ICIRA 2019
Conference Program

The 12th International Conference on Intelligent Robotics and Applications

8-11 August 2019
Shenyang, China　　www.icira2019.org

Contents

Welcome to ICIRA 2019 !

Haibin Yu
General Chair of ICIRA 2019
Shenyang Institute of Automation,
Chinese Academy of Sciences

On behalf of the Organizing Committee, we sincerely welcome our colleagues worldwide to join us for the 12th International Conference on Intelligent Robotics and Applications (ICIRA 2019), being held in Shenyang, China. Through this conference, we intend to enhance the sharing and inspiring of individual experience and expertise in robotics, automation and mechatronics on both theory and practice.

The conference has attracted a total of 506 submissions, addressing the state-of-the-art development and research covering topics in intelligent robotics, with particular emphasis on technical challenges associated with various applications. Following the rigorous review of the submissions, a total of 378 papers (74.7% acceptance rate) were selected to be published and presented at the conference in either oral presentation or as posters. We sincerely hope that, with these contributions ICIRA 2019 will prove to be an important resource for the scientific community in the future.

The conference program arranges 6 plenary talks and 31 invited keynotes. We are privileged to have the plenary speeches given by Professor I-Ming Chen from Nanyang Technological University (Singapore), Professor Etienne Burdet from Imperial College London (UK), Professor Fumihito Arai from Nagoya University (Japan), Professor Huayong Yang from Zhejiang University (China), Prof. Yaochu Jin from University of Surrey (UK), and Professor Shugen Ma from Ritsumeikan University (Japan). We are honored to have these world-renowned researchers to share their view and expertise in ICIRA 2019.

Here we would like to express our sincere thanks to all individuals who have made a contribution to ICIRA 2019. Special thanks are extended to the paper reviewers for their thorough review of all the submissions, to the Organizing Committee and to our volunteers for their warm, thoughtful service to participants. We also would like to express our high appreciation and gratitude to our distinguished plenary talk speakers and invited keynote speakers, as well as all of the authors and participants who are attending this conference. We are sure that all your dedication and contribution will ensure ICIRA 2019 is a significant success.

Welcome to ICIRA 2019!

Conference Organization

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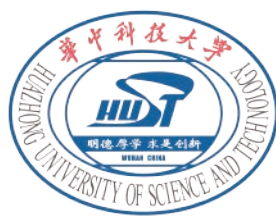
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Conference Information

Registration

The registration desk will be open during following times on the ground floor of the conference venue.

- Wednesday 7 August, 12:00-19:00
- Thursday 8 August, 08:30-20:00
- Friday 9 August, 07:00-18:00
- Saturday 10 August, 07:00-12:00

On-site registration fee

Registration type	Registration fee
Non-student Registration	3700 Chinese Yuan
Student Registration	3200 Chinese Yuan
Additional Banquet Ticket	350 Chinese Yuan

Presentation guidelines

Oral Presentation: A 15-minute oral presentation is arranged for each paper in oral sessions including a 12 minutes' slides and 3 minutes' Q&A. It is expected that you bring your own PowerPoint slides to the conference either with/without your personal laptop. The desktop/laptop, the projector, the display port/cable and the wireless presenter will be provided by our staff in oral sessions.

Poster Presentation: Our staff will print the A0 portrait posters out and ready for you in the poster sessions. You are expected to respond to the questions raised by the attendees during the presentation of your poster.

Internet

During the period of the conference, standard access to Internet is available within the conference venue.

Best Paper Award

The ICIRA 2019 Best Paper Award will be announced on 10 August during the conference banquet.

Banquet

ICIRA 2019 Banquet will be held at 19:00 on Saturday 10 August, at the Main Hall on 3rd Floor (3楼东北会堂).

Conference Venue

Shenyang Northeast Hotel (99 Harbin Road, Shenyang, Liaoning, China, 110003) Tel: +86-24-62508888

Secretariat Contact

Xi'ai Chen (18642089802)
Xin Zhang (18842343283)
Dalin Zhou (13991918896)

Session Rooms

The plenary talks will be all arranged at the Main Hall on 3rd Floor (3楼东北会堂).

The poster demonstrations will be all arranged at the Longfeng Hall on 2nd Floor (2楼隆奉厅)

The oral presentations will be arranged at:

FrA1, FrB1, FrC1, SaA1: Longfeng Hall A on 2nd floor (2楼隆奉A厅)

FrA2, FrB2, FrC2, SaA2: Longfeng Hall B on 2nd floor (2楼隆奉B厅)

FrA3, FrB3, FrC3, SaA3, SaB1, SaC1: No. 8 Meeting Room on 5th floor (5楼第八会议室)

FrA4, FrB4, FrC4, SaA4, SaB2, SaC2: No. 9 Meeting Room on 6th floor (6楼第九会议室)

FrA5, FrB5, FrC5, SaA5, SaB3, SaC3: No. 6 Meeting Room on 3rd floor (3楼第六会议室)

FrA6, FrB6, FrC6, SaA6, SaB4, SaC4: No. 7 Meeting Room on 3rd floor (3楼第七会议室)

FrA7, FrB7, FrC7, SaA7, SaB5, SaC5: Activity Room on 5th floor (5楼活动室)

FrA8, FrB8, FrC8, SaA8, SaB6, SaC6: No. 2 Meeting Room on 3rd floor (3楼第二会议室)

Program at a glance

8th August

08:30–23:30	Conference Registration (Location: Atrium on the ground floor, 1 楼大堂)
11:00–13:00	Buffet Lunch
13:00–15:00	Refreshment and Poster Session 1 & 2 (Location: Longfeng Hall on 2nd floor, 2 楼隆奉厅)
15:00–17:00	Refreshment and Poster Session 3 & 4 (Location: Longfeng Hall on 2nd floor, 2 楼隆奉厅)
18:00-	Social Reception

9th August

07:00–08:30	Conference Registration (Location: Atrium on the ground floor, 1 楼大堂)
08:30–09:00	Opening Ceremony (Location: Main hall on the 3rd floor, 3 楼东北会堂)
09:00–09:45	Plenary Talk 1: Prof. I-Ming Chen (Location: Main hall on the 3rd floor, 3 楼东北会堂)
09:45–10:30	Plenary Talk 2: Prof. Etienne Burdet (Location: Main hall on the 3rd floor, 3 楼东北会堂)

Time	Session							
10:30-11:00	Refreshment							
11:00-12:30 Keynotes & Oral presentations	**Grouped Sessions** (30mins for each keynote+15mins for each oral presentation in every session)							
	FrA1	FrA2	FrA3	FrA4	FrA5	FrA6	FrA7	FrA8
	Parallel robotics Longfeng Hall A on 2nd floor (2 楼隆睿 A 厅)	**Wearable and assistive devices and robots for healthcare** Longfeng Hall B on 2nd floor (2 楼隆睿 B 厅)	**Swarm intelligence and multi-robot cooperation** No. 8 Meeting Room on 5th floor (5 楼第八会议室)	**Compliant manipulation learning and control for lightweight robot** No. 9 Meeting Room on 6th floor (6 楼第九会议室)	**Modular robots and other mechatronic systems** No. 6 Meeting Room on 3rd floor (3 楼第六会议室)	**Robotic technology for deep space exploration** No. 7 Meeting Room on 3rd floor (3 楼第七会议室)	**Unmanned underwater vehicles** Activity Room on 5th floor (5 楼活动室)	**Robotic grasping and manipulation with incomplete information and strong disturbance** No. 2 Meeting Room on 3rd floor (3 楼第二会议室)
12:30-14:00	Buffet Lunch							
14:00-14:45	Plenary Talk 3: Prof. Fumihito Arai (Location: Main hall on the 3rd floor, 3 楼东北会堂)							
15:00-16:30 Keynotes & Oral presentations	**Grouped Sessions** (30mins for each keynote+15mins for each oral presentation in every session)							
	FrB1	FrB2	FrB3	FrB4	FrB5	FrB6	FrB7	FrB8
	Fuzzy Modelling for automation, control, and robotics Longfeng Hall A on 2nd floor (2 楼隆睿 A 厅)	**Computational intelligence inspired robot navigation and SLAM** Longfeng Hall B on 2nd floor (2 楼隆睿 B 厅)	**Wearable sensing based limb motor function rehabilitation** No. 8 Meeting Room on 5th floor (5 楼第八会议室)	**Autonomous control of unmanned aircraft systems** No. 9 Meeting Room on 6th floor (6 楼第九会议室)	**Marine Bio-inspired robotics and soft robotics: materials, mechanisms, modeling, and control** No. 6 Meeting Room on 3rd floor (3 楼第六会议室)	**Human centered robotics** No. 7 Meeting Room on 3rd floor (3 楼第七会议室)	**Bio-inspired wall climbing robot** Activity Room on 5th floor (5 楼活动室)	**Robot intelligence technologies and system integration** No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

Time	Session
16:30-16:45	Refreshment
16:45-18:30 Keynotes & Oral presentations	**Grouped Sessions** (30mins for each keynote+15mins for each oral presentation in every session)

FrC1	FrC2	FrC3	FrC4	FrC5	FrC6	FrC7	FrC8
Swarm intelligence unmanned system	**Medical robot**	**Soft locomotion robot**	**Robotics for cell manipulation and characterization**	**Underwater acoustic and optical signal processing for environmental cognition**	**Signal processing and underwater bionic robots**	**Human biomechanics and human-centered robotics**	**Intelligent robots for environment detection or fine manipulation**
Longfeng Hall A on 2nd floor (2 楼隆睿 A 厅)	Longfeng Hall B on 2nd floor (2 楼隆睿 B 厅)	No. 8 Meeting Room on 5th floor (5 楼第八会议室)	No. 9 Meeting Room on 6th floor (6 楼第九会议室)	No. 6 Meeting Room on 3rd floor (3 楼第六会议室)	No. 7 Meeting Room on 3rd floor (3 楼第七会议室)	Activity Room on 5th floor (5 楼活动室)	No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

Time	Session
18:30-20:00	Buffet Dinner
20:00-21:00	Recruitment Seminar for Talent Acquisition - Shenyang Institute of Automation, Chinese Academy of Sciences (Location: Longfeng Hall on 2nd floor, 2 楼隆睿厅)

10th August

Time	Session
07:00-09:00	Conference Registration (Location: Atrium on the ground floor, 1 楼大堂)
09:00-09:45	Plenary Talk 4: Prof. Huayong Yang (Location: Main hall on the 3rd floor, 3 楼东北会堂)
09:45-10:30	Plenary Talk 5: Prof. Yaochu Jin (Location: Main hall on the 3rd floor, 3 楼东北会堂)
10:30-11:00	Refreshment
	Grouped Sessions (30mins for each keynote+15mins for each oral presentation in every session)

Time								
11:00-12:30 Keynotes & Oral presentations	**SaA1** Field robots — Longfeng Hall A on 2nd floor (2楼隆睾A厅)	**SaA2** Man-machine interactions — Longfeng Hall B on 2nd floor (2楼隆睾B厅)	**SaA3** Navigation/Localization — No. 8 Meeting Room on 5th floor (5楼第八会议室)	**SaA4** Nonlinear systems and control — No. 9 Meeting Room on 6th floor (6楼第九会议室)	**SaA5** Human-robot interaction — No. 6 Meeting Room on 3rd floor (3楼第六会议室)	**SaA6** Piezoelectric actuators and micro-nano manipulations — No. 7 Meeting Room on 3rd floor (3楼第七会议室)	**SaA7** Teleoperation robot — Activity Room on 5th floor (5楼活动室)	**SaA8** Fault detection, testing and diagnosis — No. 2 Meeting Room on 3rd floor (3楼第二会议室)
12:30-14:00	Buffet Lunch							
14:00-14:45	Plenary Talk 6: Prof. Shugen Ma (Location: Main hall on the 3rd floor, 3楼东北会堂)							
15:00-16:30 Keynotes & Oral presentations	**SaB1** Robot intelligence, learning and linguistics — No. 8 Meeting Room on 5th floor (5楼第八会议室)	**SaB2** Robot legged locomotion — No. 9 Meeting Room on 6th floor (6楼第九会议室)	**SaB3** Compliant mechanisms — No. 6 Meeting Room on 3rd floor (3楼第六会议室)	**SaB4** Computer integrated manufacturing — No. 7 Meeting Room on 3rd floor (3楼第七会议室)	**SaB5** Collective and social robots — Activity Room on 5th floor (5楼活动室)	**SaB6** Human-robot collaboration — No. 2 Meeting Room on 3rd floor (3楼第二会议室)	Grouped Sessions (30mins for each keynote+15mins for each oral presentation in every session)	
16:30-16:45	Refreshment							
16:45-18:30 Keynotes & Oral presentations	**SaC1** Development of high-performance joint drive for robots — No. 8 Meeting Room on 5th floor (5楼第八会议室)	**SaC2** Mobile robots and intelligent autonomous systems — No. 9 Meeting Room on 6th floor (6楼第九会议室)	**SaC3** Continuum mechanisms and robots — No. 6 Meeting Room on 3rd floor (3楼第六会议室)	**SaC4** Robot mechanism and design — No. 7 Meeting Room on 3rd floor (3楼第七会议室)	**SaC5** Visual and motional learning in robotics — Activity Room on 5th floor (5楼活动室)	**SaC6** Robot vision and scene understanding — No. 2 Meeting Room on 3rd floor (3楼第二会议室)	Grouped Sessions (30mins for each keynote+15mins for each oral presentation in every session)	
19:00-	Closing Ceremony/Conference Banquet (Location: Main hall on the 3rd floor, 3楼东北会堂)							

11th August

Time	Event
09:00-18:30	Joint ICIRA-CCRS Events (only applicable for those who have jointly registered for CCRS 2019)
09:00-10:30	Joint Plenary Talk 1: Prof. Yangsheng Xu Joint Plenary Talk 2: Prof. Jie Chen (Location: Main hall on the 3rd floor, 3楼东北会堂)
10:30-11:00	Refreshment
11:00-12:10	Joint Keynote 1: Dr. Min Tan (Location: Main hall on the 3rd floor, 3楼东北会堂) Joint Keynote 2: Prof. Xilun Ding (Location: Longfeng Hall on 2nd floor, 2楼隆奉厅) Joint Keynote 3: Prof. Tiejun Huang (Location: Main hall on the 3rd floor, 3楼东北会堂) Joint Keynote 4: Prof. Xianmin Zhang (Location: Longfeng Hall on 2nd floor, 2楼隆奉厅)
12:10-14:00	Buffet Lunch
14:00-15:30	Guest Forums: Prof. Han Ding, Prof. Huayong Yang, Dr. Haibin Yu, Prof. Hong Liu, Prof. Xiangyang Zhu (Location: Main hall on the 3rd floor, 3楼东北会堂)
15:30-18:20	Forums on Subjects Nano Robot Medical Robot Bionic Robot Swarm Robot Industrial Robot

Plenary Talks

Friday 9 August

Saturday 10 August

Talk: Intelligent Robots and Hidden Champions

Date: Friday 9 August

Time: 09:00-09:45

Venue: Main Hall on 3rd Floor (3楼东北会堂)

Speaker: Professor I-Ming Chen

Abstract:

Industrial robot manipulators in the factories with similar morphology are treated as automation equipment for mass production purpose, for example, those in the automobile factories. However, when more and more robots are getting out of the factories and entering different types of environments, such as hospitals, homes, warehouses, construction sites, etc., their morphology can be drastically different in order to perform different tasks and interact with human beings. The roles of these robots are similar to those of human professionals rather than automation equipment with uniformalty. An intelligent robot normally possesses three basic functions: perception, cognition and action. The demands for these functions are scenario-dependent, which is analogous to the profession-dependent job requirements in the human society. This lecture explores the economy and technical challenges in design and deployment of intelligent robots in the future society in a broad perspective. We draw the term "Hidden Champions" coined by German economist, Hermann Simon in 1986 to describe the role and development of intelligent robots. Simon first used the term to describe the small, highly specialized world-market leaders in Germany. These smaller companies are normally known only in their own area, by customers and suppliers, but not to the wider public or business community. When these companies are very successful on the international markets, they are hidden champions. Intelligent robots, like a hidden champion, need to have very specific capability to tackle an application scenario. The robot developer, likewise, needs to be focus on domain-specific industry in order to create technology barrier and stay competitive to become the market leader. This lecture will discuss the importance of system morphology, perception, learning/cognition, and actions to an intelligent robot used in three emerging application domains: logistics, construction and social education. We will share the experience and challenges of a number of robotics projects that have been or are being rolled out to the real world, such as logistics picking robots, smart painting robots, and social robots, to examplify the "Hidden Champion" nature of intelligent robots outside of factory floors.

Biography:

Professor I-Ming Chen is an internationally renowned robotics researcher. He received the B.S. degree from National Taiwan University, M.S. and Ph.D. degrees from California Institute of Technology, Pasadena, CA respectively. He has been with the School of Mechanical and Aerospace Engineering of Nanyang Technological University (NTU) in Singapore since 1995. He is Director of Robotics Research Centre in NTU from 2013 to 2017. He is a member of the Robotics Task Force 2014 under the National Research Foundation which is responsible for Singapore's strategic R&D plan in future robotics. He is now the Program Leader for National Robotics Program in Construction 4.0 in Singapore. His research interests are in logistics and construction robots, wearable devices, human-robot interaction and industrial automation. Professor Chen is Fellow of Singapore Academy of Engineering, Fellow of IEEE and ASME, General Chairman of 2017 IEEE International Conference on Robotics and Automation (ICRA 2017) in Singapore. He is Editor-in-chief Elect for IEEE/ASME Transactions on Mechatronics and will assume Editor-in-Chief from Jan 2020. Furthermore, Prof Chen is an avid entrepreneur in robotics. He is the founder and CEO of Transforma Robotics Pte Ltd developing robots for construction industry and founder and CTO of Hand Plus Robotics Pte Ltd developing robotics and AI solutions for logistics and manufacturing industry.

Title: Interaction Control in Humans and with Robots

Date: Friday 9 August

Time: 09:45-10:30

Venue: Main Hall on 3rd Floor (3楼东北会堂)

Speaker: Professor Etienne Burdet

Abstract:

My talk will present some of our attempts to i) understand how humans skilfully interact with their environment, and ii) endow robots with similarly successful control behaviours. Twenty years ago, we discovered how humans constantly adapt their muscle activations to identify and adapt to the dynamic environment they are working with. I will first present this discovery and how it lead to novel adaptive control behaviours for robots, which will enable them to interact with rigid and soft environments, with perspective in fields such as manufacturing and medical robotics. In recent years, we studied how humans physically interact with each other, e.g. during physical neurorehabilitation after a stroke or while dancing. By examining the behaviours of individuals when their right hands are physically connected, we could show how haptic information enables humans to estimate partners' motor plan and use it to improve one own performance. Embodied as a robot partner, this model was verified as it induced the same improvements in motor performance as a human partner. These results elucidate the haptic communication taking place between physically interacting humans and promise collaborative robot systems with human-like assistance.

Related publications
- Burdet et al. (2013), Human Robotics - neuromechanics and motor control. MIT Press.
- Y Li et al. (2018), Force, impedance, and trajectory learning for contact tooling and haptic identification. IEEE Transactions on Robotics 34(5): 1170-82.
- A Takagi et al. (2017), Physically interacting individuals estimate the partners goal to enhance their movements. Nature Human Behaviour 1: 0054.
- Y Li et al (2019), Differential game theory for versatile physical human–robot interaction. Nature Machine Intelligence 1(1): 36.

Biography:

Dr. Etienne Burdet is Chair of Human Robotics at the Imperial College of Science, Technology and Medicine in UK. He is also a visiting Professor at University College London. He holds an MSc in Mathematics (1990), an MSc in Physics (1991), and a PhD in Robotics (1996), all from ETH-Zurich. He was a postdoctoral fellow with TE Milner from McGill University, Canada, JE Colgate from Northwestern University, USA and Mitsuo Kawato of ATR in Japan. Professor Burdet's group uses an integrative approach of neuroscience and robotics to: i) investigate human motor control, and ii) design efficient systems for training and rehabilitation, which are tested in clinical trials.

Talk: Innovation of Robots with Bionic Design

Date: Friday 9 August

Time: 14:00-14:45

Venue: Main Hall on 3rd Floor (3楼东北会堂)

Speaker: Professor Fumihito Arai

Abstract:

Design selected by nature is based on evolution and we can get an idea how to design the robot. There are a lot of different kinds of robot design inspired by nature. Design policy of the robot is important for innovation in robotic technologies. In this talk, bionic design approach for the robots is introduced to improve performance of the robot as well as to add new functions to the robot. Especially, it is a big challenge to realize a milli, micro, and nano-scaled robot, and bionic design is attracting big attention. In this talk, several examples of miniature sized robots will be introduced. To realize miniature sized robots, energy supply is one of the key issues. We developed a new self-propelled micro-swimmer by the glucose biofuel cell and electroosmotic propulsion. It is driven by self-electroosmotic propulsion (EOP) generated by biofuel cell (BFC) with biofuels (glucose and O_2). Another important application of robot with bionic design is a patient simulator. We have developed Bionic Humanoid, which is an elaborate human model equipped with sensors and actuators to serve as a substitute for and test animals. Bionic Humanoid uses artificial materials to precisely recreate the structure of the human and to mimic physical property of the human. MEMS and 3D printing technologies are used to fabricate as well as to evaluate Bionic Humanoid. Bionic Humanoid is equipped with bionic sensors to monitor and quantify the force applied by the operator. Bionic sensor is designed so that the sensor-embedded model recreates the structure of the human and mimics physical property of the human. The Bionic Humanoid can be used, for example, to quantify the requirements of medical doctors, assess surgical skills, replicate physical constraints for the development of a medical device, and provide young surgeons with training opportunities. Recent progress of Bionic Humanoid will be introduced and discussed for future medical innovation. In summary, bionic design is quite important for innovation of robot.

