and Kun Li

Room : THE RESIDENCE 4, 17:00-18:15, Saturday, July 21, 2018

SaC4(1) 17:00-17:15

Distributed tracking control for second-order multi-agent systems with aperiodically intermittent position measurements

Fuyong Wang, Zhongxin Liu and Zengqiang Chen

College of Computer and Control Engineering, Nankai University, China

- This article investigates the distributed tracking control problem for second-order multi-agent systems with aperiodically intermittent position measurements. By introducing a distributed filter for each follower, a new kind of consensus protocol without velocity measurements is designed for second-order distributed tracking control. Some sufficient conditions are obtained such that the second-order multi-agent systems can achieve consensus tracking, under the common assumption that each agent can only communicate with its neighbors intermittently. Finally, numerical simulations are provided to verify the theoretical analysis.

SaC4(2) 17:15-17:30

Group Consensus for Second-order Nonlinear Multi-agent Systems with Time-delay

Weixun Li
Tianjin University of Technology and Education, China
Limin Zhang
Liaoning Technical University , China
Wen Qin
Nanjin University of Technology, China

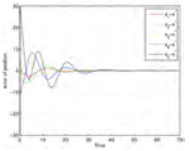
- Group consensus for second-order multi-agent systems with nonlinear dynamics and time delay was studied.
- An appropriate protocol was given to guarantee the multi-agent systems reach group consensus with performance index under external disturbances .
- The group consensus control scheme with uncertainties was considered, sufficient conditions are obtained such that the multi-agent systems can reach robust group consensus.

SaC4(3) 17:30-17:45

Tracking control of multi-agent systems with arbitrary weights

Lin Shi[a] and Dongmei Xie[a,b]
[a]School of Mathematics, Tianjin University, Tianjin, People's Republic of China
[b]School of Mathematics, Xinjiang Normal University, Urumqi, People's Republic of China

- A sufficient condition to guarantee the positive stability of matrix H for arbitrary weights.
- Which nodes should have direct connection with the leader?
- What's the range size of the leader adjacency coefficients?
- Some sufficient consensus tracking control conditions are obtained for MASs.



Tracking error of position.

SaC4(4) 17:45-18:00

The study on the coverage control problem in multi-agent systems based on evolutionary game theory

Jian Zhang, Jianlei Zhang
Department of Automation, College of Computer and Control Engineering, Nankai University, Tianjin, China

- We focus on the problem: how a group of mobile agents realize the biggest coverage on the surroundings and keep the system connected. Distributed control algorithms adopted here, and the initial condition is that these agents are randomly distributed in two dimensions. We introduce a method based on evolutionary game theory and our results show that this solution can increase the average coverage rate of the systems.

A snapshot of a systems with 40 agents.

SaC4(5) 18:00-18:15

Distribute Consensus Tracking of Multi-USV Systems

Jin-bo Hu and Zhi-wei Liu
School of Autumation, Huazhong University of science and technology, China
Ming-feng Ge
School of Automation, China University of Geosciences, China

The tracking problem can be divided into two parts, the coordination part and the tracking part.

A distributed estimator is introduced for the estimation of the leader system.

A Sliding mode control method is introduced to obtain the controller of the USV.

Simulation examples are given to demenstrate the theoretical results.

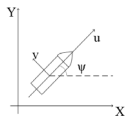
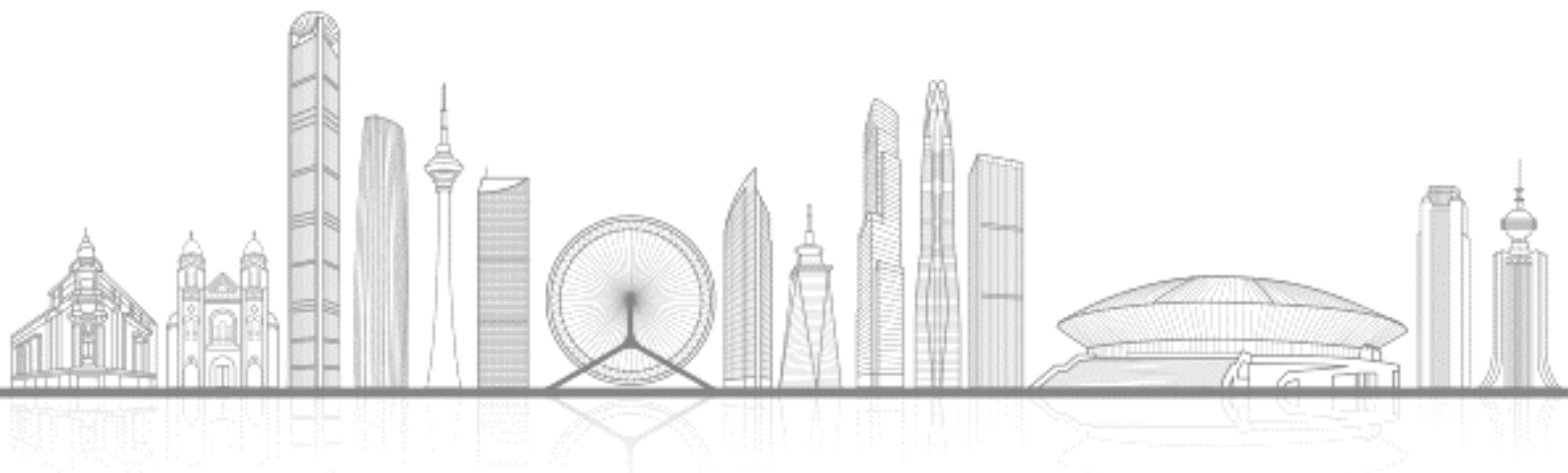


Figure 1 model of a USV

Technical Sessions

July 22nd, 2018



SuA1 Sliding Mode Control and Mechatronics 1

Session Chairs: Xiangyu Wang and Ning Wang

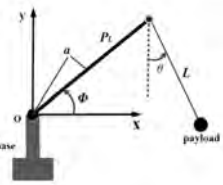
Room : THE RESIDENCE 1, 13:20-14:50, Sunday, July 22, 2018

SuA1(1) 13:20-13:35

Payload Lifting Control of Underactuated Boom Cranes Using Sliding Mode Theory

Biao Lu, Yongchun Fang, and Ning Sun
Institute of Robotics and Automatic Information System (IRAIS),
Nankai University, China

- Boom cranes are typical underactuated systems with high nonlinearity and strong couplings.
- Parameter uncertainty, external disturbance, etc., may degrade the control performance for boom cranes.
- A sliding mode controller is developed for boom cranes to counteract the various disturbances.
- Simulation results verify the efficiency of the proposed method.



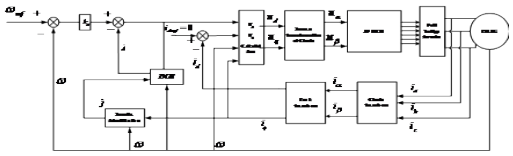
Schematic illustration of a boom crane.

SuA1(2) 13:35-13:50

Composite anti-disturbance Control of permanent Magnet synchronous Motor based on feedback linearization

Shengquan Li, Jianbo Xu, Shenghua yuan, Juan Li
School of Hydraulic, Energy and Power Engineering, Yang Zhou University.
Key Laboratory of Measurement and Control of Complex Systems of Engineering, Ministry of Education, Southeast University, Nanjing.

- The feedback linearization model of nonlinear plant PMSM is established by using the feedback linearization method of lie differential.
- Disturbance observer is used to observe the disturbance, and the influence of interference is eliminated through feedforward compensation.
- Considering that the change of load inertia will affect the performance of the speed regulating system, the method of moment of inertia identification is added.

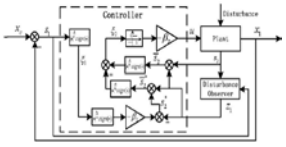


SuA1(3) 13:50-14:05

Second-order Sliding Mode Control of Nonlinear Systems with Nonvanishing Mismatched Disturbance

Lu Liu and Shihong Ding
School of Electrical and Information Engineering, Jiangsu University, China
Haibo Du
School of Electrical Engineering and Automation, Hefei University of Technology, China

- Subjecting to the systems with Nonvanishing mismatched disturbance
- Estimating the disturbance by a finite-time disturbance observer
- Designing a second-order sliding mode control method
- Possessing a strong robustness with the matched and mismatched disturbance



Block diagram of controller design

SuA1(4) 14:05-14:20

Disturbance observer-based finite-time control for a quadrotor aircraft

Haibo Du[1], Kunbin Liu[1], Di Wu[1], Wenwu Zhu[1], and Shihong Ding[2]
1 Hefei University of Technology, Hefei, China
2 Jiangsu University, Zhenjiang, China

- Control objective: The quadrotor aircraft with the external disturbances converge to the desired position *in a finite time*
- The quadrotor aircraft model:

$$\begin{aligned}\ddot{x} &= -\frac{K_1}{m}\dot{x} + \frac{T}{m}(\cos\phi\sin\theta\cos\psi + \sin\phi\sin\psi),\\ \ddot{y} &= -\frac{K_2}{m}\dot{y} + \frac{T}{m}(\cos\phi\sin\theta\sin\psi - \sin\phi\cos\psi),\\ \ddot{z} &= -\frac{K_3}{m}\dot{z} + \frac{T}{m}\cos\phi\cos\theta - g.\end{aligned}$$

$$\begin{aligned}J_1\ddot{\phi} &= -K_4\dot{\phi} + l\tau_1 + d_1(t),\\ J_2\ddot{\theta} &= -K_5\dot{\theta} + l\tau_2 + d_2(t),\\ J_3\ddot{\psi} &= -K_6\dot{\psi} + c\tau_3 + d_3(t),\end{aligned}$$

