

IEEE ICMA 2026

2026 23rd IEEE International Conference on Mechatronics and Automation

第 23 届 IEEE 机电一体化与自动化国际会议

AUGUST 2 - 5, 2026

CHANGCHUN, JILIN, CHINA

Conference Proceedings

Conference Digest



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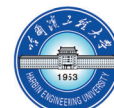
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Conference Digest

2026 IEEE International Conference on Mechatronics and Automation

IEEE ICMA 2026

**Changchun, Jilin, China
August 2-5, 2026**

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IEEE ICMA 2026 Conference Digest

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Foreword

On behalf of the IEEE ICMA 2026 Conference Organizing Committee, it is our great pleasure, an honor, and a privilege to welcome you to Changchun for the 2026 IEEE International Conference on Mechatronics and Automation. This conference reflects the growing interest in the broad research areas of mechatronics, robotics, sensors and automation.

IEEE ICMA 2026 marks the **23rd** edition of the IEEE ICMA annual conference series. We are proud to announce that a high number of **552** papers were submitted from **28** countries and regions, including **528** contributed papers, **24** papers for organized sessions, and **356** papers were accepted for oral or poster presentations at the conference after a rigorous full-paper review process, achieving an acceptance rate of less than **65%**. Presentations at IEEE ICMA 2026 are organized in **7** parallel tracks, for a total of **52** sessions, including **1** poster session, taking place during the three conference days. We are fortunate to be able to invite **five** distinguished speakers to deliver Keynote Speech and plenary talks.

We are very pleased that you are joining us at IEEE ICMA 2026 in Changchun to take part in this unique experience. The main objective of IEEE ICMA 2026 is to provide a forum for researchers, educators, engineers, and government officials involved in the general areas of mechatronics, robotics, sensors and automation to disseminate their latest research results and exchange views on the future research directions of the related fields. IEEE ICMA 2026 promises to be a great experience for participants from all over the world, with an excellent technical program as well as social activities.

We would like to express our most sincere appreciation and thanks to all of our sponsoring societies and organizations and to all the individuals who have contributed to the organization of this conference. Our special thanks are extended to our colleagues in the Program Committee for their thorough review of all the submitted papers, which is vital to the success of this conference. We must also extend our thanks to our Organizing Committee and our volunteers who have dedicated their time toward ensuring the success of this conference. Last but not least, we thank all the contributors for their support and participation in making this conference a great success. Finally, we wish you a great conference and enjoyable stay in Changchun, Jilin, China.



Kazuhiro Kosuge
General Chair



Wenzheng Wu
General Chair



Lei Ren
Program Chair



Yi Liu
Program Chair



Shuxiang Guo
Organizing Chair

Welcome Message

It is my honor to welcome you to the 2026 IEEE International Conference on Mechatronics and Automation (IEEE ICMA 2026) on behalf of Jilin University. We are delighted to host the Conference, which is the 23rd edition of the IEEE ICMA annual conference series. The Conference reflects the growing interest in the broad research areas of mechatronics, robotics, sensors, and automation.

Jilin University is a national key comprehensive university directly under the Ministry of Education. 19 disciplines have entered the top 1% worldwide in the ESI rankings, among which five disciplines rank among the top 1‰ worldwide, and one ranks among the top 1‰‰ worldwide. In 2017, the university was selected as one of the first national first-class university construction universities. We currently have 6 National Key Laboratories, 1 National Major Science and Technology Infrastructure Facility, 1 “Belt and Road” Joint Laboratory, 1 National Engineering Laboratory, 6 National-Local Joint Engineering Laboratories, 1 National Engineering Technology Research Center, 4 National International Science and Technology Cooperation Bases (International Joint Research Centers), and 18 Key Laboratories/Research Centers of the Ministry of Education. The School of Mechanical and Aerospace Engineering of Jilin University originated from the Department of Mechanical Manufacturing of Changchun Automobile and Tractor Institute, the predecessor of Jilin University of Technology, which was founded in 1955. In 2018, on the basis of the School of Mechanical Science and Engineering, the School of Mechanical and Aerospace Engineering was established. The school has set up 5 departments, namely Mechanical Manufacturing and Automation, Mechanical Design and Automation, Mechatronic Engineering, Mechanics, and Industrial Engineering. It possesses 16 provincial and ministerial-level scientific and technological innovation platforms, including the Key Laboratory of CNC Equipment Reliability of the Ministry of Education. The school has a contingent of high-level talents, including dual-appointed academicians, awardees of the National Science Fund for Distinguished Young Scholars, Distinguished Professors under the Ministry of Education’s Major Talent Program, and Leading Scientific and Technological Innovation Talents of the National Ten Thousand Talents Program. It has successively received 5 national-level science and technology awards and over 20 first prizes or above at the provincial and ministerial levels. The discipline of Mechanical Engineering was selected as one of the first batch of national first-level key disciplines in 2007. In 2017, Mechatronic Engineering, developed through the integration and coordinated construction of school resources, was honored as a national key discipline for national defense. Supported by the Double First-Class Initiative, the Mechanical and Bionic

Engineering discipline group, with Mechanical Engineering as the leading discipline, was approved by the Ministry of Education as a key first-class discipline group at Jilin University. In the fifth round of discipline evaluation, the discipline was rated A. The Engineering discipline has entered the top 1‰ globally in the ESI rankings. In recent years, our research in related fields such as mechanical testing, reliability of electromechanical equipment, and mechatronics has become increasingly active and has achieved a series of important advances.