Biography:

Fumihito Arai is a Professor of Department of Micro-Nano Mechanical Science & Engineering at Nagoya University, Japan. He also serves as a Deputy Director of Institute of Nano-Life-Systems at Nagoya University. He received Master of Engineering degree from Tokyo Univ. of Science in 1988. He received Dr. of Engineering from Nagoya University in 1993. Since 1994, he was Assistant Professor of Nagoya University. Since 2005, he was Professor of Tohoku University. Since 2010, he has been Professor of Nagoya University. He was the Vice-President for Technical Activities, IEEE Nanotechnology Council (2002, 2003). He was AdCom Member of IEEE Robotics and Automation Society (RAS) (2009-2011, 2012-2014), and he serves as AdCom Member of RAS again since 2019. He was the Vice President for Technical Activities, IEEE RAS (2014-2015, 2016-2017). He was Editor in Chief of Advanced Robotics (2012-2017). His research fields are Micro-nano Robotics and Bio-Robotics. He received 88 awards on his research activities, for example, Early Academic Career Award in Robotics and Automation from IEEE Robotics and Automation Society in 2000, Best Conference Paper Award at ICRA2012. He is the author of 399 journal papers. He is a member of IEEE.

Talk: The Development of Robotic Technologies Applied to the Mobile Construction Machinery

Date: Saturday 10 August

Time: 09:00-09:45

Venue: Main Hall on 3rd Floor (3楼东北会堂)

Speaker: Professor Huayong Yang

Abstract:

Tunnel Boring Machine (TBM) is a large machine especially designed to construct tunnels. A new robotic system is undergoing a development to change the cutting tools on a working cuter head of TBM automatically. New approaches to explore robotic systems have been also taken to improve the safety and productivity of TBM.

Aiming at the complex internal structure of cutterhead chamber, and high pressure and humidity working environment, the design of multi-joint snake-like manipulator and the dry-wet separation post-drive method are developed. A novel follow-the-leader path planning method for snake-like manipulator is also developed. As the manipulator moves forward, all the sections follow the path that the tip of manipulator has passed. Operator only need to control the direction of the distal section and the advance or retreat of the manipulator, which greatly simplifies human-computer interaction. A virtual three-dimensional working environment is built to realize efficient and reliable interactive control mode, reduces the difficulty of operation and improves the detection efficiency. Some changes of these robotic systems could be also applied to other mobile construction machinery.

Biography:

Huayong Yang received a PhD degree of Philosophy from the University of Bath in 1988, and joined the Department of Mechanical Engineering at the Zhejiang University as a Post-doctor researcher in 1989. He is now the dean of school of Mechanical Engineering, and also the director of the State Key Laboratory of Fluid Power and Mechatronic Systems, Zhejiang University. He was elected as a member of the Chinese Academy of Engineering in 2013.

He is a prolific researcher with more than 189 invention patents, (co)authored 3 academic books and over 160 SCI technical papers. His research interests are in motion control and energy saving of mechatronic systems, development of fluid power component and system, integration of electrohydraulic system and engineering application, robotics, bio-design and manufacturing. He was appointed as a Cheung Kong Chair Professor by MOE in 2005. He has been a fellow member of the Chinese Mechanical Engineering Society, and a member of the Academic and Advisory Committees of 7 State Key Laboratories of TsingHua University, Zhejiang University, Shanghai Jiaotong University, Huazhong University of Science and Technology, Harbin Institute of Technology, Central South University and Chongqing University.

He was recipient of the first prize of the National Scientific and Technological Progress in 2012 and the second prize in 2003.

Talk: Morphogenetic Self-organization of Swarm Robots

Date: Saturday 10 August

Time: 09:45-10:30

Venue: Main Hall on 3rd Floor (3楼东北会堂)

Speaker: Professor Yaochu Jin

Abstract:

This talk introduces a morphogenetic approach to the self-organizing swarm robots using genetic and cellular mechanisms governing the biological morphogenesis. We demonstrate that the morphogenetic algorithms are able to autonomously generate patterns and surround moving targets without centralized control. Finally, morphogen based methods for self-organization of simplistic robots that do not have localization and orientation capabilities are presented.

Biography:

Yaochu Jin is currently a Distinguished Chair Professor in Computational Intelligence, Department of Computer Science, University of Surrey, Guildford, U.K., where he heads the Nature Inspired Computing and Engineering Group. He was a Finland Distinguished Professor funded by the Finnish Funding Agency for Innovation and a Changjiang Distinguished Visiting Professor appointed by the Ministry of Education, China. Dr Jin is the Editor-in-Chief of the IEEE TRANSACTIONS ON COGNITIVE AND DEVELOPMENTAL SYSTEMS and Co-Editor-in-Chief of Complex & Intelligent Systems. He is an IEEE Distinguished Lecturer and former Vice President for Technical Activities of the IEEE Computational Intelligence Society. He is the recipient of the 2018 IEEE Transactions on Evolutionary Computation Outstanding Paper Award, and the 2015 and 2017 IEEE Computational Intelligence Magazine Outstanding Paper Award. He is an IEEE Fellow.

Talk: Rethinking Robotics R&D for Real World and Environment-adaptive Robots

Date: Saturday 10 August

Time: 14:00-14:45

Venue: Main Hall on 3rd Floor (3楼东北会堂)

Speaker: Professor Shugen Ma

Abstract:

Google's parent company Alphabet continues to scale back its robot ambitions, shutting down Schaft, a little-known Japanese robotics team it purchased in 2013, after it sold Boston Dynamics, a well-known company for its flashy YouTube videos and animal-like robots, to SoftBank. Rethinking Robotics, a pioneer in the development of robots that were emotionally sympathetic, also closed its doors in the last October. What problems for the R & D of robots are not well analyzed, even though the sales of the industrial robots increased by 35% to 381,335 units and the sales of the service robots for personal and domestic use increased by 25% to about 8.5 million units. In this talk, I bring questions – How to enlarge the robot markets and what kind of robots should be emphasized to R & D. As a suggestion, I think that the business model of robotics industry would need to be reconsidered and the problem-solving robotics technologies are highly required in the society. As an example of the R & D of robotics technologies, I will introduce a multilink-articulated robot for inspecting and exploring pipelines, which is composed of by omnidirectional and hemispherical wheels, a pair of the hemispherical wheels attaches at the end of the robot to quickly align the steering direction while the omnidirectional wheels generates enough propelling force forward and backward, to prevent critical leakage accidents. Some other robots developed in our laboratory will be also introduced.

Biography:

Professor Shugen Ma received his Ph.D. degrees in Mechanical Engineering Science from Tokyo Institute of Technology in 1991. From 1991 to 1992 he was a Research Engineer with Komatsu Ltd and from 1992 to 1993 he was a Visiting Scholar at the University of California, Riverside. Professor Ma joined the Department of Systems Engineering, Ibaraki University, as an Assistant Professor in July 1993. In October 2005, he moved to Ritsumeikan University, where he is currently a professor in the Department of Robotics. Professor Ma was awarded by the CAS "Hundred Talent Program" in 2001, the Tianjin "Thousand Talents Plan" in 2012, and the national "Thousand Talents Plan" in 2014. He also stayed in Johns Hopkins University as a Visiting Professor in 2014. His current research interests include the design and control of environment-adaptive robots and field robotics. Professor Shugen Ma is Fellow of IEEE, Fellow of JSME, and General Chairman of IROS 2022 in Japan, respectively. He has co-founded the ROBIO conference and served as the general chair of the first event. Professor Ma also successfully established two start up companies in China with his students, organizing innovative robotics education and training service programs. He was an associate Editor of the IEEE Transaction on Robotics from December 2003 to November 2007, an Editor of Advanced Robotics from April 2007, and serves many societies and conferences.

Poster Sessions

Thursday 8 August

Poster Session 1

Date: Thursday 8 August

Time: 13:00-15:00

Venue: Longfeng Hall on 2nd Floor (2楼隆奉厅)

ID	Title	Authors
21	Robot Programming Language Based On VB Scripting for Robot Motion Control	Zheng Li, Sheng Gao, Wei Zhang, Xiaoyuan Liu
52	Secrecy Energy efficiency maximization for UAV-aided communication systems	Meng Hua, Chunguo Li, Luxi yang
54	Design and Analysis of Motor Control System for Drilling Fluid Continuous Wave Generator Based on Improved Active Disturbance Rejection Control and Hysteresis Current Control	Botao Zhou, Jiafeng Wu, Ning Han, Mwelango Martin
59	New rigid-soft coupling structure and its stiffness adjusting device	Liu Che, Mu Hengyang, Diansheng Chen, Min Wang
60	Co-simulation Based on ADAMS and Simulink for Direct Yaw Moment Control System of 4WD-EV	Yaping Wang, Liping Zhang, Sen Cao, Zheng Zhang
70	Specular Surface Measurement with Laser Plane Constraint to Reduce Erroneous Points	Huayang Li, Xu Zhang, Leilei Zhuang, Yilin Yang
76	A Cooperative Obstacle-avoidance Approach for Two-manipulator Based on A* Algorithm	Jinlong Zhao, Yongsheng Chao, Yiping Yuan
84	Research on Safety Control Method of Multi-rotor Unmanned Aerial Vehicle under Super-Strong Wind Field	Yongqiang Hou, Yuqing He, Wei Huang, Qianhan Wang, Hao Zhou
86	Path Planning of UAV-UGV Heterogeneous Robot System in Road Network	Mengqing Chen, Yang Chen, Zhihuan Chen, Yanhua Yang
111	Appearance-Based Gaze Tracking: A Brief Review	Jiaqi Jiang, Xiaolong Zhou, Sixian Chan, Shengyong Chen
123	Simulation Analysis of PID Closed-Loop Control of Current of SBW	Li Zhanfeng, Du Shuang
129	An FFT-based method for analysis, modeling and identification of kinematic error in harmonic	Shi Xiaoli, Yong Han, Jianhua Wu, Zhenhua Xiong
158	Improved CPG model based on Hopf oscillator for gait design of a new type of hexapod robot	Xiangyu Li, Hong Liu, Xuan Wu, Rui Li, Xiaojie Wang

ID	Title	Authors
161	Fault-tolerant Control of Robotic Manipulators with/without Output Constraints	Ting Lei, ye he, Xiaoan Chen, Xue Zhao
163	A Path Planning Method under Constant Contact Force for Robotic Belt Grinding	Wang Tao, Huan Zhao, Qianlong Xie, Xiangfei Li, Han Ding
170	Adaptive Impedance Control for Robotic Polishing with an Intelligent Digital Compliant	qianlong xie, Huan Zhao, Tao Wang, Han Ding
183	Kinematic Analysis and Speed Control of 3SPS-1S Parallel Mechanism for End Actuator of Segment Erector	Lintao Wang, Ji Li, Lei Zhao
216	Viewpoint Planning of Robot Measurement System Based on V-REP Platform	Zhonghang Ma, Xu Zhang, Lin Zhang, Limin Zhu
231	Modeling and analysis of human lower limb in walking motion	Huan Zhao, Junyi Cao, Ruixue Wang
243	A Self-Calibration Method for Mobile Manipulator	Hangbo Zou, Yinghao Li, Sijun Zhu, Kanfeng Gu, Xinggang Zhang, Mingyang Zhao
253	Neural Networks-Based PID Precision Motion Control of a Piezo-Actuated Microinjector	Yizheng Yan, Qingsong Xu
276	Dynamics modeling of a 2-DOFs mechanism with rigid joint and flexible joint	YanLin Chen, Baizhe Song, Xianmin Zhang, Yanjiang Huang
286	A HoloLens Based Augmented Reality Navigation System for Minimally Invasive Total Knee Arthroplasty	Li Wang, Zewen Sun, Xiaohui Zhang, Zhen Sun, Junchen Wang
317	A methodology for multi-goal trajectory planning in welding	Nianfeng Wang, Yaoqiang He, Xianmin Zhang
331	Automatic programming for dual robots to grinding intersecting curve	Shibo Han, Xingwei Zhao, Qi Fan, Bo Tao
342	Real-Time Human-Posture Recognition for Human-Drone Interaction using Monocular Vision	Chenglin Cai, Shaowu Yang, Peifeng Yan, Jinkai Tian, Linlin Du, Xuejun Yang
371	Research on motion evolution of soft robot based on VoxCAD	Yueqin Gu, Xuecheng Zhang, Qiuxuan Wu, Yancheng Li, Botao Zhang, Farong Gao, Yanbin Luo
389	Research on Measurement and Deformation of Flexible Wing Flapping Parameters	Jie Yuan, Chao Wang, Peng Xie, Chaoying Zhou

ID	Title	Authors
391	Haptic Joystick Impedance Control with Gravity Compensation	Yong-Jin Ock, Zhan-Ming Gu, Jong-Woo An, Jang-Myung Lee
424	DOREP: an educational experiment platform for robot control based on MATLAB and the real-time controller	Liu Guanghui, Han Bing, Li Qingxin, Zhang Hualiang
443	Force/Motion Hybrid Control of Three Link Constrained Manipulator Using Sliding Mode	Sheng Gao, Wei Zhang, Weiguo Kong, Hucun Ren, Bopi Jin
477	HSVM-based human activity recognition using smartphones	Santiago Grijalva, Wilbert G. Aguilar, Gonzalo Cueva, José David Ramírez Rojas
482	R-3RPS robot-based mathematical modeling for a military flight simulator	Cristhian Guerrón, Wilbert G. Aguilar, Rolando Reyes, Nicolás Pinto, Santiago Chamorro, Manolo Paredes
497	Toward human-in-the-loop PID control based on CACLA reinforcement learning	Junpei Zhong, Yanan Li
513	Adaptive Hybrid Impedance Control Algorithm Based on Subsystem Dynamics Model for Robot	Zihao Luo, Jianfei Li, Jie Bai, wang yaobing, Li Liu
516	Trajectory Planning based on Optimal Control and Exact Derivatives	Xiaodong Zhang, Ling Tu, Jiafeng Wu, Shurong Li

Poster Session 2

Date: Thursday 8 August

Time: 13:00-15:00

Venue: Longfeng Hall on 2nd Floor (2楼隆奉厅)

ID	Title	Authors
24	The UAV path planning method based on lidar	Lanxiang Zheng, Ping Zhang, Jia Tan, Mingxuan Chen
42	An improved artificial potential field method for mobile robots using environmental information	Haiyi Kong, Chenguang Yang, Zhaojie Ju, Jinguo Liu
72	A Flexure-based XY Precision Positioning Stage with Integrated Displacement PVDF Sensor	Mingxiang Ling
90	A novel method for finger vein segmentation	Zeng JunYing, Wang Fan, Chuanbo Qin, Gan Junying, Zhai Yikui, Zhu Boyuan
93	An Underwater Robot Positioning Method based on EM-ELF Signals	Guan Wang, Huanyu Ding, Hongwei Xia, Changhong Wang
109	Video-Guided Sound Source Separation	Junfeng Zhou, Feng Wang, Di Guo, Huaping Liu, Fuchun Sun
127	In-hand manipulation for active object recognition	Xiang Dou, Xinying Xu, Huaping Liu
131	Designing Bionic Path Robots to Minimize the Metabolic Cost of Human Movement	Jing Fang, Jianping Yuan, Qi Li
137	CSLAM and GPS based Navigation for Multi-UAV Cooperative Transportation System	Hang Yu, Fan Zhang, Panfeng Huang
142	Underwater image target detection with cascade classifier and image preprocessing method	Lingcai Zeng, Bing Sun, Wei Zhang, Daqi Zhu
155	Research on HDD-UJ Robot Joint Structure Design and Motion Regulation Strategy	Zhongtao Li, Tianhong Luo
176	Design and Modeling of a Continuous Soft Robot	Wenbiao Wang, Hailiang Meng, Guanjun Bao
177	A New Concept of UAV Recovering System	Jun Jiang, Houde Liu, Bo Yuan, Xueqian Wang, Bin Liang
182	Autopilot System of Remotely Operated Vehicle Based on Ardupilot	Zongtong Luo, Xianbo Xiang, Qin Zhang

ID	Title	Authors
185	Optimized SOM Algorithm to Solve Problem of Invalid Task Allocation	Yun Qu, Daqi Zhu, mingzhi chen
186	Multiple underwater target search path planning based on GBNN	Tingting Zhu, Mingzhong Yan, ZhenZhong Chu
191	Robust Controller Design for Non-Linear System with Perturbation Compensation	Saad jamshed, Muhammad Hamza Khan, Wang Jie, Min Cheol Lee
196	Trajectory Tracking Control of a 7-Axis Robot Arm Using SMCSPO	Wang Jie, Saad jamshed, Dong Jun Kim, Bao Yulong, Min Cheol Lee
197	Adaptive whole-arm grasping approach of tumbling space debris by two coordinated hyper-redundant manipulators	Wenya Wan, Chong Sun, Jianping Yuan, Xianghao Hou, Yufei Guo, Yinong O-yang, Qixin Li, Liran Zhao, Hao Shi, Dawei Han
198	Design of Control System and Human-Robot-Interaction System of Teleoperation Underwater Robot	Pengcheng Xu, Qingjun Zeng, Guangyi Zhang, Chunlei Zhu, Zhiyu Zhu
204	A Survey of Underwater Acoustic SLAM System	Min Jiang, Sanming Song, Yiping Li, Wenming Jin, Jian Liu, Xisheng Feng
256	Haptic Feedback with a Reservoir Computing-Based Recurrent Neural Network for Multiple Terrain Classification of a Walking Robot	Pongsiri Borijindakul, Noparit Jinuntuya, Poramate Manoonpong
279	Detecting Untraversable Regions for Navigating Mobile Robot on Pedestrian Lanes	Jiatong Bao, Xiaomei Yao, Hongru Tang, Aiguo Song
283	A Prediction Method of Contact Force in Precise Teleoperation with Time Delay	Pengwen Xiong, Aiguo Song, Jianqing Li, Yao Lei
284	Numerical Simulation of Collision between an Oil Tanker and Ice	Aifeng Zhang, Lihong Wu, Lanxuan Liu, Xiong Chen, Xinyu Zhao
307	Threshold-dependent joint bilateral filter algorithm for enhancing 3D gated range-intensity correlation imaging	Yuqing Yang, Xinwei Wang, Liang Sun, Jianan Chen, Han Dong, Minmin Wang, Shaomeng Wang, Yan Zhou
318	Indoor navigation system using the Fetch robot	Huishen Zhu, Brenton Leighton, Yongbo Chen, Xijun Ke, Songtao Liu, Liang Zhao
356	Design of Morphing Wing Leading Edge with Compliant Mechanism	Ziang Zhang, Wenjie Ge, Yaqing Zhang, Rongyi Zhou, Haijun Dong, Yonghong Zhang

ID	Title	Authors
365	Planetary Rover Path Planning Based on Improved A* Algorithm	Weihuai Wu, Xiao mei Xie, Mingzhu Wei, Xin Chen, Nian Liu, Peng Yan, Omar Mechali, Limei Xu
411	Design and Analysis of a Planar 3-DOF Large Range Compliant Mechanism with Leaf-type Flexure	Bao Yang, Chi Zhang, Hongtao Yu, Miao Yang, Guilin Yang, Silu Chen
442	Design and Simulation of a Push Recovery Strategy for Biped Robot	Dandan Hu, Ruoqiao Guan, Peiran Yu
495	Robot Intelligent Trajectory Planning based on PCM guided Reinforcement Learning	Jian Fu, Ce cao, Jinyu Du, Siyuan Shen
496	Monocular Visual-Inertial SLAM with Camera-IMU Extrinsic Automatic Calibration and Online Estimation	Linhao Pan, Fuqing Tian, Wenjian Ying, Bo She
500	An Online Motion Planning Approach of Mobile Robots in Distinctive Homotopic Classes by a Sparse Roadmap	Xiaoyuan Zhang, Biao Zhang, Chenkun Qi, Zhousu Li, Huayang Li
518	Close-range Angles-only Relative Navigation of Multi-Agent Cluster for On-orbit Servicing Mission	Baichun Gong, Sha Wang, Shuang Li, Lili Zheng

Poster Session 3

Date: Thursday 8 August

Time: 15:00-17:00

Venue: Longfeng Hall on 2nd Floor (2楼隆奉厅)

ID	Title	Authors
2	Human-AGV Interaction: Real-time Gesture Detection Using Deep Learning	Jiliang Zhang, LI PENG, Wei Feng, Zhaojie Ju, Honghai Liu
6	Coverage Path Planning for Complex Structures Inspection Using Unmanned Aerial Vehicle (UAV)	Randa Almadhoun, Tarek Taha, Jorge Dias, Lakmal Seneviratne, Yahya Zweiri
8	Infrared and Visible Image Fusion: A Region-based Deep Learning Method	Chunyu Xie, Xinde Li
20	Development of Four Rotor Fire Extinguishing System for Synchronized Monitoring of Air and Ground for Fire Fighting	Shihan Liu, Lifu Hu
34	Active Affordance Exploration for Robot Grasping	Huaping Liu, Yuan Yuan, Yuhong Deng, Xiaofeng Gao, Yixuan Wei, Kai Lu, Bin Fang, Di Guo, Fuchun Sun
91	Fault diagnosis and prediction method of SPC for engine block based on LSTM neural network	Chunying Jiang, ping jin, Yuxiang Kang, Changlong Ye
101	Real Time Object Detection Based on Deep Neural Network	Tarek Teama, Hongbin Ma, Ali Maher, Mohamed Kassab
132	Image Deblurring Based on Fuzzy Kernel Estimation in HSV Color Space	Aidi Zhao, Jianhua Zhang, Xiaoling Lv, minglu zhang
133	A Fast and Robust Template Matching Method with Rotated Gradient Features and Image Pyramid	Yanjiao Si, Wenchao Wang, Zelong Zheng, Xu Zhang
135	Multi-Vehicle Detection and Tracking Based on Kalman Filter and Data Association	Lie Guo, Ge Pingshu, Danni He, Dongxing Wang
167	Multi-scale Feature Fusion Single Shot Object Detector Based on DenseNet	Minghao Zhai, Junchen Liu, Wei Zhang, Chen Liu, Wei Li, Yi Cao
172	Semi-direct Tracking and Mapping with RGB-D Camera	Ke Liu, Xiaolin Gu, Min Yang, Yi Zhang, Shun Guan
175	Towards Deep Learning based Robot Automatic Choreography System	Ruiqi Wu, Wenyao Peng, Changle Zhou, Fei Chao, Longzhi Yang, Chih-Min Lin, Changjing Shang