- Finite-time controller design:

$$\tau_1 = \frac{J_1}{l}\left[\ddot{\phi}_d + \frac{K_4 l}{J_1}\dot{\phi}_d + a_p \mathrm{sig}^{\beta_1}(\phi_d - \phi) + a_d \mathrm{sig}^{\beta_2}(\dot{\phi}_d - \dot{\phi}) - \dot{d}_\phi\right],$$

$$\tau_2 = \frac{J_2}{l}\left[\ddot{\theta}_d + \frac{K_5 l}{J_2}\dot{\theta}_d + a_p \mathrm{sig}^{\beta_1}(\theta_d - \theta) + a_d \mathrm{sig}^{\beta_2}(\dot{\theta}_d - \dot{\theta}) - \dot{d}_\theta\right],$$

$$\tau_3 = \frac{J_3}{c}\left[\ddot{\psi}_d + \frac{K_6}{J_3}\dot{\psi}_d + a_p \mathrm{sig}^{\beta_1}(\psi_d - \psi) + a_d \mathrm{sig}^{\beta_2}(\dot{\psi}_d - \dot{\psi}) - \dot{d}_\psi\right].$$

$$\begin{cases}\dot{\tilde{\phi}} = -\frac{K_4 l}{J_1}\dot{\phi} + \frac{l}{J_1}\tau_1 + \dot{d}_\phi + \rho_1 \mathrm{sig}^{1/2}(\dot{\phi} - \dot{\tilde{\phi}}),\\ \dot{d}_\phi = \rho_2 \mathrm{sign}(\dot{\phi} - \dot{\tilde{\phi}}),\end{cases}$$

$$\begin{cases}\dot{\tilde{\theta}} = -\frac{K_5 l}{J_2}\dot{\theta} + \frac{l}{J_2}\tau_2 + \dot{d}_\theta + \rho_1 \mathrm{sig}^{1/2}(\dot{\theta} - \dot{\tilde{\theta}}),\\ \dot{d}_\theta = \rho_2 \mathrm{sign}(\dot{\theta} - \dot{\tilde{\theta}}),\end{cases}$$

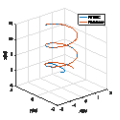
$$\begin{cases}\dot{\tilde{\psi}} = -\frac{K_6}{J_3}\dot{\psi} + \frac{c}{J_3}\tau_3 + \dot{d}_\psi + \rho_1 \mathrm{sig}^{1/2}(\dot{\psi} - \dot{\tilde{\psi}}),\\ \dot{d}_\psi = \rho_2 \mathrm{sign}(\dot{\psi} - \dot{\tilde{\psi}}),\end{cases}$$

SuA1(5) 14:20-14:35

Non-singular Terminal Sliding Mode Tracking Control of a Quadrotor with External Disturbances

Ning Wang[1] and Qi Deng [1]
[1]School of Marine Electrical Engineering, Dalian Maritime University, China

- A nominal non-singular terminal sliding mode control framework is established to achieve trajectory tracking control of a quadrotor.
- A finite-time disturbance observer is accurately reject complex disturbances.
- The finite-time stability of the closed-loop tracking system can be guaranteed by Lyapunov approach.



Trajectory tracking

SuA1(6) 14:35-14:50

Terminal Sliding-Mode Observer for Online Estimation of State-of-Charge of Batteries

Yong Feng, Jiacheng Du, Chen Xue
Department of Electrical Engineering, Harbin Institute of Technology, China
Fengling Han, Xinhuo Yu
School of Science, School of Engineering, RMIT University, Australia

- An online estimation method for the State-of-Charge(SoC) of Li-ion batteries is proposed.
- A terminal sliding mode observer is designed for accurate SoC estimation.
- The observer design compensates inaccuracy of the first order RC equivalent circuit model of Li-ion batteries.
- The method attenuates chattering existed in traditional sliding-mode observer methods.

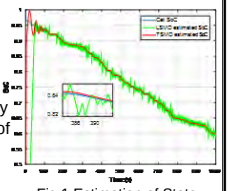


Fig.1 Estimation of State-of-Charge

SuA2 Connected and Automated Vehicles 1

Session Chairs: Yongfu Li and Yongsheng Qian

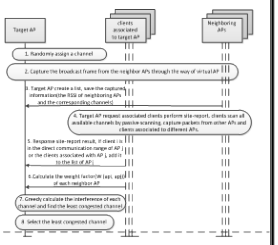
Room : THE RESIDENCE 2, 13:20-14:50, Sunday, July 22, 2018

SuA2(1) 13:20-13:35

Decentralized Partially Overlapping Channel Assignment for Multiple Independent AP in Uncoordinated High-dense WLANs

Jianjun Lei, Jin Zhang and Jiarui Tao
School of Computer Science and Technology, Chongqing University of Posts and Telecommunications, China

- Propose a interference factor that considers both channel overlapping degree and distribution of clients
- Assign partially overlapping channel to reduce interference for legacy 802.11 WLANs
- Present a decentralized channel selection algorithm and procedure for independent AP in high-dense WLANs
- Improve channel utilization and system throughput



Channel Selecting Procedure

SuA2(2) 13:35-13:50

A Novel Personalized Dynamic Route Recommendation Approach Based on Pearson Similarity Coefficient in Cooperative Vehicle-Infrastructure Systems

Danlei Shan
College of Transport and Communications, Shanghai Maritime University, China
Wenjuan Zhou
School of Traffic and Transportation, Beijing Jiaotong University, China
Jianqiang Wang
School of Traffic and Transportation, Lanzhou Jiaotong University, China

- Realize a personalized dynamic route recommendation approach.
- Consider the negative factors such as weather, accidents and traffic control.
- Design a feasible route search algorithm.

The main interface of the system

SuA2(3) 13:50-14:05

Progressive Probabilistic Hough Transform based Nighttime Lane Line Detection for Micro-traffic Road

Yongfu Li and Zhanji Yang
College of Automation, Chongqing University of Posts and Telecommunications, China

- Nighttime Lane Line Detection
- Micro-traffic Road
- Progressive Probabilistic Hough Transform
- A three-level framework to detect the lane line

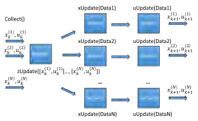
Figure 1. Lane line detection result image

SuA2(4) 14:05-14:20

Large Scale Huber Regression

Dajiang Lei, Zhijie Jiang, Meng Du, Hao Chen, and Yu Wu
College of Computer, Chongqing University of Posts and Telecommunications, China

- Huber regression is a robust linear regression for noisy data.
- Transforming the Huber regression problem into a global consensus problem and a sharing problem.
- Distributed Huber regression algorithm based on sample segmentation.
- Distributed Huber regression algorithm based on feature segmentation



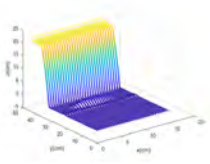
Distributed Huber regression algorithm flowchart

SuA2(5) 14:20-14:35

Volume Measurement of Moving Irregular Objects Using Linear Laser and Camera

Yantao Sun and Tangwen Yang
Institute of Information Science, Beijing Jiaotong University, China
Xiaoqing Cheng and Yong Qin
State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, China

- A non-contact volume measurement method for irregular objects is proposed.
- The truncated gaussian distribution is used to extract the center of light stripe.
- The measurement error is less than 4.5% at the distance of 2 meters away from the measurement devices.



Reconstruction model.

SuA2(6) 14:35-14:50

Optimization And Coordination Of Urban Railway Last Train Timetable

Xuexin Wang, Yongsheng Qian*, Junwei Zeng, and Xuting Wei
School of Traffic and Transportation, Lanzhou Jiaotong University, Lanzhou ,China.

- In the last train time of the urban railway transits, the timetable optimization should first ensure the reachability of passengers. Due to the uncertain connection order of train in each line, in this paper, a 0-1 variable is introduced to describe the convergence of trains in the last train time and to establish a network transfer model. By adjusting the departure time of the train, a timetable optimization model with the objective of connecting maximum passengers is presented and solved by genetic algorithm. Finally, based on the analysis of the important transfer stations in Chengdu Metro Network, the validity of the model is verified. The results show that the overall number of connected passengers increased by 17.6%. This model can effectively improve the accessibility of passengers.

