2026 4rd International Conference on Control and Robot Technology (ICCRT 2026) & 2026 8th International Conference on Mechatronics Systems and Control Engineering (ICMSCE 2026)

August 18-20, 2026

Tokai University (Shonan Campus), Hiratsuka, Japan

Co-sponsored by

Patrons

Technically Supported by

Media partner

https://iccrt.org/; https://icmsce.com/

Table of Contents

Welcome Message

On behalf of the organizing committee, it is our great honor and pleasure to welcome you to attend the 2026 4rd International Conference on Control and Robot Technology (ICCRT 2026) and 2026 8th International Conference on Mechatronics Systems and Control Engineering (ICMSCE 2026), held in Tokai University (Shonan Campus), Hiratsuka, Japan during August 18-20. 2026.

ICCRT & ICMSCE 2026 brings together leading experts, researchers, and practitioners from around the globe to share cutting-edge advancements, innovative ideas, and collaborative insights in the fields of Control and Robot Technology, Mechatronics Systems and Control Engineering. This conference serves as a premier platform for fostering interdisciplinary discussions, exploring emerging technologies, and addressing the challenges and opportunities in these rapidly evolving domains.

Over the course of three days, you will have the opportunity to engage in keynote speeches, technical sessions, all designed to facilitate knowledge exchange and collaboration. We are confident that the diverse perspectives and expertise represented here will lead to meaningful discussions and groundbreaking outcomes.

On behalf of all the conference committees, we would like to thank all the authors as well as the technical program committee members and reviewers. Their high competence, their enthusiasm, their time and expertise knowledge, enabled us to prepare the high-quality final program and helped to make the conference become a successful event.

We wish you a productive, inspiring, and enjoyable conference experience. Welcome to ICCRT & ICMSCE 2026!

ICCRT & ICMSCE 2026 Organizing Committee
August 2026

Conference Committees

Honorary Chair

Hisato Kobayashi, Hosei University, Japan

Conference Chairs

Katsuhiko Inagaki, Tokai University, Japan
Ming Xie, Nanyang Technological University, Singapore
Mihoko Niitsuma, Chuo University, Japan

Program Chairs

Chun-Yi Su, Concordia University, Canada
Ahmad Lotfi, Nottingham Trent University, UK
Giuseppe Carbone, University of Calabria, Italy
Raul Campiho, Instituto Superior de Engenharia do Porto, Portugal

Local Chair

Hiroshi Kimura, Tokai University, Japan

International Steering Committees

Cheng Chin, Newcastle University in Singapore, Singapore
Houxiang Zhang, Norwegian University of Science and Technology, Norway

Steering Chairs

Stefano Mariani, Politecnico di Milano, Italy
Wei Dong, Harbin Institute of Technology, China
Yoshifumi Morita, Nagoya Institute of Technology, Japan

Advisory Chairs

Huosheng Hu, University of Essex, UK
John Watkins, Wichita State University, USA

Chapter Chairs

Sara Lee Kit Yee, Tunku Abdul Rahman University of Management and Technology, Malaysia
Alexander Arntz, University of Applied Sciences Ruhr West, Germany
Qiang Cheng, University of Kentucky, USA
Chul-Hee Lee, Inha University, Korea

Publicity Chairs

Lei Chen, Shandong University, China

Syuan-Yi Chen, National Taiwan Normal University, Taiwan

Sai Hong Tang, Universiti Putra Malaysia, Malaysia

Publication Chairs

Ong Hui Min, Singapore Institute of Electronics, Singapore

Chua Wei Ting, Singapore Industrial Automation Association, Singapore

Paolo Mercorelli, Leuphana University, Germany

Yuming Zhang, University of Kentucky, USA

Hamidreza Nemati, University of Hertfordshire, UK

Treasurer

Minyuan Yuan, Wuhan University, China

Technical Committee Chairs

Hwa-Jen YAP, Universiti Malaya, Malaysia

Mohd Ashraf Ahmad, University Malaysia Pahang, Malaysia

Technical Committees

Yap Hwa Jen, University of Malaya, Malaysia

Syuan-Yi Chen, National Taiwan Normal University, Taiwan

Rosli Bin Omar, Universiti Tun Hussien Onn Malaysia, Malaysia

Sheng Lu Yu, National Taiwan normal university, Taiwan

Javier Gozalvez, Universidad Miguel Hernandez de Elche, Spain

Kamran Iqbal, University of Arkansas, USA

Sansanee Auephanwiriyakul, Chiang Mai University, Thailand

Mohd Aliff Afira Sani, Universiti Kuala Lumpur, Malaysia

Cheng Chin, Newcastle University, Singapore

Carlos Renato Vázquez Topete, Tecnológico de Monterrey, Mexico

Dirman Hanafi, Universiti Tun Hussein Onn Malaysia, Malaysia

Sara Lee Kit Yee, Tunku Abdul Rahman University of Management and Technology, Malaysia

Lin Lih Poh, Tunku Abdul Rahman University of Management and Technology, Malaysia

Tang Sai Hong, Universiti Putra Malaysia, Malaysia

Megha Bhushan, University of Seville, Spain

Said Fadlo, ENSAM Hassan II University of Casablanca, Morocco

Ibrahim Sultan, Federation University, Australia

Nasharuddin Bin Zainal, Universiti Kebangsaan Malaysia, Malaysia
Zati Hakim Azizul Hasan, Universiti Malaya, Malaysia
Hamzah Bin Arof, University of Malaya, Malaysia
Charles C. Nguyen, Catholic University of America, USA
Tri Kuntoro Priyambodo, Gadjah Mada University, USA
Mohd Ashraf Ahmad, University Malaysia Pahang, Malaysia
Amir Akramin bin Shafie, International Islamic University Malaysia, Malaysia
Ivan Buzurovic, Harvard University, USA
Wen-Fang Xie, Concordia University, Canada
Lee Hui Shan, Universiti Tunku Abdul Rahman, Malaysia
Sallehuddin Mohamed Haris, Universiti Kebangsaan Malaysia, Malaysia
Chin Kar Mun, Tunku Abdul Rahman University of Management and Technology, Malaysia
Wencen Wu, San Jose State University, USA
Abhishek Phadke, Christopher Newport University, USA
Gheorghe Grigoras, Technical University of Iasi, Romania
Huseyin Canbolat, Ankara Yildirim Beyazit University, Turkey
Yu-Sheng Lu, National Taiwan Normal University, Taiwan
Radu-Emil Precup, Politehnica University of Timisoara, Romania
Paolo Mercorelli, Leuphana University, Germany
Maki Habib, The American University in Cairo, Egypt
Lounis Adouane, University of Technology of Compiègne, France
Gheorghe-Daniel Andreescu, Politehnica University Timisoara, Romania
Jamaludin Bin Jalani, University Tun Hussein Onn Malaysia, Malaysia
Ali Sophian, International Islamic University Malaysia, Malaysia
Kazem Abhary, University of South Australia, Australia
Mrutyunjaya Panda, Utkal University, India
Patrick Goh Kuan Lye, Universiti Sains Malaysia, Malaysia
Ajit Jha , University of Agder, Norway
Rui Araujo, University of Coimbra, Portugal
Tingjun Lei, University of North Dakota, USA
Abdul Nasir Bin Abd. Ghafar, University Malaysia Pahang, Malaysia
Chao Zeng, University of Liverpool, UK
Tariq Masood, University of Strathclyde, UK
Mohd Aliff Afira Bin Hj. Sani, Universiti Kuala Lumpur, Malaysia
Koorosh Gharehbaghi, RMIT University, Australia
Sylvain Bertrand, ONERA - Paris-Saclay University, France
Weitian Wang, Montclair State University, USA
Cezary Zieliński, Warsaw University of Technology, Poland

Dequan Zeng, East China Jiaotong University, China
Jee Hou Ho, University of Nottingham, Malaysia
Tanveer Saleh, International Islamic University Malaysia, Malaysia
Muhammad Hassan Tanveer, Kennesaw State University Marietta, USA
Marco Brocanelli, The Ohio State University, USA
Raul Campiho, Instituto Superior de Engenharia do Porto, Portugal
Masayoshi Tomizuka, University of California, USA
Michael Khoo Boon Chong, Universiti Sains Malaysia, Malaysia

Guideline for Onsite Attendance

Important Notes

- Please enter the meeting room at least 15 minutes before your session. Your punctual arrival and active involvement will be highly appreciated.
- Please wear your name tag for all the conference activities. Lending it to others is not allowed. If you have any companying person, please do inform our staff in advance.
- Please keep all your belongings (laptop and camera etc.) at any time. The conference organizer does not assume any responsibility for the loss of personal belongings.
- Please show name tag and meal coupons when dining.
- Due to force majeure including but not limited to earthquake, natural disaster, war and country policy, the organizer reserves the rights to change the conference dates or venue with immediate effect and takes no responsibility.