ID	Title	Authors
193	Trajectory Tracking Control of Wheeled Mobile Robots Using Backstepping	Sunxin Wang, Xuefeng Bao, Shaohua Zhang, Shen Gaopan
230	Surface Defect Inspection Under a Small Training Set Condition	Wenyong Yu, yang zhang, Hui Shi
235	A Collision-free Path Planning Method using Direct Behavior Cloning	Zijing Chi, Lei Zhu, Fan Zhou, Zhuang Chungang
240	3D Pose Estimation of Robot Arm with RGB Images Based on Deep Learning	Fan Zhou, Zijing Chi, Zhuang Chungang, Han Ding
274	Straightness error assessment of linear axis of CNC machine tool based on data-drive method	Yang Hui, Xuesong Mei, Gedong Jiang, Fei Zhao
287	Two-person Interaction Recognition Based on Video Sparse Representation and Improved Spatio-Temporal Feature	Jiangtao Cao, Peiyao Wang, Shuqi Chen, Xiaofei Ji
288	Human Interaction Recognition based on the Co-occurring Visual Matrix Sequence	Xiaofei Ji, Linlin Qin, Xinmeng Zuo
290	Mobile Robot Autonomous Navigation and Dynamic Environmental Adaptation in Large-Scale Outdoor Scenes	Qifeng Yang, Daokui Qu, Fang Xu
299	A stereo matching method combining feature and area information for power line inspection	Jing Wang, Dongsheng Zhang, Xinghan Sun, Xinrong Zhang
313	Image Stitching Based on Improved SURF Algorithm	Jinxian Qi, Gongfa Li, Zhaojie Ju, Disi Chen, Du Jiang, Bo Tao, Guozhang Jiang, Ying Sun
330	Neural Network based Electronics Segmentation	Senwei Ma, Xiaoyuan Fan, lei wang, Jun Cheng, Chengjun Xu
332	Multi-scale densely connected dehazing network	Tong Cui, Zhen Zhang, Yandong Tang, Jiandong Tian
361	Automatic analysis of calibration board image orientation for online hand-eye calibration	Shan Du, Jianhua Zhang, Xiaoling Lv
410	Residual Attention Regression for 3D Hand Pose Estimation	Jing Li, Long Zhang, Zhaojie Ju
414	Fixation Based Object Recognition in Autism Clinic Setting	Sheng Sun, Shuangmei Li, Wenbo Liu, Xiaobing Zou, Ming Li
418	View Invariant Human Action Recognition Using 3D Geometric Features	Qingsong Zhao, Shijie Sun, Xiaopeng Ji, Lei Wang, Jun Cheng

ID	Title	Authors
425	Visual-based Crack Detection and Skeleton Extraction of Cement Surface	Du Jiang, Gongfa Li, Ying Sun, Jianyi Kong, Bo Tao, Dalin Zhou, Disi Chen, Zhaojie Ju
434	Visual Servoing Control Based on Reconstructed 3D Features	Degang Xu, Lei Zhou, Yifan Lei, Tiantian Shen
445	A Coarse Registration Algorithm between 3D Point Cloud and CAD Model of Non-cooperative Object for Space Manipulator	Qimeng Tan, Delun Li, Congcong Bao, Ming Chen, Yun Zhang
460	Improved Driving Stability with Series Elastic Actuator and Velocity Controller	Jinuk Bang, Haneul Yoon, Jihyeon Kim, Jangmyung Lee
461	Non-concentric Circular Texture Removal for Workpiece Defect Detection	Shujia Qin, Di Guo, Heping Chen, Ning Xi
479	Monocular vision-based dynamic moving obstacles detection and avoidance	Wilbert G. Aguilar, Leandro Alvarez, Santiago Grijalva, Israel Rojas
484	Landmark based eye ratio estimation for driver fatigue detection	Ramiro Galindo, Wilbert G. Aguilar, Rolando Reyes
506	Path planning based navigation using LIDAR for an Ackerman Unmanned Ground Vehicle	Wilbert G. Aguilar, David Sandoval, Alex Limaico, Martin Villegas-Pico, Israel Asimbaya

Poster Session 4

Date: Thursday 8 August

Time: 15:00-17:00

Venue: Longfeng Hall on 2nd Floor (2楼隆奉厅)

ID	Title	Authors
5	Dexterity-based dimension optimization of Muti-Dof robotic manipulator	Yang Jing, Ming Hu, Jin Lingyan, Zhao Deming
40	Parameter Optimization of eel robot based on NSGA-II algorithm	Anfan Zhang, Shugen Ma, Bin Li, Minghui Wang, Jian Chang
58	Safety and waterproof design of multi-functional assisted bath robot	Yuan Fu, He Zhimin, Diansheng Chen
75	Experimental Research on Dynamic Characteristics of Truss Structure for Modular Space Deployable Truss Antenna	Dake Tian, Rongqiang Liu, Lu Jin, Hongwei Guo, Zongquan Deng
87	The Study of Wheel Driving Torque Optimization of Mars Rover with Active Suspension in Obstacle Crossing	Ling Tang, Tao Liu, Shimin Wei, Yafang Liu
98	Workspace Simulation and Analysis of a Dual-arm Nursing Robot	Libo Zhang, Su Wang, Xingang Miao
106	Design and simulation of heavy load Wheeled mobile robot driving mechanism	Yang Zhang, Zhi-gang Xu, Song-kai Liu, Qing-yun Wang
130	Design and Recognition of Two-Dimensional Code for Mobile Robot Positioning	Wei Huang, Asihaer Maomin, Zhenguo Sun
207	The Design of 3-D Space Electromagnetic Control System for High-precision and Fast-response Control of Capsule Robot with 5-DOF	Li Song, Xiuping Yang, Hu Hang, Guanya Peng, Wenxuan Wei, Yuguo Dai, Lin Feng
212	Designing, Modeling and Testing of the Flexible Space Probe-Cone Docking and Refueling Mechanism	Longfei Huang, Zhi Li, Jianbin Huang, Wenlong Wang, Wen Li, Bo Meng, Yujia Pang, Xu Han, Zhimin Zhang
222	Large Contact Area Trajectory Planning Algorithm for Fuel Tank with Irregular Surfaces	Xing Fan, Haibo Xu, Wenyu Huang, Yufeng Lin
239	A General Kinematics Model for Trajectory Planning of Upper Limb Exoskeleton Robots	Qiaoling Meng, Qiaolian Xie, Zhipeng Deng, Hongliu Yu

ID	Title	Authors
245	Dynamics modeling method of module manipulator using Spatial Operator Algebra	Xiao Tao, Zhang Xiaodong, Xiong Minghua
250	A Modified Cartesian Space DMPs Model for Robot Motion Generation	Nailong Liu, Zhaoming Liu, Long Cui
261	Robot Brush-writing System of Chinese Calligraphy Characters	Jie Li, Huasong Min, Haotian Zhou, Hongcheng Xu
277	Robot Workspace Optimization and Deformation Compensation in Grinding	Xiaoteng Zhang, Bing Chen, Junde Qi, Niu Zhiyang
295	A Novel Hedgehog-inspired Pin-array Robot Hand with Multiple Magnetic Pins for Adaptive Grasping	Hang Yuan, Wenzeng Zhang
302	Underwater de-scattering range-gated imaging based on numerical fitting and frequency domain filtering	Minmin Wang, Xinwei Wang, Yuqing Yang, Liang Sun, Yan Zhou
303	Adaptive Threshold Processing of Secondary Electron Images in Scanning Electron Microscope	Weiguo Bian, Mingyu Wang, Zhan Yang
305	Design of Finger Exoskeleton Rehabilitation Robot using the Flexible Joint and the MYO Armband	Jianxi Zhang, Jianbang Dai, Sheng Chen, Guozheng Xu, Xiang Gao
322	Long-term Real-time Correlation Filter Tracker for Mobile Robot	Shaoze You, Hua Zhu, Menggang Li, Lei Wang, Chaoquan Tang
324	IMU-aided Ultra-Wideband Based Localization for Coal Mine Robots	Menggang Li, Hua Zhu, Shaoze You, Lei Wang, ZHang Zheng, Chaoquan Tang
334	Kinematic analysis of a flexible planar 2- DOF parallel manipulator	Jiaqi Zhu, Bin Li, Haozhi Mu, Qi Li
335	Object Dimension Measurement Based on Mask R-CNN	Zuo Wei, Bin Zhang, Pei Liu
354	Research on Spatial Target Classification and Recognition Technology Based on Deep Learning	Yujia Pang, Zhi Li, Bo Meng, Zhimin Zhang, longfei huang, Jianbin Huang, Xu Han, Yin Wang, Xiaohui Zhu
357	Kinematics solution and workspace analysis of a seven(DOF) Redundant Manipulator	Cunfeng Wu, Juan Wu, Shizheng Zhang, Ting Miao, Guanchen Zong
359	Design of a Master-slave Composite Wall Climbing Robot System for Penstock Assembly Welding	Jiashe Zhu, Zhenguo Sun, Wei Huang, Qiang Chen
373	Dual-source fluid bending and side-swing compound multi-joint finger	Weiping Kong, Wenzeng Zhang

ID	Title	Authors
380	Dynamics Analysis of the Human-machine System of the Assistive Gait Training Robot	Tao Qin, Xin Meng, Jinxing Qiu, Dingjian Zhu, Jianwei Zhang
394	Design and Implementation of Hovering Flapping Wing Micro Air Vehicle	Jiaxiang Li, Chao Wang, Jing Liu, Peng Xie, Chaoying Zhou
396	Minimally invasive instrument joint design based on variable stiffness of transmission efficiency	Longkai Chen, Fan Zhang, Guohua Cui, Jing Sun, Minhua Zheng, Ruijun Pan
402	A Posture Planning Method in Clustered Synergy Sub-space for HIT/DLR Hand II	Li Jiang, Bingchen Liu, Shaowei Fan, Hong Liu
423	Design of Embedded Structure Variable Stiffness Pneumatic Actuator	Yiqing Li, Wen Zhou, Yan Cao, Feng Jia
429	An Efficient Turning Control Method Based on Coordinating Driving for an Underwater Snake-like Robot with a Propeller	Shan Li, Xian Guo, Junfang Zhou, Chao Ren, Shugen Ma
448	A Smooth Gait Planning Framework for Quadruped Robot Based on Virtual Model Control	Jian Tian, Chao Ma, Cheng Wei, Yang Zhao
457	An Adaptive Parameter Identification Algorithm for Post-capture of a Tumbling Target	Jia Xu, Yang Yang, Yan Peng, Xiaomao Li, Shuanghua Zheng, Jianxiang Cui
474	Continuous path planning for free-floating space manipulator based on Genetic algorithm	Long Zhang
521	Review of Research on the Chinese Space Station Robots	Wang Youyu, Daming Li, Chengwei Hu, Yaobing Wang, Zixin Tang, Nian Wang

Oral Sessions & Invited Keynotes

Friday 9 August

Saturday 10 August

FrA1: Parallel robotics (53, 112, 404, 471)

Time: August 9th Friday, 11:00-12:30

Venue: Longfeng Hall A on 2nd floor (2 楼隆奉 A 厅)

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Chairs: Prof. Haitao Liu, Prof. Huafeng Ding

Keynote: Cable-driven Parallel Robots and Industrial

Applications

Invited Speaker: Dr Stéphane Caro, CNRS, France

FrA1-1 Structure design and kinematic analysis of a partially-decoupled 3T1R parallel manipulator

> **Ke Xu, Haitao Liu, Huiping Shen, Tingli Yang**

FrA1-2 A New Four-limb Parallel Schoenflies Motion Generator with End-effector Full-Circle Rotation via Planetary Gear Train

> **Guanglei Wu, Zirong Lin, Huiping Shen, Wenkang Zhao, Sida Zhang**

FrA1-3 Design and Kinematic Analysis on A Novel Serial-Parallel Hybrid Leg for Quadruped Robot

> **Jianzhuang Zhao, Kai Liu, Fei Zhao, Zheng Sun**

FrA1-4 A Novel 5-DOF Hybrid Robot without Singularity Configurations

> **Xin Tian, Tieshi Zhao, Erwei Li**

FrA1: **Parallel robotics (53, 112, 404, 471)**

Invited Keynote

Invited Speaker

Dr Stéphane Caro

Talk: Cable-driven Parallel Robots and Industrial Applications

Abstract: Cable-Driven Parallel Robots (CDPRs) form a particular class of parallel robots whose moving platform is connected to a fixed base frame by cables. The connection points between the cables and the base frame are referred to as exit points. The cables are coiled on motorized winches. Passive pulleys may guide the cables from the winches to the exit points. A central control system coordinates the motors actuating the winches. Thereby, the pose and the motion of the moving platform are controlled by modifying the cable lengths. CDPRs have several advantages such as a relatively low mass of moving parts, a potentially very large workspace due to size scalability, and reconfiguration capabilities. Therefore, they can be used in several applications, e.g. heavy payload handling and airplane painting, cargo handling, warehouseapplications, large-scale assembly and handling operations, and fast pick-and-placeoperations. Other possible applications include the broadcasting of sporting events, haptic devices, support structures for giant telescopes, and search and rescue deployable platforms. This keynote will deal with the design, modeling, workspace analysis and control of CDPRs. A focus will be put on the development of CDPRs in Nantes, France, and their potential industrial applications.

Biography: Stéphane Caro received the Engineering and M.Sc. degrees in mechanical engineering from Ecole Centrale Nantes (ECN), Nantes, France, in 2001, and the Doctorate degree in mechanical engineering from the University of Nantes in 2004. He was a Post-doctoral Fellow in the Centre for Intelligent Machines, McGill University,Montreal, QC, Canada from 2005 to 2006. He was awarded the accreditation to supervise research (HDR) in 2014. He is currently Research Director at the National Centre for Scientific Research (CNRS) and works in the Nantes Digital Science Laboratory (LS2N), UMR CNRS 6004, France. He is the head of the "Robots and Machines for Manufacturing Society and Services" (RoMaS) team at LS2N. He is also a part-time researcher at IRT Jules Verne, a mutualized industrial research institute. Moreover, he is a lecturer at Ecole Centrale de Nantes and IMT Atlantique Bretagne-Pays de la Loire, France. His research interests include design and modeling of cable-driven parallel robots, conceptual design of parallel robots, robust design,kinematic analysis, singularity analysis and type-synthesis of parallel robots,sensitivity analysis, tolerance synthesis, and design optimization. He is the author of 66 papers published in international journals, 155 papers presented in internationalconferences, 46 contributions in books and 5 patents.

FrA2: Wearable and assistive devices and robots for healthcare (56, 77, 105, 251)

Time: August 9th Friday, 11:00-12:30

Venue: Longfeng Hall B on 2nd floor (2 楼隆奉 B 厅)

Chairs: Dr. Jindong Liu, Dr. Benny Lo

Keynote: Modular and Soft E-Tattoos for Mobile Biometrics Sensing

Invited Speaker: Dr Nanshu Lu, The University of Texas at Austin, USA

FrA2-1 A Preliminary Study on Surface Electromyography Signal Analysis for Motion Characterization during Catheterization

> **Tao Zhou, Olatunji Omisore, Wenjing Du, Wenke Duan, Yuan Zhang, Lei Wang**

FrA2-2 Design and Control of a Novel Series Elastic Actuator for Knee Exoskeleton

> **Chenglong Qian, Aibin Zhu, Jiyuan Song, Huang Shen, Xiaodong Zhang, Guangzhong Cao**

FrA2-3 Comparison of Different Schemes for Motion Control of Pneumatic Artificial Muscle using Fast Switching Valve

> **Shenglong Xie, Binrui Wang, Dijian Chen**

FrA2-4 Recognition of Pes Cavus Foot using Smart Insole: A Pilot Study

> **Zhanyong Mei, Kamen Ivanov, Ludwig Lubich, Lei Wang**

Invited Keynote

Invited Speaker
Dr Nanshu Lu

Talk: Modular and Soft E-Tattoos for Mobile Biometrics Sensing

Abstract: In the past few years, ultrathin and ultrasoft epidermal electronics (a.k.a. e-tattoos) emerged as the next generation wearables for telemedicine, mobile health, performance tracking, human-machine interface (HMI) and so on. We report the design, fabrication, and validation of modular and reconfigurable wireless e-tattoos for personalized sensing. Such e-tattoos feature a multilayer stack of stretchable layers of distinct functionalities – a near field communication (NFC) layer capable of wireless charging, a Bluetooth layer in charge of wireless data transmission, a data acquisition and signal processing layer, and an electrode/sensor layer. We demonstrate that these different layers of e-tattoos can be disassembled and swapped out multiple times to form different e-tattoos of different sensing capabilities. Such modular and wireless e-tattoos can be rapid-prototyped via a dry, digital and cost-effective fabrication process – the "cut-solder-paste" process. They have been successfully applied to wirelessly measure a variety of biometrics.

Biography: Nanshu received her Ph.D. from Harvard University in 2009 and spent two years as a Beckman Postdoctoral Fellow at UIUC. She joined the University of Texas at Austin in 2011 and became tenured Associate Professor in 2017. She has published more than 80 journal articles with more than 9000 citations in the field of soft bioelectronics. She has been named 35 innovators under 35 by MIT Technology Review and has received NSF CAREER Award and multiple DOD Young Investigator Awards.

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沈阳市科学技术协会
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FrA3: Swarm intelligence and multi-robot cooperation (12, 26, 117, 125, 517)

Time: August 9th Friday, 11:00-12:30

Venue: No. 8 Meeting Room on 5th floor (5 楼第八会议室)

- -

Chairs: Xiaodong Yi, Prof. Haitao Zhang,Dr. Yunlong Wu

Keynote: From Biological Swarm Intelligence to Cooperation of Cross-Domain Unmanned Systems

Invited Speaker: Prof Haitao Zhang, Huazhong University of Science and Technology, China

FrA3-1 Multi-robot Collaborative Assembly Research for 3C Manufacturing--Taking Server Motherboard Assembly Task as an Example

Jinyu Xu, Yanpu Lei, Jia-Wei Luo, Yue Wu, Hai-Tao Zhang

FrA3-2 Multiagent Reinforcement Learning for Swarm Confrontation Environments

Guanyu Zhang, Yuan Li, Xinhai Xu, Huadong Dai

FrA3-3 Distributed Adaptive Formation Control of Team of Aerial Robot Swarms in Cluttered Environments

Zhipeng Xie, Youlian Long, Hui Cheng

FrA3-4 Resource planning for UAV swarms based on NSGA-II

Jinge Li , Yuan Yao, Gang Yang, Xingshe Zhou

FrA3-5 A Semantic Segmentation based Lidar SLAM system towards Dynamic Environments

Jian Rui, Su Weihua, Ruihao LI, Zhang Shiyue, Jiacheng Wei, Boyang Li, Ruqiang Huang

Invited Keynote

Invited Speaker
Prof Haitao Zhang

Talk: From Biological Swarm Intelligence to Cooperation of Cross-Domain Unmanned Systems

Abstract: From the human crowds to various biological collective motions such as birds flocks, fish schools, insects and bacteria colonies and cell migrations, there are extensive mass movements in nature. The system composed of interconnected and moving individuals has emerged rich and highly coordinated swarm intelligence behavior. For example, fish swarm in the water in a seemingly chaotic but orderly way. When they encounter predators or obstacles, they suddenly gather or disperse, showing a very strict division and cooperation. Starling flocks gather tens of thousands of birds to form complex patterns during migration, presenting dynamically agitated and illusory scenes in the air. In the micro-world, cell, bacteria, viruses and other populations also form collective movements for diffusion, migration, foraging. The group intelligence in nature shows its amazing charm and provides a rich ideological source for the understanding and optimization of industrial and social groups. Exploring swarm intelligence and mechanism with the assistance of the perspective of self-organizing evolution of biological groups has become an international frontier and hotspot research direction in the fields of automation science, system science, computer science, physical science, etc. From the application point of view, this work helps pave the way from mechanism of swarm intelligence evolution mechanism to the cooperative control of cross-domain autonomous unmanned systems, assembly of swarm intelligent robots, etc.

Biography: Hai-Tao Zhang, Vice Dean of School of Artificial Intelligence and Automation, Huazhong University of Science and Technology, Distinguished Professor of Central China Scholar, Young Scholar of Chang Jiang Scholars' Award Program of Minister of Education, National Young Top Talent, and Winner of National Excellent Youth Fund. Born in 1977, he received his Bachelor and Ph. D. from University of Science and Technology of China in 2000 and 2005, respectively. In 2007, he was engaged in post- doctoral research at Cambridge University in England. He was promoted to Professor in 2010. He has visited University of California, University of Virginia and other academic institutions. His research interests include swarm intelligence, cooperative control of autonomous USVs, etc. He has hosted more than 20 projects such as Joint Key Fund, Excellent Youth Fund and Major Research Plan of National Natural Science Foundation. He has published/been accepted 84 SCI journal papers, including 38 papers in Automatica and IEEE Trans./Mag. as first or corresponding author. His collective motions' phase-transition work was selected as research highlights in Nature Physics in 2016. He has applied or authorized 32 patents of invention (including 2 American patents). He has won the first prize of Natural Science in Hubei Province, and the gold award of Genevan International Invention Exhibition. Prof. Zhang is an IEEE Senior Member who serves/have served as Editorial Board members of several International SCI Journals such as IEEE Trans. Circuits and Systems II, Asian Journal of Control.

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FrA4: Compliant manipulation learning and control for lightweight robot (323, 358, 376, 397)

Time: August 9th Friday, 11:00-12:30

Venue: No. 9 Meeting Room on 6th floor (6 楼第九会议室)

Chairs: Chin-Yin Chen, Dr. Yuwang Liu

Keynote: Creative Design and Reconfiguration Analysis of Multi-mode Parallel Mechanisms

Invited Speaker: Dr Xianwen Kong, Heriot-Watt University, UK

FrA4-1 A Nonsqueezing Torque Distribution Method for an Omnidirectional Mobile Robot with Powered Castor Wheels

Wenji Jia, Guilin Yang, Chongchong Wang, Qiang Liu, Zaojun Fang, Chin-Yin Chen

FrA4-2 A Two-Step Self-Calibration Method with Portable Measurement Devices for Industrial Robots Based on POE Formula

Lefeng Gu, Guilin Yang, Zaojun Fang, Wenjun Shen, Tianjiang Zheng, Chin-Yin Chen, Chi Zhang

FrA4-3 Obstacle Avoidance of a redundant robot using virtual force field and null space projection

Yiming Jiang, Chenguang Yang, Zhaojie Ju, Jinguo Liu

FrA4-4 Modeling of Torque Ripple for Integrated Robotic Joint

Yusheng Liao, Chi Zhang, Chongchong Wang, Chin-Yin Chen, Qiang Xin, Silu Chen

Invited Keynote

Invited Speaker

Dr Xianwen Kong

Title: Creative Design and Reconfiguration Analysis of Multi-mode Parallel Mechanisms

Abstract: Reconfigurable mechanisms and robots have attracted much attention from many researchers during the past three decades to meet the need of systems that can adapt to production and environment change as well as multi-function products. Multi-mode parallel mechanisms are novel reconfigurable parallel mechanisms that are disassembly-free and use a minimum number of actuators. One multi-mode parallel mechanism can act as two or more conventional parallel mechanisms. This talk mainly covers a brief introduction to reconfigurable parallel mechanisms, an overview of creative design of conventional parallel mechanisms, creative design of multi-mode parallel mechanisms, and reconfiguration analysis of multi-mode parallel mechanisms based on quaternions and tools from computer algebraic geometry.