SuA3 Power Systems 1

Session Chairs: Qi Wang and Bingtuan Gao

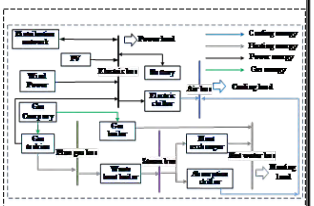
Room : THE RESIDENCE 3, 13:20-14:50, Sunday, July 22, 2018

SuA3(1) 13:20-13:35

Day-Ahead Centralized Optimal Dispatching of Active Distribution Power System with Combined Cooling, heating and Power-based Microgrids

Lin Li and Qingshan Xu
School of Electrical Engineering, Southeast University, Nanjing 210096, China
Xianxu Huo, Baoguo Zhao
State Grid Tianjin Electric Power Company, Tianjin 300010, China

- The devices of CCHP-based microgrid are modeled independently, and energy balance constraints are established by the load types in CCHP micorgrids.
- CCHP-based microgrids and active distribution network as a common subject, use centralized modeling methods to establish an economic optimization goal.
- Simulation results of Zhongxin district , Tianjin, China show that the proposed approach are effective and economical.



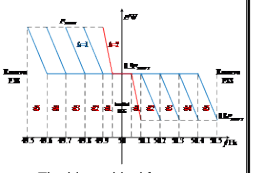
Energy supply structure of CCHP-based microgrid

SuA3(2) 13:35-13:50

Research on the Frequency Regulation Strategy of Virtual Synchronous based Photovoltaic Power Plant

Libin Yang[1], Jiatian Gan[1], Chaopeng Xia[2], Zhengyang Hu[2], Bingtuan Gao[2] and Linan Qu[3]
[1] Electric Power Research Institute, State Grid Qinghai Electric Power Company, China
[2] School of Electrical Engineering, Southeast University, China
[3] China Electric Power Research Institute, China

- The energy storage system(ESS) controlled by virtual synchronous generator (VSG) is designed to provide inertial support for photovoltaic power plant.
- Adopting droop control strategy can enable photovoltaic units to provide primary frequency regulation.
- The reserve ESS is put into operation when the frequency is out of the allowable range.



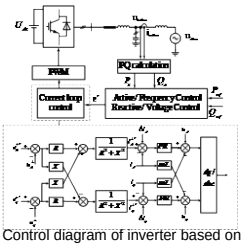
The hierarchical frequency regulation strategy

SuA3(3) 13:50-14:05

Unbalanced Control Strategy of Improved Virtual Synchronous Generator in Power Grid

Dong Liang, Chaoyun Qin, Jin Zong
State Grid Jibei Electric Power Co. Ltd., Beijing, China
Xichun Wu, Jun Mei, Bingbing Wang
School of Electrical Engineering, Southeast University, Nanjing, China

- An improved virtual synchronous generator control strategy under unbalanced grid voltage is formulated.
- No need to use positive and negative sequence double current inner loop control structure
- The simulation results show that the control strategy can suppress the fluctuation of active power.



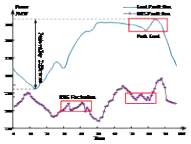
Control diagram of inverter based on VSG control

SuA3(4) 14:05-14:20

Decision-making Method for Demand Side Resources to Participate in Demand Response Scenarios Considering Uncertainty of Renewable Energy Generation

Haiwen Shao and Ciwei Gao
School of Electrical Engineering, Southeast University, China
Songsong Chen, Huaguang Yan, and Dezhi Li
Beijing Key Laboratory of Demand Side Multi-Energy Carriers Optimization and Interaction Technique, China Electric Power Research Institute, China

- The modes of renewable energy generation and load are introduced;
- The probability models of typical demand response scenarios are proposed;
- Considering different renewable energy penetration rates, typical scenarios are analyzed.



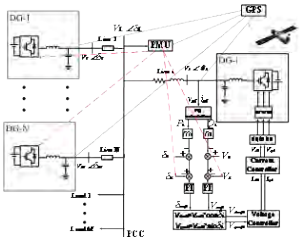
Changes in Demand for Typical Scenarios

SuA3(5) 14:20-14:35

A Novel Angle Droop Control Method Based on PMU Measurement for Accurate Power Sharing of Multiple Distributed Generators

Sijia Wang, Xiangyu Wu and Yin Xu
The School of Electrical Engineering, Beijing Jiaotong University, China

- The supplementary control is designed as $\delta_{adj} = K_1(\delta_i - \delta_L) + K_2\int(\delta_i - \delta_L)dt$
- δi and δL will converge to the same value in the steady state. If δi of all DGs are the equal, according to, the active power of DGs can be shared as: $m_1P_1 = m_2P_2 = \cdots = m_NP_N$.
- Similarly, $Vrefi$ can be adjusted to achieve the accurate reactive power sharing. $V_{adj} = K_3(V_i - V_L) + K_4\int(V_i - V_L)dt$



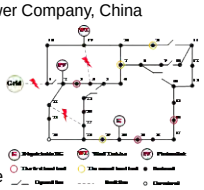
Proposed Control Structure Based on PMU measurement

SuA3(6) 14:35-14:50

Distributed Generation for Service Restoration Considering Uncertainties of Intermittent Energy Resources

Chen Li, Yin Xu, Jinhan He, Ying Wang, and Pinghao Ni
School of Electrical Engineering, Beijing Jiaotong University, China
Jinli Wang
China Electric Power Research Institute, China
Shu Liu
State Grid Shanghai Municipal Electric Power Company, China

- Restoration Model—A Mixed-integer Second-order Cone Program(MISOCP)
- Uncertainties of DGs—Gaussian Mixture Model(GMM)
- Owing to uncertainties of DGs—Chance Constraints
- Solving Chance Constraints—Sample Average Approximation (SAA)



Results of restoration strategies

SuA4 Robotic Vision

Session Chairs: Yang Cong and Chenguang Yang

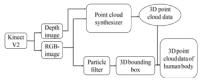
Room : THE RESIDENCE 4, 13:20-14:50, Sunday, July 22, 2018

SuA4(1) 13:20-13:35

A Method to Track and Acquire the 3D Point Cloud Data of Object

Zunran Wang, Chenguang Yang and Zhijun Li
College of Automation Science and Engineering,
South China University of Technology, China
Yang Cong
Shenyang Institute of Automation, Chinese Academy of Sciences, China

- A framework for tracking an object and acquiring point cloud data is proposed.
- The framework is based on particle filter.
- The particles are based on the physical constraints.
- The 3D data will be compressed through using a novel algorithm in our future work.

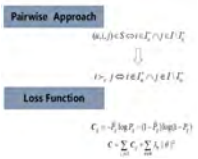


SuA4(2) 13:35-13:50

Pairwise Factorization Machines for Personalized Ranking with Implicit Feedback

Guankun Jin and Tao Ku
Digital Factory Department, Shenyang Institute of Automation,Chinese Academy of Sciences, China

- Pairwise Learning for Recommendation from Implicit Feedback
- Incorporate Context Information to the model
- Combine Factorization Machines with Pairwise Learning
- Ranking FM and Optimiaztion Methods

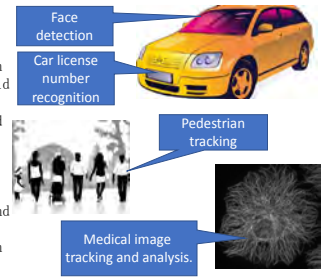


SuA4(3) 13:50-14:05

Target Tracking Based on Improved Particle Filter Algorithm and Camshift Method

Shuang Zheng and Heping Chen
Shenzhen Academy Robotics, ShenZhen, China
Email: zhshwind@163.com
Liang Yuan
Xinjiang University, Urumqi, China

Vision-based object tracking (single-target tracking, multi-target tracking) has always been a hot research topic in the field of computer vision, and has become more and more widely used in applications such as traffic vehicle monitoring, intelligent video surveillance, and human behavior analysis. Target tracking under complex background conditions, especially Multi-target tracking, has always been the focus and difficulty in visual tracking.



SuA4(4) 14:05-14:20

Research on Optimization of SURF Algorithm Based on Embedded CUDA Platform

Peng Ding Fei Wang Deying Gu Haixiang Zhou Qiming Gao Xinyan Xiang
Faculty of Robot Sci. & Eng., Northeastern University, China

- In this paper, the traditional SURF matching algorithm is optimized in two aspects: accuracy and real-time on Embedded CUDA Platform.
- Optimized SURF algorithm is realized on the embedded CUDA platform, which makes full use of the parallel computing power of GPU and CUDA memory management mechanism.
- Experimental results show that the algorithm proposed in this paper has better accuracy and real-time performance.

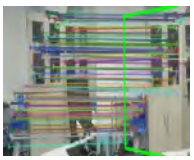


Fig.1. Improved SURF matching effect

SuA4(5) 14:20-14:35

Tracking for Grabing Robot Based on Multiple Feature

Yifan Wang, Fei Wang, Chen Liang, Wei Wu, Haobo Zhao, Yuze Zhang
Faculty of Robot Sci. & Eng., Northeastern University, China

- To solve problems encountered in capturing moving objects in the field of intelligent assembly, a modified algorithm based on correlation filtering and HOG is proposed.
- AlexNet depth network was used and the second layer of convolution was selected as the feature of target tracking.
- Through a lot of experiments, it was verified that the depth feature has high accuracy and robustness.

Fig.1. Robot grasping experiment

SuA4(6) 14:35-14:50

Robot Tactile Sensing: Vision Based Tactile Sensor for Force Perception

Tao Zhang, Yang Cong, Xiaomao Li and Yan Peng
Tao Zhang and Yang Cong is with the State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, University of Chinese Academy of Sciences, China.
Xiaomao Li and Yan Peng is with the School of Mechatronic Engineering and Automation, Shanghai University, Shanghai, China.