We sincerely hope that IEEE ICMA 2026 will provide a forum for researchers, educators, engineers, and government officials involved in the general areas of mechatronics, robotics, sensors, and automation to disseminate their latest research results and exchange views on the future research directions of the related fields.

Finally, on behalf of Jilin University, I would like to express my sincere gratitude to all of the sponsoring societies and organizations, as well as all the individuals who contributed to the organization of the Conference. Also, special thanks are owed to all the authors, session organizers, plenary speakers, and exhibitors for contributing their research work and making IEEE ICMA 2026 a successful and fruitful event. To all participants, I extend my heartfelt welcome and thanks for attending this event, and I wish you a very pleasant stay here in Changchun, Jilin Province, China.



Guoxing Zhang

Vice President of Jilin University

Advisory Council Chair of IEEE ICMA 2026

Welcome Message

On behalf of College of Mechanical and Electrical Engineering, Harbin Engineering University, it is my great honor to extend a warm welcome to all participants attending the 2026 IEEE International Conference on Mechatronics and Automation (IEEE ICMA 2026), which will be held in Changchun, Jilin, from August 2 to August 5. We are delighted to take responsibility for organizing this important event, marking the 23rd edition of the IEEE ICMA conference series. As one of the premier annual gatherings in the field, the conference reflects the growing global interest in mechatronics, robotics, sensors, and automation.

To begin with, I would like to briefly introduce the College of Mechanical and Electrical Engineering, Harbin Engineering University. Established in 1996, the College has developed into a dynamic academic and research institution covering intelligent manufacturing engineering, mechatronics engineering, mechanical design and automation, industrial design, and related interdisciplinary fields. With a strong faculty team, advanced laboratories, and a solid foundation in mechanical engineering, robotics, underwater equipment, modern manufacturing, and intelligent systems, the College has made significant contributions to both national defense technology and civil engineering applications. In recent years, it has undertaken numerous major research projects, achieved distinguished scientific and technological awards, and fostered a vibrant environment for innovation, international exchange, and talent cultivation. The College warmly welcomes scholars, experts, and participants from around the world to join this conference, exchange ideas, strengthen collaboration, and explore the future of mechanical and electrical engineering together.

We are confident that IEEE ICMA 2026 will serve as a vital platform for researchers, educators, engineers, and policymakers engaged in the fields of mechatronics, robotics, sensors, and automation. This conference provides an excellent opportunity to share cutting-edge research findings and engage in meaningful discussions on emerging trends and future directions in these rapidly evolving disciplines.

We sincerely look forward to welcoming you to Changchun and hope that your participation in IEEE ICMA 2026 will be both intellectually enriching and professionally rewarding.



Jianan Xu, Professor
Dean, the College of Electromechanical Engineering
Harbin Engineering University

Welcome Message

On behalf of the College of Engineering, Southern University of Science and Technology, it is my great honor to extend a warm welcome to all participants attending the 2026 IEEE International Conference on Mechatronics and Automation (IEEE ICMA 2026), which will be held in Changchun, Jilin, from August 2 to August 5. We are delighted to take responsibility for organizing this important event, marking the 23rd edition of the IEEE ICMA conference series. As one of the premier annual gatherings in the field, the conference reflects the growing global interest in mechatronics, robotics, sensors, and automation.

To begin with, I would like to briefly introduce the College of Engineering at Southern University of Science and Technology (SUSTech). Established in May 2015, the College was created in response to the national call for reforming and modernizing engineering education in China. Since its inception, the College has taken a pioneering role in advancing innovative educational practices and cultivating future engineering leaders.

The College offers a comprehensive range of academic programs across various levels, including one Postdoctoral Mobile Station, two doctoral degree programs, four master's degree programs, and 22 undergraduate programs. It serves as a hub for over 318 distinguished scholars recruited from world-renowned institutions. Our faculty includes 23 academicians, 25 recipients of the National Science Fund for Distinguished Young Scholars, 15 recipients of the National Science Fund for Outstanding Young Scholars, and 23 Changjiang Scholars awarded by the Ministry of Education of China. The College has also established strong academic and research collaborations with leading universities and research institutes across America, the Pan-Pacific region, and Europe.

We are confident that IEEE ICMA 2026 will serve as a vital platform for researchers, educators, engineers, and policymakers engaged in the fields of mechatronics, robotics, sensors, and automation. This conference provides an excellent opportunity to share cutting-edge research findings and engage in meaningful discussions on emerging trends and future directions in these rapidly evolving disciplines.

We sincerely look forward to welcoming you to Changchun and hope that your participation in IEEE ICMA 2026 will be both intellectually enriching and professionally rewarding.