Oral & Poster Presentation

- Regular oral presentation: 15 minutes (including Q&A).
- Get your presentation PPT or PDF files prepared. Presentations MUST be uploaded at the session room at least 15 minutes before the session starts.
- Laptop (with MS-Office & Adobe Reader), projector & screen, laser pointer will be provided in all oral session rooms.
- Poster Presenters should bring your poster to the conference venue and put it on designated place.

Guideline for Online Attendance

Platform: ZOOM

- Step 1: Download ZOOM from the link: https://zoom.us/download

How to use ZOOM

* A Zoom account is not required if you join a meeting as a participant, but you cannot change the virtual background or edit the profile picture.

- Rename: Before you enter the conference room, please change your name to Paper ID + Name
- Chat and raise your hand: During the session, if you have any questions, please let us know by clicking “raise your hands” and use “chat” to communicate with conference secretary.
- When you deliver your online speech, please open your camera.
- During the Question section, if you have any questions about keynote speakers or authors, you can also click “raise your hands” or “chat”
- Share Screen: Please open your power point first, and then click “share screen” when it’s your turn to do the presentation.

How to join the conference online

- Find your paper ID and suitable meeting ID on the conference program.
- Open the ZOOM, click the join, paste the meeting ID, then you can join the conference.
- Click the stop share after you finish your presentation

Time Zone

- **Japan Standard Time (GMT+9)**

Device

- A computer with an internet connection (wired connection recommended)
- USB plug-in headset with a microphone (recommended for optimal audio quality)
- Webcam: built-in or USB plug-in

Online Room Information

Online Room Information

Zoom ID: **816 1130 0144**

Zoom Link: **https://us02web.zoom.us/j/81611300144**

* Please rename your Zoom Screen Name in below format before entering meeting room.

Role	Format	Example
Conference Committee	Position-Name	Conference Chair-Prof.
Keynote/ Invited Speaker	Position-Name	Keynote/Invited Speaker-Prof.
Author	Session Number-Paper ID-Name	S1-MT0001/MT5001-Name
Delegate	Delegate-Name	Delegate-Name

Conference Venue

Venue: Tokai University Shonan Campus, Building 19, 7th floor
Building name: Techno Cube / Building 19
Campus address: 4-1-1 Kitakaname, Hiratsuka, Kanagawa 259-1292, Japan
https://www.u-tokai.ac.jp/about/campus/campus-shonan/

Access from Central Tokyo to Tokai-daigaku-mae Station

1. Basic route from central Tokyo

The nearest railway station to the venue is Tokai-daigaku-mae Station on the Odakyu Odawara Line.

For most participants staying in central Tokyo, the simplest route is to travel first to Shin- juku Station, which is the main Tokyo terminal of the Odakyu Odawara Line, and then take an Odakyu Line train toward the western Kanagawa area.

Central Tokyo → Shinjuku Station → Odakyu Odawara Line → Tokai-daigaku-mae Station

From Shinjuku Station, guests can take an Odakyu Line train bound for destinations such as Odawara, Hakone-Yumoto, Hadano, or Isehara, depending on the timetable. Travel time from Shinjuku to Tokai-daigaku-mae Station is typically about 60–80 minutes, depending on the train type and transfers.

2. Typical routes

Starting from Shinjuku: Take the Odakyu Odawara Line directly from Shinjuku Station toward Tokai-daigaku-mae Station. Depending on the service, a transfer may be required at a major station such as Hon-Atsugi, Isehara, Hadano, or another station.

Starting from Tokyo Station: Take the JR Chuo Line or another suitable JR/subway route to Shinjuku Station, then transfer to the Odakyu Odawara Line for Tokai-daigaku-mae Station.

Starting from Shibuya: Take the JR Yamanote Line, JR Saikyo Line, or another suitable route to Shinjuku Station, then transfer to the Odakyu Odawara Line.

Starting from Shinagawa: Take the JR Yamanote Line or another suitable JR route to Shinjuku Station, then transfer to the Odakyu Odawara Line.

The organizer doesn't provide accommodation, and we suggest you make an early reservation. You can refer to the accommodation subscription suggestions on the official website.

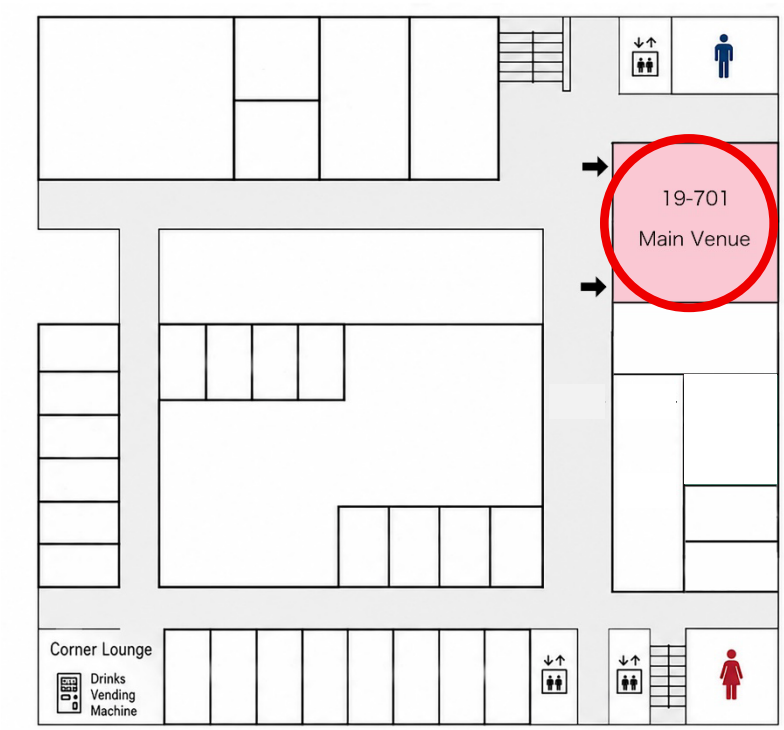
https://iccrt.org/iccrt2026-accommodation.html

Conference Rooms Directions

The ICCRT 2026 Venue & Access page has an "Open in Google Maps" link for Building 19, please using the following link below

https://www.iccrt.org/iccrt2026-access.html

Building 19, 7th floor



A floor plan showing the locations of the conference rooms

Simple Program

August 18, 2026 (Tuesday)

Onsite Registration

Registration Time: 13:00-17:00
Venue: Tokai University Shonan Campus, Building 19, 7th floor **Conference Room: 19-701**
Campus address: 4-1-1 Kitakaname, Hiratsuka, Kanagawa 259-1292, Japan
1. Arrive at the Tokai University Shonan Campus, Building 19, 7th floor; **2. Inform the conference staff of your paper ID;** **3. Sign your name on the Participants list;** **4. Sign your name on Lunch & Dinner requirement list;** **5. Check your conference kits;** **6. Finish registration.**

Online Test
Time Zone: GMT+9

Online Test **Zoom ID: 816 1130 0144** **Link: https://us02web.zoom.us/j/81611300144**	**Duration**
Prof. Maria Pia Fanti	15:00-15:10
Assoc. Prof. Deepika Koundal	15:10-15:20
Session 3 (Online): MT0015, MT0006	15:20-15:40

Note: If you are not available from 15:00 to 15:40 on August 18, please contact your conference secretary.