Biography: Dr Xianwen Kong is a lecturer and Programme Co-director of MSc Robotics at Heriot-Watt University, UK and a member of Edinburgh Centre for Robotics, a joint venture between Heriot-Watt University and the University of Edinburgh. His research interests include mechanisms and robotics focusing on the creative design of parallel manipulators with their applications in manufacturing and renewable energy. He has authored or co-authored one monograph (with Prof C. Gosselin) published by Springer, two US patents and more than 200 publications in journals and conference proceedings. The Russian translation and Chinese translation of the monograph were published by the Russian publisher FIZMATLIT – Nauka Publishers and the China Machine Press in 2012 and 2013 respectively. Dr Kong served as the Program Chair/Co-chair for the ASME/IEEE ReMAR in 2009, 2012 and 2015 and the ASME IDETC 2016 and 2018. He was an invited lecturer for the International Summer School on Screw-Theory Based Methods in Robotics hold in Italy, China, Brazil and Canada from 2009 to 2016. He is an elected member of the ASME Technical Committee on Mechanisms and Roboticsand servesas an associate editor for ASME Journal of Mechanisms and Robotics, Mechanism and Machine Theory and Mechanical Sciences, a member of editorial board of the Chinese Journal of Mechanical Engineering. He received several awards including the 2012 Freudenstein/General Motors Young Investigator Award. A morphing machinedeveloped by Dr Kong's team was on display in the Science and Technology Galleries at the National Museum of Scotland from July 2016 to February 2017 for creating spark of interest that leads to new discoveries.

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FrA5: Modular robots and other mechatronic systems (190, 271, 329, 485)

Time: August 9th Friday, 11:00-12:30

Venue: No. 6 Meeting Room on 3rd floor (3 楼第六会议室)

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Chairs: Prof. Yisheng Guan, Prof. Zhuming Bi, Prof. Shugen Ma

Keynote: M3 (Musculoskeletal Mechanics and Mechatronics)

Engineering: Biomechanical Engineering from Human and for Human

Invited Speaker: Prof Lei Ren, The University of Manchester, UK

FrA5-1 A bio-inspired self-repair approach for modular self-reconfigurable robots

Dongyang Bie, Yu Zhang, Xingang Zhao, Yanhe Zhu

FrA5-2 Reconfigurable design and structure optimization of SCARA

Zhao Chun, Yanjie Wang, Hao Muyu, Luo Minzhou

FrA5-3 Modular Design of 7-DOF Cable-Driven Humanoid Arms

Hao Jiang, Tao Zhang, Cai Xiao, Jian Li, Yisheng Guan

FrA5-4 Design and Locomotion Analysis of a Retractable Snake-like Robot Based on 2-RRU/URR Parallel Module

Hui Bian, Lanlan Sun, Lei Yunfei

Invited Keynote

Invited Speaker

Prof Lei Ren

Talk: M3 (Musculoskeletal Mechanics and Mechatronics) Engineering: Biomechanical Engineering from Human and for Human

Abstract: A wide variety of physical movements can be achieved by the human neuromusculoskeletal system, from normal walking to the skilful performance of a professional dancer. All these motor tasks involve the load transmission and distribution through the body, balance and coordination. The quest toward understanding how these tasks are achieved by the human body has been of interest to scientists for centuries. This talk presents our recent attempts to explore the in-vivo working condition of the human musculoskeletal system during different motor activities, and also to develop humancentred robotics based on learnt biomechanical principles. This involves a range of researches into the biomechanics and motor control of human motions at different system levels using an integrated experimental, computational and bio-robotic approaches. Our long term aim is to gain comprehensive understanding of the functions of musculoskeletal systems and the interactions between the musculoskeletal and neuromotor systems. Such research provide solid scientific foundation for the development of novel preventative and rehabilitative programs and devices, clinical diagnostic and surgical techniques, and also human-centred robotics based on bio-inspired principles.

Biography: Prof. Ren is a Reader in Biomechanics and Biorobotics at School of Mechanical, Aerospace and Civil Engineering, University of Manchester, and the leader of the Biomechanics Research Specialism. He also holds a Changjiang Professorship at Jilin University. He researches in the field of biomechanics and bioinspired robotics. He has been the PI and Co-I of over 20 research projects funded by UK Ministry of Defence, EPSRC, BBSRC, NSFC and MoST etc. Prof. Ren has over 150 peer-reviewed publications. His research works have been reported by many major international medium including Nature, Science News, Wired, Telegraph, Science Daily and BBC etc. He sits in the Council of Chairs, Biomedical Engineering Society (BMES), and also serves as the associate editor of Frontiers in Bioengineering and Biotechnology, the editorial board members of Journal of Bionic Engineering, PLoS One and Journal of Healthcare Engineering. He is the member of UK EPSRC Peer Review College and also grant expert reviewers for UK EPSRC, BBSRC, MRC, Leverhulme Trust, French National Research Agency, NSFC and UNESCO etc.

FrA6: Robotic technology for deep space exploration(22, 71, 368, 406, 412, 417)

Time: August 9th Friday, 11:00-12:30

Venue: No. 7 Meeting Room on 3rd floor (3 楼第七会议室)

Chairs: Dr. Yaobing Wang, Dr. Lei Chen

FrA6-1 Kinematic Characteristics Analysis of a Double-ring Truss Deployable Antenna Mechanism

Bo Han, Yundou Xu, Jiantao Yao, Dong Zheng, Yongsheng Zhao

FrA6-2 Conceptual Design of Ejection, Aerostat and Rolling Group Detectors

Qunzhi Li, Chao Ma, Wangjun Zhang, Han Wang, Zhihui Zhao

FrA6-3 A Self-calibration Method of Lander Manipulator for Deep Space Exploration Mission

Qingxuan Jia, Shao Wen, Gang Chen, Yifan Wang, Lanpu Li

FrA6-4 A Hybrid Deep Reinforcement Learning Algorithm for Intelligent Manipulation

Chao Ma, Jianfei Li, Jie Bai, Yaobing Wang, Bin Liu, Jing Sun

FrA6-5 Virtual-sensor-based Planetary Soil Classification with Legged Robots

Shuang Wu, Lei Chen, Bin Liu, Chu Wang, Qingqing Wei, Yaobing Wang

FrA6-6 Virtual force senor based on PSO-BP neural network for legged robots in planetary exploration

Chu Wang, Shuang Wu, Lei Chen, Bin Liu, Qingqing Wei, Yaobing Wang

FrA7: Unmanned underwater vehicles (208, 213, 259, 272, 370, 375)

Time August 9th Friday, 11:00-12:30

Venue: Activity Room on 5th floor (5 楼活动室)

Chairs: Prof. Daqi Zhu, Prof. Xianbo Xiang

FrA7-1 Path Planning For Swarm AUV Visiting Communication Node

Chao Geng, Guannan Li, Hongli Xu

FrA7-2 A dynamic tracking control for the 4500m-Human Occupied Vehicle

Wenyang Gan, Daqi Zhu, Zhen Hu

FrA7-3 Development of A Full Ocean Depth Hydraulic Manipulator System

Yanzhuang Chen, Qifeng Zhang, Xisheng Feng, Liangqing Huo, Qiyan Tian, Linsen Du, Yunfei Bai, Cong Wang

FrA7-4 Thruster fault identification for autonomous underwater vehicle based on time-domain energy and time-frequency entropy of fusion signal

Baoji Yin, Xi Lin, Wenxian Tang, Zhikun Jin

FrA7-5 Design and Implementation of Monitoring System for Deep Sea Ore Sampling Machine

Donglei Dong, Xianbo Xiang, Jinrong Zheng, Qin Zhang

FrA7-6 An Automated Launch and Recovery System for USVs based on the Pneumatic Ejection Mechanism

Shuanghua Zheng, Yang Yang, Yan Peng, Jianxiang Cui, Junjie Chen, Xingang Jiang, Yonghui Feng

FrA8: Robotic grasping and manipulation with incomplete information and strong disturbance (218, 285, 379, 381, 400, 421)

Time: August 9th Friday, 11:00-12:30

Venue: No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

- -

Chairs: Prof. Yuan Yuan, Dr. Shuguang Li, Dr. Chong Sun

FrA8-1 Development of Bolt Screwing Tool Based on Pneumatic Slip Ring

> Qi Zhang, Xie Zongwu, Yechao Liu, Hong Liu

FrA8-2 Deep Grasping Prediction with Antipodal Loss for Dual Arm Manipulators

> Dong Yunlong, Xiangdi Liu, Bidan Huang, Chunlin Ji, Jianfeng Xu, Han Ding, Ye Yuan

FrA8-3 Artificial Neural Network based Tactile Sensing Unit for Robotic Hand

> Dong Kyo Jeong, Dong-Eon Kim, ailing Li, Jang-Myung Lee

FrA8-4 Bounded Recursive Optimization Approach for Pose Estimation in Robotic Visual Servoing

> Yuchen Zhang, Bo Chen, Li Yu, Haiyu Song

FrA8-5 The Energy Management for the impact/vibration control in the Non-cooperative Space Target Capture

> Lisheng Deng, FANG Qun, Cheng-xi WANG, SHI Hao, Ming-Xiao WANG, Wenya Wan

FrA8-6 Force Analysis and Experiment of Variable Stiffness Soft Actuator Based on Particle Jamming

> Fengyou Jiang, Fengyu Xu, Hongliang Yu, Yurong Song, Xudong Cao

FrB1: Fuzzy Modelling for automation, control, and robotics (61, 164, 503)

Time: August 9th Friday, 15:00-16:30

Venue: Longfeng Hall A on 2nd floor (2 楼隆奉 A 厅)

- -

Chairs: Dr. Longzhi Yang, Dr. Chengyuan Chen, Dr. Yanpeng Qu, Dr. Tianhua Chen, Dr. Jie Li

Keynote: Reconfigurable Aerospace Systems

Invited Speaker: Prof Fengfeng Xi, Ryerson University, Canada

FrB1-1 Variable Universe Fuzzy Control for Direct Yaw Moment of Distributed Drive Electric Vehicle

> **Sen Cao, Yaping Wang, Haoran Jia, Zheng Zhang**

FrB1-2 Force control polishing device based on fuzzy adaptive impedance control

> **Pengfei Chen, Huan Zhao, Xin Yan, Han Ding**

FrB1-3 A Study of TSK Inference Approaches for Control Problems

> **Jie Li, Fei Chao, Longzhi Yang**

Invited Keynote

Invited Speaker

Prof Fengfeng Xi

Talk: Reconfigurable Aerospace Systems

Abstract: In this talk a reconfigurable system design methodology will be presented based on modules that are fundamental to realize system reconfiguration. The presented method consists of three pillars: module determination, module design and module synthesis. Module determination is to identify basic elements from a given set of functions for reconfiguration using axiomatic theory. Module design is to generate basic adaptive elements for reconfiguration using metamorphic theory. Module synthesis is to combine these elements to form a reconfigurable system against a set of criteria using multi-disciplinary design optimization (MDO) theory. The developed method has been applied to design a number of reconfigurable aerospace systems. Examples of continuous (shape adaptive) reconfigurable systems comprise morphing wings and morphing cabin. Examples of discrete reconfigurable systems contain reconfigurable aerospace manufacturing systems for riveting and polishing. Real-case designs will be presented to demonstrate the effectiveness of this science-based design methodology for reconfigurable systems.

Biography: Fengfeng (Jeff) Xi obtained his Ph.D. degree from the University of Toronto and conducted his NSERC Post-Doctoral research at McGill University. He gained extensive industrial experience through seven years of work as project leader at the National Research Council of Canada (NRC). Currently, he is Professor with the Department of Aerospace Engineering of Ryerson University, in Toronto, Canada, and Director of Ryerson Institute for Aerospace Design and Innovation (RIADI). Over the last two decades, he has been working extensively in the area of reconfigurable systems, and founded the Reconfigurable Systems Laboratory (RSL) at Ryerson. His initial work included discrete reconfigurable systems such as reconfigurable serial and parallel robots, with applications to abrasive machining and riveting. His current work focuses on continuous (shape adaptive) reconfigurable systems such as morphing wings and cabins. He will serve as the Conference Chair for the 2021 IEEE/IFToMM International Conference on Reconfigurable Mechanisms & Robots (ReMar2021).

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FrB2: Computational intelligence inspired robot navigation and SLAM (19, 320, 374, 463)

Time: August 9th Friday, 15:00-16:30

Venue: Longfeng Hall B on 2nd floor (2 楼隆奉 B 厅)

Chairs: Prof. Naoyuki Kubota, Dr. Yuichiro Toda, Dr. Weihong Chin, Dr. Jin Seok Woo

Keynote: Learning Robot Localisation, Navigation and Autonomy from Vision

Invited Speaker: Dr Sen Wang, Heriot-Watt University, UK

FrB2-1 Improved neural network 3D space obstacle avoidance algorithm for mobile robot

Yuchuang Tong, Jinguo Liu, Yuwang Liu, Zhaojie Ju

FrB2-2 An Improved A Algorithm Based on Loop Iterative Optimization in Mobile Robot Path Planning

Gang Peng, Lu Hu, Wei Zheng, Shan Liang Chen

FrB2-3 Indoor Environment RGB-DT Mapping for Security Mobile Robots

Lijun Zhao, Yu Liu, Xinkai Jiang, Ke Wang, Zigeng Zhou

FrB2-4 Navigate to Remember: A Declarative Memory Model for Incremental Semantic Mapping

Wei Hong Chin, Naoyuki Kubota, Zhaojie Ju, Honghai Liu

Invited Keynote

Invited Speaker

Dr Sen Wang

Talk: Learning Robot Localisation, Navigation and Autonomy from Vision

Abstract: Robotics is undergoing an exciting transition from manufacturing automation to autonomous systems operating in complex and dynamic environments, e.g., open street and deep sea. One of the big challenges to the adoption of autonomous robots in the wild is to achieve reliable and persistent autonomy. In this talk, I will describe our works on robot perception and learning for full autonomy, ranging from model based autonomous navigation to deep learning based visual odometry. The use of high-level visual semantics for challenging robot vision tasks will be also discussed.

Biography: Dr. Sen Wang is an Assistant Professor in Robotics and Autonomous Systems at Heriot-Watt University, UK and a faculty member of Edinburgh Centre for Robotics, a £120M joint venture between Heriot-Watt and Edinburgh Universities for excellent Robotics and AI research. He is also the Director of the Perception and RObotics (PRO) Group at Heriot-Watt. Previously, he was a post-doctoral researcher at the University of Oxford, working on autonomous mobile robots. His research focuses on robot perception and long-term autonomy, especially autonomous navigation, robot vision, SLAM and robot learning. His work has been published in major venues in robotics, computer vision and artificial intelligence areas, including IJRR, ICRA, IROS, CVPR, AAAI and IJCAI, and been awarded a Best Paper Award and an Outstanding Paper Award. He has been PI/Co-I of several projects funded by EPSRC and EU H2020 with over 40 million GBP funding in total, and serves as an Associate Editor for 2019 IEEE International Conference on Robotics and Automation (ICRA).

FrB3: Wearable sensing based limb motor function rehabilitation (258, 348, 468, 476)

Time: August 9th Friday, 15:00-16:30

Venue: No. 8 Meeting Room on 5th floor (5 楼第八会议室)

- -

Chairs: Dr. Yinfeng Fang, Dr. Xiaofei Ji, Prof.Gongfa Li, Dr. Dalin Zhou

Keynote: Assistive exoskeletons for motion assistance: mechanism design, motion intention detection and control

Invited Speaker: Dr Shaoping Bai, Aalborg University, Denmark

FrB3-1 Design of a Sensor Insole for Gait Analysis

Kamen Ivanov, Zhanyong Mei, Ludwig Lubich, Nan Guo, Deng Xile, Zhichun Zhao, Olatunji Omisore, Derek Ho, Lei Wang

FrB3-2 Multiple Features Fusion System for Motion Recognition

Jiang Hua, Zhaojie Ju, Disi Chen, Dalin Zhou, Haoyi Zhao, Du Jiang, Gongfa Li

FrB3-3 Classification Methods of sEMG Through Weighted Representation-based K-nearest Neighbor

Shuai Pan, Jing Jie, Kairui Liu, Jinrong Li, Hui Zheng

FrB3-4 A Soft Capacitive Wearable Sensing System for Lower-limb Motion Monitoring

Xingxing Ma, Jiajie Guo, Kok-Meng Lee, Luye Yang, Minghui Chen

Invited Keynote

Invited Speaker
Dr Shaoping Bai

Title: Assistive exoskeletons for motion assistance: mechanism design, motion intention detection and control

Abstract: As the global ageing predictions become reality, assistive exoskeletons are being increasingly considered as future aids to help elderly persons staying active in their daily living tasks and rehabilitation systems for effectively restoring patient's motor functions. The exoskeletons are also considered as useful power assistance for labor workers in the manual work to reduce muscle fatigue and to prevent musculoskeletal injuries. This talk is focused on the development of exoskeletons for assistive applications. A brief overview of exoskeletons with their classification and applications will be presented. The design and development challenges will be discussed, including mechanism design, human-exoskeleton interaction modeling, motion intention detection by means of force myograph sensors and assistance control. In the talk, research projects on exoskeleton at Aalborg University will be presented, together with progresses and results newly obtained.

Biography: Dr. Shaoping Bai is an Associate Professor at the department of Materials and Production, Aalborg University (AAU), Denmark. His research interests include assistive robots, parallel manipulators, walking robots, dynamics and design. He is one of the founders of Centre for Robotics Research (CRR), AAU. He was the coordinator of the CRR for the year 2010-2012. Dr. Bai leads several national and international research projects in exoskeletons, including EU AAL project AXO-SUIT and IFD Grand Solutions project EXO-AIDER, among others. Dr. Bai is a recipient of IEEE CIS-RAM 2017 best paper, IFToMM MEDER 2018 best application paper, and Grand Prize of WearRAcon Innovation Challenges 2018. Dr. Bai is an Associate Editor of ASME J. of Mechanisms and Robotics, an Associate Editor of IEEE Robotics and Automation Letters, and a deputy chair of IFToMM Technical Committee of Robotics and Mechatronics.

FrB4: Autonomous control of unmanned aircraft systems (45, 46, 134, 427)
Venue: No. 9 Meeting Room on 6th floor (6 楼第九会议室)

Chairs: Dr. Yifeng Niu, Dr. Yirui Cong

Keynote: The Motion Control of Robotic Systems by Using Anti-Disturbance Control Method

Invited Speaker: Prof Yuan Yuan, Northwestern Polytechnical Univeristy, China

FrB4-1 Reorientation Control for A Microsatellite with Pointing and Angular Velocity Constraints

Zhenxin Feng, Jianguo Guo, Zhou Jun

FrB4-2 Real-Time Trajectory Replanning for Quadrotor using OctoMap and Uniform B-splines

Jia Hu, Zhaowei Ma, Yifeng Niu, Wenli Tian, Wenchen Yao

FrB4-3 Analysis of Disturbance Effect of a Cable on Underwater Vehicle

Zhandong Li, Jingkui Li, Jianguo Tao, Wei Wang, Yang Luo

FrB4-4 Bionic Design and Attitude Control Measurement in a Double Flapping-wing Micro Air Vehicle

Xuedong Zhang, Huichao Deng, Shengjie Xiao, Lili Yang, Xilun Ding

Invited Keynote

Invited Speaker
Prof Yuan Yuan

Talk: The Motion Control of Robotic Systems by Using Anti-Disturbance Control Method

Abstract: In engineering practice, it is pervasive that the robotic systems are subjected to multi-source disturbances, such as external/internal disturbance and sensor noises. These disturbances, if not handled appropriately, might lead to serious performance degradation or even instability of the robotic system. As such, it becomes a nature must to design practical motion control algorithms such that the controlled robotic systems could resist the considered disturbances while being stabilized. Fortunately, recent years have witnessed an ever-increasing research interest in the investigation of the anti-disturbance control algorithms which makes tremendous practical sense. Different from traditional feedback control algorithms, the anti-disturbance control method normally enjoy more design freedom by adopting both feedforward controller and feedback controller, which yields a composite control scheme. The feedforward controller is capable of eliminating the disturbances in an online manner, which creates an ideal environment for the robotic system. In this talk, I would present the basic design principles to implement the anti-disturbance control protocol to the robotic systems. To facilitate the practitioners, I would provide concrete examples to show how our method could be applied to real-world robotic systems, such as quadrotor and pneumatic artificial muscles

Biography: Yuan Yuan is currently a full professor in School of Astronautics, Northwestern Polytechnical Univeristy (NPU), China. Dr. Yuan received his Ph.D. in Computer Science and Technology in Tsinghua University in 2015 and B.Sc. degree in electrical engineering from the School of Instrumental Science and Opto-electronics Engineering, Beihang University in 2009. Prior to joining NPU, Dr. Yuan works as a research fellow in Brunel University London, U.K. and as an Associate Researcher in City University of HongKong. Dr. Yuan is an IEEE Senior Member, a Reviewer, Mathematical Reviews, and serves as Associate Editor for Neurocomputing, International Journal of Advanced Robotic Systems, and Mathematical Problems in Engineering. He also served as Guest Editor for International Journal of General Systems and International Journal of Advanced Robotic Systems. Dr. Yuan is the receipt of the best paper award for 2018 IEEE Chinese Guidance, Navigation and Control Conference.