Mingwei Chen, Professor
Dean, the College of Engineering
Southern University of Science and Technology (SUSTech)

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Stein, Cathryne	Su, Chanmin Q.	Su, Chanmin Q.	Su, Chun-yi
Su, Liying	Sugar, Tom	Sugita, Naohiko	Suh, Il Hong
Sun, Baoyuan	Sun, Daqian	Sun, Dong	Sun, jinwei
Sun, Kangning	Sun, Xiaojun	Sun, Yong	Sun, Yu
Sun, Zhaowei	Suzuki, Keisuke	Suzuki, Minoru	Suzuki, Takahiro
Suzuki, Yuji	Tadakuma, Kenjiro	Takahashi, Ryoichi	Takahashi, Satoru
Takahashi, Satoshi	Takahashi, Tatsuro	Takaiwa, Masahiro	Takamasu, Kiyoshi
Takanobu, Hideaki	Takasaki, Masaya	Takeda, Takashi	Takeda, Yukio
Takesue, Naoyuki	Takubo, Tomohito	Tan, Jeffrey	Tan, Jindong
Tan, Lihai	Tan, Min	Tan, Zhenfan	Tanaka, Mami
Tanaka, Takayuki	Tang, Mo	Tang, Yike	Tanikawa, Tamio
Tanji, Yuichi	Tao, Nongjian	Tarumi, Hiroyuki	Terada, Hidetsugu

Tian, Yantao	Tomita, Naohide	Tonet, Oliver	Torii, Akihio
Touge, Tetsuo	Tsagarakis, Nikos	Tsai, Ching-Chih	Tsuji, Toshio
Tsukada, Toshihiko	Tsukamoto, Hiroshi	Tsumaki, Yuichi	Tsunoda, Okitoshi
Tung, Steve	Ueno, Satoshi	Vachkov, Gancho	Vai, Ming-I
Vanderborght, Bram	Vernon, Brent	Vlacic, Ljubo	Voos, Holger
Wada, Masayoshi	Wada, Osami	Wada, Takahiro	Wan, Feng
Wan, Xinhua	Wang, Baikun	Wang, Cheng	Wang, DongMei
Wang, Gang	Wang, Guoli	Wang, Hua	Wang, Joseph
Wang, Keqi	Wang, Lizhen	Wang, Ludan	Wang, Michael Yu
Wang, Peishan	Wang, Pu	Wang, Shuchen	Wang, Shuxing
Wang, Tongyu	Wang, Wen	Wang, Xianghong	Wang, Xiaoyun
Wang, Xin	Wang, Xinsong	Wang, Yafeng	Wang, Yuechao
Wang, Yuezong	Wang, Zhidong	Wang, Zhuo	Wang, Zongyi
Wang, Zuobin	Warisawa, Shin-ichi	Watanabe, Keigo	Watanabe, Mutsumi
Wei, Wei	Wen, Bangchun	Wen, Paul	Wong, Pak-Kin
Wu, Changhua	Wu, Gang	Wu, Jinglong	Wu, Lei
Wu, Qiong	Wu, Shijing	Wu, Xiaofeng	Wu, Xiaojun
X.Yang, Simon	Xi, Jeff	Xi, Zhihong	Xiang, Zhengrong
Xiao, Jizhong	Xiao, Lan	Xiao, Nan	Xie, Lihua
Xie, Ming	Xie, Shane	Xie, Shaorong	Xin, Ming
Xing, Huiming	Xiong, Caihua	Xu, Bo	Xu, Chunquan
Xu, De	Xu, Dingjie	Xu, Fen	Xu, Honghai
Xu, Jianan	Xu, Lixin	Xu, Mengguo	Xu, Qingsong
Xu, Shijie	Xu, Yaoqun	Xue, AnKe	Xue, Dingyu
Yakou, Takao	Yamada, Takayoshi	Yamaguchi, Tomomi	Yamamoto, Manabu
Yamamoto, Motoji	Yamamoto, Yoshio	Yamashita, Atsushi	Yamaura, Hiroshi
Yan, Shaoze	Yan, Shengyuan	Yan, Zhao	Yanagihara, Mamoru
Yang, Cheng	Yang, Enxia	Yang, Erfu	Yang, Fang
Yang, Guiliin	Yang, Hyun Suck	Yang, Jianwu	Yang, Jing
Yang, Kwangjin	Yang, Qingsheng	Yang, Wu	Yang, Xiukun
Yang, Yong	Yang, Yousheng	Yang, Zhaojun	Yano, Masafumi
Yao, Yiyu	Ye, Cang	Ye, Changlong	Ye, Shujiang
Ye, Xiufen	Yi, Byung-Ju	Yi, Chuanyun	Yi, Jianqiang