August 19, 2026 (Wednesday)

Morning Sessions Venue: Tokai University Shonan Campus, Building 19, 7th floor Room: 19-701		Duration
Opening Remark	Prof. Katsuhiko Inagaki, Tokai University, Japan	9:00-9:05
Keynote Speech 1	Prof. Hisato Kobayashi, Hosei University, Japan Speech Title: Coexistence of Humans and "Physical AI"	9:05-9:45
Keynote Speech 2	Prof. Sho Yokota, Toyo University, Japan Speech Title: Designing Intuitiveness: Mobility, Robotics, and Human Interaction	9:45-10:25
Group Photo & Coffee Break		**10:25-10:40**
Keynote Speech 3 (Online)	Prof. Maria Pia Fanti, Polytechnic University of Bari, Italy Speech Title: Artificial intelligence and digital twin approaches for Last Mile Delivery Management	10:40-11:20
Invited Speech (Online)	Assoc. Prof. Deepika Koundal, University of Eastern Finland, Finland Speech Title: From Neurons to Foundation Models: Modern Deep Learning Architectures	11:20-11:40
Lunch		**11:40-13:00**

Afternoon Sessions **Venue: Tokai University Shonan Campus, Building 19, 7th floor** **Room: 19-701**		
Session 1	**Topic:** System Design and Intelligent Control for Smart Healthcare and Service Robots Session Chair: Dr. Chinvudh Uahchinkul, Tokai University, Japan **Presentations:** MT5003-A, MT5006-A, MT5008-A, MT5004-A, MT5009-A, MT5002-A	**13:00-14:30**
Session 2	**Topic:** Intelligent Robotic Manipulation and Optimal Control Based on Imitation Learning Session Chair: Assoc. Prof. Mariam Md Ghazaly, Universiti Teknikal Malaysia Melaka, Malaysia **Presentations:** MT5014-A, MT5007-A, MT5011-A, MT5015-A, MT5012	**14:30-15:45**
Coffee Break & Poster Session **Topic: Environmental Dynamic Perception and Intelligent Control System** **Presentations: MT5005, MT5010-A, MT0005**		**15:45-16:15**
Session 3	**Topic:** Advanced Control Theory and Intelligent Sensing: Event-Triggered Control and System Modeling Session Chair: Prof. Hiroshi Kimura, Tokai University, Japan **Presentations**: MT0010, MT0011, MT0004, MT0015(Online), MT0006(Online)	**16:15-17:30**
Dinner		**17:45-19:30**

Note:

(1) One Best Presentation will be selected from each presentation session, and the Certificate for Best Presentation will be awarded at the end of each session by Session Chairs.

(2) Regular each Presentation: about 15 Minutes including 2-3 Minutes for Question and Answer.

Detailed Program

Opening Remark	
Time	**9:00-9:05, August 19, 2026**
Venue	**Tokai University Shonan Campus, Building 19, 7th floor** **Room: 19-701**

Prof. Katsuhiko Inagaki

Tokai University, Japan

Katsuhiko Inagaki received the B.E., M.E., and Dr. Eng. degrees in electrical engineering from Hosei University, Tokyo, Japan, in 1990, 1992, and 1995, respectively. He was a Research Assistant with the Department of Control Engineering, Tokai University, from 1995 to 1996. From 1996 to 2001, he was an Assistant Professor with the Department of Applied Computer Engineering, Tokai University, where he served as an Associate Professor from 2001 to 2013. Since 2013, he has been a Professor with the same department.

His research interests include robotics, mechatronic system design, and robotics and mechatronics education. He is a member of the Robotics Society of Japan (RSJ), the Society of Instrument and Control Engineers (SICE), the Japan Society of Mechanical Engineers (JSME), and the Institute of Electrical and Electronics Engineers (IEEE).

Keynote Speech 1

Host	Prof. Katsuhiko Inagaki Tokai University, Japan	**Time**	9:05-9:45, August 19, 2026
		Venue	Tokai University Shonan Campus, Building 19, 7th floor, Room: 19-701

Prof. Hisato Kobayashi

Hosei University, Japan

Hisato Kobayashi got B.S., M.S., and D.E. degrees from Waseda University in 1974,1976 and 1979, respectively. He joined Hosei University in 1984. He is now a Professor Emeritus Hosei University. From 2001 to 2002, he was the founding president of Hosei University Research Institute, California. He was the Founding Dean of the Faculty of Engineering and Design from 2007 to 2008. He was a board member of the Robotics Society Japan (RSJ) from 1994 to 1996.

He was a board member of The Society of Instrument and Control Engineers (SICE) from 2002 to 2004 and the vice president from 2018 to 2020. He was editor-in-chief of Advanced Robotics, Journal of RSJ, from 1997 to 2002.

From 2003 to 2005, he was the chairman of the automatic control committee, Science Council Japan, and a member of Science Council Japan from 2006 to 2014. From 2010 to 2013, he was a Program Officer at the Japan Society for the Promotion of Science. Since 2008, he has been the chairman of the Standing Steering Committee IEEE International Conference on Robot and Human Interactive Communication.

He is an IEEE Life Fellow

Speech Contents

Speech Title: Coexistence of Humans and "Physical AI"

Abstract: Recently, the term "Physical AI" has been gaining attention. When people hear "Physical AI," many might imagine humanoid robots, but Physical AI is not limited to humanoid robots. Physical AI should be understood as AI that can not only provide information but also perform some form of physical action.So, what is the difference between conventional automation equipment (such as industrial robots) and Physical AI? With conventional automation equipment, humans have designed and implemented operations based on the laws of physics. All operations were designed from a human perspective, and every action was conceived within the framework of human behavior and perspective. In contrast, Physical AI allows the AI to perform physical actions by adding hardware. What actions are permitted and which are considered desirable should be determined through dialogue with humans (designers). However, the possibility that the AI might perform actions not anticipated by humans (designers) cannot be ruled out. In this presentation, I will introduce the possibilities of Physical AI while also outlining its challenges and potential risks.

Keynote Speech 2

Host	Prof. Katsuhiko Inagaki Tokai University, Japan	**Time**	9:45-10:25, August 19, 2026
		Venue	Tokai University Shonan Campus, Building 19, 7th floor,Room: 19-701

Prof. Sho Yokota

Toyo University, Japan

Sho Yokota received a Ph.D. degree from Hosei University, Tokyo, Japan, in 2006, and a Doctorate in Robotics (Docteur en Robotique) from the Université de Versailles Saint-Quentin-en-Yvelines, Versailles, France, in 2009. He worked at Tokyo University of Technology, Japan, from 2006 to 2009 and at Setsunan University, Osaka, Japan, from 2009 to 2014. Since 2014, he has been with the Department of Mechanical Engineering, Toyo University, Japan, where he is currently a Professor.

His research interests include human-robot interaction, human assistive systems, mechanical design, mobility systems, robotics, and mechatronics. Prof. Yokota has published more than 200 papers and authored four books. He served as the General Chair of the IEEE 13th International Conference on Human System Interaction (HSI 2020). He was also the Chair of the Technical Committee on Human Factors and a member of the Administrative Committee (AdCom) of the IEEE Industrial Electronics Society in 2016 and 2017. Currently, he serves as an Associate Editor of the ROBOMECH Journal (Springer).