- Tactile sensing is important for both humans and robots especially about force sensing.
- In this paper, focusing on force sensing, we first develop a stereo vision based optical multi-modal sensor.
- A contact force field will be estimated by tracking markers in the soft skin.

The schematic of our tactile sensor.

SuB1 Sliding Mode Control and Mechatronics 2

Session Chairs: Wei He and Qun Sun

Room : THE RESIDENCE 1, 15:20-16:50, Sunday, July 22, 2018

SuB1(1) 15:20-15:35

Discrete-Time Quasi-Sliding Mode Control of Induction Motors

Yong Feng, Xuanxuan Wen, Chen Xue
Department of Electrical Engineering, Harbin Institute of Technology, China
Xinhuo Yu, Fengling Han
School of Engineering, School of Science, RMIT University, Australia

- A DSMC is proposed for discrete-time systems and digitalized continuous systems.
- It is developed to make the systems to satisfy the existence of the sliding mode.
- The DSMC is also applied for speed control of induction motors.
- The IM control system can achieve faster convergence and higher steady-state accuracy.

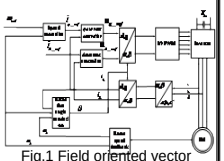


Fig.1 Field oriented vector control system

SuB1(2) 15:35-15:50

Non-singular Terminal Sliding Mode Control of Inverter-Fed PMSM System with chattering elimination

Jian Wen, Qinbo Nie, Yanmin Wang, Member, IEEE, Qinyuan Xu, Yong Feng

Contribution：

- **This paper proposes a novel non-singular terminal sliding mode (NTSM) control approach with function of chattering elimination for PMSM.**
- **The dead time and switching delay of inverter is considered and an integrated nonlinear model of PMSM, inverter and mechanical load is established.**
- **An improved NTSM control method with chattering elimination is proposed by using the concept of relative degree.**
- **An auxiliary adaptive control law is combined to overcome unknown uncertainties of inverter.**

SuB1(3) 15:50-16:05

Second-order Non-singular Terminal Sliding Mode Optimal Control of Uncertain Flexible Manipulator

Qinyuan Xu, Weihua Wang, Hongwei Xia, Yanmin Wang, Yong Feng

Contribution：

- **This paper proposes a second-order nonsingular terminal sliding mode(NTSM) optimal control approach for two-link flexible manipulator with uncertainty.**
- **The system is decomposed into an input-output subsystem and a zero dynamics subsystem to solve its non-minimum phase problem.**
- **A second-order NTSM with two-layer sliding surface is proposed to eliminate the chattering by on the basis of relative degree.**
- **The stability of zero dynamic subsystem is guaranteed by choosing parameters obtained by genetic algorithm.**

SuB1(4) 16:05-16:20

Research on Dynamic Speed Estimation Method for Asynchronous Motor

Jinyong Shangguan, Jinsen Hou，Zhenyou Wang, Jiali Hou and Chong Wang*
School of Mechanical & Automotive Engineering, Liaocheng University, China

- According to previous researches, model reference adaptive system, sliding mode observer and Kalman Filtering with rather low dynamic characteristic were reported. The dynamic characteristics have therefore theoretically analyzed. Based on the mathematical model of asynchronous motor, speed estimation algorithms of model reference adaptive, sliding mode observer and dynamic speed estimator speed senseless models were established in MATLAB/SIMULNK software, the simulation results show that the dynamic speed estimation algorithm has better dynamic performance and excellent stability and reliability than other methods.

SuB1(5) 16:20-16:35

precision monocular plane measurement for large field of view

Laigang Zhang
Liaocheng University, China (zhanglaigang@ lcu.edu.cn)
Yibin Li
Shandong University, China
Yongjun Zhao
MH Robot & Automation Co,.ltd, China
Qun Sun,Ying Zhao
Liaocheng University, China

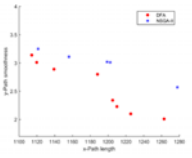
In this paper high precision monocular plane measurement method with large FOV is proposed based on the FLPT that is constructed by multiple small targets. The small target is placed at 9 different positions on the measuring plane, and capture images. Multiple small plane targets are transformed into a large plane target by plane constraint. Calibrate camera by FLTP , the homography matrix of the measurement plane to the image plane is calculated to realize the plane measurement of the large field of view. The experimental results show that the proposed method has a high overall measurement accuracy.

SuB1(6) 16:35-16:50

A Developed Firefly Algorithm for Multi-objective Path Planning Optimization Problem

Peng Duan, Junqing Li, Hongyan Sang, Yuyan Han
School of Computer Science, Liaocheng University, China
Qun Sun
School of Mechanical and Automotive Engineering, Liaocheng University, China

- Grid map extension is realized to ensure the safety of planned path.
- Path length and path smoothness are selected as two important optimization objectives.
- Different evolutionary operators are carried out to search the optimal solutions.
- The well-known ZDT1 instance and the canonical NSGA-II are tested fully to make comparison with the developed firefly algorithm.



The approximate Pareto fronts on R_1 based on the two algorithms.

SuB2 Connected and Automated Vehicles 2

Session Chairs: Hao Zhu and Hongguang Pan

Room : THE RESIDENCE 2, 15:20-16:50, Sunday, July 22, 2018

SuB2(1) 15:20-15:35

A Beam Guardrail Detection Algorithm using Lidar for Intelligent Vehicle

Hao Zhu, Bin Guo
Automotive Electronics and Embedded System
Engineering Research Center, Department of Automation, Chongqing
University of Posts and Telecommunications, Chongqing 400065, China

- Layered feature of Lidar scanning data is used to segment the point cloud into lines.
- Two novel features: corner feature and height feature.
- A clustering algorithm is used to remove some noise extracted points.
- A performance measure is defined to evaluate the performance of the proposed algorithm.

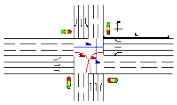
Figure Guardrail detection result

SuB2(2) 15:35-15:50

A Speed Guidance-based Signal Control Method for Divisible Platoon in CVIS

Shu-yang Dong, Jian Zhang, *Member, IEEE*, Han Wang , Bin Ran,
Jiangsu Key Laboratory of Urban ITS, Southeast University, China
Hua-chun Tan
Dept. of Transportation Engineering, Beijing Institute of Technology, China

- Divisible Platoon Communication Structure and Split Rules
- Signal Control Strategy for Divisible Platoons
- Speed Guidance Method and Phase Release Time Calculation
- Simulation in SUMO and Analysis



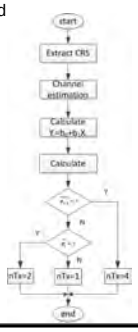
Studied Scenario

SuB2(3) 15:50-16:05

Antenna Port Number Detection Algorithm Based on Channel Estimation in LTE System

Xiaolong Yang , Zhihao Li, Mu Zhou and Pengchun Jiang
Chongqing Key Lab of Mobile Communications Technology,
Chongqing University of Posts and
Telecommunications, China

- Channel Estimation Method based on Phase Rotation
- Antenna Port Number Detection
- Performance Simulation and Analysis

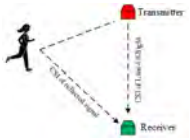


SuB2(4) 16:05-16:20

Human Activity Recognition System Based on Channel State Information

Xiaolong Yang, Ailin He, Mu Zhou , Qing Jiang and Zhihao Li
Chongqing Key Lab of Mobile Communications Technology, Chongqing
University of Posts and Telecommunications, China

- Brief introduction of Channel State Information
- Extraction of activity durations based on adaptive detection threshold
- Human activity recognition based on random subspace classifier ensemble



The process of test

SuB2(5) 16:20-16:35

Air Visibility Prediction Based on Multiple Models

Hongguang Pan, Jikang Xue, Mengtao Huang, Xinyu Lei
College of Electric and Control Engineering, Xi'an University of Science and Technology, Xi'an, China
jkxue1993@163.com

- Support vector machine and genetic neural network are used to predict the air visibility
- Particle swarm optimization neural network is used to predict the air visibility
- The three methods take temperature and humidity, PM2.5 concentration and PM10 concentration as input variables
- The particle swarm optimization neural network is optimal method by comparing performance of three methods

SuB2(6) 16:35-16:50

Model Predictive Control for Uncertain Discrete-time T-S Fuzzy Systems via Event-triggered Dynamic Output Feedback Scheme

Xiaoming Tang and Li Deng
College of Automation, Chongqing University of Posts and Telecommunications, Chongqing

This paper proposes an event-triggered dynamic output feedback model predictive control approach for uncertain discrete-time Takagi-Sugeno (T-S) fuzzy systems with bounded disturbance. An event-triggered communication is introduced to determine whether the measured output should be released or not. The parameter-dependent dynamic output feedback controller is online designed and the MPC optimization problem which minimizes the upper bound of a quadratic objective function in an infinite time horizon can be solved. A numerical example is given to demonstrate the effectiveness of the proposed new design techniques.