Yin, Guofu	Yin, Zhengsheng	Yin, Zhouping	Ying, Lixia
Ying, Xianghua	Yokoi, Kazuhito	Yokokohji, Yasuyoshi	Yokota, Sho
Yoshida, Shunichi	You, Bo	Young, Nak	Yu, Dejie
Yu, Huadong	Yu, Jie	Yu, Junzhi	Yu, Qiang
Yu, Shui	Yu, Xiaoyang	Yu, Yong	Yu, Yueqing
Yu, Zhangguo	Yuan, Jianjun	Yuan, Juntang	Yuan, Libo
Yuan, Xiaobu	Yue, Chunfeng	Yue, Dong	Yue, Yong
Yun, Chao	Yuta, Shinichu	Zeng, Chunnian	Zha, Hongbin
Zhang, Baida	Zhang, Chengjin	Zhang, Dan	Zhang, Dianlun
Zhang, Hong	Zhang, Jianpei	Zhang, Jianwei	Zhang, Jinxiu
Zhang, Lei	Zhang, Lijun	Zhang, Lixun	Zhang, Mingjun
Zhang, Rubo	Zhang, Sen	Zhang, Songyuan	Zhang, Xianmin
Zhang, Xiaolong	Zhang, Xiaoyu	Zhang, Xinming	Zhang, Xuping
Zhang, Yanhua	Zhang, Yi	Zhang, Yimin	Zhang, Yong
Zhang, Yongde	Zhang, Yonggang	Zhang, Youmin	Zhang, Yunong
Zhang, Zhaohui	Zhang, Zhe	Zhao, Cangwen	Zhao, Chunhui
Zhao, Lin	Zhao, Qing	Zhao, Xin	Zhao, Xinhua
Zhao, Yuxin	Zhao, Zhijun	Zheng, Fei	Zheng, Guibin
Zheng, Jinyang	Zheng, Liang	Zheng, Lingling	Zheng, Yuanfang
Zhong, Ning	Zhou, Wei	Zhou, Xunyu	Zhu, Chi
Zhu, Chunbo	Zhu, George	Zhu, Jianguo	Zhu, Qidan
Zhu, Xiangyang	Zhu, Xiaorui	Zhu, Xilin	Zhu, Yu
Zu, Jean	Zyada, Zakarya		

IEEE ICMA 2026 Conference

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General Information

Jilin

Jilin is a province in the North East of China, It is bordered by Heilongjiang on the north, Liaoning to the south, Inner Mongolia on the west and North Korea on the east. It covers an area of about 187,400 sq km, 2% of the total country area. This location gives Jilin Province its favorable temperate climate, which includes a lengthy winter with snow that can start as early as October and last until April. Despite the winter cold, people flock to this area for the Ice Lantern Festival and the winter sports. Jilin is known as an area for winter sports and has produced some of the best ski resorts in China. However, Jilin has many other natural and historical attractions to entertain its residents and visitors.

Jilin is a united multi-ethnic province of 49 ethnic groups including Han, Korean, Manchu, Mongolian, Hui, Xibo and so on, with a total population of 27.085 million. The Korean ethnic group lives mainly in the cities of Yanbian, Jilin, Tonghua and Baishan; the Mongolian ethnic group and Xibo, in Baicheng and SongYuan; the Manchu and Hui, in Changchun, Jilin, Tonghua and Siping.

The province, from the east to the west is divided into four ecological areas – primitive forests stretching in the Changbai Mountains, secondary vegetation covers in the hilly central and eastern part, the SongLiao Plains in central part, and grasslands and wetland in west Jilin. With a high forest cover rate, an intact ecological system, rich fauna and flora, and abundant precipitation, the Changbai Mountains in east Jilin forms a major protection screen for the eco-environment of Jilin province and of the entire northeast China as well. Dense secondary woods and man-made forests cover the hilly east and central Jilin, endowing a major section of the Songhua River with rich water and mineral resources. With its flat and fertile land protected by a complete chain of shelter forests, and with all the fine conditions for the cultivation of quality farm produce, the Songliao Plain in the central part is a major grain producing centre nicknamed “Golden Corn Belt” and “homeland of Soybeans”. As extensions of the Horqin Grassland, the grassland and wetland in the west are vast and abound in subterranean and passing water, form an ecological transition belt between a moderately moist forests-grassland and a semi-arid grassland-desert area, and provides a major passageway for migrating birds. The low-lying terrain of Jilin receives plenty of sunshine and solar heat, and has vast potentials for developing agriculture and animal husbandry.

Changchun

Changchun is the capital of Jilin province and although Changchun has been more than 200 years old, it is still a young city comparing other historical cities in China, like Xian. It is located the central part of Songliao Plain, covering a total area of 20,571 square kilometers (about 8,012 square miles). Being the capital city of Jilin Province with a population of more than 6 million, it is one of the major cities in Northeast China and is the largest center for China's automotive industry. If territory of China is in a shape of rooster, therefore Changchun is one eye of this huge rooster. You can imagine its important position. Changchun has long, cold winters with the temperature dropping as low as -30°C; there is little snow, but the city is very windy and the air is dry. The present Changchun is charming city with several fine names which can give you a general impression of this big city.

Spring City of Northland: Changchun is of monsoon climate, locating in the transitional belt from wet area to sub-dry area. The four seasons varies a lot and the climate is rather pleasant, therefore Changchun is honored Spring City of North-land

Forest City: Woods, forest, people, city interweave together to show you a distinctive characteristic of Changchun. 39% of Changchun ground has been clothed with greenage, which makes Changchun one of top cities in this aspect. Green plants in and around Changchun make the city become a big oxygen bar, providing people to enjoy real fresh air.

Barn: Spring is dry and windy; summer is wet and rainy; autumn is sunny and cool; winter is cold. Generally speaking rain and heat come in the same season. Besides, favorable climate and enough sunshine provide very good condition for the growth of crops. Changchun teems with corn and soybean; therefore, it is praised as barn.