Speech Contents

Speech Title: Designing Intuitiveness: Mobility, Robotics, and Human Interaction

Abstract: Modern robotic and mobility systems have achieved significant advances in sensing, control, and automation. However, the development of systems that people can operate and understand intuitively remains an important challenge.

This keynote introduces our research activities in human-centered robotics and human-machine interaction. The talk presents a range of studies, including body-motion-based interfaces, personal mobility systems, assistive robotic technologies, and other robotic systems designed to improve usability and interaction between humans and machines. Through these examples, the keynote discusses design approaches that take human characteristics into account and aim to provide more natural and effective interaction.

By reviewing these research efforts, the talk highlights the importance of considering human users in the design of robotic and mobility systems.

Keynote Speech 3 (Online)

Time	10:40-11:20, August 19, 2026 (GMT+9)
Zoom ID	816 1130 0144
Zoom Link:	https://us02web.zoom.us/j/81611300144

Prof. Maria Pia Fanti

Polytechnic University of Bari, Italy

Maria Pia Fanti (IEEE Fellow and Fellow of the Asia-Pacific AIA) received the Laurea degree in electronic engineering from the University of Pisa, Pisa, Italy, in 1983. She was a visiting researcher at the Rensselaer Polytechnic Institute of Troy, New York, in 1999. Since 1983, she has been with the Department of Electrical and Information Engineering of the Polytechnic of Bari, Italy, where she is currently a Full Professor of system and control engineering and Chair of the Laboratory of Automation and Control. Her research interests include modeling and control of complex systems, intelligent transportation systems, smart logistics; Petri nets; consensus protocols; fault detection. Prof. Fanti has published more than +310 papers and two textbooks on her research topics. She was senior editor of the IEEE Trans. on Automation Science and Engineering and member at large of the Board of Governors of the IEEE Systems, Man, and Cybernetics Society. Currently, she is Associate Editor of the IEEE Trans. on Systems, Man, and Cybernetics: Systems, member of the AdCom of the IEEE Robotics and Automaton Society, and chair of the Technical Committee on Automation in Logistics of the IEEE Robotics and Automation Society. Prof. Fanti was General Chair of the 2011 IEEE Conference on Automation Science and Engineering, the 2017 IEEE International Conference on Service Operations and Logistics, and Informatics and the 2019 Systems, Man, and Cybernetics Conference.

Speech Contents

Speech Title: Artificial intelligence and digital twin approaches for Last Mile Delivery Management

Abstract: Last-mile delivery has long been a significant challenge in urban logistics, being the last leg of the package's journey from the distribution center to the final addressee. Issues related to the increasing environmental impact, inefficiency of traditional delivery methods, and traffic congestion have highlighted the urgent need for more efficient and sustainable solutions.

This talk presents some recent strategies to solve the last-mile delivery problem based on Digital Twin tools and autonomous robots. An optimization layer determines the optimal routes of the robots, and a simulation model deals in real time with system unpredictable events, such as road traffic and accidents. Some case studies are presented for validating the proposed approaches.

Invited Speech (Online)

Time	**11:20-11:40, August 19, 2026 (GMT+9)**
Zoom ID	**816 1130 0144**
Zoom Link:	**https://us02web.zoom.us/j/81611300144**

Assoc. Prof.
Deepika Koundal

University of Eastern Finland, Finland

Deepika Koundal is currently associated as an Associate Professor with University of Petroleum and Energy Studies, Dehradun and Adjunct Professor in Ho Chi Minh City Open University, Vietnam. She is listed as world's top 2% researcher and has received the recognition and honorary membership from Neutrosophic Science Association from University of Mexico, USA. She is the awardee of best paper award by Journal of visual communication and image representation – Elsevier in 2023. She is also selected as a Young scientist in 6th BRICS Conclave by NIAS-DST in 2021. She is the awardee of research excellence award given by UPES in 2022, 2023 and by Chitkara University in 2019. She received the Master and Ph.D. degrees in computer science & engineering from the Panjab University, Chandigarh in 2016. She has published more than 80 research articles in reputed SCI and Scopus indexed journals, conferences, two patents and four books. She is also serving as Associate Editor in IEEE Transaction in Artificial Intelligence, Healthcare Analytics, BMC Medical Imaging, Plos One, Supply Chain Analytics and International Journal of Computer Applications. She also has served on many technical program committees as well as organizing committees and invited to give guest lectures and tutorials in Faculty development programs, international conferences and summer schools. Her Areas of Interest are Artificial Intelligence, Biomedical Imaging and Signals, Image Processing, Soft Computing, Machine Learning/ Deep Learning. She has also served as reviewer in many repudiated journals of IEEE, Springer, Elsevier, IET, Wiley and Sage.

Speech Contents

Speech Title: From Neurons to Foundation Models: Modern Deep Learning Architectures

Abstract: Modern deep learning has evolved from biologically inspired artificial neurons to powerful foundation models capable of solving diverse tasks across computer vision, natural language processing, speech recognition, and multimodal learning. This paper reviews the progression of deep learning architectures, beginning with perceptrons and multilayer neural networks, followed by convolutional neural networks, recurrent neural networks, long short-term memory networks, generative adversarial networks, transformers, and large foundation models. It highlights the architectural innovations, training paradigms, and applications that have shaped this evolution while discussing current challenges, including computational cost, interpretability, data dependency, and ethical concerns, along with emerging research directions.

Session 1 (13:00-14:30)

Topic: System Design and Intelligent Control for Smart Healthcare and Service Robots
Session Chair: Dr. Chinvudh Uahchinkul, Tokai University, Japan
Time: 13:00-14:30, August 19, 2026
Venue: Tokai University Shonan Campus, Building 19, 7th floor
Room: 19-701

***Presenters are recommended to enter the meeting room 10 mins in advance.**
***Presenters are recommended to stay for the whole session in case of any absence.**
***After the session, there will be a group photo for all presenters.**

MT5003-A (13:00-13:15)

Development of a Compact Dispensing Robot System with Image Recognition Functionality for Cell Culture

Takuya Asakura, Junichi Watanabe, Kenta Shinha and Hiroshi Kimura
Tokai University, Japan

Abstract—This study explores the diverse factors contributing to variability in reproducibility in life sciences research. Recognizing the potential impact of environmental and human factors, we focused on introducing laboratory automation. Previously, we designed an innovative automated media replacement system that uses a compact, multifunctional robotic arm equipped with image-recognition capabilities to accurately locate objects. However, while it demonstrated greater precision than human performance standards, it lagged significantly behind in terms of work efficiency. Previously, we had been replacing culture media using only a general-purpose robotic arm, but we developed a dispensing robot to divide the tasks and improve operational efficiency. Using multiple robots has increased flexibility, enabled simultaneous task execution, and made operations more efficient. Testing of this compact dispensing robot system confirmed that it reduced processing time by 20% compared to a previously developed system and achieved an excellent waste liquid rate exceeding 97%. Comparative trials with human operators demonstrated the system's exceptional consistency in executing complex exchange procedures, surpassing or matching human performance benchmarks.