SuB3 Power Systems 2

Session Chairs: Yingjun Wu and Bingtuan Gao

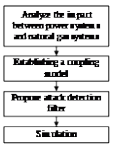
Room : THE RESIDENCE 3, 15:20-16:50, Sunday, July 22, 2018

SuB3(1) 15:20-15:35

A Method to Attack Detection Considering Power Peak Regulation by Natural Gas Generator

Hao Xu and Yingjun Wu
Nanjing University of Posts and Telecommunications, China
Manli Li and Ming Ni
NARI Group Corporation, China

- Natural gas generator is commonly used for power peak regulation.
- The natural gas system and the electric power system form a complex coupling system.
- This paper introduces the models of natural gas system, distribution network and loads.
- A method to detect the attack in such a coupling system is proposed.



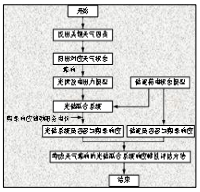
The main content of the article

SuB3(2) 15:35-15:50

Analysis of the Characteristics of PV generation equipped with storage for Power Grid Frequency Response

Xinyi Liang and Yingjun Wu
Nanjing University of Posts and Telecommunications, China
Ciwei Gao
School of Electrical Engineering, Southeast University, China
Songsong Chen, Huaguang Yan and Dezhi Li
Beijing Key Laboratory of Demand Side Multi-Energy Carriers Optimization and Interaction Technique and China Electric Power Research institute,China

- The most influential factors of weather conditions on PV power generation are investigated
- Studies the decision-making of PV generation equipped with storage participating into frequency response.
- Analyze characteristics of frequency response of PV generation equipped with storage affected by weather conditions .



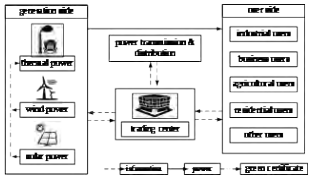
Process of this article

SuB3(3) 15:50-16:05

A Bidding Optimization Method for Renewable Energy Cross-regional Transaction under Green Certificate and Carbon Emissions Trading Mechanisms

Jing Ling[1], Long Zhang[2], Yiqian Sun[3], Lei Zhang[4], Ning Chen[4], Bingtuan Gao[1]
[1]School of Electrical Engineering, Southeast University, Nanjing 210096, China
[2]Electric Power Research Institute, State Grid Xinjiang Electric Power Corporation Ltd, Urumqi 830002, China
[3]State Grid Xinjiang Electric Power Corporation Ltd, Urumqi 830063, China
[4] China Electric Power Research Institute State Key Laboratory of Operation and Control of Renewable Energy & Storage Systems, Nanjing 210003, China

- A cooperative game approach is formulated for power plants in sending end area to schedule the bidding strategies.
- A profit distribution model is established according to the marginal contribution of each power plant in the cooperation.
- Simulation results show that the proposed approach can increase the profit of each power plant.



Cross-regional power transaction market structure

SuB3(4) 16:05-16:20

A multi-stage game model for the false data injection attack against power systems

Qi Wang, Xingpu Cai, Wei Tai, Yi Tang
The School of Electrical Engineering , Southeast University.

- a game-theoretic approach is proposed to analyze the detailed multi-stage dynamic attack-defense process to protect the critical measurements.
- The case study of the game model on the IEEE 9-bus system in both one-stage and multi-stage process were solved and constrasted.

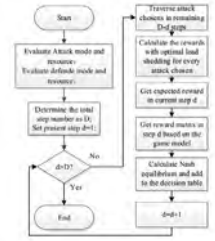


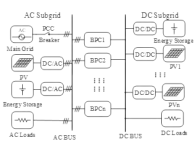
Fig.1 Multi-stage defense strategy making process

SuB3(5) 16:20-16:35

State of Charge Based Decentralized Coordination Control for Multiple Bidirectional Power Converters in a Hybrid AC/DC Microgrid

Zeyan Lv, Pengcheng Yang, Yanghong Xia,
College of Electrical Engineering, Zhejiang University
Miao Yu and Wei Wei
College of Electrical Engineering, Zhejiang University

- Researched a hybrid microgrid topology with energy storages in both AC side and DC side
- Proposed a SOC signal deliver strategy without communication lines
- Proposed a SOC management strategy for multiple bidirectional power converters



Hybrid microgrid topology with two energy storages

SuB3(6) 16:35-16:50

Average-Value Modeling of Photovoltaic Generation Systems

Zeqi Hong, Yin Xu, Jinghan He, and Pinghao Ni
the School of Electrical Engineering, Beijing Jiaotong University, China
Yong Yao
the State Grid Chongqing Power Company, China

- A parametric is introduced to construct the generalized average-value model (AVM) of a two-stage three-phase inverter.
- The AVM of inverter is integrated into a photovoltaic (PV) generation system.
- The PV generation system model is implemented in a distribution system to prove its validity and effectiveness.
- The model helps improve the efficiency of electromagnetic simulation for distributed generations.

SuB4 Automation in Real-world Applications

Session Chairs: Tao Li and Guoli Song

Room : THE RESIDENCE 4, 15:20-16:50, Sunday, July 22, 2018

SuB4(1) 15:20-15:35

Data-Driven Modeling for PDF Shaping of Fiber Length Distribution in Refining Process

Mingjie Li and Ping Zhou
State Key Laboratory of Synthetical Automation for Process Industries, Northeastern University, China

- Pulp quality in the refining process mainly depends on the shape of fiber length distribution
- Mean of fiber length is insufficient to describe the shape of fiber length distribution
- Data-driven modeling method is proposed for the PDF shaping of fiber length distribution

SuB4(2) 15:35-15:50

Optimization on Management Strategies for Spare Parts Inventories of Wind Turbine Components

Xudong Wang and Qinmin Yang
State Key Laboratory of Industrial Control Technology,
College of Control Science and Engineering, Zhejiang University, China
Qi Chen and Lingkun Fu
State Key Laboratory of Wind Power System,
Zhejiang Windey Co., Ltd., China

- The purpose of the optimization is reducing the operation and maintenance costs existing in wind farms.
- The optimization model is established with non-stationary stochastic demands under continuous review (*r, Q*) polices.
- The stock-out penalty cost caused by the shortage of spare parts is quantified based on importance of the wind turbine component.

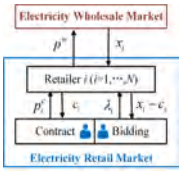
Logistics system: wind farm and its original equipment manufacturer

SuB4(3) 15:50-16:05

Modeling and Simulation of Electricity Retail Market with Oligopolistic Equilibrium Method

Chen Zhao, Shaohua Zhang, Xian Wang
Department of Automation, Shanghai University, Shanghai, China
Tao Li
Department of Mathematics, East China Normal University, Shanghai, China

- A Bertrand equilibrium model is established for retailers' bidding in the electricity retail market considering retailers' contract trading.
- Market share function is introduced to describe the differences in reputation among retailers.
- The existence and uniqueness of the Nash equilibrium are proved.
- Theoretical analysis and numerical simulation show retailer's market power can be mitigated by contract trading in the oligopolistic retail market.



Sale and purchase structure of the retailer

SuB4(4) 16:05-16:20

Forecasting and Analysis of EUR/USD Exchange Rate Moving Direction with Support Vector Machine

Zhao A. and Zhang D.
College of computer science and technology,
Zhejiang University of Technology, China
Shi J.Q.
College of computer science and technology,
Zhejiang University of Technology, China

- Applied the forecasting model to the history data of per four hours of EUR/USD
- SVM with the new features is used as a classifier to forecast the direction
- Have a futher adjust to the forecasted result of SVM

SuB4(5) 16:20-16:35

Adaptive robust model tracking control of nonlinear dynamical systems with unmatched disturbances

Yuchao Wang, Sanyan Chen, Wenrui Shi, Lijia Xu
College of Mechanical and Electrical Engineering, Sichuan Agricultural University, Yaan 625014, China

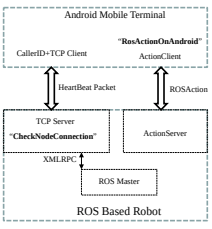
In this paper, the problem of adaptive robust model tracking for nonlinear dynamical systems with parametric uncertainties and unmatched disturbances has been studied. It has been assumed that the unmatched disturbances are continuous and have unknown upper bounds. It has been also assumed that the parameter uncertainties are unknown. An adaptive robust controller for tracking reference model have been proposed. In the presence of parameter uncertainties and unmatched disturbances, the tracking error can be guaranteed to be uniformly ultimately bounded by using our proposed controller. Finally, a numerical example is given to illustrate the validity of the proposed control scheme.

SuB4(6) 16:35-16:50

Reliable Communication Mechanism Design for Interaction Between Android and ROS

Zhenzhou Shao and Mengnan Li
College of Information Engineering, Capital Normal Unversity, China
Ying Qu
Engineering College, The University of Tennessee, Knoxville, USA

- This paper presents the communication reliability mechanism in the interaction between the android and ROS based robot.
- *CheckNodeConnection* is proposed to detect the network anomaly and avoid the robot running out of control.
- *RosActionOnAndroid* communication mechanism is presented to enable the preemptable tasks and execution status feedback.