City of Automobiles: Changchun is the cradle of Chinese automobile industry, a famous auto city in China. On July 13, 1956, a truck branded with Jiefang was produced, which opened a new age for Chinese auto industry. This truck was the first automobile entirely made by Chinese. Famous and Changchun International Automobile Fair makes Changchun a real City of Automobiles.

City of Films: Changchun Film Studio was the first one after the found of People's Republic of China. It is praised as the cradle of Chinese film industry. For dozens of years, a great many excellent domestic films and dubbed films were produced here which gained a good fame for Changchun Film Studio both at home and abroad. As a calling card of Changchun, ceremonious Changchun Film Festival has enhanced its honor.

Hotel Information

Shangri-La Hotel, Changchun

IEEE ICMA 2026 will be held in the city of Changchun, at Shangri-La Hotel, Changchun, which serves as both the official conference hotel and the venue for the technical program. Being the first and only international 5 star hotel, Shangri-La Hotel, Changchun, Shangri-La Hotel, located in the centre of Changchun, the hotel's 458 guest rooms and 98 fully serviced apartments provide a convenient, private and quiet haven. The hotel sits at the junction of Chongqing Road and Xian Road-the financial, business and entertainment center of Changchun city. Shangri-La Hotel, Changchun features the city's largest ballroom, along with 7 function rooms in various sizes and several fine restaurants, making it a focal point for virtually any traveler visiting the city.



The way to IEEE ICMA 2026 Conference site

Shangri-La Changchun, sits at the junction of Chongqing Road and Xian Road - the financial, business and entertainment center of Changchun. Hotel is about 3.6 kilometers from the Puppet Manchurian Palace, is about 36.5 kilometers from Changchun Longjia International Airport and about 3.7 kilometers from Changchun's train station. There are numerous options to reach Shangri-La Changchun. Guests can choose between hotel limousine pick-up, taxi and airport shuttle bus.



1) Taxi

Taxis can be found on the ground floor of the arrivals hall. Taxis are metered, and fare between Changchun International airport and Shangri-La Changchun, generally costs around CNY 120 (USD 20) per journey.

2) Airport Shuttle Bus

Airport shuttle buses can be found on the ground floor of the arrivals hall. A one-way trip will cost approximately CNY 24 (about USD 4). This trip may take longer as the bus has many stops en route to the hotel.

3) Hotel Limousine

You can arrange for an airport pick-up by our hotel limousine by providing your flight details and estimated time of arrival when booking online. Alternatively, you can contact the hotel directly by telephone at (86 431) 8898 1818 or email the hotel at reservations.slcc@shangri-la.com

Attractions

Changbai Mountains

The Changbai Mountains Nature Reserve in east Jilin Province should be the first natural scenery of Jilin Province. Because there are a lot of white pumices and snow on the chief mountain-"Bai Tou Shan", it got its name "Changbai Shan". To the people of north China, Changbai Mountains is a "Mother Mountain", because it is not only the origin of Manchu, but also the cradle of Songhua, Tumen and Yalu



It is the supporting living environment of diverse northeast generations. Now, this "Holy Mountain" has been a protection screen for the eco- environment of some northeast areas. The Tianchi Lake is the most famous spot of Changbai Mountains which was formed by the volcano. Because of its high elevation (height above sea level 2194 meters), people called it "Lake of Heaven".

Xiang Hai

Another nature preserve in Jilin is Xianghai on the edge of the Songliao Plain and in Tongyu County in eastern Horqin Grassland. This preserve contains more than 100 swamps of varying sizes, a wide variety of fish, more than 250 different herbal plants, and a wide variety of trees. Xianghai Nature Reserve is the natural habitat for 293 kinds of precious birds, including six breeds of cranes. The idyllic prairie and the local Mongol folklore combine to make this bird watching place a very fascinating place.



Imperial Palace of Puppet Manchurian State

Pu Yi, the last Emperor of the Qing Dynasty, lived in Chang Chun, the capital city of Jilin, in an Imperial Palace for 14 years (1931 - 1945). This luxurious palace, which also was the administrative departments of the 'Puppet Manchurian Government', has hills, gardens, ponds, swimming pools, and various other forms of recreational facilities. The architecture and design of this 12-hectare (30-acre) palace is a



worthy site to visit for its beauty and unique historical importance. Photographs of the emperor, his weddings, wives, parents, and English teacher are on display in the museum.

Weather

The climate of Changchun is in the transition belt between the eastern humid hilly region and the western semiarid flat region, a continental sub humid monsoon climate of medium latitudes.

The east and the south are not far away from the sea, yet Changbai Mountain obstructs and slows down summer monsoon; the west and the north are the flat Songliao Plain, continental polar airs from Siberia proceed without hindrance and various monsoons have serious effect here. So the climate characteristics here are: it is very long and extremely cold in winter; it is dry and windy in spring; it is very short and warm in summer; and it is sunny and cloudless but the difference in temperature is very large in autumn. Usually, the maximum temperature 33°C in August and the minimum temperature -29°C in February. Annual temperature changes significantly, with distinctive four seasons. The best time for traveling is in summer and autumn.