FrB5: Marine Bio-inspired robotics and soft robotics: materials, mechanisms, modeling, and control (140, 392, 519)

Time: August 9th Friday, 15:00-16:30

Venue: No. 6 Meeting Room on 3rd floor (3 楼第六会议室)

- -

Chairs: Dr. Li Wen, Prof. Junzhi Yu, Dr. Tiefeng Li, Dr. Rongjie Kang

Keynote: Biomimetics on gecko locomotion: From Biology to Engineering

Invited Speaker: Prof Zhendong Dai, Nanjing University of Aeronautics and Astronautics, China

FrB5-1 A Novel Dual-drive Soft Pneumatic Actuator with the Improved Output Force

> **Shoufeng Liu, Fujun Wang, Guanwei Zhang, Zhu Liu, Wei Zhang, Yanling Tian, Dawei Zhang**

FrB5-2 A gecko-inspired robot employs scaling footpads to facilitate stable attachment

> **Zhongyuan Wang, Kebo Deng, Qingyao Bian, Zhendong Dai**

FrB5-3 Measurement Method of Underwater Target Based on Binocular Vision

> **Xiufen Ye, Hao Chen**

Invited Keynote

Invited Speaker
Prof Zhendong Dai

Talk: Biomimetics on gecko locomotion: From Biology to Engineering

Abstract: Geckos have been studied for many years for their excellent moving abilities on various substrates. The paper reports our studies on the gecko adhesive mechanism, attaching and detaching dynamics, artificial adhesive materials and modification, gecko-inspired robot. Here we measured the contact/ tribo-electrifiction, results show that contact/tribo-electric charge between toes of gecko and substrate greatly influence the adhesion between setae and substrate. Our studies show that geckos prefer to detach from substrate by toe abduction, instand of peeling from substrate. Vertically carbon-nanotube array increases the adhesive, space circumstance heavily decreases the adhesive performance of polymer-based adhesive materials. We developed gecko-inspired robot and carried out experiments on micro-gravity simulating status.

Biography: Dr. Zhendong Dai, Fellow of International Society of Bionic Engineering, director and founder of IBSS at NUAA, Professor of Astronautics, Mechanical Engineering, Mechanics, Materials Science and Engineering. He obtained his Master and Doctor degree from NUAA in 1986 and 1999 respectively. He set up a theory of tribo-irreversible thermodynamics from 1995 to 2000, started bionic study by joining Gorb group in Institute of Development Biology, Max-Plank-Institute, Germany, in 2000. He developed 3D force sensors and set up a facility to measure the 3D reaction force and to observe the motion behaviors simultaneously, studied the adhesive mechanism and the detaching technique used by gecko were subtly investigated.

He has charged number of important projects, including two NSFC key projects and three key international collaboration projects, authored 6 books and more than 400 peer reviewed papers.

His research interests include biomimetic on legged locomotion—gecko-mimicking robot, biological gecko-robot, locomotion dynamics and artificial adhesive; lightweight structures and materials —bio-inspired lightweight structure, multifunctional foamed metal; and tribology.

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FrB6: Human centered robotics (181, 200, 202, 228, 336)

Time: August 9th Friday, 15:00-16:30

Venue: No. 7 Meeting Room on 3rd floor (3 楼第七会议室)

Chairs: Prof. Chengdong Wu, Prof. Lijin Fang, Prof. Jinhua She, Prof. Xin Chen, Asso. Prof. Fei Wang, Asso. Prof. Zhentao Liu

FrB6-1 Deep learning based noise level classification of Medical images

> **Yifei Zhang, Chengdong Wu, Jianning Chi, Xiaosheng Yu**

FrB6-2 Deep Learning Based Gesture Recognition and Its Application in Interactive Control of Intelligent Wheelchair

> **Xingqun Zhou, Fei Wang, Jianhui Wang, Yufan Wang, yan junlang, guilin zhou**

FrB6-3 Cross-Subject EEG-Based Emotion Recognition with Deep Domain Confusion

> **Zhang Weiwei, Fei Wang, Wu Shichao, Xu Zongfeng, Jiang Yang, Zhang Yahui**

FrB6-4 Development of Mixed Reality Robot Control System Based on HoloLens

> **Xuanmeng Sha, Zixi Jia, WeiDong Sun, Hao Yida, Xingang Xiao, Hanlu Hu**

FrB6-5 Improvement of Mask-RCNN Object Segmentation Algorithm

> **Xin Wu, Wen Shiguang, Yuan-ai Xie**

FrB7: Bio-inspired wall climbing robot
(50, 102, 227, 255, 353)
Time: August 9th Friday, 15:00-16:30
Venue: Activity Room on 5th floor (5 楼活动室)

- -

Chairs: Prof. Linsen Xu, Dr. Fengyu Xu

FrB7-1 Jinfu Liu, Linsen Xu, Shouqi Chen, Hong Xu, Gaoxin Cheng, Tao Li, Qingfeng Yang

> **Qi Zhang, Xie Zongwu, Yechao Liu, Hong Liu**

FrB7-2 The Graspable Algorithm for a Wall-climbing Robot with Claws

> **Fanchang Meng, Yiquan Guo, Fengyu Xu, Guoping Jiang, Bei Wang**

FrB7-3 A Novel Tracked Wall-Climbing Robot with Bio-Inspired Spine Feet

> **Yanwei Liu, SanWa Liu, Limeng Wang, Xuan Wu, Yan Li, Tao Mei**

FrB7-4 A wall climbing robot arm capable of adapting to multiple contact wall surfaces

> **Shiyuan Bian, Yuliang Wei, Feng Xu, Min Tang, Deyi Kong**

FrB7-5 Development of Control System with Double-closed Loop for a Multi-mode Wall-climbing robot

> **Hong Xu, Linsen Xu, Gaoxin Cheng, Shouqi Chen, Jinfu Liu**

FrB8: Robot intelligence technologies and system integration (17, 187, 362, 364, 403, 415)
Time: August 9th Friday, 15:00-16:30
Venue: No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

Chairs: Dr. Yuichiro Toda, Dr. Xiang Li, Dr. Dalai Tang

FrB8-1 Method on Human Activity Recognition Based on Convolutional Neural Network

> **Zhang Haibin, Naoyuki Kubota**

FrB8-2 A Web Based Security Monitoring and Information Management System for Nursing homes

> **Ying Li, Ying Xu, Lv Yi, Junchen Wang**

FrB8-3 Region of Interest Growing Neural Gas for Real-time Point Cloud Processing

> **Yuichiro Toda, Xiang Li, Takayuki Matsuno, Mamoru Minami**

FrB8-4 Detection of Divergence Point of the Optical Flow Vectors Considering to Gaze Point while Vehicle Cornering

> **Hiroyuki Masuta, Yusuke Nagai, Yuta Kumano, Tatsuo Motoyoshi, Kei Sawai, Takumi Tamamoto, Ken'ichi Koyanagi, Toru Oshima**

FrB8-5 Automatic fiber detection and focus system from image frames.

> **Wei Quan, Haibing Zhang, Naoyuki Kubota**

FrB8-6 Lifelog Generation Based on Informationally Structured Space

> **Dalai Tang, Naoyuki Kubota**

FrC1: Swarm intelligence unmanned system (15, 16, 31, 141, 148, 264, 310, 478)

Time: August 9th Friday, 16:45-18:30

Venue: Longfeng Hall A on 2nd floor (2 楼隆奉 A 厅)

Chairs: Dr. Qi Dong, Dr. Feifei Gao

Keynote: New Insights into Bio-inspired Intelligence for Autonomous Robots with Their Applications
Invited Speaker: Dr Chaomin Luo, Mississippi State University, USA

FrC1-1 User Association and Power Allocation in UAV-based SWIPT System

Mei Yang, Fei Huang, Yongling Zeng, Yunzhen Wu, Chuanshuo Zhang

FrC1-2 Joint Location Selection and Supply Allocation for UAV Aided Disaster Response System

Nanxin Wang, Jingheng Zheng, Jihong Tong, Kai Zhang

FrC1-3 Energy Minimization for Rotary-Wing UAV Enabled WPCN

Fahui Wu, Dingcheng Yang, Lin Xiao

FrC1-4 An Efficient Image Quality Assessment Guidance Method for Unmanned Aerial Vehicle

Xin Guo, Xu Li, Lixin Li, Qi Dong

FrC1-5 Equal Gain Combining Based Sub-Optimum Posterior Noncoherent Fusion Rule for Wireless Sensor Networks

Fucheng Yang, Jie Song, Yilin Si, Lixin Li

FrC1-6 Secure Transmission Design for UAV-Based SWIPT Networks

Shidang Li, Chunguo Li, Hui Zhong

FrC1-7 Spectrum Sharing Scheme for Multi-UAVs Relay Network Based on Matching Theory

Jingmin Zhang, Xiaomin Liu, Lixin Li, Fucheng Yang, Qi Dong, Xiaokui Yue

FrC1-8 A Hybrid Multiagent Collision Avoidance Method for Formation Control

Zezhi Sui, Zhiqiang Pu, Jianqiang Yi, Tianyi Xiong

Invited Keynote

Invited Speaker
Dr Chaomin Luo

Talk: New Insights into Bio-inspired Intelligence for Autonomous Robots with Their Applications

Abstract: Nowadays, computational intelligence and machine learning techniques play an increasingly important role on robotics, control, automation, and embedded systems. In this research, bioinspired intelligence and machine learning methodologies are developed for a variety of realworld applications such as autonomous vehicle systems, mobile robot control, intelligent control, and embedded systems. A sequence of novel neural dynamics, evolutionary computation, swarm intelligence, and deep reinforcement learning techniques, associated with numerical and heuristic methods, for intelligent vehicle motion control, and tracking control are developed. Various innovative biologically-inspired neural networks (BINN) algorithms are developed for motion control, navigation, robot vision, mapping and tracking control motivated through biological neural systems as most of biological neural systems are bounded and stable.
Effectiveness, feasibility, and efficiency of the proposed real-time motion control, intelligent control, navigation, localization, vision, and map building models of autonomous mobile robots have been successfully validated by comparison studies and actual experiments. A series of intelligent mobile robots equipped with various sensors have been developed to validate effectiveness and efficiency of the proposed intelligent methodologies.

Biography: Dr. Chaomin Luo received his Ph.D. in Department of Electrical and Computer Engineering at University of Waterloo, in 2008, his M.Sc. in Engineering Systems and Computing at University of Guelph, Canada, and his B.Eng. in Electrical Engineering from Southeast University, Nanjing, China. He is currently Associate Professor in the Department of Electrical and Computer Engineering, at the Mississippi State University. He was panelist in the Department of Defense, USA, 2015-2016, 2016-2017 NDSEG Fellowship program and panelist in 2017 NSF GRFP Panelist program. He was the General Co-Chair of 2015 IEEE International Workshop on Computational Intelligence in Smart Technologies, and Journal Special Issues Chair, IEEE 2016 International Conference on Smart Technologies, Cleveland, OH. He was publication co-chair in the 2018 IEEE International Conference on Information and Automation (IEEE ICIA2018). Currently, he is Associate Editor of International Journal of Robotics and Automation, and International Journal of Swarm Intelligence Research. He was the Publicity Chair in 2011 IEEE International Conference on Automation and Logistics. He was on the Conference Committee in 2012 International Conference on Information and Automation and International Symposium on Biomedical Engineering and Publicity Chair in 2012 IEEE International Conference on Automation and Logistics. He was a Chair of IEEE SEM - Computational Intelligence Chapter; a Vice Chair of IEEE SEM- Robotics and Automation and Chair of Education Committee of IEEE SEM. He has extensively published in reputed journal and conference proceedings, such as IEEE Transactions on Neural Networks, IEEE Transactions on SMC, IEEE-ICRA, and IEEE-IROS, etc. His research interests include engineering education, computational intelligence, intelligent systems and control, robotics and autonomous systems, and applied artificial intelligence and machine learning for autonomous systems. He received the Best Paper Award in the IEEE International Conference on Information and Automation (IEEE ICIA2017). He is an ASEE, INFORMS, and IEEE member. He is currently an Associate Editor of The 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IEEE-IROS 2019).

FrC2: Medical Robot (29, 79, 184, 312, 501)

Time: August 9th Friday, 16:45-18:30

Venue: Longfeng Hall B on 2nd floor (2 楼隆奉 B 厅)

Chair: Dr. Yinfeng Fang

Keynote: Assitive Robot for Endovascular Catheterization

Invited Speaker: Dr Jindong Liu, Imperial College London, UK

FrC2-1 FES Proportional Tuning Based on sEMG

> **Yu Zhou, Jia Zeng, Kairu Li, Honghai Liu**

FrC2-2 A Noninvasive Calibration-free and Model-free Surgical Robot for Automatic Fracture Reduction

> **Shijie Zhu, Yitong Chen, Yu Chen, Jiawei Sun, Zhe Zhao, Changping Hu, Gangtie Zheng**

FrC2-3 Application of Haptic Virtual Fixtures on Hot-line Work Robot-assisted Manipulation

> **Yutao Chen, Jing Zhu, Min Xu, Hao Zhang, Xuming Tang, Erbao Dong**

FrC2-4 Force Modeling of Tool-tissue Interaction Force during Suturing

> **Shuai Gao, Shijun Ji, Mei Feng, Qiumeng Li, Xiuquan Lu, Zhixue Ni, Yan Li**

FrC2-5 Simulation Analysis of Trajectory Planning for Robot-Ass

> **WanRu Fei, Baosen Tan, Shaolong Kuang, Yubo Fan, Wenyong Liu**

Invited Keynote

Invited Speaker
Dr Jindong Liu

Talk: Assitive Robot for Endovascular Catheterization

Abstract: Over the last decade, there has been a growing interest in teleoperated robotic catheterization systems for endovascular intervention, by offering advantages to conventional catheterization techniques including reduced radiation exposure, increased precision and stability of motion and added operator comfort. In Hamlyn Centre, we are aiming to bring technology and innovation in robotics to benefit patients. Catheter robot is one of the main research directions.

The purpose of this talk is to provide an overview of robotic catheterization systems. It will also introduce an existing prototype of a hands-on master-slave endovascular robotic system with improved motion/force sensing and haptic feedback, to allow for intuitive human-robot interaction and collaborative control. The incorporation of motion/contact force sensing and force feedback is significant for enhancing the safety of the procedure while compensating for the haptic cues that would be felt by the operator during conventional catheter navigation. The talk will also explore integration of skill models, learned from multiple demonstration of the procedure, for shared control between operator and robot.

Biography: Dr. Liu is an honorary research fellow at the Hamlyn Centre for Robotic Surgery, Imperial College London. He is interested in fields related to Biologically Inspired Mobile Robotics, mainly include natural human-robot interaction, biomimic robotic fish and compliant manipulator for healthcare and surgery robotics. He has a PhD from the University of Essex where he focused on biologically inspired autonomous robotic fish. He successfully built the first autonomous robotic fish. In 2010, he moved to London and joined the Hamlyn Centre, Imperial College London. Now he is focusing on natural human-robot speech interaction, pervasive sensing and healthcare robots. His articles have been published in Neurocomputing, Journal of Bionic Engineering, Journal of Neural Network World and International Journal of Automation and Computing. He is a senior member of IEEE and reviewer of conferences and journals of IEEE and Springer including IEEE Trans. of Neural Network, IROS and ICRA, etc. He published over 70 papers in peer reviewed international conferences and journals. In 2013, his paper had been evaluated as "Most cited Article in 2012" in J. of Bionic Eng. He is listed in the Marquis Who's Who in the world since 2008.

FrC3: Soft locomotion robot (309, 378, 420, 422, 458)

Time: August 9th Friday, 16:45-18:30

Venue: No. 8 Meeting Room on 5th floor (5 楼第八会议室)

Chairs: Dr. Bo Li, Prof. Guimin Chen

Keynote: Design and control of soft robots

Invited Speaker: Prof Guoying Gu, Shanghai Jiao Tong University, China

FrC3-1 Design and Experimental Study of a New Flexible Driven Parallel Soft Massage Robot

Yanzhi Zhao, Hang Wei, Pengbo Li, Guoqing Li, Lizhe Qi, Hongnian Yu

FrC3-2 A vacuum-powered soft linear actuator strengthened by granular jamming

Yangqiao Lin, Jun Zou, Huayong Yang

FrC3-3 A Soft Robot for Ground Crawling: Design and Analysis

Yuxuan Lu, Fengyu Xu, Yudong Yang, Fanchang Meng

FrC3-4 Analysis and Application of the Bending Actuators Used in Soft Robotics

Wen Zhou, Jiahuan Chen, Xudong Wang, Jiadong Hu, Yiqing Li

FrC3-5 An Active Steering Soft Robot for Small-bore T-branch Pipeline

Tianbo Li, Yang Yang, Yonggan Liu, Yongjian Zhao, Yan Peng, Jun Ke, Yuyi Zhai

Invited Keynote

Invited Speaker
Prof Guoying Gu

Talk: Design and control of soft robots

Abstract: Conventional industrial robots with the rigid actuation technology have made great progress for humans in the fields of automation assembly and manufacturing. With an increasing number of robots needing to interact with humans and unstructured environments, soft robots made of soft materials are promising, capable of sustaining large deformation while inducing little pressure or damage when maneuvering through confined spaces. However, design, fabrication, modeling and control of soft robots still have grand challenges because of the inherent large nonlinear behaviors of soft materials. On the other hand, these challenges also provide the exciting opportunities for the robotic society and multidisciplinary integrations are required to create a new generation of biological-like soft robots. In this talk, I will introduce soft robotics and present our recent achievements on soft actuators, sensors and robots.

Biography: Guoying Gu is a Professor of School of Mechanical Engineering at Shanghai Jiao Tong University. His research interests include soft robotics, smart materials actuated systems, bioinspired robot design and motion control. He is the author or co-author of over 80 publications, which have appeared in Science Robotics, Science Advances, IEEE/ASME Trans., Advanced Functional Materials, Soft Robotics, etc., as book chapters and in conference proceedings. Prof. Gu is the winner of multiple awards including Young Changjiang Scholar of the Ministry of Education, National Science Fund for Excellent Young Scholars, The first prize of natural science of Ministry of Education, Best Paper Award at ICIRA 2016 and IEEE-ICIA 2011. Now he serves as Associate Editor of IEEE Transactions on Robotics, Editorial Board Member of International Journal of Advanced Robotic Systems, and Topic Editor of Frontiers in Robotics and AI.

FrC4: Robotics for cell manipulation and characterization (301, 401, 428, 439)

Time: August 9th Friday, 16:45-18:30

Venue: No. 9 Meeting Room on 6th floor (6 楼第九会议室)

Chairs: Prof. Xin Zhao, Associate Prof. Yanding Qin, Associate Prof. Mingzhu Sun

Keynote: Force-Sensing Robotic Micromanipulation Systems

Invited Speaker: Dr Qingsong Xu, University of Macau, China

FrC4-1 A Cell Manipulation Method Based on Stagnation Point of Swirl

Zhiming Ou, Qin Zhang, Hao Yang

FrC4-2 Experimental study of the behavior of muscle cells on projection micro-stereolithography printed micro-structures

Qian Gao, Qinyi Wang, Didi Li, Weiqi Ge, Xue Meng, Guoqing Jin, Haiyi Liang, Xifu Shang, Runhuai Yang

FrC4-3 Automatic micropipette tip detection and focusing in industrial micro-imaging system

Xiaohui Cheng, Jiahong Xu, Xin Zhao, Mingzhu Sun

FrC4-4 Morphologic Reconstruction of 2D Cellular Micro-scaffold Based on Digital Holographic Feedback

Xin Li, Huaping Wang, Qing Shi, Juan Cui, Tao Sun, Hongpeng Qin, Qiang Huang, Toshio Fukuda

Invited Keynote

Invited Speaker

Dr Qingsong Xu

Talk: Force-Sensing Robotic Micromanipulation Systems

Abstract: Robotic micromanipulation systems are demanding devices to realize automated manipulation of tiny samples. Majority of existing robotic micromanipulation systems work based on displacement sensing and control. The lack of force sensing prevents the wide application of the devices. In modern precision engineering industry, there are increasing needs for advanced micromanipulation equipment with microforce sensing and control capabilities. The development of force-sensing microinjectors and microgrippers enable extensive applications involving biological field with guaranteed safety and accuracy of advanced robotic manipulation. This talk reports our recent work on design and development of new force-sensing robotic micromanipulation systems dedicated to biological micromanipulation tasks. In particular, force-sensing microinjectors and microgrippers are presented as typical examples. New microforce sensor design is conducted for targeted applications. Novel control schemes have been developed to fuse the position and force control to enable a safe and reliable manipulation. The effectiveness of the systems have been demonstrated by carrying out microinjection and microgripping operation of biological cells. The developed force-sensing robotic micromanipulation systems have demonstrated wide applications in the fields of biomedical engineering, gene engineering, and so on. Future works on related domain will be discussed.

Biography: Qingsong Xu is the Director of Smart and Micro/Nano Systems Laboratory and Associate Professor of electromechanical engineering at the University of Macau. He was a visiting scholar at the University of California, Los Angeles (UCLA), USA, the RMIT University, Melbourne, Australia, the National University of Singapore, Singapore, and the Swiss Federal Institute of Technology (ETH Zurich), Switzerland. His current research area involves micro/nano-mechatronics and systems, robotics and automation, and intelligent control.Prof. Xu is a Senior Member of IEEE. He currently serves as a Technical Editor of IEEE/ASME Transactions on Mechatronics (TMECH) and an Associate Editor of IEEE Transactions on Automation Science and Engineering (T-ASE) and IEEE Robotics and Automation Letters (RA-L). He has published 3 monographs and over 250 technical papers in international journals and conferences. According to the Citation Report of Web of Science from Clarivate Analytics, his h-index is 33.Prof. Xu is the recipient of Toshio Fukuda Best Paper Award in Mechatronics from 2016 IEEE International Conference on Advanced Robotics and Mechatronics. He has received multiple times of Macao Science and Technology Awards(2014, 2016, 2018) from Macao SAR, China.