SuC1 Robot Control and Planning

Session Chairs: Krzysztof R. Kozlowski and Chao Ren

Room : THE RESIDENCE 1, 17:00-18:15, Sunday, July 22, 2018

SuC1(1) 17:00-17:15

The Path Planning Method of Tensegrity Robot Based on A* Algorithm

Chang Jian, Li Bin
State Key Laboratory of Robotics, Shenyang Institute of Automation Chinese Academy of Sciences, China
Liu Wenyuan
Northeastern University, Computer and information engineering college, China

- Structure model established of tensegrity robot
- Structure model analysis of tensegrity robot
- Path planning of TR-6 based on A* algorithm which includes model established of environment and evaluation function design

Figure Prototype of TR-6

SuC1(2) 17:15-17:30

Improved Fuzzy Logic Rules and Effective Searching Box Method for Mobile Robot Obstacle Avoidance

Zubing Liu, Heping Chen and Xianhe Wen
Shenzhen Academy of Robotics, China
Liang Yuan
College of Mechanical Engineering, Xinjiang University, China

- Simplified fuzzy logic and effective searching box are used to improve performance of Obstacle avoidance.
- The experiment platform is a three-wheel omni-directional robot in LabVIEW simulation environment.
- The success rate of the improved obstacle avoidance algorithm is improved by 45%~60%.

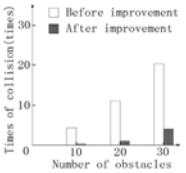


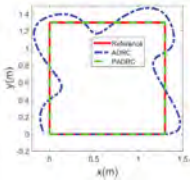
Figure 1. Comparison of the collision frequency of the algorithm before and after the improvement.

SuC1(3) 17:30-17:45

Passivity-based Active Disturbance Rejection Control of an Omnidirectional Mobile Robot

Chao Ren[1], Yutong Ding[1] and Shugen Ma[1,2]
[1]School of Electrical and Information Engineering, Tianjin University, China
[2]Department of Robotics, Ritsumeikan University, Japan

- A passivity-based active disturbance rejection control scheme is proposed.
- A modified reduced-order extended state observer is designed, to avoid the inverse operation of matrix.
- The proposed approach effectively exploits the natural dissipation of the dynamics system.
- Simulations are conducted to verify the effectiveness of the proposed approach.



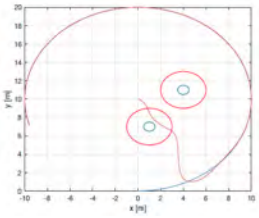
Simulation Results

SuC1(4) 17:45-18:00

Collision Avoidance with Artificial Potential Function for Two-Wheeled Mobile Robot Tracking Desired Trajectory

Krzysztof Kozłowski and Wojciech Kowalczyk
Poznań University of Technology, Poznań, Poland
Institute of Automation and Robotics

- Two trajectory tracking control algorithms for differentially-driven mobile robots,
- Collision avoidance using Artificial Potential Functions,
- Stability proof,
- Numerical verification.



SuC1(5) 18:00-18:15

An Autonomous Air-Ground Cooperative Field Surveillance System with Quadrotor UAV and Unmanned ATV Robots

S. Zhang[1,2], H. Wang[1,2], S. He[1,2], C. Zhang[1,2] and J. Liu[1,2]
1.Institute of Robotics and Automatic Information System, Nankai University, Tianjin, China
2.Tianjin Key Laboratory of Intelligent Robotics, Tianjin, China

- In this paper we present a cooperative system for field surveillance
- The system consists of a Quadrotor UAV and a Unmanned ATV
- The vehicles can work in the field environment autonomously

The Field Surveillance System

SuC2 Medical Robotics and Systems

Session Chairs: Airu Yin and Donghao Lv

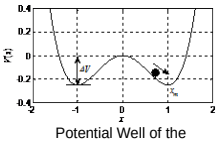
Room : THE RESIDENCE 2, 17:00-18:15, Sunday, July 22, 2018

SuC2(1) 17:00-17:15

Detection Research on Tiny Remainders inside Sealed Electronic Components

Wang Shicheng, Liu Yongxin
Army Aviation Institute, China
Li Cuie
Beijing City University, China

- Remainder would affect the reliability of component seriously.
- PIND is a method of remainder detection proposed by NASA.
- The impact intensity has a direct influence on the detection results.
- But for tiny remainders the signals are so low that swamped by noises.
- So, the detection method based on stochastic resonance is presented for the tiny remainders.



Potential Well of the Bistable System

$$V(x) = -\frac{a}{2}x^2 + \frac{b}{4}x^4 \quad a>0, b>0$$

$$\dot{y} = ay - \bar{b}y^3 + \bar{s}(t) + N_0(t)$$

SuC2(2) 17:15-17:30

A Shallow Neural Network based Short Text Classifier for Medical Community Question Answering System

Hong Cai and Ziwei Li and Cuiting Yan and Jie Liu and Airu Yin
CCCE&CS, Nankai University, China

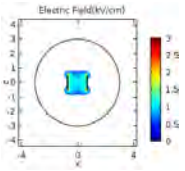
- We crawls and constructs a real Chinese medical Q&A dataset and conducts experimental verification.
- A shallow CNN is used to obtain key words and phrase features from the context through different sizes of filter and pooling strategies as well as learning characteristic-level sequence feature of sentences.
- Experiments illustrate the effectiveness of our method in domain of MCQA comparing with some popular approach in text classification from natural language processing

SuC2(3) 17:30-17:45

Study on the Optimal Electric Field Parameters of Electrode Based on Irreversible Electroporation

Donghao Lv, Xiaobo Yang, Yang Li, and Xinchun Wang
School of Information and Technology, Inner Mongolia University of Science and Technology, China

- The model of electric field in different area of action lays the foundation for calculating the electric field distribution around the electrode
- Experimental results show that with the increase of electrode distance, the trend of non-connection and invagination are more and more obvious
- It is possible to find optimal parameters for tumor therapy to achieve an efficient killing effect on tumor and to minimize the side effects of surrounding normal tissue



The simulation of electric field distribution with pulse

SuC2(4) 17:45-18:00

A Novel Method for Measuring the Flow Rate of High Viscous Fluid in Polymer Injection Well by Nonuniform Magnetic Field Electromagnetic Flowmeter

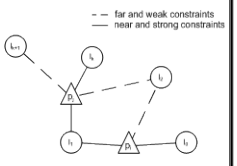
Yanjun Wang, Haoyu Li, Xingbin Liu, Longlin Chen and Ronghua Xie, Lianfu Han
Harbin Institute of Technology, Harbin, China
Daqing Oilfield Limited Company, Daqing, China
Lihy@hit.edu.cn
Dlts_liuxb@petrochina.com.cn

SuC2(5) 18:00-18:15

Map Optimization With Distance-based Covariance in Industrial Field

Wanbiao Lin, Lei Sun, Jianchao Song, Jingtai Liu
Institute of Robotics and Automatic Information System, Nankai University
Xinwei Chen
Minjiang University, China

- Noise-distance model is constructed based on experiment results
- The covariance of each constraint can be estimated according to the noise-distance model
- The precision of map can be improved by graph optimization with distance-based covariance



SuC3 Power Systems 3

Session Chairs: Congzhi Huang and Xiaoyan Sun

Room : THE RESIDENCE 3, 17:00-18:15, Sunday, July 22, 2018

SuC3(1) 17:00-17:15

A Wind Turbine Classification Method Using Fuzzy C-means Algorithm Based on Self-adjusting Chaotic Particle Swarm Optimization

Zhiwei Xue[1], Xiaohui Lu[1], Qiang Guo[2], Longying Zhang[2], Songtao Zhang[3], Congzhi Huang[3]

1. State Grid Shanxi Electric Power Company, Taiyuan, 030001, China

2. State Grid Shanxi Electric Power Research Institute, Taiyuan, 030001, China

3. School of Control and Computer Engineering, North China Electric Power University, Beijing 102206, China

E-mail: hcz190@ncepu.edu.cn

Abstract—A wind turbine classification method using fuzzy c-means algorithm based on self-adjusting chaotic particle swarm optimization (SACPSOFCM) is proposed in this paper. According to the historical operating data, wind turbines are classified into several classes with different running state using SACPSOFCM. The wind turbines running in good condition and with stable and high power output are given the dispatch priority. The calculation of the subsequent load command dispatch will be greatly reduced based on the classification. It is verified by experiments that wind turbines can be correctly classified by SACPSOFCM according to real operating data, and the experimental results prove the clustering performance superiority of SACPSOFCM over the fuzzy c-means algorithm based on particle swarm optimization (PSOFCM).

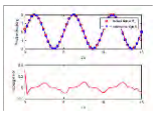
SuC3(2) 17:15-17:30

Adaptive Control for Hysteresis motor driving servo System with Preisach Model

Xuehui Gao and Bo Sun

Department of Mechanical and Electrical Engineering, Shandong University of Science and Technology, China

- An adaptive controller is proposed for hysteresis motor driving servo system
- The hysteresis nonlinearity is described by Preisach model
- High order neural network(HONN) estimates the unknown parameters
- Tracking error is represented as a scalar error
- Lyapunov function guarantees the stability of the closed-loop system



Adaptive control results and Tracking error

SuC3(3) 17:30-17:45

Output Feedback Switching Controller Design for LTI System with H2 Performance Realizations

Weilin Wu, Wei Xie, Wei He, Langwen Zhang

College of Automation Science and Technology, South China University of Technology

- This paper focuses on designing a switching controller, which includes several LTI controllers designed beforehand and independently for a specific LTI plant. All these controllers are capable of stabilizing the plant with corresponding H2 control performance criterions. It's possible to find a suitable state space realization for any given family of controller transfer matrices, which not only guarantees certain H2 performance of the overall closed-loop system under arbitrary switching but also guarantees corresponding H2 performance of local subsystems at each switching points.