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Daily	-13	-8	1	12	21	25	29	27	20	12	0	-10
Nightly	-25	-22	-11	0	7	14	18	18	9	0	-11	-21

Transportation

Changchun Longjia International Airport

Changchun Longjia International Airport, is around 35 km east of Changchun's city center. The airport is large and clean, and passengers can find standard amenities such as restaurants, cafes, shops, lounges, credit card acceptance, etc. The major routes throughout the day are to domestic destinations Shanghai (2:20h) and Beijing (1:40h). There are also some international flights to various destinations in Korea (Seoul; ICN - with Asiana) and Japan (Nagoya with CZ).

From the airport there are some regular coach services (RMB 20 each way) available to the center (e.g. People's Square). The travel time takes around 45 minutes. A Taxi to/from the city costs RMB 80-100 including the toll.

Public Bus Service

Changchun has an extensive bus network and most of the buses cost only RMB 1. However, if those who can't read Chinese will find it nearly impossible to use the network as the signage is all in Chinese characters. Most buses go to the bus station outside the train station, and other central areas such as Guilin Lu Chongqing Lu and Hongqi Jie. Be aware that the buses are often extremely crowded and especially uncomfortable during the hot summers as there is no air conditioning. Taxis are cheaper than most in other Chinese cities and the fare starts at RMB 5 up to 2.5km, then RMB 2 per kilometer respectively. Changchun has lots of one-way streets, so don't panic if it seems your driver is lapping the block.

Useful Information

- **Language:** Official language is Mandarin and most people also use their local dialect. The standard spoken Chinese is Putonghua. English can be understood by many young people and is used in hotels and big restaurants. In all tourist hotels, staff can speak in English, Japanese and other languages. They can also write down addresses or instructions in Chinese for taxi drivers or others. In addition, roads in major cities are signposted in Pinyin, the official Romanization system of the Chinese characters, which makes it quite easy to get around with the help of a map.
- **Currency:** Renminbi (RMB) is the only currency to be used in China. RMB is also called Chinese Yuan. The unit of Renminbi is yuan and with smaller denominations called jiao and fen. The conversion among the three is: 1 yuan = 10 jiao = 100 fen. Paper notes are issued in denominations of 1, 5, 10, 20, 50 and 100 yuan. Coins are issued in denominations of 1 yuan, 5 jiao and 1 jiao. Money exchanges by cash or traveler's cheques can be made at the branches of Bank of China at Changchun Longjia International Airport, hotels and tourist stores. Please remember to keep the receipt to exchange back to foreign currency when leaving China.
- **Credit Cards:** Visa, Master Card and American Express are the most commonly used in China. Cards can be used in most middle to top-range hotels, Friendship and department stores, but they cannot be used to finance your transportation costs.
- **Time:** GMT + 8 hours (the whole of China is set to Beijing time)
- **Electricity:** Electricity is 220 Volts, 50 AC; plugs can be three-pronged angled, three-pronged round, two flat pins or two narrow round pins.
- **Water:** Bottled mineral water can easily be bought in all stores and street kiosks for RMB3. And sometimes hotels provide it free of charge. Furthermore, potable water is only available in a few 4 to 5 star hotels, while water in thermos flasks in rooms is usually non-potable tap water.
- **Measurement:** In Metric system
- **Tipping:** Tipping is not customary outside of the foreign joint-venture hotels and is officially discouraged. But hotel bellboys usually expect RMB 2 – 5 per bag.
- **Attention:** Smoking is prohibited in public places in Changchun, such as hospitals, office buildings, theatres, cinemas, museums, planes, and trains
- **Emergency telephone number:** 110 - Police; 119 – Fire; 120 – Ambulance