FrC5: Underwater acoustic and optical signal processing for environmental cognition

(25, 28, 252, 454)

Time: August 9th Friday, 16:45-18:30

Venue: No. 6 Meeting Room on 3rd floor (3 楼第六会议室)

- -

Chairs: Prof. Qingwu Li, Prof. Xiufen Ye, Prof. Hongli Xu, Prof. Xinwei Wang, Asso. Prof. Lihong Wu, Asso. Prof. Sanming Song

Keynote: Machine Vision for Robots and Aerial Vehicles

Invited Speaker: Prof Shengyong Chen, Tianjin University of Technology, China

FrC5-1 Numerical prediction of self-propulsion point of AUV with a discretized propeller and MFR method

> **Lihong Wu, Xisheng Feng, Xiannian Sun, Tongming Zhou**

FrC5-2 Underwater Image Restoration based on Red Channel and Haze-Lines prior

> **Dabing Yu, Guanying Huo, Yan Liu, Yan, Jinxing Xu**

FrC5-3 Improved Multi-Object Tracking Algorithm for Forward Looking Sonar Based on Rotation Estimation

> **Xiufen Ye, Xinglong Ma**

FrC5-4 A Launch and Recovery System for Unmanned Surface Vehicle based on Floating Bracket

> **Junjie Chen, Yang Yang, Xingang Jiang, Xiaolong He, Shaorong Xie, Yan Peng, Dong Qu**

Invited Keynote

Invited Speaker
Prof Shengyong Chen

Talk: Machine Vision for Robots and Aerial Vehicles

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 open questions in the presentation are summarized to include: Where is the object? Who is who? What is meaningful? What represents the object? What happen? Variety of examples and videos are shown in the talk to show the recent outputs of the research group.

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 researcher 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. 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 applied over 100 patents and published over 150 scientific papers in international journals, five of which received Best Paper Awards from IEEE and IET societies.

FrC6: Signal processing and underwater bionic robots (36, 92, 382, 426, 447)

Time: August 9th Friday, 16:45-18:30

Venue: No. 7 Meeting Room on 3rd floor (3 楼第七会议室)

Chair: Prof. Qiao Hu

Keynote: MRAC based Synchronization Strategy for Master-Slave Manipulators with Unknown Parameters

Invited Speaker: Prof Qingkai Han, Northeastern University, China

FrC6-1 Novel Spread Spectrum Based Underwater Acoustic Communication Technology for Low Signal-to-Noise Ratio Environments

Feng Zhou, Wenbo Zhang, Gang Qiao, Zongxin Sun, Bing Liu, Wenting Zheng, Liang Li

FrC6-2 Application of PMN-PT piezoelectric monocrystal in wideband transducer with composite rod matching layer

Feng-hua Tian, Jun Li, Yi-ming Liu, Zhuo Xu, Yun-chuan Yang

FrC6-3 Optimal Anti-Submarine Search Path for UUV via an Adaptive Mutation Genetic Algorithm

Wenjun Ding, Hui Cao, Hao Wu, Mao Zhaoyong

FrC6-4 An Improved Genetic Algorithm for Optimal Search Path of Unmanned Underwater Vehicles

Mao Zhaoyong, Liu Peiliang, Wenjun Ding, Guo Hui

FrC6-5 A review of Biomimetic Artificial Lateral Line Detection Technology for Unmanned Underwater Vehicles

Qiao Hu, Chang Wei, Yu Liu, Zhenyi Zhao

Invited Keynote

Invited Speaker
Prof Qingkai Han

Talk: MRAC based Synchronization Strategy for Master-Slave Manipulators with Unknown Parameters

Abstract: A new adaptive control, i.e., the model reference adaptive control (MRAC) based synchronization strategy is proposed for the master-slave manipulators, which is especially powerful for the case of the structure parameters of the slaves could be unknown. Firstly, according to the synchronization error definition and the Lyapunov stability theory as well as the MRAC method, a new adaptive controller is designed to achieve the motion synchronization of general master-slave system under the condition of structure parameters unknown. Then, taking two 3-DOF manipulators as the prototype of the master-slave system, the dynamical model of the whole system together with its synchronization controller are established to achieve the predetermined synchronous motion patterns of each corresponding joint of the master and slave. At last, numerical simulations prove that the effectiveness of the adaptive synchronization strategy to the master-slave system but a transient moving process unavoidable.

Biography: Professor Qingkai Han now is the Dynamics and Vibration Group leader in School of Mechanical Engineering and Automation, Northeastern University, China, and was the professor in mechanical design in School of Mechanical Engineering of Dalian University of Technology, China. He received his B.S. degree and M.S. degree in mechanical engineering from University of Science and Technology Liaoning, in 1990 and 1993, and the Ph.D. degree in Mechanical Engineering from Northeastern University, China, in 1997. His research Areas of interest are: mechanical dynamics, nonlinear system analysis, vibration and noise control, condition monitoring and fault diagnosis, data processing and software.

FrC7: Human biomechanics and human-centered robotics (63, 64, 210, 419, 502, 504)

Time: August 9th Friday, 16:45-18:30

Venue: Activity Room on 5th floor (5 楼活动室)

Chairs: Prof. Lei Ren, Prof. Guowu Wei, Prof. Qining Wang, Prof. Zhihui Qian

FrC7-1 Capacitive Sensing Based Knee-Angle Continuous Estimation by BP Neural Networks

> **Dongfang Xu, Qining Wang**

FrC7-2 Concept and Prototype Design of A Soft Knee Exoskeleton with Continuum Structure (SoftKEX)

> **Zhihao Zhou, Xiuhua Liu, Qining Wang**

FrC7-3 An Improved Model to Estimate Muscle-tendon Mechanics and Energetics During Walking With a Passive Ankle Exoskeleton

> **Nianfeng Wang, Yihong Zhong, Xianmin Zhang**

FrC7-4 Design and Development of a Linkage-Tendon Hybrid Driven Anthropomorphic Robotic Hand

> **Haosen Yang, Guowu Wei, Lei Ren**

FrC7-5 Predict Afferent Tactile Neural Signal for Artificial Nerve Based on Finite Element Human Hand Model

> **Yuyang Wei, Lei Ren, Guowu Wei**

FrC7-6 Screw Displacement and Its Application to the In Vivo Identification of Finger Joint Axes

> **Yiming Zhu, Zirong Luo, Guowu Wei, Lei Ren**

FrC8: Intelligent robots for environment detection or fine manipulation (178, 194, 280, 341, 344, 372)

Time: August 9th Friday, 16:45-18:30

Venue: No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

Chairs: Dr. Wenfu Xu, Dr. Han Yuan

FrC8-1 Design and Integration of a Reconfiguration Robot

> Jun Jiang, Lunfei Liang, Bo Yuan, Houde Liu, Bin Liang

FrC8-2 The longitudinal stability of FWMAVs considering the oscillation of body in forward flight

> Dong Xue, Bifeng Song, Wenping Song, Wenqing Yang, Wenfu Xu

FrC8-3 Design and Control of a Small Intelligent Camera Stabilizer for a Flapping-wing Robotic Bird

> Xu Liang, Erzhen Pan, Xu Hui, Juntao Liu, Yuanpeng Wang, Xiaokun Hu, Wenfu Xu

FrC8-4 Movement-Mode-Switching Mechanism for a Hybrid Wheel/legged Mobile Robot

> Xiaolin Guo, Yufeng Su, Han Yuan

FrC8-5 Two Experimental Methods to Test the Aerodynamic Performance of HITHawk

> Erzhen Pan, Hui Xu, Juntao Liu, Xu Liang, Yuanpeng Wang, Xiaokun Hu, Wenfu Xu

FrC8-6 Tension Optimization of A Cable-DrivenCoupling Manipulator Based on RobotDynamics with Cable Elasticity

> Yanan Li, Ying Li, Deshan Meng, Liu Yu, Xueqian Wang, Bin Liang

SaA1: Field robots(147, 156, 223, 431)

Time: August 10th Saturday, 11:00-12:30

Venue: Longfeng Hall A on 2nd floor (2 楼隆奉 A 厅)

Chairs: Prof. Liang Ding, Prof. Ming Yue, Prof. Haibo Gao, Dr. Weihua Li

Keynote: Automated Pipeline Inspection with Field Robots

Invited Speaker: Dr Zheng Liu, University of British Columbia (Okanagan Campus), Canada

SaA1-1 An improved artificial potential field method for Path planning of mobile robot with subgoal adaptive selection

> **Zenan Lin, Ming Yue, Xiangmin Wu, Haoyu Tian**

SaA1-2 Trajectory Planning for Digital Camouflage Spray Painting Robot Based on Projection Method

> **Zhang Xutang, Shi Wen, Wang Bohao, Li Jianming, Zhang Ling**

SaA1-3 Basic research on wireless remote control rabbit animal robot movement

> **Yong Peng, Zilin Wang, Qian Zhang, Shaohua Du, Yang Zhao, Luonan Yang, Jianing Liu, Yawei Cheng, Aidi Wang, Yingjie Liu**

SaA1-4 Analysis and Optimization of the Drive System of the Mobile Robot Arm in Unmanned Mining Working Face

> **Lijuan Zhao, Zuen Shang**

Invited Keynote

Invited Speaker

Dr Zheng Liu

Talk: Automated Pipeline Inspection with Field Robots

Abstract: Pigs and robots serve as platforms to carry one or more sensory payload into the pipeline for condition assessment in both the oil & gas industry and water sector. The fundamental requirements of such a system include: ability to traverse the entire pipe in a reasonable time without getting stuck; ability to inspect the pipe with acceptable accuracy and resolution, and ability to transmit the inspection data to the outside for reporting or save the data locally. Although tethered robotic systems are popular for pipeline inspection for the sake of power supply and communications, free-swimming robotic platforms are emerging for practical inspection applications nowadays. However, the robotic inspection platforms are always facing the challenge to negotiate through all possible scenarios that may exist inside a pipeline network. This presentation will review the challenges as well as the state-of-the-art of field robots to perform the automated pipeline inspection. The field robots across the oil & gas industry and the water sector will be covered. The effort for future research and development is foreseen and discussed.

Biography: Zheng Liu received the Doctorate degree in engineering from Kyoto University, Kyoto, Japan, in 2000, and the Ph.D. degree from the University of Ottawa, Canada, in 2007. From 2000 to 2001, he was a Research Fellow with Nanyang Technological University, Singapore. He then joined the National Research Council of Canada (Ottawa, Ontario) as a Governmental Laboratory Visiting Fellow nominated by NSERC. From 2002, he became a Research Officer associated two research institutes at NRC. From 2012 to 2015, he worked as a full Professor with Toyota Technological Institute, Nagoya, Japan. He is now with the Faculty of Applied Science at the University of British Columbia - Okanagan. His research interests include data/information fusion, computer vision, machine learning, smart sensor and industrial IoT, condition-based maintenance, and non-destructive inspection and evaluation. He is a senior member of IEEE and a member of SPIE. He is co-chairing the IEEE IMS technical committee (TC-1). He holds a Professional Engineer license in both British Columbia and Ontario. Dr. Liu serves on the editorial board for journals including IEEE Transactions on Instrumentation and Measurement, IEEE Transactions on Mechatronics, IEEE Journal of RFID, Information Fusion, Machine Vision and Applications, and Canadian Journal of Electrical and Computer Engineering.

SaA2: Man-machine interactions (189, 266, 395, 467)

Time: August 10th Saturday, 11:00-12:30

Venue: Longfeng Hall B on 2nd floor (2 楼隆奉 B 厅)

Chair: Dr. Tong Cui

Keynote: Robot autonomous operation based on physical relationship and functional reasoning in collaborative scenarios

Invited Speaker: Prof Xuguang Lan, Xi'an Jiaotong University, China

SaA2-1 A study of real-time EEG-feedback on attention combined with virtual reality

> **Yue Wang, Xiaotong Shen, Haowen Liu, Tiantong Zhou, Sari Merilampi, Ling Zou**

SaA2-2 Continuous estimation of grasp kinematics with real-time surface EMG decomposition

> **Chen Chen, Shihan Ma, Xinjun Sheng, Xiangyang Zhu**

SaA2-3 Intelligent Robot Arm: Vision-based Dynamic Measurement System for Industrial Applications

> **Lei Chen, Haiwei Yang, Pei Liu**

SaA2-4 Research on Autonomous Face Recognition System for Spatial Human-robotic Interaction based on Deep Learning

> **Ming Liu, Na Dong, Qimeng Tan, Bixi Yan, Jingyi Zhao**

Invited Keynote

Invited Speaker
Prof Xuguang Lan

Talk: Robot autonomous operation based on physical relationship and functional reasoning in collaborative scenarios

Abstract: The talk briefly introduces the progress and challenges of robots in terms of intelligence, especially the difficulty of robots' self-understanding and manipulation in human-computer cooperation. Aiming at the difficult problem, a manipulation method based on physical stability and object function is proposed for multi-objective stacked object scenes, training in the real data and virtual reality data. In order to further expand the learning effect of the training in virtual reality and image data, we studied the zero-shot learning method, by constructing the orthogonal space and orthogonal quantization method to realize the transfer learing of the model method. Finally, by combining the correct crawling order and grasping location, we can make the robot accurately capture and work on multiple target stacks in the correct order and function.

Biography: Xuguang Lan received Ph.D. degree in Pattern Recognition and Intelligent System from Xi'an Jiaotong University in 2005. He was a postdoctor in department of computer science, Xi'an Jiaotong University from Dec. 2005 to Jan. 2008. He was a visiting scholar of Northwestern University from Sep. 2013 to Oct. 2014, and Ecole Centrale de Lyon from May. 2005 to Oct. 2005. Currently, he is a professor at Institute of Artificial Intelligence and Robotics, and vice dean of the college of Artificial Intelligence of in Xi'an Jiaotong University. His main research areas include computer vision, robot learning, and human-machine integration. He is a member of a council and deputy secretary-general of the Chinese Society of Cognitive Sciences, the deputy director of the "Cognitive System and Information Processing" Committee of the Artificial Intelligence Society, etc. He is a member of the editorial board of the international journal IET "Cognitive Computation and Systems", editor of "Pattern Recognition and Artificial Intelligence" and "Journal of Dynamics and Control", and IEEE CYBER 2019 Program Co-Chair, He has published more than 60 papers in journals and conferences such as IEEE Trans. and CVPR, and has obtained more than 10 national invention patents. In recent years. he has presided over more than 10 scientific research projects such as the key program of National Natural Science Foundation of China, the National Science and Technology Major Project, and the 863 and 973 Subprojects. He is a member of IEEE.

沈阳市科学技术协会
Shenyang Association for Science and Technology

SaA3: Navigation/Localization (96, 293, 455)

Time: August 10th Saturday, 11:00-12:30

Venue: No. 8 Meeting Room on 5th floor (5 楼第八会议室)

Chair: Dr. Xin Zhang

Keynote: Some Insights into the Fundamental Structure of SLAM Problems

Invited Speaker: Dr Shoudong Huang, University of Technology Sydney, Australia

SaA3-1 Stereo Visual SLAM Using Bag of Point and Line Word Pairs

Wei Zhao, Kun Qian, Zhewen Ma, Xudong Ma, Hai Yu

SaA3-2 A Separate Data Structure For Online Multi-hypothesis Topological Mapping

Changyang Gong, Gang Chen, Wei Dong, Xinjun Sheng, Xiangyang Zhu

SaA3-3 Keyframe-based dynamic elimination SLAM system using YOLO detection

Gumin Jin, Xingjun Zhong, Shaoqing Fang, Deng Xiangyu, Jianxun Li

Invited Keynote

Invited Speaker

Dr Shoudong Huang

Talk: Some Insights into the Fundamental Structure of SLAM Problems

Abstract: Robot navigation in unknown environments, particularly when an external location reference such as a global positioning system (GPS) is not available, requires the robot to be able to build a map of the environment and simultaneously estimate its own location within the map. Robust solutions to the "Simultaneous Localization and Mapping (SLAM)" problem, therefore, underpin successful robot deployment in different domains such as urban search and rescue, underground mining, underwater surveillance, planetary exploration, and many other industry applications. SLAM problem has been studied for more than 20 years and many filter based and optimization based SLAM algorithms have been developed. This talk will cover some insights into the fundamental nonlinear structure of the SLAM problems as well as some of the recent techniques for solving different SLAM problems.

Biography: Shoudong Huang received the Bachelor and Master degrees in Mathematics, Ph.D in Automatic Control from Northeastern University, P.R. China in 1987, 1990, and 1998, respectively. He was a faculty member in the Department of Mathematics at Northeastern University, China from 1990 to 1998. After his PhD study, he worked at the University of Hong Kong for 1.5 years and The Australian National University for 2 years as a Research Fellow in control area. He joined the Australian Research Council (ARC) Centre of Excellence for Autonomous Systems in 2004 and started to work on robotics. He is currently an Associate Professor at Centre for Autonomous Systems, Faculty of Engineering and Information Technology, University of Technology, Sydney, Australia. His research interests include mobile robot simultaneous localization and mapping (SLAM), path planning, exploration and control. Shoudong Huang has secured over 2 million AUD research grants. He has published one book and more than 100 papers. He has won the best paper award in the 14th International Conference on Control, Automation, Robotics and Vision, 2016. He is currently an Associate Editor for IEEE Transactions on Robotics. He has been an Associate Editor for International Journal of Advanced Robotics Systems from 2015 to 2017, an Associate Editor for IEEE International conference on Robotics and Automation (ICRA) from 2007 to 2009 and from 2013 to 2018, and an Associate Editor for IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) from 2008 to 2010 and from 2012 to 2018. In 2018, he has been listed as the top 100 Most Influential Scholar in the field of Robotics by AMiner.

SaA4: Nonlinear systems and control

(82, 146, 343, 480)

Time: August 10th Saturday, 11:00-12:30

Venue: No. 9 Meeting Room on 6th floor (6 楼第九会议室)

Chair: Dr. Yiming Jiang

Keynote: Employing Nonlinear Benefits in Engineering: Theory, Methods, and Applications

Invited Speaker: Dr Xingjian Jing, The Hong Kong Polytechnic University, China

SaA4-1 Controller Design by Using Simultaneous Perturbation Stochastic Approximation with Changeable Sliding Window

Qing Lu, Zhou Jun

SaA4-2 Robust Adaptive Force Tracking Impedance Control for Robotic Capturing of Unknown Objects

Guotao Li, huang hailin, Bing Li

SaA4-3 Research on Control Algorithms of Underactuated Gymnastic Robot's Leaping Between Horizontal Bar

Wenkang Lian, Ying Li, Liu Yu, Yan Zhang, Yong Liu

SaA4-4 Nonlinear Dynamic Analysis of Inclined Impact oscillator with a Harmonically External Excitation

Mei Wu, Ming Hu

Invited Keynote

Invited Speaker

Dr Xingjian Jing

Talk: EmployingNonlinearBenefitsin Engineering: Theory,Methods, and Applications

Abstract: Nonlinear phenomena are ubiquitous in all engineering systems and in most cases regarded as negative factors to system integration and performance improvement. Therefore, there has been a general tendency to circumvent, design around them, control them, or simply ignore them. However, the research development on nonlinear dynamics nowadays continuously reveals that nonlinear phenomena can bring many amazing and advantageous effects in very practical engineering problems such as vibration control, energy harvesting, structure health monitoring, micro/nano-electro-mechanical systems, and so on. Some researchers took a step further by introducing intentional strong nonlinearities in their design approaches, with the aim to obtain benefits that would not be available in linear or linearized settings. The study on nonlinearity is experiencing a profound shift of methodology from the previous "troubleshooting" one to an active and promising theme of exploring and employing beneficial effects of nonlinear phenomena.

Therefore, employing nonlinearity in engineering applications is a challenging but very promising topic in the literature in recent years. Nonlinearity can be employed in various vibration control, energy harvesting and structure health monitoring for achieving advantageous performance. This talk will focus on a brief introduction of a theory for nonlinear analysis and design in the frequency domain with several new concepts such as nonlinear characteristic output spectrum (nCOS) or nonlinear output frequency response function (NOFRF). This method can present a novel and powerful insight into understanding nonlinear dynamics, developed in recent years. Following this, some R&D activities will be introduced about a class of bio-inspired anti-vibration structures and their applications in passive vibration control, energy harvesting systems, fault detection and diagnosis and robotics etc, recently investigated in HK PolyU.

Biography: Xingjian Jing (M'13, SM'17) received the B.S. degree from Zhejiang University, China, in 1998, the M.S. degree and PhD degree in Robotics from Shenyang Institute of Automation, Chinese Academy of Sciences, in 2001 and 2005 respectively. He achieved the PhD degree in nonlinear systems and signal processing from University of Sheffield, U.K., in 2008. He is now an Associate Professor with the Department of Mechanical Engineering, the Hong Kong Polytechnic University (PolyU). Before joining in PolyU as an Assistant Professor in Nov 2009, he was a Research Fellow with the Institute of Sound and Vibration Research, University of Southampton. His current research interests include: nonlinear dynamics, vibration and control. Dr Jing is the recipient of a series of academic and professional awards including 2016 IEEE SMC Andrew P. Sage Best Transactions Paper Award, 2017 TechConnect World Innovation Award in US, 2017 EASD Senior Research Prize in Europe and 2017 the First Prize of HK Construction Industry Council Innovation Award. He has published more than 130 referred SCI papers and obtained a number of patents filed in China and US. He currently serves as Technical Editor of IEEE/ASME Trans. on Mechatronics, and Associate Editor of Mechanical Systems and Signal Processing. He was the lead editor of a special issue on "Exploring nonlinear benefits in engineering" published in Mechanical Systems and Signal Processing 2019.

SaA5: Human-robot interaction (153, 244, 475, 498)

Time: August 10th Saturday, 11:00-12:30

Venue: No. 6 Meeting Room on 3rd floor (3 楼第六会议室)

Chairs: Prof. Min Jiang, Dr. Qingyang Hong, Dr. Minghui Shi, Dr. Fei Chao, Dr. Jian Fu

Keynote: Regional Feedback Control - A New Approach for Robotic Manipulation in Task Space

Invited Speaker: Dr Xiang Li, The Chinese University of Hong Kong, China

SaA5-1   Language and Robotics: Complex Sentence Understanding

> **Seng Beng Ho, Zhaoxia Wang**

SaA5-2   Dynamic Motion Planning Algorithm in Human-Robot Collision Avoidance

> **Lei Zhu, Zijing Chi, Fan Zhou, Zhuang Chungang**

SaA5-3   Landmark-Based Virtual Path Estimation for Assisted UAV FPV Tele-Operation with Augmented Reality

> **Santiago Grijalva, Wilbert G. Aguilar**

SaA5-4   Concurrent Probabilistic Motion Primitives for Obstacle Avoidance and Human-Robot Collaboration

> **Jian Fu, Wang ChaoQi, Jinyu Du, Fan Luo**

Invited Keynote

Invited Speaker

Dr Xiang Li

Talk: Regional Feedback Control - A New Approach for Robotic Manipulation in Task Space

Abstract: Task-space sensory feedback information is used in many modern robot control systems. However, existing task-space sensory feedback control methods of robot are valid in a local sense and commonly limited by several open issues, e.g. limited sensing zone, singularity, single or simple control mode, unforeseen changes, etc. The global stability problem of task-space control system has not been systemically solved. In this talk, a regional feedback control methodology for robots is presented. Each feedback/mode is employed in a local region, and the combination of regional information ensures the global convergence of robot motion. Instead of designing multiple controllers in different regions and switching between them, the regional feedback method integrates the use of multiple feedback/modes in a single controller. The transition from one feedback/mode to another is embedded in the controller without using any hard or discontinuous switching. It will be shown that the proposed control method is a unified formulation to various robotic systems in multiple scales, e.g. optical tweezers, 3C robots, exoskeleton, and it also significantly improves the performance of robotic systems in terms of autonomous capabilities, intelligence, and stability.