SuC3(4) 17:45-18:00

sliding mode control of the dc-dc converter based on high-gain observer

Hebin Wang, Chunhong Han, and Rui Bai

Liaoning University of Technology Jinzhou, China,

- The Model of Buck Converter
- Design of the Buck Converter With High Gain Observer
- Design of The Sliding Mode Control Based on High Gain Observer

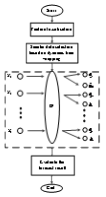
SuC3(5) 18:00-18:15

Interval Day-ahead Load Forecast of Micro Grid with Fuzzy Similar Data Selection and Gaussian Process

Hui Shao, Xiaoyan Sun, Lin Zhao and Jingren Wang

School of Information and Control Engineering, China University of Mining and Technology, China

- A fuzzification method of the most important features impacting the load forecast is presented.
- The similar data selection based on the fuzzified features and dynamic time warping is proposed .
- The Gaussian process with the fuzzified features is trained to obtain the load interval forecast.



Framework of our algorithm

SuC4 Structural Analysis and Evolutionary Dynamics of Complex Systems

Session Chairs: Chengyi Xia and Guoyuan Qi

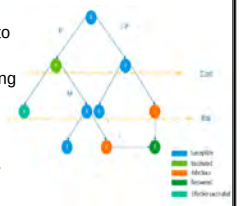
Room : THE RESIDENCE 4, 17:00-18:15, Sunday, July 22, 2018

SuC4(1) 17:00−17:15

Incorporating game theory into voluntary vaccination

Xinyu Wang[a], Peican Zhu[b], and Zhen Wang[a]
[a]Center for OPTicall Magery Analysis and Learning (OPTIMAL),
[b] School of Computer Science
Northwestern Polytechnical University (NWPU)

- We integrate a game-theoretic framework into the SIR epidemiological process.
- We also try to investigate the effects of varying different factors on the voluntary vaccination coverage.
- Our work sheds light on how benefits affect individuals' choices regarding to vaccination.

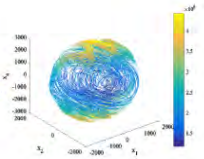


SuC4(2) 17:15−17:30

A Hamiltonian Conservative chaotic system

Guoyuan Qi
School of Electrical Engineering and Automation
Tianjin Polytechnic University, China

1. Literature review and problem statements
2. Modelling of a 4D Euler equation
3. Modelling of a Hamiltonian conservative chaotic system with Large Lyapunov exponent
1. Analysis of 4D Hamiltonian chaotic system



SuC4(3) 17:30−17:45

A fast graph clustering algorithm based on the belief dynamics

Hui-Jia Li,
School of Management Science and Engineering,
Central University of Finance and Economics, Beijing 100080, China. (email:hjli@amss:ac:cn)
Zhan Bu ,
Jiangsu Provincial Key Laboratory of E-Business, Nanjing University
of Finance and Economics, Nanjing 210003, China.
Chengyi Xia
School of Computer Communication and Engineering, Tianjin University of Technology,
Tianjin 300384, China.

The traditional optimization or heuristic methods are usually used based on the assumption that clusters are groups of nodes similar to each other, they often compare the internal and external cohesion of a subgraph. However, to obtain an acceptable accuracy, these methods usually have a high-level computational complexity. To detect the cluster configuration with a high speed, in this paper, we introduces a new algorithm that discovers the network clusters using the limit state of the belief dynamics model we proposed. Under the strict convergence condition of belief dynamics, the cluster labels of the corresponding node will converge to the ideal states. The algorithm is very fast and its computational complexity is O(N) for sparse networks, which is very easy to implement. Extensive simulations using both synthetic benchmark networks and realworld networks.

SuC4(4) 17:45−18:00

Exploring small-world property of brain network during fatigue-driving

Weidong Dang and Zhongke Gao
School of Electrical
and Information Engineering, Tianjin University, China

- Conducting simulated driving experiments to explore the change of small-world property in brain network
- Phase lag index is applied to construct the brain functional network from EEG signals
- the small-world property increases after the driving fatigue occurs
- Providing an insight into the self-optimizing mechanism of brain for maintaining efficient information processing

Driving simulator device and experimental scene settings

SuC4(5) 18:00−18:15

A Novel Community Detection Algorithm Based on the Node Correlation Strength in Complex Networks

Yongping Luo, Li Wang, Shiwen Sun, Chengyi Xia
Key Laboratory of Intelligence Computing and Novel Software Technology,
Tianjin University of Technology, China

- The node correlation strength is proposed and used to measure the similar nodes;
- A novel algorithm based on the node correlation strength is proposed and named NCS;
- The number of community given by the NSC algorithm is consistent with the actual number;
- The time complexity of the NCS algorithm is close to $O(n + m)$.

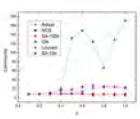


Figure 1 Number of communities given by the current algorithms

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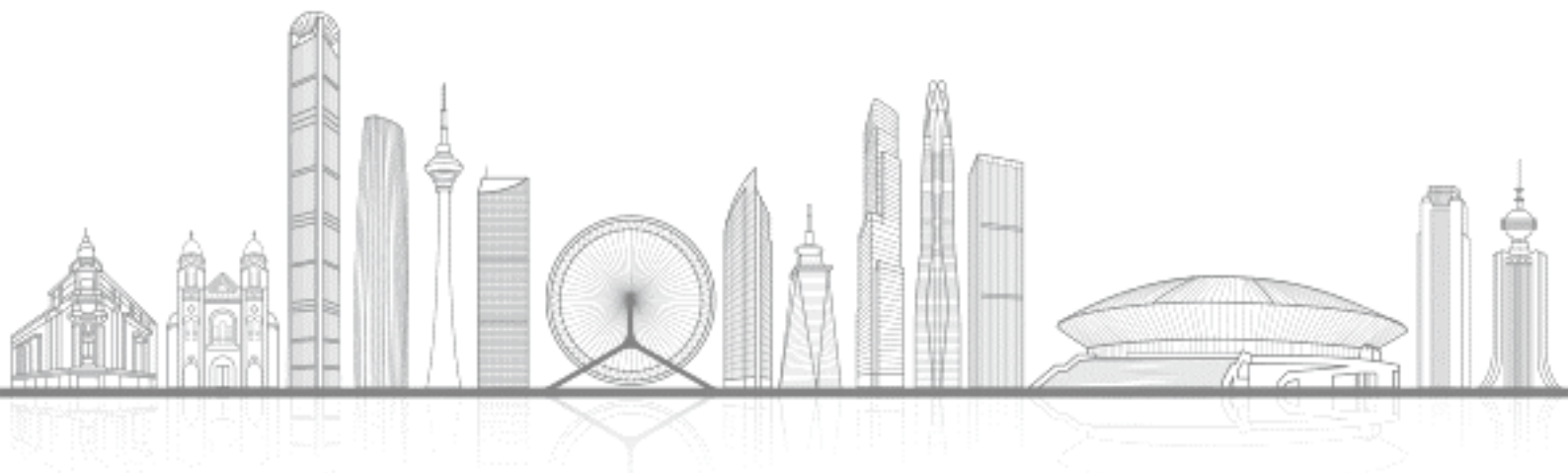

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Li, Zerui		FrPoA
Li, Zhengxi		SaPoB
		SaPoB
Li, Zhi		FrC2
Li, Zhihao		SuB2
Li, Zhihao		SuB2
Li, Zhijun		FrPoB
		SaA2
		SuA4
Li, Ziwei		SuC2
Lian, Chao		FrC1
Lian, Yufeng		SaPoA
Liang, Bin		FrB2
Liang, Chen		SuA4
Liang, Dong		SaPoB
		SuA3
Liang, Jiaqi		FrC4
Liang, Wei		FrB6
Liang, Xiao	CC	FrC5
	CC	FrPoA
	CC	FrPoB
Liang, Xinyi		SuB3
LIAO, Qinghai		FrPoA
Lin, Jiaxi		FrC4
Lin, Lei		SaPoA
Lin, Shanrong		SaA4
Lin, Wanbiao		SuC2
Lin, Yang		SaA4
Lina, Hao		SaPoA
Ling, Huang		SaPoB
Ling, Jing		SuB3
Ling, Rui		SaPoB
Ling, Yancui		SaPoA
Liu, Baolu		SaB4
Liu, Bin		FrPoA
liu, bin		FrPoB
Liu, Bing		SaPoB
Liu, Bingyang		SaC1
Liu, Changqing		SaB4
Liu, Ding		FrB6
Liu, Dong		FrPoB
		SaA2
Liu, Dongfang		SaA4
		SaB4
Liu, Guang		FrA3
Liu, Guocong		SaA1
Liu, Guodong		SaB4
Liu, Hong		SaB3
Liu, Houde		FrB2
Liu, Huaping		FrA2
		FrA2
Liu, Jie		SuC2
Liu, Jingtai		FrA4
		FrA5
		FrC4
		SaC3
		SuC1
		SuC2
Liu, Jinkun		SaPoA
		SaPoA
Liu, Jizhu		FrPoA
Liu, Kaijian		FrB4
Liu, Kunbin		SuA1
Liu, Lei		SaPoA
Liu, Liang		FrA3
Liu, Lianqing		FrA6
		FrC1
		FrC2
		FrC4
		SaC1
	CC	SaC3
Liu, Lin		SaPoA
Liu, Lu		SuA1