Conference Information

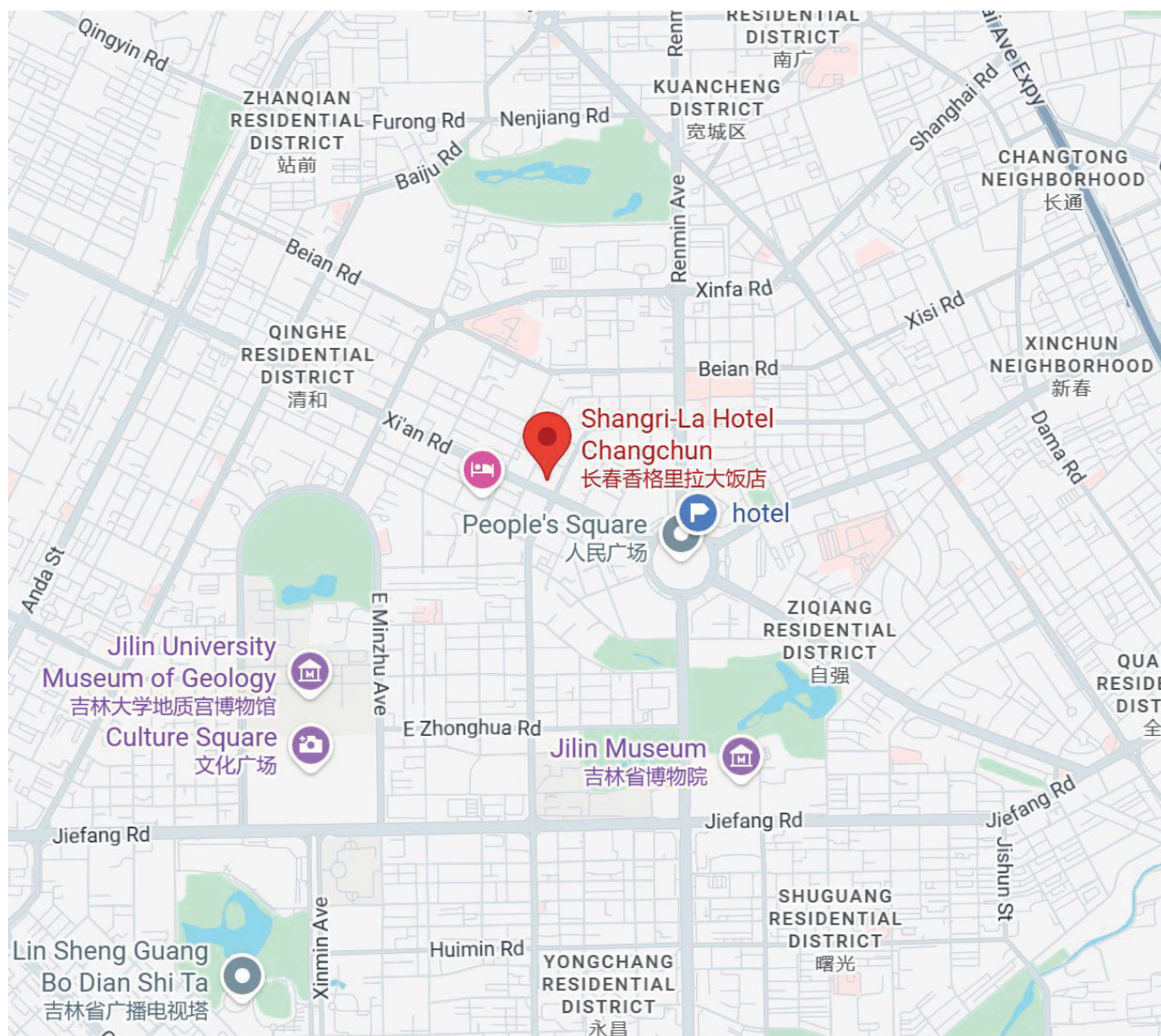
Conference Venue

IEEE ICMA 2026 will be held in the city of Changchun, at Shangri-La Hotel, Changchun, which serves as both the official conference hotel and the venue for the technical program.

Shangri-La Hotel, Changchun is the city's only international luxury hotel. The hotel sits at the junction of Chongqing Road and Xian Road-the financial, business and entertainment center of Changchun city. Shangri-La Hotel, Changchun features the city's largest ballroom, along with 7 function rooms in various sizes and several fine restaurants, making it a focal point for virtually any traveler visiting the city. Wireless internet access is available throughout function spaces and public areas.



Location of Shangri-La Changchun



Chinese Address Cards

Shangri-La Hotel, Changchun

长春香格里拉酒店

地址: 中国长春市西安大路569号

Tel: (86 431) 8898 1818

E-mail: jerry.yu@shangri-la.com

Conference Registration

A conference registration desk will be set up and opened at the Pre-Function Area of Shangri-La hotel during the following hour:

August 2, 2026: 13:30 ~ 18:30 (near the Grand Ballroom of 2nd Floor)

August 3, 2026: 07:30 ~ 18:00 (near the Grand Ballroom of 2nd Floor)

August 4, 2026: 08:00 ~ 18:00 (near the Grand Ballroom of 2nd Floor)

Exhibition

The Exhibition will be held from 14:00 on August 2 to 16:00 on August 4 at the Pre-Function Area of Shangri-La hotel.

Internet Access

Free Internet access will be provided during the conference period, to the IEEE ICMA 2026 participants at the Conference Room on 2nd floor of the Shangri-La Hotel. Broadband Internet access services are also provided at the conference hotels for a fee. For the fee information, please contact the hotel you are staying directly.

Social Events

The social events organized by the IEEE ICMA 2026 include the conference reception, the awards banquet, the conference registration, etc.

Conference Reception

The Conference Reception will be held from 18:00 to 20:00 on August 2, 2026 at the Pre-Function Area, 2F of Shangri-La hotel (长春香格里拉酒店2楼宴会厅前厅). All the Conference participants are welcomed to join this event.

Awards Banquet

The Awards Banquet will be held from 18:30 to 21:00 on August 4, 2026 at Grand Ballroom, 2F, Shangri-La hotel (长春香格里拉酒店2楼大宴会厅). All the conference participants are welcomed to join this event.