Biography: Xiang LI received the Bachelor and Master degrees from Beijing Institute of Technology in 2006 and 2008, and the PhD degree from Nanyang Technological University in 2013 respectively. From 2012 to 2015, he was working as a Research Fellow at Nanyang Technological University. From 2015 to 2016, he was working as a Research Fellow at National University of Singapore. Since 2016, he has been working as a Research Assistant Professor at the Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong. Xiang LI is the Associate Editor of IEEE Robotics & Automation Magazine and the Associate Editor of 2019 IEEE International Conference on Robotics and Automation (ICRA). He received the Highly Commended Paper Award in 2013 IFToMM International Symposium on Robotics and Mechatronics, the Best Paper in Robotic Control in 2017 International Conference on Advanced Robotics, the Best Application Paper Finalists in 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), and the T. J. Tarn Best Paper in Robotics in 2018 IEEE International Conference on Robotics and Biomimetics. His research interests include robot control, visual servoing, micro-manipulation, and human-robot interaction. Xiang LI is the scholar of "The Thousand Talents Plan" at Tsinghua University.

SaA6: Piezoelectric actuators and micro-nano manipulations (119, 214, 321, 326, 327, 507)

Time: August 10th Saturday, 11:00-12:30

Venue: No. 7 Meeting Room on 3rd floor (3 楼第七会议室)

Chairs: Prof. Yingxiang Liu, Prof. Long Cheng, Prof. Xiaolong Lu, Prof. Bowen Zhong

Keynote: Advanced Control for Piezoelectric Positioners
Invited Speaker: Prof Xinkai Chen, Shibaura Institute of Technology, Japan

SaA6-1 Finite Element Analyses of Working Principle of the Ultrasonic Needle-Droplet-Substrate System for Multiple-Function Manipulation

> **Xiaomin Qi, Qiang Tang, Pengzhan Liu, Junhui Hu**

SaA6-2 A Composite Controller for Piezoelectric Actuators based on Action Dependent Dual Heuristic Programming and Model Predictive Control

> **Shijie Qin, Long Cheng**

SaA6-3 Regenerative Chatter Control with Piezoelectric Actuator for Micro-structure Surface Turning

> **Yang Wang, Lue Zhang, Tao Chen, Lining Sun**

SaA6-4 Control and Testing of a Serial-Parallel XYZ Precision Positioner with a Discrete-Time Sliding Model Controller

> **Yanling Tian, Yue Ma, Fujun Wang, Kangkang Lu, Xiaolu Zhao, Mingxuan Yang, Dawei Zhang**

SaA6-5 Modeling and Testing of a Novel Decoupled XY Nano-positioning Stage

> **Fujun Wang, Xiaolu Zhao, Huo Zhichen, Yanling Tian, Yue Ma, Dawei Zhang**

SaA6-6 Effect of damping factor variation on eigenfrequency drift for ultrasonic motors

> **Dawei An, Qingshuang Ning, Weiqing Huang, Haodong Xue, Jianhui Zhang**

Invited Keynote

Invited Speaker

Prof Xinkai Chen

Talk: Advanced Control for Piezoelectric Positioners

Abstract: Piezoelectric actuators exhibit merits of high displacement resolution, quick response, simple structure,large power weight ratio, large thrust weight ratio, quiet operation, self-locking when power is off, noelectromagnetic interference and so on. These merits make them good candidates for applications in systemswith special requirements. Piezoelectric positioners are popular devices to achieve ultrahigh precisionpositioning with nanometer-level accuracy and high speed. These kinds of positioners play a key role inadvanced technologies, such as biology, materials science, lithography, etc. However, advanced control forpiezoelectric positioners is very complicated because of the strong coupling between the hysteresisnonlinearity and the vibration dynamics of the piezoelectric actuators. In addition, both the hysteresis andthe dynamics can vary with the environmental and load conditions. This talk discusses the modelling and the advanced control for the piezoelectric positioners. Furthermore, other kinds of smart material-basedactuators and positioners will also be discussed.

Biography: Xinkai Chen received his Ph.D. degree in engineering from Nagoya University, Japan, in 1999. He is currently a professor in the Department of Electronic and Information Systems, Shibaura Institute of Technology, Japan. His research interests include adaptive control, smart materials, hysteresis, sliding modecontrol, machine vision, and observers. Dr. Chen has been serving on the editorial boards of several journals,including IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology,IEEE Transactions on Industrial Electronics, ASME/IEEE Transactions on Mechatronics, European Journal of Control, etc. He has also severed as organizing committee members for several international conferences.

SaA7: Teleoperation robot (35, 97, 99, 152, 296, 390)

Time: August 10th Saturday, 11:00-12:30

Venue: Activity Room on 5th floor (5 楼活动室)

Chairs: Prof. Aiguo Song, Prof. Pengwen Xiong

SaA7-1 A control system framework model for cloud robots based on service-oriented architecture

> Kui Qian, Yiting Liu, Aiguo Song, Jialu Li

SaA7-2 WSMR dynamics based DWA for leader-follower formation control

> Yun Ling, Jian Wu, Zhenxing Zhang, Changcheng Wu

SaA7-3 Adaptive Position and Force Tracking Control in Teleoperation System with Time-varying Delays

> Haochen Zhang, Aiguo Song, Huijun Li

SaA7-4 Designer of A Multi-DOF Adaptive Finger for Prosthetic Hand

> Changcheng Wu, Qingqing Cao, Yuchao Yan, Fei Fei, Dehua Yang, Baoguo Xu, Hong Zeng, Aiguo Song

SaA7-5 A Neural Network Based Method for Judging the Rationality of Litigation Request

> Huifang Cheng, cui tong, Feng Ding, Sheng Wan

SaA7-6 Design of a Wireless Six-axis Wrist Force Sensor for Teleoperation Robots

> Wanglong Chen, Shuyan Yang, Quan Hu, Aiguo Song

SaA8: Fault detection, testing and diagnosis
(1, 3, 103, 304)
Time: August 10th Saturday, 11:00-12:30
Venue: No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

Chair: Dr. Zhaojie Ju

SaA8-1 KPCA-based Visual Fault Diagnosis for Nonlinear Industrial Process

Jiahui Yu, Hongwei Gao, Zhaojie Ju

SaA8-2 Innovation Ability Cultivation Quality Evaluation Model of Machinery Postgraduate by Mechatronics Engineering

Bin Zhao, Kexin Li, Diankui Gao, Lizhi Xu

SaA8-3 A study on step-by-step calibration of robot based on multi-vision measurement

Rui Li, Bingrong Wang, Yang Zhao

SaA8-4 Characteristic Frequency Input Neural Network for Inertia Identification of Tumbling Space Target.

Chuan Ma, Jianping Yuan, Dejia Che

SaB1: Robot intelligence, learning and linguistics (168, 233, 241, 446)

Time: August 10th Saturday, 15:00-16:30

Venue: No. 8 Meeting Room on 5th floor (5 楼第八会议室)

Chair: Prof Jian Fu

Keynote: From Automation to Learned Autonomy - A New Era for Intelligent Robots

Invited Speaker: Dr Zhibin Li, University of Edinburgh, UK

SaB1-1 Towards End-to-End Speech Recognition with Deep Multipath Convolutional Neural Networks

> **Wei Zhang, Minghao Zhai, Zilong Huang, Chen Liu, Wei Li, Yi Cao**

SaB1-2 Robot Intelligent Trajectory Planning based on PCM guided Reinforcement Learning

> **Teng Xiang, Jian Fu, Cong Li, Zhaojie Ju**

SaB1-3 Fast Robot Motor Skill Acquisition Based on Bayesian inspired Policy Improvement

> **Jian Fu, Shen Siyuan, Ce Cao**

SaB1-4 Control of Nameplate Pasting Robot for Sand Mold Based on Deep Reinforcement Learning

> **Tuo Guiben, Li Te, Haibo Qin, Bin H, Liu Kuo, Wang Yongqing**

Invited Keynote

Invited Speaker

Dr Zhibin Li

Talk: From Automation to Learned Autonomy - A New Era for Intelligent Robots

Abstract: The scientific goal of robot locomotion and manipulation is to develop machines to traverse various terrains, deliver payload, and perform manipulation tasks with a mixed level of autonomy: from remote control to fully autonomous operation. This talk will cover main research challenges in control, planning, and machine learning, and the innovation of these research domains that can make a step change for solving real-world problems. Particularly, I will showcase some new results from deep reinforcement learning combined with control and optimization in a hierarchical framework to self-learn goal-oriented policies on various locomotion, dexterous manipulation & grasping tasks. All these technologies are the building blocks for outdoor inspection, disaster response, and can further revolutionize the supply chain (warehouse picking & packing, last-mile delivery), search & rescue, infrastructure maintenance, and space robotics.

Biography: Dr. Zhibin Li is a Lecturer (Assistant Professor) at the School of Informatics, the University of Edinburgh. During 2013 to 2015, Dr Li participated in the DARPA Robotics Challenge (DRC) Finals as part of the WALK-MAN DRC team, contributing to the control and development of a full-size humanoid robot WALK-MAN. Dr Li has rich experience in working with real robot platforms, and has built strong expertise in the areas of force & compliance control, optimisation based motion planning and whole-body control, and machine learning for achieving dynamic motions and intelligent behaviour of high-DoF robots.
He is now the head of Advanced Robotics Lab and his research focuses on a variety of control technologies - control, optimisation and machine learning - for solving challenging problems in dynamic motion control (manipulation, grasping, locomotion), and complex behaviours of mobile (wheeled & tracked) and legged robots (quadruped & humanoid). His has current research projects on: autonomous robotic manipulation by data-efficient learning; mulit-contact whole-body motion planning; deep learning of robot locomotion; visual-haptic immersive tele-operation; autonomous stair-climbing of logistic/delivery robots; soft robotic gripper for handling fragile objects.

SaB2: Robot legged locomotion (124, 281, 294, 316)

Time: August 10th Saturday, 15:00-16:30

Venue: No. 9 Meeting Room on 6th floor (6 楼第九会议室)

- -

Chair: Dr. Yuwang Liu

Keynote: Locomotion of Beetles

Invited Speaker: Prof Si-Qin Ge, Institute of Zoology, Chinese Academy of Sciences, China

SaB2-1 SLIP Model-based Foot-to-Ground Contact Sensation via Kalman Filter for Miniaturized Quadruped Robots

> **Junjie Yang, Hao Sun, Dongping Wu, Xiaodong Chen, Changhong Wang**

SaB2-2 Stability Analysis and Fixed Radius Turning Planning of Hexapod Robot

> **Dajiang Yu, Yongqin Chen**

SaB2-3 The Mechanical Design and Torque Control for the Ankle Exoskeleton During Human Walking

> **Handong Xu, Yibing Li, Biwei Tang, Xiang Kui**

SaB2-4 Stable 3D Biped Walking Control with Speed Regulation Based on Generalized Virtual Constraints

> **Jianfei Li, wang yaobing, Tao Xiao, Dawei Zhang**

Invited Keynote

Invited Speaker
Prof Si-Qin Ge

Talk: Locomotion of beetles

Abstract: The thorax is the locomotory center of the insects. The acquisition of wings has long been considered as a key factor for the highly successful evolutionary adaptation of insects. And the legs play an important role in the locomotion, participating in crawling, jumping, swimming, flying and other movement behavior. Coleoptera (beetle) is the most special and successful groups in insect evolution. The described species are as many as 380,000 which is one of the biggest orders in Insecta. Based on the geometric morphological analysis, mechanical analysis and simulation of morphology and structure, we focus on the wings and legs of beetles to explore the locomotion, functional morphology and evolution of insect's thorax, using optical microscope, scanning electron microscope, micro CT and 3D reconstruction, high-speed cameras and other imaging technology. For beetles, in order to lift the heavy body, the hind wing must be a certain size to be aerodynamically functional. Given that large and thin hind wings are vulnerable to damage, they must be folded to be stored below the elytra for protection during ground locomotion and unfold before flying. Based on the special folding/unfolding function of beetle's hind wings, we explore the morphological variances, unfolding function of beetle's hind wings and thorax comparative morphology of leaf beetles in flight polymorphism. We found the proximal and distal parts of hind wings are separate modules, and vein changes of the apical folding area are independent and strongly influence the entire venation variance of the hind wing. The hind wing unfolding time of beetles is positively correlated with beetle body quality and hind wing unfolding strategy is related to the apical area morphology of hind wing. We deduced hydraulic pressure mechanism of beetle hind wing unfolding is like inflatable origami. We also described in detail and compared the external and internal features of the thorax in the flying polymorphism of several beetles. Legs of beetles have a lot of different forms and perform different functions, which are one of the most important organs for the beetles to adapt to different habitats. We analyzed the inter-leg coordination of crawling leg of a soldier beetle and found the motion coordination mode is the combination of tripod gait and wave gait, which coordinate with the speed. We investigated the external and internal structures and motion parameters of legs in three carabid beetles of free-living and cave-dwelling. Due to the cave environment, there are certain morphological differences between the surface-living and cave-dwelling ground beetles which may further influence the locomotion behavior of them. We also analyzed a rotation leg functioning as intimidation role in a stem beetle. The rotate process can be divided into four phases, and the rotating angle range between 0 - 170°. The rotation of trochanter drives the rotation of the legs by a pair of "screw-nut" structures. A previously unidentified self-righting strategy of a flea beetle was reported. We discovered the beetle land on its feet successfully 85% of the time by performing dual-axial rotations. The beetle may fling and beat wings to slow down to augment the flight duration and alleviate impact when landing and tends to select a proper means to landing safely according to the initial kinematics and landing environment. Our studies provide the theoretical basis and new perspectives for studies of the morphological evolution of wings and legs of beetles. Investigations about locomotion mechanism bring new ideas to applications in biomimetic field.

Biography: Dr. Si-Qin Ge, Fellow of Entomological Society of Entomology of China and USA, vice director of Key Laboratory of Zoological Systematics and Evolution, Chinese Academy of Sciences, professor of Entomology, Functional Morphology and Evolution. She obtained her Doctor degree from University of Chinese Academy of Sciences in 2002, and finished her Post Doctor research in Friedrich-Schiller-Universität Jena, Germany during 2006-2007. She set up the standard of image capture systems of Micro-CT, CLSM, MRI, FIB which conducted in insect structure analysis. Also she set up a bionic application flat-form for multi-dimensional database including external and internal insect structures and mechanical model of insect locomotion organs. She conducted co-evolution analysis of insect locomotor systems and their related structures, constructed mechanical analysis and modelling of insect related structures. All of these provided the basic support for deeply integration of insect structures and its bionic applications. She has charged number of important projects, including NSFC and Chinese Academy of Sciences projects, authored 5 books and more than 80 peer reviewed papers. Her research interests mainly focused on the morphology of insects and its evolutionary trends and bionic applications. She currently addressing on three parts. 1. Biomechanics, energetics, and evolution of key structures of insects, e.g. structures related to locomotion of jumping, walking, flying, feeding and reproduction. The control of the movement is being studied from both morphological and biomechanical perspectives by using a combination of innovative techniques, such as μ-CT, CLSM, SIM, MRI, SBFSEM, FIB, Computer-based 3-dimensional reconstructions, behavioral analyses with high-speed three-dimensional videography, particle-image velocimetry and metabolic measurements. 2. Morphological changes and mechanism during development of metamorphosis. 3. Discovery and application of new innovative techniques for functional morphology.

SaB3: Compliant mechanisms

(89, 114, 139, 205, 260, 386)

Time: August 10th Saturday, 15:00-16:30

Venue: No. 6 Meeting Room on 3rd floor (3 楼第六会议室)

Chairs: Dr. Chi Zhang, Dr. Haiyue Zhu, Dr. Hui Tang, Dr. Benliang Zhu

Keynote: Our Recent Progress in Design of Compliant Mechanisms

Invited Speaker: Dr Guangbo Hao, University College Cork, Ireland

SaB3-1 A Generalized Mathematical Model for the Bridge-type and Lever-type Mechanism

Fangxin Chen, Jingnan Cai, Wei Dong, Zhijiang Du

SaB3-2 A novel giant magnetostrictive driven-vibration isolation stage based on compliant mechanism

Xiaoqing Sun, Jun Hu, Jiuru Lu, Zhilei Wang

SaB3-3 Topological synthesis of compliant mechanisms using a level set-based robust formulation

Benliang Zhu, Mohui Jin, Xianmin Zhang, Hongchuan Zhang

SaB3-4 Flexure-Based Variable Stiffness Gripper for Large-Scale Grasping Force Regulation with Vision

Zhu Haiyue, Li Xiong, Chen Wenjie, Chi Zhang

SaB3-5 Kinetostatic modeling of redundantly actuated planar compliant parallel mechanism

Miao Yang, Hongtao Yu, Xiaolu Huang, Chi Zhang, Guilin Yang, Zaojun Fang

SaB3-6 A Novel Flexure Deflection Device with Damping Function Towards Laser Reflector of 3D Lithography

Guixin Zhang, Tang Hui, Xun Chen, Xiaohui Guo, Jiedong Li, Haoyu Pan, Shuo Li

Invited Keynote

Invited Speaker
Dr Guangbo Hao

Talk Title: Our Recent Progress in Design of Compliant Mechanisms

Abstract: Compliant mechanisms are usually monolithic smart structures taking advantage of material's elasticity to transfer movement, load, or energy, which attract increasing attentions over last two decades. The elimination of assembly enables them to be miniaturized for use in MEMS devices. The absence of backlash and friction allows the production of high-precision movements, making them suitable for nanopositioning, medical devices, and space applications. This talk will present some recent progress in designing compliant mechanisms developed in our research group. These designs includes multi-axis compliant parallel manipulators, stiffness-variable joint, compliant keyboard key, multi-mode compliant gripper, and load-independent anti-bulking flexure bearing. The talk will end up with discussing several promising directions in compliant mechanisms.

Speaker bio: Dr. Guangbo Hao is a Senior Lecturer (Associate Professor) with University College Cork, Ireland. He is an Academic Associate in Tyndall National Institute and a Visiting Lecturer in University College Dublin. His current research interests focus on design of compliant mechanisms and robotics as well as their applications in precision engineering, energy harvesting and biomedical devices. His research works were indicated by 2 filed patents and 110+ peer-reviewed publications. He is a member of the ASME Mechanisms and Robotics Committee and is serving as the Executive Editor of the IFToMM journal: Mechanical Sciences (MS) and the overseas editorial board member of Chinese Journal of Mechanical Engineering (CJME). He has been the recipient of a series of research awards/prizes including: the solo winner of the Young Engineers Research Paper Prize 2012 presented by IMechE and Engineers Ireland, the solo winner of 2017 ASME Compliant Mechanisms Award in Application and the joint winner of the 2018 ASME Compliant Mechanisms Award.

SaB4: Computer integrated manufacturing

(7, 10, 11, 107, 291)

Time: August 10th Saturday, 15:00-16:30

Venue: No. 7 Meeting Room on 3rd floor (3 楼第七会议室)

Chair: Dr. Xin Zhang

Keynote: Design and Fabrication of Origami Robots

Invited Speaker: Dr Ketao Zhang, Queen Mary University of London, UK

SaB4-1 Development of workshop management system for assembly production process

Pengfei Zeng, Yuyu Hao, Changwu Wu, Chunjing Shi, Yongping Hao

SaB4-2 Dynamic Scheduling of Dual-Resource Constrained Blocking Job Shop

Ze Tao, Xiaoxia Liu

SaB4-3 Study on No-wait Flexible Flow Shop Scheduling with Multi-Objective

Ze Tao, Xiaoxia Liu

SaB4-4 Dynamic Behavior Analysis and Multi-sensor Modal Information Fusion for Robotic Milling System

Daxian Hao, Wei Wang, Gang Zhang, Qilong Wang, Chao Yun

SaB4-5 Design of screw fastening tool based on SEA

Liming Tan, Cheng Sun, Muye Pang, Xiang Kui, Biwei Tang

Invited Keynote

Invited Speaker
Dr Ketao Zhang

Talk: Design and Fabrication of Origami Robots

Abstract: The recent cross-disciplinary study on origami and kinematic structures opens a new trend of research on foldable mechanisms and evolved flexible robots, especially on the design methodology and manufacturing process for constructing three-dimensional active structures from two-dimensional at-sheet models. In contrast to the conventional mechanisms, the origami-enabled mechanisms have distinct flexibility and foldability which are expected in real world applications. The emerging development of origami-inspired mechanical systems enables knowledge on origami in artistic discipline being well integrated in a wide range of areas in engineering such as architecture design and fabrication of micro-robotic systems. This talk will describe design principles and manufacturing technologies for the development of origami-folding inspired robotic devices with inherent compliance for medical and aerial applications.

Biography: Dr Ketao Zhang is a Lecturer in Robotics within the Centre for Advanced Robotics at Queen Mary University of London (QMUL). Before his appointment at QMUL, he was a senior postdoctoral researcher in the Aerial Robotics Lab at Imperial College London. He had been a leading postdoctoral researcher at the Multifingered Robotic Hand Lab of King's College London after completing a joint PhD programme between King's College London (UK) and Beijing Jiaotong University (China). His research focuses on innovative robot mechanisms, robotic manipulators, morphable soft-bodied robots and aerial robots, as well as their applications to autonomous technologies for challenging environments. He has published more than 50 refereed full papers in top journals and prestigious conferences in the field of engineering design and robotics.