- M -

- N -

- O -

- P -

- Q -

- R -

- S -

Wang, Youqing		SaB4
	CC	SaB4
Wang, Yuchao		SuB4
Wang, Yue		FrA6
Wang, Yufan		FrC4
Wang, Zhanshan		SaA4
Wang, Zhe		FrPoA
		SaC3
Wang, Zhen		SuC4
Wang, Zhenyou		SuB1
Wang, Zhepei		FrA3
Wang, Zunran		SuA4
Wei, Hongxing		SuB4
Wei, Lei		FrPoA
Wei, Meng		FrPoB
Wei, Wei		SaPoB
		SuB3
Wei, Xuting		SuA2
Wei, Zhinong		SaPoB
Weixun, Li		SaC4
Wen, Xianhe		SuC1
Wen, Xuanxuan		SuB1
Wen, Yangdong		FrC2
Wu, Changcheng		FrC1
Wu, Di		SuA1
Wu, Dongrui		FrC5
wu, jinting		FrPoA
Wu, Jinyong		FrPoA
Wu, Shuangjiang		FrC1
Wu, Shuo		FrC3
Wu, Wei		SuA4
Wu, Weilin		SuC3
Wu, Xiangyu		SuA3
Wu, Xichun		SaPoB
		SuA3
Wu, Yinan		SaPoA
Wu, Yingjun		SuB3
	CC	SuB3
Wu, Yu		SuA2
Wu, Yue		SaB2
Wu, Zeyi		FrB1

- X -

Xi, Ning		FrB5
		FrB6
		SaB1
xi, yafei		SaB3
Xia, Chaopeng		SuA3
Xia, Chengyi		SuC4
		SuC4
	CC	SuC4
Xia, Yanghong		SaPoB
		SuB3
xia, zeyang		SaC1
Xian, Bin		FrC5
	CC	FrC5
Xiang, Ji		SaB2
	CC	SaB2
Xiang, Xinyan		SuA4
Xiao, Jizhong	CC	FrA6
		FrC4
	CC	FrC4
Xiao, Junhao		FrA3
Xiaoping, Ma		SaB2
Xie, Bin		FrPoB
Xie, Cheche		FrPoA
Xie, Dongmei		SaC4
Xie, Dongmei	CC	SaC4
Xie, Wei		SuC3
xin, Jin		SaB2
Xin, Jing		FrB6
xin, zhou		SaPoB
Xinfang, Zhang		FrA4
Xing, Li		SaPoA
xing, xuyan		SaC1
Xingyao, Yu		FrB2
Xingzi, Bi		FrB2
Xiong, Rong		FrA6
Xiong, Xiaogang		FrC1
Xu, Changbao		FrPoA
Xu, Chao		FrA3
Xu, Fang		FrPoA
xu, fulai		FrA4
Xu, Guozheng		SaC1
Xu, Juanjuan		FrA1
Xu, Lin		FrPoB
		FrPoB
Xu, Qingshan		SuA3
Xu, Qingsong		FrB1
Xu, Rui		FrPoA
Xu, Wei		SaC3
		SaC3
Xu, Wenfu		FrB2
		FrB2
Xu, Xiaohuo		FrA2
Xu, Xiubo		FrPoB
Xu, Yin		SaPoB
		SuA3
		SuA3
		SuB3
Xu, Yuan		SaA2
Xue, Cuihong		FrPoA
Xue, Jikang		SuB2
Xue, Yusheng		FrPoA
Xue, Zhiwei		SuC3
Xueming, Li		SaPoB
Xueqian, Wang		FrB2

- Y -

Yan, Cuiting		SuC2
Yan, Fei		FrA3
Yan, Huaguang		SuA3
		SuB3
Yan, Jiawen		FrB3
Yan, Lei		FrB2
Yan, Peng		SuA4
Yan, Zhiyuan		FrB3
Yan, Zichen		SaA4
Yang, Chenguang		SaA2
	CC	SaA2
		SuA4
	CC	SuA4
Yang, Chunyu		FrPoA
Yang, Dehua		FrC1
Yang, Guocai		SaB3
Yang, Jun		SaPoB
		SaPoB
Yang, Kaizhi		SaC1
Yang, Kun		FrB5
Yang, Lei		SaPoA
Yang, Libin		SuA3
Yang, Liying		SaB4
Yang, Longwen		FrPoA
Yang, Min		FrC1

- Z -

Zhang, Peng		SaB1
Zhang, Qian		FrA4
		FrA4
Zhang, Senlin		FrB4
Zhang, Shangjun		SaA4
Zhang, Shaohua		SuB4
Zhang, Shiyong		SuC1
Zhang, Sisi		FrPoB
Zhang, Songtao		SuC3
Zhang, Tao		FrPoB
		SuA4
Zhang, Weiguo		SaPoB
Zhang, Wentao		FrB6
Zhang, Xiaodong		SaB1
	CC	SaB1
Zhang, Xiaolu		FrB5
Zhang, Xinghui		FrB5
Zhang, Xinyi		FrPoB
Zhang, Xinyu		FrA2
Zhang, Xuebo		FrPoB
		SaA2
		SaA2
	CC	SaPoA
	CC	SaPoB
Zhang, Yan		SaPoA
Zhang, Yanan		FrPoA
Zhang, Yiduo		FrA4
Zhang, Ying		SaPoA
Zhang, Yingjie		FrPoB
Zhang, Yinlong		FrB6
Zhang, Yizhai	CC	SaC3
Zhang, You-min		FrB6
Zhang, Yufeng		FrPoA
Zhang, Yuzhe		SuA4
Zhang, Zhengqiang		SaPoA
Zhao, A.		SuB4
Zhao, Baoguo		SuA3
Zhao, Baoliang		FrB3
Zhao, Chen		SuB4
Zhao, Guowei		SaC3
		SaC3
Zhao, Haobo		SuA4
zhao, kexue		FrPoB
zhao, kuang		FrA3
Zhao, Kuang		FrA3
zhao, Liang		SaC1
Zhao, Lin		SuC3
Zhao, Minghui		FrPoB
zhao, quan		FrPoA
zhao, xiaoguang		FrPoA
Zhao, Xiaoyu		SaB3
Zhao, Xin		FrPoA
Zhao, Xingang		SaC1
Zhao, Xinlong		FrC1
Zhao, Yang		FrPoB
Zhao, Ying		SuB1
Zhao, Yiwen		FrA5
		SaC1
Zhao, Yongjun		SuB1
zhao, yuan		FrPoB
Zhao, Yue		FrPoB
Zhao, Yuliang		FrC1
		FrC4
Zhao, Yunbo		FrPoA
Zhao, Yunpeng		FrA5
ZHENG, Jianyong		SaPoB
Zheng, Qingwen		FrB3
Zheng, Shuang		SuA4
zheng, xuemei		FrPoA
Zheng, You		FrA2
zheng, yuan		FrA3
zhenning, pan		SaPoB
Zhijian Ji, Prof.		FrA1
		FrPoB
Zhinong, Wei		FrPoB
zhiping, Liu		FrC3
zhiqiang, zheng		FrC2
Zhirui, Zhao		SaPoA
Zhongjie, Meng		FrB2
Zhongxi, Liu		FrPoB
Zhou, Bin		FrPoA
Zhou, Chongkai		FrB1
Zhou, Chujie		FrPoB
Zhou, Haixiang		SuA4
zhou, han		FrA3
Zhou, Han		FrA3
Zhou, Jie		SaB1
Zhou, Lelai		FrB5
Zhou, Linna		FrPoA
Zhou, Meng		SaB2
Zhou, Mo		FrA2
Zhou, Mu		SuB2
		SuB2
Zhou, Peilin		FrC2
Zhou, Shanshan		FrPoB
Zhou, Wei		SaPoB
Zhou, Weisong		SaA4
	CC	SaA4
Zhou, Wenjuan		SuA2
Zhou, Wenli		FrC3
	CC	FrC3
Zhou, Xingqun		FrA5
zhou, yong		FrA3
Zhou, Yong		FrA3
Zhou, Zhengyuan		FrA3
Zhou, Zhihao		SaA1
Zhou, Zhiwei		SaA1
Zhu, Bing		SaC3
Zhu, Erlin		SaB3
Zhu, Hao		SuB2
	CC	SuB2
Zhu, Hua		SaC2
Zhu, Jiangcheng		FrA3
Zhu, Jinchao		FrC4
Zhu, Mingyue		SaC3
zhu, peican		SuC4
Zhu, Qianxiang		FrPoB
Zhu, Wenwu		SuA1
Zhu, Xiaojun		FrA4
Zhu, Ya		FrPoB
Zhuang, Yan		FrA3
	CC	FrA3
zhuikui, Tan		SaPoB
Zong, Jin		SaPoB
		SuA3
Zou, Fengshan		FrPoA
Zou, Qiang		SaA2
Zou, Wuhao		FrC2
Zuo, Zhiqiang		FrB6