MT5006-A (13:15-13:30)

Development of a Digital Twin System for Knee Exoskeleton: Torque Simulation and Experimental Validation

You-Han Chen[2], Wei-Lin Lai[1], Chia-Ming Chang[2], Ye-Cheng Zeng[2], Tran Le Anh Quan[2], Jia-Yush Yen[2], Fu-Cheng Wang[3] and Wei-Li Hsu[4]
1: Graduate Institute of Intelligent Manufacturing Technology, National Taiwan University of Science and Technology, Taiwan
2: Department of Mechanical Engineering National Taiwan University of Science and Technology, Taiwan
3: Department of Mechanical Engineering, National Taiwan University, Taiwan
4: School and Graduate Institute of Physical Therapy National Taiwan University, Taiwan

Abstract—This study proposes a digital twin model that integrates adaptive fuzzy impedance control for exoskeleton systems, addressing the inherent uncertainties of such systems. The model utilizes real-time data from inertial measurement units to simulate human gait and calculate joint torques, ensuring stable and adaptive locomotion. Developed in MATLAB Simscape, the model is based on a humanoid bipedal robot and incorporates the Cart-Table and Linear Inverted Pendulum models to enhance balance control. The system employs Proportional-Integral and Linear Quadratic Regulator strategies to maintain balance under dynamic conditions. Motor outputs are integrated with the digital twin model, sensors, and motor feedback, including angular velocity and current state. Fuzzy impedance control is applied to adaptively adjust impedance parameters. This model facilitates knee function during activities such as standing, walking, and sitting. Multi-action testing has verified the system's stability and adaptability. Future research will focus on integrating intention detection capabilities and broadening the model's application scope.

MT5008-A (13:30-13:45)

Robotic Arm System for Multi-Angle Lung Ablation: Integrating Remote Center of Motion Control and Rib-Avoidance Path Planning

Chi-Chuan Lee[1], Kung-Cheng Chou[2] and Jia-Yush Yen[2]
1: Graduate Institute of Automation and Control, National Taiwan University of Science and Technology, Taiwan
2: Department of Mechanical Engineering National Taiwan University of Science and Technology, Taiwan

Abstract—This study develops an image-guided robotic auxiliary system designed for percutaneous needle-based tumor ablation. By deeply integrating Cone-Beam Computed Tomography (CBCT) imaging with robotic spatial coordinate transformation, the system enhances surgical precision, efficiency, and safety. Utilizing the Techman Robot TM5-700 as the execution platform, the system incorporates a Remote Center of Motion (RCM)

control strategy. This strategy ensures that the surgical instrument rotates around a fixed entry point, thereby minimizing physical trauma to the surrounding tissues at the insertion site. To address common anatomical obstructions in lung surgery, a rib-avoidance path planning algorithm based on rib geometry is implemented to automatically exclude potential collision trajectories, ensuring the safety of the needle path.

In terms of spatial localization, the Kabsch algorithm is employed for coordinate calibration, combined with visual landmarks to effectively compensate for hardware deviations and achieve precise transformation between the image space and the robot's workspace. Furthermore, real-time communication between 3D Slicer and MATLAB is established via the OpenIGTLink protocol, allowing the robot's dynamic movements to be synchronized within the medical imaging interface. This provides operators with intuitive verification of robotic precision. Through various applications of the RCM strategy, the system supports multi-tumor ablation and realtime needle path adjustment to bypass minor obstacles without the need for re-insertion, significantly enhancing surgical flexibility.

In conclusion, this research successfully constructs an automated auxiliary system integrating image navigation, coordinate calibration, RCM constraints, and rib avoidance. Experimental results demonstrate that the system effectively improves spatial accuracy and treatment completeness of tumor ablation, showing significant clinical potential for optimizing surgical workflows and reducing recurrence rates.

MT5004-A (13:45-14:00)

Development of an Automation System for Rapid Pathogenic Microorganism Identification Using Collaborative Robots

Junichi Watanabe, Rajalakshmi Balasubramanian, Tadashi Imanishi, Kenta Shinha and Hiroshi Kimura

Tokai University, Japan

Abstract—In the diagnosis of bacterial infectious diseases, conventional culture-based testing, which remains the current mainstream method, has the drawback of requiring 1–2 days to obtain results. In contrast, nanopore DNA sequencing enables highly accurate identification within 5–6 hours; however, the entire testing process is performed manually, raising concerns about operator infection risk and human error caused by repeated pipetting of minute liquid volumes. Conventional automation approaches also have limitations: automated liquid-handling systems lack versatility and are difficult to integrate into pathogen-identification workflows, while humanoid robots pose challenges in terms of installation costs and required space. Therefore, a versatile system capable of operating in a general laboratory environment is needed. To address these issues, we

developed a system that integrates a six-axis collaborative robot and an electric pipette as a step toward the full automation of pathogen identification workflows. The proposed system is designed to work in coordination with existing laboratory equipment, such as a centrifuge and a bio-shaker, with the aim of automating operations, including dispensing, mixing, and centrifugation, involved in antimicrobial treatment, PMA treatment, and DNA extraction pretreatment. In this presentation, we report on the design and implementation details of the system, as well as studies toward its performance evaluation.

MT5009-A (14:00-14:15)

Development of an Robotics for Glaucoma Surgery

Ssu-Han Chen[1], Jia-Yush Yen[2], I-Jong Wang[3], Bo-I Kuo[3], Chi-An Dai[4], Po-Jen Shih[5], Fu-Cheng Wang[6] and Zheng-Xuan Huang[1]

1: Graduate Institute of Automation and Control, National Taiwan University of Science and Technology, Taiwan

2: Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taiwan

3: Department of Ophthalmology, National Taiwan University Hospital, Taiwan

4: Department of Chemical Engineering, National Taiwan University, Taiwan

5: Department of Biomedical Engineering, National Taiwan University, Taiwan

6: Department of Mechanical Engineering, National Taiwan University, Taiwan

Abstract—This study aims to develop an assistant robotic system for Minimally Invasive Glaucoma Surgery (MIGS) to address the limitations of traditional manual procedures, such as restricted degrees of freedom (DOF) in the narrow intraocular space, difficulties in incision control, and surgeon physical fatigue. The hardware architecture utilizes a 7-DOF robotic arm, leveraging its kinematic redundancy to optimize the operational flexibility of surgical instruments within the eye.

The core technical contribution involves establishing a digital model of the 7-axis robotic arm within the MATLAB/Simulink environment and implementing a Remote Center of Motion (RCM) control strategy. By imposing kinematic constraints at the ocular entry point, the system ensures that the instrument remains pivotally fixed at the incision site while following the prescribed surgical trajectory, thereby minimizing trauma to ocular tissues. Finally, this research successfully established the feasibility of the proposed RCM control strategy in ophthalmic applications and demonstrated the significant potential of robotic-assisted systems for minimally invasive glaucoma surgery.

MT5002-A (14:15-14:30)

A Soft Haptic Interface using Cable-driven Continuum with Mechanical Fiber Jamming for Variable Stiffness

Chinvudh Uahchinkul, Satoishi Muramatsu and Katsuhiko Inagaki
Tokai University, Japan

Abstract—The haptic device of the continuum robot has been developed previously with the ability to teleoperate the continuum robot easily. In the past, fiber jamming along with haptic devices has been developed with the ability to measure the change in position while varying the stiffness to add more feedback to the user. In this paper, we show the design of a cable-driven continuum robot integrated with mechanical fiber jamming structures to provide variable stiffness properties that differ from typical designs by omitting the pressure source to activate the jamming state and using it as a haptic interface. The design used in this research is based on a standard cable-driven continuum, which uses cables to drive and move the device, with the addition of a fiber stack inside the continuum body. Due to the design of the continuum body, when the antagonistic cable pairs are pulled and the robot is shortened, the body generates a compression force on the fiber stack. This increases the friction between each fiber, resulting in an increase in the stiffness of the overall structure.

The device uses data from the servo motors attached to the cables that route along the actuator's body to estimate the current position of the continuum device. The data from the servo motors, along with the dimensions of the pulleys and the physical continuum robot, are used to calculate the pulled length of the cables. Based on the lengths of the four cables, the current position of the device is calculated using the constant curvature model of the continuum section. Each cable is connected to a servo motor that can measure and control both the position and the current, which directly relates to the cable's pulled length and tension. Because the structure is embedded with a fiber jamming mechanism, stiffness can be controlled through the compression of the robot length. By controlling the cable tension or the motor current, the overall structural stiffness is controlled, while the motor position related to the cable length is used to calculate the current position. Through this system, the device is able to measure the current bending position while simultaneously controlling structural stiffness, which enables additional applications.