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沈阳市科学技术协会
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SaB5: Collective and social robots (37, 441, 483, 515)

Time: August 10th Saturday, 15:00-16:30

Venue: Activity Room on 5th floor (5 楼活动室)

- -

Chair: Dr. Disi Chen

Keynote: Wearable Series-Parallel-Reconfigurable Supernumerary Robotic Limb

Invited Speaker: Prof Yanhe Zhu, Harbin Institute of Technology, China

SaB5-1 Promoting Constructive Interaction and Moral Behaviors using Adaptive Empathetic Learning

Jize Chen, Yanning Zuo, Dali Zhang, Zhenshen Qu, Changhong Wang

SaB5-2 A Fast Visual Feature Matching Algorithm in Multi-Robot Visual SLAM

Nian Liu, Mingzhu Wei, Xiaomei Xie, Mechali Omar, Xin Chen, Weihua Wu, Peng Yan, Limei Xu

SaB5-3 Mechanical Design and Kinematic Control of a Humanoid Robot Face

Yu Qiu, Chongming Xu, Manjia Su, Hongkai Chen, Yisheng Guan, Haifei Zhu

SaB5-4 LTF Robot: Binocular Robot with Laser-point Tracking and Focusing Function

Shuang Song, Wenzeng Zhang

Invited Keynote

Invited Speaker
Prof Yanhe Zhu

Talk: Wearable Series-Parallel-Reconfigurable Supernumerary Robotic Limb

Abstract: The wearable Supernumerary Robotic Limb (SRL) is an additional arm or finger which can be nstalled on the human body and cooperates with the human arm or finger for the purpose of assisting human, enhancing human strength and improving human work efficiency. We have designed a Series-Parallel-Reconfigurable Supernumerary Robotic Limb. The two 3-DOF series arms, which have a large working space and flexible motion characteristics, can be combined into a 6-degree-of-freedom parallel arm for auxiliary support and gripping functions. Then the precise operation can be realized by the parallel arm due to its large output and high stiffness characteristics. By breaking through the series-parallel-reconfiguration technology of SRL for different work tasks and designing the wearable structure meeting ergonomics requirements, we solved the main contradiction between the lightweight and heavy load of Supernumerary Limb Robot and realized various auxiliary functions of SRL.

Biography: Yanhe Zhu is a Professor at Harbin Institute of Technology and the Vice Director of State Key Laboratory of Robotics and System. His research interest includes modular self-reconfiguration robots, robotic exoskeleton and supernumerary robotic limbs.
He was honored the Science Chinese Person of 2017 . Yanhe Zhu is the winner of multiple awards including Gold Award of China Excellent Industrial Design (CEID) in 2018, Best Paper Award at International Conference on BIC-TA 2017 and Four Technological Invention Awards of Province from 2014 to 2018. He is the program chair of annual conference of Chinese robotics society. He has granted over 120 patents and published over 110 research papers.

SaB6: Human-robot collaboration (57, 154, 229, 246, 289, 464)

Time: August 10th Saturday, 15:00-16:30

Venue: No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

- -

Chairs: Dr. Xuguang Lan, Dr. Fei Zhao

SaB6-1 Select and focus: action recognition with spatial-temporal attention

> **Wensong Chan, Zhiqiang Tian, Shuai Liu, Jing Ren, Xuguang Lan**

SaB6-2 Real-time Grasp Type Recognition Using Leap Motion Controller

> **Yuanyuan Zou, Honghai Liu, Jilong Zhang**

SaB6-3 Speaker-Independent Speech Emotion Recognition Based on CNN-BLSTM and Multiple SVMs

> **Zhentao Liu, Peng Xiao, Danyun Li, Man Hao**

SaB6-4 On-Line Identification of Moment of Inertia for Permanent Magnet Synchronous Motor Based On Model Reference Adaptive System

> **Yujian Zhou, Jinhua She, Wangyong He, Danyun Li, Zhentao Liu, Yonghua Xiong**

SaB6-5 Multi-Point Interaction Force Estimation for Robot Manipulators with Flexible Joints Using Joint Torque Sensors

> **Xing Liu, fei zhao, Baolin Liu, Xuesong Mei**

SaB6-6 An Insulator Image Segmentation Method for Live Working Robot Platform

> **He Wen peng, Chen Xin, Xu Jian**

SaC1: Development of high-performance joint drive for robots (201, 206, 209, 265, 278, 409)

Time: August 10th Saturday, 16:45-18:30

Venue: No. 8 Meeting Room on 5th floor (5 楼第八会议室)

Chairs: Prof. Ligang Yao, Prof. Jun Zhang

Keynote: Key Techniques on Intelligent Nursing Robot

Invited Speaker: Prof Bing Li, Harbin Institute of Technology Shenzhen Graduate School, China

SaC1-1 The multi-section design of a novel soft pneumatic robot arm with variable stiffness

> **Ligang Yao, Jingyi Li, Liu xiaodong, Hui Dong**

SaC1-2 Nonlinear Finite Element Simulation and Analysis of Double Circular Arc Spiral Bevel Gear Nutation Drive

> **Yujing Su, Ligang Yao, Jun Zhang**

SaC1-3 Design and analysis of gear profile of two-tooth difference swing-rod movable teeth transmission system

> **Rui Wei, Herong Jin, Yali Yi**

SaC1-4 Transmission Error Simulation Analysis For RV Reducer With Orthogonal Experiment Method

> **Zhang Yinghui, He Weidong, Wang Xiaoyu, Luo Yuechong**

SaC1-5 Design and finite element analysis of fiber-reinforced soft pneumatic actuator

> **Xianqi Xue, Ziheng Zhan, Yongwu Cai, Ligang Yao, Lu Zongxing**

SaC1-6 Configuration Design and Simulation of Novel Petal Tooth Nutation Joint Drive for Robot

> **Linjie LI, Guangxin Wang, Lili Zhu, Weidong He**

Invited Keynote

Invited Speaker

Prof Bing Li

Talk: Key Techniques on Intelligent Nursing Robot

Abstract: Aging of population is a global issue, traditional professional nursing and auxiliary staff has been far from meeting the growing demand gap. Intelligent nursing equipment is the first choice to alleviate medical care problems, so that the intelligent nursing robot is becoming increasingly popular. First the state-ofthe-arts of this kind of robots are reviewed, the key technologies are recognized. As compliance and high payload are two core features attached with the intelligent nursing robot. Variable stiffness actuator (VSA) has become popular due to its variability of stiffness and inherent flexibility. Because of the advantages such as improving flexibility and safety of manipulator, enhancing utilization of energy and so on, the VSA has good prospect for bionic robots, home care robots and industrial assemblies where certain energy requirements, human-computer interaction or high flexibility requirements exist. The research status of VSA in recent 10 years is introduced, and the strengths and weaknesses of different principles of VSAs are discussed. Then, a kind of VSA based on lever principle developed by the laboratory is introduced. The actuator can regulate support points and force points at the same time, realizing the change of stiffness from zero to infinite and improving the response rate of stiffness adjustment. To satisfy the application requirements for variable stiffness arm, several different transmission structures of VSA are designed to meet the functional requirements and space requirements. In this talk a high-payload manipulator based on cabledriven series-parallel mechanism is discussed. The load capacity of the manipulator is strong, and the size of the manipulator is close to that of a human arm as the actuators of the cable-driven mechanism can be rear-mounted. The load-weight ratio of the manipulator is much higher than the traditional industrial manipulator. Some other intelligent nursing equipment, such as the intelligent dispensing robot of Intravenous drug is introduced.

Biography: Prof. Bing Li received his B.S. degree and M.S. degree in mechanical engineering from Liaoning Technical University, China, in 1993 and 1995, and the Ph.D. degree in Dept. of Mechanical Engineering from The Hong Kong Polytechnic University, Hong Kong, in 2001. He was the Engineering Director of Maxbright Engineering Ltd. in Hong Kong, from 2002 and 2003. He was an Associate Professor at mechanical engineering in Harbin Institute of Technology Shenzhen Graduate School, Shenzhen, China from 2003-2006; and was a Professor since 2006. He is currently the Acting Dean of the School of Mechanical Engineering and Automation, Harbin Institute of Technology Shenzhen, China. His research interests include robotics and mechanisms, parallel kinematic machines and mechanical vibration and control. Prof. Bing Li is selected into the National Ten-thousand-talent Program of China in 2016 and The State Candidate of Millions of Talents Program in 2017. He is Currently an Associate Editor of Intelligent Service Robotics(Springer). He was also a recipient of State Technological Invention Award of China in 2014 and Natural Science Award of Shenzhen in 2016, and has been awarded Best Paper Award in Biomimetics in 2014 IEEE International Conference on Robotics and Biomimetics, and is offered the Outstanding ME Alumni Award of the Hong Kong Polytechnic University in 2017.

SaC2: Mobile robots and intelligent autonomous systems(115, 263, 308, 333, 338, 444)

Time: August 10th Saturday, 16:45-18:30

Venue: No. 9 Meeting Room on 6th floor (6 楼第九会议室)

Chair: Dr. Rongchuan Sun

Keynote: Research and development of linkaged ground mobile robot
Invited Speaker: Prof Yan-an Yao, Beijing Jiaotong University, China

SaC2-1 A Small Envelope Gait Control Algorithm based on FTL Method for Snake-Like Pipe Robot

> **Wenjuan Du, Jian Wang, Guigang Zhang, Manxian Liu**

SaC2-2 The Design of Inspection Robot Navigation Systems Based on Distributed Vision

> **Lei Wang, Hua Zhu, Peng Li, chen chang, Shaoze You, Menggang Li, Zheng Zhang**

SaC2-3 Movement Analysis of Rotating-finger Cable Inspection Robot

> **Changlong Ye, Jingpeng Li, Suyang Yu, Guanglin Ding**

SaC2-4 Autonomous Indoor Mobile Robot Exploration Based on Wavefront Algorithm

> **Chunhua Tang, Rongchuan Sun, Shumei Yu, Liang Chen, Jianying Zhen**

SaC2-5 Multi-robot path planning for complete coverage with genetic algorithms

> **Rongchuan Sun, Chunhua Tang, Jianying Zhen, Yongzheng Zhou, Shumei Yu**

SaC2-6 Design and Magnetic Force Analysis of Patrol Robot for Deep Shaft Rigid Cage Guide

> **Hongwei Tang, Chaoquan Tang, Gongbo Zhou, Xin Shu, Qiao Gao**

Invited Keynote

Invited Speaker
Prof Yan-an Yao

Talk: Research and development of linkaged ground mobile robot

Abstract: The concept of the linkaged ground mobile robot is to use the linkage mechanism to construct the body of the ground mobile robot and form a strict closed-chain system in the sense of graph theory and kinematic chain. The obtained robots can achieve various movement modes such as rolling, walking and crawling, and adapt to complex terrain obstacles through internal variable topology and external deformation ability. The robots can exert the dexterous movement function of the linkage mechanism, strong deformation ability, and the advantages of light weight and high strength. The application of linkaged ground mobile robot aims at performing detection, transportation, and various operational tasks at the complex environments where conventional vehicles and robots are difficult to overcome. The complex environments include the seriously damaged road in civil rescues, dynamic environments in military operations, and unknown complex surfaces of planetary exploration. This talk comprehensively analyzes the research and application status of wheeled, tracked, legged, spherical, serpentine and other ground mobile robots, explains and introduces the concept, theory, technology and application practice of "linkaged ground mobile robot", points out the current challenges and the future development direction.

Biography: Prof. Yan-an Yao received his B.S.E. degree in mechanical engineering from Yanshan University, China, in 1993, his M.S.E. and Ph.D. degree in mechanical engineering from Tianjin University, China, in 1996 and 1999, respectively. From 1999 to 2001, he was a postdoctoral research fellow at Shanghai Jiaotong University, China. From 2008 to 2009, he was a visiting scholar at IGM, RWTH Aachen University, Germany. Currently, he is a full professor of School of Mechanical and Electronic Control Engineering at Beijing Jiaotong University, Beijing, China and serves as the executive deputy director of the Robotics Research Center of Beijing Jiaotong University. He won the second prize of the 2017 Excellent Achievement Award of the Ministry of Education in Higher Institution of the Ministry of Education, the third prize of Beijing Science and Technology in 2013, the third prize of Beijing Science and Technology in 2018. He has published 135 papers (85 SCI/EI searches), one book, three chapters and one translation; He has also be authorized 97 invention patents. He is also a part-time professor of Central Academy of Fine Arts.

SaC3: Continuum mechanisms and robots (116, 257 349, 366, 384, 522)

Time: August 10th Saturday, 16:45-18:30

Venue: No. 6 Meeting Room on 3rd floor (3 楼第六会议室)

- -

Chairs: Dr. Rongjie Kang, Prof. Ian Walker, Dr. David Branson

Keynote: Collaborative Robotics with Continuum and Compliance
Invited Speaker: Dr Hongliang Ren, National University of Singapore, Singapore

SaC3-1 A Soft Robotic Glove for Hand Rehabilitation using Pneumatic Actuators with Variable Stiffness

> **Yiquan Guo, Fengyu Xu, Yurong Song, Xudong Cao, Fanchang Meng**

SaC3-2 Visual Servoing of Soft Robotic Arms by Binocular

> **Lizheng Feng, Xiaojiao Chen, Zheng Wang**

SaC3-3 Design of a Teleoperated Rod-driven Continuum Robot

> **Yue Liu, Shupeng Zhao, Chenghao Yang, Lisha Chen, Rongjie Kang**

SaC3-4 Aerodynamics of soft flapping wings of Caudipteryx

> **Yaser Saffar Talori, Jingshan Zhao**

SaC3-5 A Finite Element Model and Performance Analysis of a Hybrid Continuum Robot

> **Dian Zhuang, Xinrui Wang, Cijing Sun, Rongjie Kang**

SaC3-6 Design and experiment of a foldable pneumatic soft manipulator

> **Xiang Zhang, Zhuoqun Liu, Hongwei Liu, Lu Cao, Xiaoqian Chen, Yiyong Huang**

Invited Keynote

Invited Speaker

Dr Hongliang Ren

Talk: Collaborative Robotics with Continuum and Compliance

Abstract: Representing a major paradigm shift from open surgery, minimally invasive surgery (MIS) assisted by robots and sensing is emerging by accessing the surgical targets via either keyholes or natural orifices. It is challenging to get delicate and safe manipulations due to the constraints imposed by the mode of robotic access, confined workspace, complicated surgical environments and the limited available technologies, particularly in terms of endoluminal curvilinear targeting and guidance. Addressing the aforementioned challenges and aiming at human-centered flexible robots, this talk will share our recent biorobotic researches in continuum mechanisms, compliance modulations, delicate sensing, collaborative human-robot interactions, mostly in the context of medical applications. The compliant continuum robotics with embodied intelligence allows us to bypass critical important intracranial or intracorporeal structures, to conform its shape to be compliant with curvy passages, and have direct access to the target sites under proper planning and navigation, thus significantly reducing invasiveness and trauma of surgery.

Bio: Hongliang Ren is currently leading a research group on medical mechatronics in the Biomedical Engineering Department of National University of Singapore (NUS). He is an affiliated Principal Investigator for the Singapore Institute of Neurotechnology (SINAPSE), NUS (Suzhou) Research Institute, and Advanced Robotics Center at National University of Singapore (NUS). Dr. Ren received his Ph.D. in Electronic Engineering (Specialized in Biomedical Engineering) from The Chinese University of Hong Kong (CUHK) in 2008. Prior to joining NUS, he was a Research Fellow at The Johns Hopkins University, Children's Hospital Boston & Harvard Medical School, and Children's National Medical Center, USA. His main areas of interest include Biorobotics & Intelligent Control, Medical Mechatronics, Computer-Integrated Surgery, and Multisensor Data Fusion in Surgical Robotics. Dr. Ren is IEEE Senior Member and currently serves as Associate Editor for IEEE Transactions on Automation Science & Engineering (T-ASE) and Medical & Biological Engineering & Computing (MBEC). He is the recipient of NUS Young Investigator Award, IAMBE Early Career Award 2018 & Interstellar Early Career Investigator Award 2018.

SaC4: Robot mechanism and design (23, 162, 226, 383, 398, 520)

Time: August 10th Saturday, 16:45-18:30

Venue: No. 7 Meeting Room on 3rd floor (3 楼第七会议室)

Chair: Dr. Yuwang Liu

Keynote: Creative Design of Mechanisms of Robotic Equipment Invited Speaker: Prof Huafeng Ding, China University of Geosciences (Wuhan), China

SaC4-1 Design and Experimental Analysis of a Planar Compliant Parallel Manipulator

Congcong Du, Genliang Chen, Zhuang Zhang, Liqing Tang, Hao Wang

SaC4-2 Dynamics Analysis of 3-CPaR&R1R2 Hybrid Mechanism with Joint Clearance

Junchen Liu, Minghao Zhai, Baoxing Wang, Miao Lin, Wei Li, Yi Cao

SaC4-3 Underactuated robot passability analysis and optimization

Lingyu Sun, Xiaoya Liu, Zhilong Li

SaC4-4 Design and Simulation of a Miniature Jumping Gliding Robot on Water Surface

Jihong Yan, Hongwei Yao, Kai Yang, Xin Zhang, Jie Zhao

SaC4-5 Towards Intelligent Maintenance of Thermal Power Plants: A Novel Robot for Checking Water Wall Tube

Jun Yang, Hongwei Wang, Jian Zhang, Xianming Zhou

SaC4-6 Configuration Change and Mobility Analysis of a novel metamorphic parallel mechanism constructed with (rA) joint

Pu Jia, Duanling Li, Jiazhou Li

Invited Keynote

Invited Speaker
Prof Huafeng Ding

Talk: Creative Design of Mechanisms of Robotic Equipment

Abstract: In the design of various robotic equipment, conceiving the mechanisms with better performance has been a challenging issue. For a long time, it has been researchers' experience and intuition that are mostly relied on in the conception of candidate structures and the selection of one of them for the task. The structural synthesis of mechanisms which can generate a complete list of kinematic chains and mechanisms free from isomorphism and degenerate chains can provide the designers with all the independent candidate kinematic structures of mechanisms of choice. This report focuses on a novel synthesis method which is at the same time effective, automatic and designer-friendly. One can obtain all the valid topological structures of mechanisms and develop the atlas database containing all the topological graphs for these mechanisms with different numbers of links. Based on the classified atlas database, the creative design of several kinds of robotic equipment is also presented.

Biography: Prof. Dr. Huafeng Ding is a Professor and the dean of the School of Mechanical Engineering and Electronic Information, China University of Geosciences. He received his first Ph.D. in Robotics and Mechatronics from Yanshan University, China, in June 2007. He received his second Ph.D. in Mechanics and Robotics from University of Duisburg-Essen, Germany, in February 2015. He worked as an Alexander von Humboldt Fellow in Germany from 2010 to 2012. In 2014, he won the Natural Science fund for Outstanding Youth Scholars and the Fok Ying-Tong Education Foundation. His research interests include structural synthesis of mechanisms, conceptual design, control and applications of planar and spatial mechanisms. He published over 100 research papers, 1 book published by Springer. He has more than 50 patents for his inventions. He is Associate Editor for the International Journal of Mechanism and Machine Theory (2015~).

SaC5: Visual and motional learning in robotics (169, 254, 377, 387, 393, 465, 508)

Time: August 10th Saturday, 16:45-18:30

Venue: Activity Room on 5th floor (5 楼活动室)

Chairs: Dr. Hongbin Ma, Dr. Yanhong Liu

SaC5-1 A Grid-based Monte Carlo Localization with hierarchical free-form scan matching

> **Mei Wu, Hongbin Ma, Xinghong Zhang**

SaC5-2 A Method to Deal With Recognition Deviation Based on Trajectory Estimation in Real-time Seam Tracking

> **Nianfeng Wang, Suifeng Yin, Kaifan Zhong, Xianmin Zhang**

SaC5-3 3-D Dimension Measurement of Workpiece Based on Binocular Vision

> **Jiannan Wang, Hongbin Ma, Baokui Li**

SaC5-4 Co-simulation of Omnidirectional Mobile Platform Based on Fuzzy Control

> **Wenchao Zuo, Hongbin Ma, Xin Wang, Cong Han, Zhuang Li**

SaC5-5 Static Hand Gesture Recognition for Human Robot Interaction

> **Josiane Uwineza, Hongbin Ma, Baokui Li, Ying Jin**

SaC5-6 Multi-sensor Based Human Balance Analysis

> **Haichuan Ren, Zongxiao Yue, Yanhong Liu**

SaC5-7 Wrist motor function rehabilitation training and evaluation system based on human-computer interaction

> **Haichuan Ren, Qi Song, Yanhong Liu**

SaC6: Robot vision and scene understanding (113，128, 217, 224, 292, 438)

Time: August 10th Saturday, 16:45-18:30

Venue: No. 2 Meeting Room on 3rd floor (3 楼第二会议室)

Chairs: Prof. Shengyong Chen, Prof. Honghai Liu, Prof. Houxiang Zhang

SaC6-1 Semantic Situation Extraction from Satellite Image based on Neural Networks

> Xutao Qu, Dongye Zhuang, Haibin Xie

SaC6-2 Efficient ConvNet for Surface Object Recognition

> Wei Lin, Chen Quan, Xianzhi Qi, Bingli Wu, Xue Ke, Dezhao Yang, Yongzhi Wang, Jie Ma

SaC6-3 Deep Learning Based Fire Detection System for Surveillance Videos

> Hao Wang, Zhiying Pan, Zhifei Zhang, HongZhang Song, ShaoBo Zhang, Jianhua Zhang

SaC6-4 3D Scanning and Multiple Point Cloud Registration with Active View Complementation for Panoramically Imaging Large-scale Plants

> Dajing Gu, Kai Zhu, Yuechen Shao, Wei Wu, Liang GONG, Chengliang Liu

SaC6-5 Industrial Robot Sorting System for Municipal Solid Waste

> ZhiFei Zhang, Hao Wang, HongZhang Song, ShaoBo Zhang, JianHua Zhang

SaC6-6 A Method Based on Data Fusion of Multiple Sensors to Evaluate Road Cleanliness

> Xiang Yao, Wei Zhang, Wei Cui, Xu Zhang, Ying Wang, Jiale Xiong

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