All four servo motors are connected to a microcontroller for sending and receiving signals to control the motor position and current. The microcontroller is connected to a PC via USB to control the device through MATLAB software. A user interface was developed with MATLAB App Designer to enable easy human control, while also showing the current status of the motors, such as position and current. Additionally, based on the

constant curvature model, the real-time position of the device is displayed on the PC system.

From the system prototypes, we have tested the performance of our developed system to validate its capabilities. The interface device is able to bend in any direction due to its soft properties, while the real-time system shows the current position in the User Interface as the physical device moves. Furthermore, through the current control of the servo motors, the stiffness of the interface device can be controlled. The system shows an increase in bending stiffness when the motor current is increased, which results in higher cable tension and activates the jamming structure. The results show that the device is able to measure its current position and control its stiffness successfully.

Session 2 (14:30-15:45)

Topic: Intelligent Robotic Manipulation and Optimal Control Based on Imitation Learning

Session Chair: Assoc. Prof. Mariam Md Ghazaly, Universiti Teknikal Malaysia Melaka, Malaysia

Time: 14:30-15:45, August 19, 2026

Venue: Tokai University Shonan Campus, Building 19, 7th floor

Room: 19-701

***Presenters are recommended to enter the meeting room 10 mins in advance.**

***Presenters are recommended to stay for the whole session in case of any absence.**

***After the session, there will be a group photo for all presenters.**

MT5014-A (14:30-14:45)

Sim-to-Real Imitation Learning Control for Food Service Robots with Domain Randomization

Rui-Hua Xu[1], Hong-Si Su[1], Guan-An Chen[2] and Syuan-Yi Chen[2]

1: Department of Electrical Engineering, National Taiwan Normal University, Taiwan

2: Information and Communications Research Laboratories, Industrial Technology Research Institute (ITRI), Taiwan

Abstract—This paper presents a sim-to-real transfer pipeline for a food service robot assistant performing egg grasping tasks using a UR3 robotic arm. The proposed system integrates behavior cloning with recurrent neural network (BC-RNN) trained in Isaac Lab with automatically generated demonstrations via Isaac Lab Mimic, targeting reliable deployment on physical hardware without manual teleoperation. To bridge the simulation-to-reality gap, we adopt a domain randomization (DR) strategy that systematically randomizes lighting conditions, table surface color and texture, background appearance, camera color jitter, and object pose sampling. A key challenge in vision-based policies is generalizing across diverse real-world visual conditions; our DR approach addresses this by exposing the policy to a wide range of visual perturbations during training, reducing reliance on precise simulation fidelity. Through ablation experiments across eight DR configurations, the success rate in simulation improved from 0% (no DR) to 89% (full DR). Real-world evaluation on 20 fixed test positions achieved a success rate of 75% (15/20), validating the effectiveness of the proposed pipeline. Failure cases were concentrated at edge positions with extreme object orientations, suggesting that further expansion of DR coverage can close the remaining sim-to-real gap. These results

demonstrate that systematic domain randomization constitutes an effective and scalable approach for sim-to-real transfer in contact-rich food service manipulation tasks.

MT5007-A (14:45-15:00)

Isaac Sim-Based Digital Twin for Reinforcement Learning Gain Scheduling of Air-Bearing Linear Stage

Che-Yao Hsu, Jia-Yush Yen, Fu-Cheng Wang and Hao-Yu Chung
National Taiwan University of Science and Technology, Taiwan

Abstract—Conventional controller tuning for precision air-bearing linear stages relies on iterative physical experiments, which are time-consuming and risk damaging expensive equipment. This study presents a digital twin framework that integrates NVIDIA Isaac Sim with proximal policy optimization (PPO) reinforcement learning to automate gain scheduling for trajectory tracking and positioning control. A digital twin of the air-bearing stage is built within the Isaac Sim PhysX engine and connected with MATLAB Reinforcement Learning Toolbox, forming a simulator-inthe-loop training pipeline.
A hierarchical control architecture is adopted: the PPO agent serves as the upper-level decision maker that outputs controller gains, while a mid-level PID controller computes force commands at each time step. A segmented gain scheduling strategy is proposed, where PD control is applied during the motion phase and PID control is activated in the settling phase to eliminate steady-state error without integral windup. The PPO agent learns separate gain sets for each phase using a logarithmic reward function with overshoot penalty.
Simulation results show that the RL-based gain scheduling outperforms fixed-gain controllers in both tracking accuracy and settling performance. The proposed framework enables risk-free training entirely in the virtual environment, validating the feasibility of AI-driven controller tuning for precision motion platforms and laying the groundwork for future sim-to-real transfer.

MT5011-A (15:00-15:15)

Dynamic Event-Triggered Control for LPV Systems

Cheung-Chieh Ku[1], Shou-Chih Huang[1] and Yi-Jie Chen[2]
1: Department of Marine Engineering, National Kaohsiung University of Science and Technology, Taiwan
2: Kaohsiung Municipal Kaohsiung Girl's Senior High School, Taiwan

Abstract—An event-triggered control scheme for linear time-varying systems is discussed

via a dynamic triggered mechanism in this paper. The Linear Parameter Varying (LPV) description is applied to express the considered system for using the known linear control technologies. To save the unnecessary loadings form signals transmission between sensors and actuators, the dynamic event-triggered scheme is applied to design a gain-scheduled controller. For the stability issue, a novel Lyapunov function is proposed via introducing a flexible scalar. Based on the Lyapunov function, a set of sufficient conditions is derived into Linear Matrix Inequality (LMI) form. By solving those conditions, the event-triggered controller is established to guarantee the stability of LPV systems Finally, a simulation result of numerical example is provided to demonstrate the effectiveness of the proposed design method.

MT5015-A (15:15-15:30)

Vision-Based Behavior Cloning Control for Robotic Manipulator with Residual Reinforcement Learning Compensation

Hong-Si Su[1], Rui-Hua Xu[1], Guan-An Chen[2], and Syuan-Yi Chen[1]

1: Department of Electrical Engineering, National Taiwan Normal University, Taiwan

2: Information and Communications Research Laboratories, Industrial Technology Research Institute (ITRI), Taiwan

Abstract—This paper presents a hybrid imitation-and-reinforcement learning framework that augments a frozen vision-based behavior cloning (BC) policy with a residual policy trained by proximal policy optimization (PPO), for a UR3 robotic pick-and-place task in Isaac Lab. A strong BC base stays competent on in-distribution demonstrations yet still fails under out-of-distribution initial conditions and fine-grained contact; instead of retraining it or learning from scratch under sparse rewards, we keep the BC base frozen and let a lightweight residual policy add small corrections that are scaled by a mixing coefficient, combined with the base action, and clipped within a normalized action range. Three mechanisms keep residual training stable on a strong base: a zero-initialized residual head, so training starts at the BC behavior and is no worse than the base; a linearly ramped mixing coefficient that lets the critic estimate task value before the residual gains influence; and an action-L2 regularizer that drives the residual toward zero unless a positive advantage justifies a correction. In simulation, the residual policy raises the task success rate from 69.5% to 89.0% with non-overlapping 95% Wilson confidence intervals, while per-step corrections stay under about 6% of the BC action magnitude, preserving trajectory smoothness and completion time.

MT5012(15:30-15:45)

Reward Shaping for Robotic Manipulation with a Static and Distant goal

Nan-Hsi Lo

Graduate School of Science and Technology, Sophia University, Japan

Abstract—In robotic manipulation problems, such as picking up an object and moving it to a target position, the target is usually randomized so the policy learnt by the agent is more generalized. With advances in the field of Reinforcement Learning and simulation software in the recent years, there has been significant progress made in this problem and its variations. However, there has been little focus on the relationship between the possible spawn points and target positions. When we place certain conditions on the target position, we quickly see that the learning collapses and the agent does not learn a beneficial policy. Furthermore, there does not exist a universal approach one can refer to when approaching a simple pick-and-move problem. In this work, we utilize a pre-set environment provided by Isaac Sim that trains a robot arm to pick up an object and move it to a target position. We show that, by making the target position into a static goal and distancing it from the initial spawn points, the learning fails. We then introduce a region-based reward function that is easy to implement that help guides the agent to the static goal and reach a stable policy. The simplicity of the method can be a useful approach for future research of different levels of complexity.

Poster Session (15:45-16:15)

Topic: Environmental Dynamic Perception and Intelligent Control System
Time: 15:45-16:15, August 19, 2026
Venue: Tokai University Shonan Campus, Building 19, 7th floor
Room: 19-701

***Presenters are recommended to enter the meeting room 10 mins in advance.**
***Presenters are recommended to stay for the whole session in case of any absence.**
***After the session, there will be a group photo for all presenters.**

MT5005

A Motion Perception-Based Vehicle Key Fob System Using Fully Connected Network for Password Authentication and Tilting Control

Beomjoon Pyun[1], Hyeokju Jang[2], Jaemin Song[1] and Hyngjeen Choi[1]
1: Korea Automotive Technology Institute (KATECH), Republic of Korea
2: Korea Advanced Institute of Science & Technology (KAIST), Republic of Korea

Abstract—This paper proposes a motion perception-based vehicle key fob system that integrates gesture-based password authentication and tilting-based vehicle control using IMU sensors and TinyML techniques. Conventional vehicle key fob systems primarily rely on button-based interfaces and passive radio-frequency authentication, which provide limited interaction flexibility and are vulnerable to security threats such as relay attacks. To address these limitations, the proposed system combines motion-based authentication with intuitive tilting-based control within a unified embedded framework. The proposed architecture consists of an MCU transmitter, MCU receiver, Vehicle Control Unit (VCU), and a real-time vehicle simulation environment. IMU sensor data acquired from an Arduino Nano 33 BLE Sense platform are utilized to recognize user-defined gesture sequences as motion-based passwords through a TinyML-based Fully Connected Network (FCN) model. Upon successful authentication, tilting motions are converted into vehicle control commands and transmitted via BLE communication. The received signals are subsequently transformed into PWM-based driver inputs and applied to a TruckSim vehicle model integrated with MATLAB/Simulink and an NI PXI real-time platform. Experimental validation successfully demonstrated end-to-end operation of gesture-based password input, authentication, wireless communication, and tilting-based vehicle control in a real-time co-simulation environment. The results confirm the feasibility of applying motion-based interaction as an intuitive and contactless interface for next-generation

vehicle access and low-speed remote vehicle control systems. Although this work focuses primarily on system-level validation rather than performance optimization, the proposed framework demonstrates the practicality and extensibility of integrating motion-based authentication and tilting-based vehicle control into a unified automotive key fob system.

MT5010-A

Bumpless transfer event-triggered control for switched delay system with H∞ and H2 achievement via sampling input and switching rule

Chang-Hua Lien[1], Cheng-Ruei Yu[2] and Sundarapandian Vaidyanathan[3]
1: Department of Marine Engineering,National Kaohsiung University of Science and Technology, Taiwan
2: Ph.D. program of Maritime Science and Technology, National Kaohsiung University of Science and Technology, Taiwan
3: Research and Development Centre, Vel Tech University, India

Abstract—In this work, an enhanced bumpless transfer event-triggered control (BTETC) framework is introduced to ameliorate the utilization of communication resources and reduce the bump for switching in switched models subject to interval delay and linear fractional uncertainties. A mechanism involving both switching rule (SR) and sampling input (SI) is designed for H∞ together with H∞ index via an LMI-based method. Instead of relying on continuous real-time monitoring, the scheme makes use of aperiodic sampling information. The proposed BTETC approach is further applicable to switched time-delay models operating under arbitrary switching (ArS) condition. Here, we focus on interval delay and sampling rather than the constant delay and pointwise sampling commonly assumed in earlier literature. To establish this theoretical consequences, Lyapunov-Krasovskii functionals (LKF) with both common
and multiple terms are employed to compare with standard selection in the past. Finally, some examples are furnished to show the less conservatiseness and practicality of the developed consequences.

MT0005

Research on Automated Assembly Technology for Easily Deformable Thin-Walled Elbows

Weidong Wang, Bin Wang and Xin Xu
Nuclear Industry Physical and Chemical Engineering Research Institute, China

Abstract—During the development of a specific type of specialized equipment, dimension

exceeding tolerance occurred during the assembly of thin-walled elbow components, severely impacting the critical performance of the machinery. This paper investigates the design structure, assembly process, and inspection methods of the thin-walled elbow component through relevant experiments, analyzing the causes of this phenomenon. Addressing the identified causes, methods for controlling the dimensional accuracy of the formed thin-walled elbow and horizontal dimension inspection techniques are proposed, which improved the qualification rate of the thin-walled elbow components during the development phase. Furthermore, an optimized automated assembly line process flow is suggested to fundamentally solve the dimension exceeding tolerance issue for thin-walled elbow components in mass production.

Session 3 (16:15-17:30, GMT + 9)

Topic: Advanced Control Theory and Intelligent Sensing: Event-Triggered Control and System Modeling
Session Chair: Prof. Hiroshi Kimura, Tokai University, Japan
Time: 16:15-17:30, August 19, 2026
Venue: Tokai University Shonan Campus, Building 19, 7th floor
Room: 19-701
Zoom ID: 816 1130 0144
Zoom link: https://us02web.zoom.us/j/81611300144

***Presenters are recommended to enter the meeting room 10 mins in advance.**
***Presenters are recommended to stay for the whole session in case of any absence.**
***After the session, there will be a group photo for all presenters.**

MT0010 (16:15-16:30)

Dynamic Consistent Modeling and Control of Redundant Cable Suspended Parallel Robots with Pulley Kinematics

Nguyen Duc Thong[1], Nguyen Minh Trieu[2], Dang Tri Dung[2] and **Nguyen Trường Thịnh**[2]
1: Dong Thap University, Vietnam
2: University of Economics Ho Chi Minh City - UEH, Vietnam

Abstract—Cable Suspended Parallel Robots (CSPRs) provide large workspaces and high payload capacity but remain challenging to control due to cable unilateral constraints, actuation redundancy, and unmodeled dynamic effects. This pa-per presents a dynamic consistent modeling and control framework for redundantly actuated CSPRs that explicitly incorporates pulley kinematics, rigid body platform dynamics, actuator dynamics, and stiffness effects. Unlike conventional approaches that treat cable exit points as fixed and neglect actuator coupling, the proposed model accounts for pulley induced geometric variations and motor ‑ cable transmission dynamics, improving tension prediction and motion accuracy. A quadratic programming formulation is employed to compute feasible positive cable tensions while minimizing internal force energy. To enhance robustness under varying payload conditions, a realtime mass estimation scheme is embedded within a feedforward proportional ‑ derivative control architecture. The approach is experimentally validated on an 8 cable CSPR with 6 DoF handling pay-loads up to 353 kg. Comparative results demonstrate significant reductions in cable tension fluctuation and motor position error, particularly during accelerated multi axis trajectories. The findings confirm that integrating pulley-aware kinematics with dynamic consistent

control substantially improves stability, accuracy, and robustness in high performance CSPR applications.

MT0011 (16:30-16:45)

Precision LiDAR Mapping and Geometric Segmentation for Autonomous Monitoring of Edible Bird Nests

Tran Tuyet Quyen[12], Nguyen Minh Trieu[3], Tran Le Anh Tuan[3] and **Nguyen Truong Thinh**[3]

1: College of Engineering, Can Tho University, Vietnam

2: Soc Trang Vocational College, Vietnam

3: University of Economics Ho Chi Minh City - UEH, Vietnam

Abstract—Edible bird nest (EBN) farming requires accurate monitoring under low-light, confined indoor conditions where vision-based systems are unreliable. This study presents a compact robotic framework that performs 3D mapping and geometric detection of swiftlet nests using a vertically actuated 2D LiDAR sensor. Multi-layer scanning reconstructs dense point clouds of wooden nesting frames, while systematic and statistical ranging errors are calibrated to achieve ±4 mm accuracy. Localization is performed via iterative closest point (ICP) alignment against a pre-defined structural map, reducing drift in the structured environment. A two-stage segmentation strategy combining line extraction and RANSAC filtering separates planar wall features from semicircular nest geometries. Experimental results demonstrate reliable nest localization and size estimation with approximately 3 mm radius deviation. The proposed system offers a computationally efficient and illumination-robust solution for precision monitoring in indoor agricultural robotics.

MT0004 (16:45-17:00)

High Fidelity Modeling and Characterization of a Fiber-Reinforced Soft Actuator for Precision Finger Rehabilitation

Mariam Md Ghazaly[1], Han Seow Xuan[1], Nurdiana Nordin[1], Norafizah Abas[1], Zulkeflee Abdullah[1], Isa Halim[1], Mizah Ramli[1], Ku Noor Dhaniah Ku Muhsen[2] and Madihah Maharof[3]

1: Universiti Teknikal Malaysia Melaka, Malaysia

2: Universiti Malaysia Perlis, Malaysia

3: Islamic University of Technology, Bangladesh

Abstract — Soft pneumatic actuators (SPAs) have gained significant attention in

rehabilitative robotics due to their inherent compliance, low cost, and adaptable degrees of freedom. However, the highly nonlinear behavior of elastomeric materials often leads to unpredictable deformation, which limits their application in precision hand rehabilitation. This study presents the design and high-fidelity modeling of a fiber-reinforced soft bending actuator developed for finger rehabilitation applications. The actuator employs a hybrid material architecture combining hyperelastic silicones (Dragon Skin 30 and EcoFlex 00-50) with inextensible fiberglass and Kevlar fibers to constrain radial expansion and enhance longitudinal bending. A computational modeling framework was developed using Finite Element Analysis (FEA) in Abaqus CAE to predict actuator deformation under pneumatic loading. Physical prototypes were fabricated using precision 3D-printed molds and experimentally characterized under pressures up to 0.170 MPa. The experimental results show strong agreement with the simulation predictions, achieving approximately 95% accuracy in bending angle estimation. The comparison indicates that the finite element model accurately predicts the actuator deformation behavior, with a maximum deviation of approximately 5% between simulation and experimental results. These results validate the effectiveness of the proposed modeling framework for accurately predicting the nonlinear behavior of fiber-reinforced soft actuators. The proposed approach provides a reliable methodology for the design and optimization of application-specific soft actuators, supporting the development of next-generation wearable rehabilitation devices and soft robotic hand exoskeletons.

MT0015 (Online 17:00-17:15 Japan local time GMT+9)

Modeling and Identification of Inter-Axis Crosstalk in Position-dependent Geometric Errors of Large Gantry Machine Tools

Yi Yang, Yilin Bai, Erkang Hu and Qingzhen Bi
Shanghai Jiao Tong University, China

Abstract—Large-span gantry machine tools suffer from obvious non-rigid deformation under quasi-static operating conditions. The serial layout of crossbeams and saddles easily induces inter-axis crosstalk between the Y and Z axes, which deteriorates volumetric positioning accuracy. Nevertheless, the ISO standard adopts rigid-body kinematic modeling, which restricts position-dependent geometric errors (PDGEs) to univariate functions of individual axes and thus fails to characterize inter-axis crosstalk behavior. By analyzing the bending and torsional mechanisms of the Y-axis crossbeam induced by the self-weight and eccentric loads of the Z-axis saddle, this study establishes a geometric error propagation model embedded with Y-Z crosstalk terms. Following ISO standard specifications, Chebyshev polynomials are adopted to parameterize uniaxial PDGEs. For the Y-axis pitch and roll errors sensitive to Z-axis displacement, both uniaxial PDGE

components and Y-Z coupling terms are integrated to construct a comprehensive error model that accounts for Z-axis induced crosstalk. Experimental validation demonstrates that compared with the conventional ISO rigid-body model, the proposed extended model lowers the root-mean-square (RMS) prediction errors of volumetric positioning at validation points by roughly 37.36% in the X direction and 57.92% in the Y direction, whereas the Z-direction prediction accuracy shows negligible improvement.

MT0006 (Online 17:15-17:30 Japan local time GMT+9)

Backstepping Terminal Sliding Mode Control for Maglev Systems with the Help of EKF

Mohammad Diab, Benedikt Haus and **Paolo Mercorelli**
Leuphana University of Lueneburg, Germany

Abstract—The Maglev system under consideration serves as a fundamental example of a train technology where a magnet is suspended using an electrical coil at a precise point. This concept finds applications in various sectors, including industry, where minimizing mechanical friction enhances energy efficiency and reduces wear. This approach offers multiple benefits such as reduced wear, lower noise emissions, and the capability for much higher travel speed compared to traditional wheel-rail systems. This paper presents the application of Terminal Sliding Mode Control (TSMC) for the Maglev system, which is tested in combination with the Backstepping method. The controller is evaluated based on simulation studies. The Maglev system considered in this paper is developed by Zeltom. In this system, not all state variables are directly measured. To be able still to control the system using TSMC, the unmeasured variable will be estimated using an Extended Kalman filter (EKF), which will estimate the variables resistance and inductance too.

August 20, 2026 (Thursday)

Display Presentation of speeches from the morning session on August 19th.		Duration
Opening Remark	Prof. Katsuhiko Inagaki, Tokai University, Japan	10:30-10:35
Keynote Speech 1	Prof. Hisato Kobayashi, Hosei University, Japan Speech Title: Coexistence of Humans and “Physical AI”	10:35-11:15
Keynote Speech 2	Prof. Sho Yokota, Toyo University, Japan Speech Title: Designing Intuitiveness: Mobility, Robotics, and Human Interaction	11:15-11:55
Keynote Speech 3 (Online)	Prof. Maria Pia Fanti, Polytechnic University of Bari, Italy Speech Title: Artificial intelligence and digital twin approaches for Last Mile Delivery Management	11:55-12:35
Invited Speech (Online)	Assoc. Prof. Deepika Koundal, University of Eastern Finland, Finland Speech Title: From Neurons to Foundation Models: Modern Deep Learning Architectures	12:35-13:15

Note

Call for Papers

AICCC 2026

December 18-21, 2026 | Tokyo, Japan **Submission deadline: September 5, 2026**

2026 9th Artificial Intelligence and Cloud Computing Conference (AICCC 2026)

Conference Website: https://www.aiccc.net/ e-mail: **aiccc.contact@gmail.com**

The accepted and registered papers can be published in ***AICCC 2026 ACM Conference Proceedings, which will be sent to be indexed by Ei Compendex and Scopus.***

Submission System: **https://www.zmeeting.org/submission/AICCC2026**

Keynote Speakers:

Prof. Runhe Huang, Hosei University, Japan

Prof. Gaurav Sharma, University of Rochester, USA (IEEE Fellow, SPIE fellow)

Prof. Cheng-Hsuan Li, National Taichung University of Education,Taiwan

Conference will be held in **The University of Electro-Communications, Tokyo, Japan.**