IEEE ICMA 2026

Floor Map of Conference Rooms

Shangri-La Hotel, Changchun

Conference Room 1-7 and Grand Ballroom

Ballroom3

宴会厅3

IEEE Women in Engineering Event-2026.08.02

World Premium Workshops-2026.08.02

Keynote Speech 1-2026.08.02

Keynote Speech 2-2026.08.02

Pre-Function Area

宴会厅前厅

Reception-2026.08.02

Poster Session-2026.08.03

Registration Desk

注册台

LEVEL 2

Ballroom 1 & Ballroom 2

宴会厅1和2

Opening Ceremony-2026.08.03

Plenary Talk #1-2026.08.03

Plenary Talk #2-2026.08.03

Industry-Academia-Research
Collaboration Forum-2026.08.03

Grand Ballroom

大宴会厅

Award Banquet-2026.08.04

Exhibition Site

企业展览

Room 1

君子兰厅

Plenary Talk #3
2026.08.04

Room 2

杜鹃百合厅

LEVEL 3

Room 5

长春厅

Room 6

西安厅

Room 3

武汉厅

Room 4

沈阳厅

Room 7

上海厅

Conference Room Area

IEEE ICMA 2026 Conference Workshop

IEEE Women in Engineering Event

World Premium Workshops on Mechatronics and Robotics

Sunday, August 2, 2026

13:30 - 15:00

Ballroom 3, 2F

Shangri-La Hotel, Changchun, Jilin, China

Robotics for Medical and Rehabilitation Applications

Venue: Ballroom 3

2F, Shangri-La Hotel, Changchun

Date and Time: 13:30 - 15:00, August 2, 2026

Organizers:

Prof. Mei Feng, Professor and PhD Supervisor, Jilin University, National-Level Young Talent, Jilin Provincial High-Level Talent, Head of the Jilin Provincial Rehabilitation Assistive Device R&D Studio, and Leader of the Changchun Industry-University-Research Innovation Team.

About the workshop:

This IEEE Women in Engineering Event focuses on innovation, technology translation, and female leadership in medical and rehabilitation robotics. It brings together distinguished women from academia, industry, and clinical practice to discuss advances in robotic technologies, product development, regulatory approval, entrepreneurship, and the translation of academic research into practical healthcare solutions.

Through panel discussion, interactive dialogue, and networking activities, the event aims to highlight women's contributions to mechatronics and medical robotics, promote collaboration across engineering, healthcare, and industry, and provide mentoring opportunities for students and early-career researchers. It also seeks to inspire more young women to pursue careers in robotics, advanced manufacturing, and healthcare technology while strengthening diversity and inclusion within the IEEE RAS/WIE community.

List of Speakers and Schedule

Time	Topics	Speaker List
13:30-13:35	Welcome Speech	Prof. Mei Feng Professor and PhD Supervisor, Jilin University National-Level Young Talent Jilin Provincial High-Level Talent
13:35-13:50	Embodied Intelligence-Driven Autonomous Soft-Tissue Manipulation for Surgical Robots	Prof. Qi Dou Associate Professor Department of Computer Science and Engineering The Chinese University of Hong Kong PhD Supervisor · National Young Talent
13:50-14:05	Synergistic Rehabilitation System Integrating Exoskeleton and TEAS Based on Continuous sEMG Decoding	Dr. He Li Assistant Researcher Institute of Acupuncture and Moxibustion First Teaching Hospital of Tianjin University of Traditional Chinese Medicine PhD · Beijing Institute of Technology (2025)
14:05-14:20	Stent Design and Information Sensing for Thrombectomy Procedures	Prof. Shengnan Lv Professor School of Mechanical Engineering and Automation Beihang University National Young Talent
14:20-14:35	Deformable Object Manipulation for Home Robots	Prof. Yixing Gao Associate Professor School of Artificial Intelligence, Jilin University CAST Young Talents Support Program IEEE ICRA 2024 New Generation Star Project
14:35-14:50	Exploration of Medical Robotics Research and Technology Transfer	Prof. Mei Feng Professor, Jilin University PhD Supervisor · National-Level Young Talent Jilin Provincial High-Level Talent
14:50-15:00	Discussion Q and A	All speakers

IEEE ICMA 2026 Conference
Robotics for Medical and Rehabilitation Applications

Workshop Talk 1

**Embodied Intelligence-Driven Autonomous Soft-Tissue
Manipulation for Surgical Robots**

Qi Dou

Associate Professor
Department of Computer Science and Engineering
The Chinese University of Hong Kong
PhD Supervisor · National Young Talent



Abstract:

China's rapidly aging population is increasing pressure on traditional healthcare systems, while embodied intelligence offers new opportunities for medical robotics. This talk presents our recent work on embodied-intelligence-driven autonomous laparoscopic surgery. It introduces SurRoL, our fully developed surgical-robotics simulator, and VPPV, a perception-and-decision framework built upon it. Together, they enable generalizable autonomous soft-tissue manipulation, including tissue retraction and vascular clipping. The talk will also examine key technical challenges, future directions in medical embodied intelligence, and lessons from our ongoing research.

Qi Dou is an Associate Professor in Computer Science and Engineering at The Chinese University of Hong Kong, a PhD supervisor, and a young talent scholar. Her research spans artificial intelligence, robotics, and healthcare, emphasizing intelligent surgical robots, smart healthcare, and safe embodied intelligence. She received the CUHK Young Researcher Achievement Award (2025) and Exemplary Teaching Award (2022). She serves as Associate Director of the CUHK Institute of Intelligent Medical and Extended Reality and holds roles at the T Stone Robotics Institute and two InnoHK robotics centres. Her honors include the IEEE EMBS Early Career Achievement Award, the He Xiangjian Young Scientist Award, and the Hong Kong Young Scientist Award. She has published over 100 papers, with more than 40,000 Google Scholar citations and an h-index of 80. Her work has received MICCAI, ICRA, TBME, and MedIA paper awards. She is an associate editor, area chair for NeurIPS, ICML, ICRA, and CVPR, and General Co-Chair of MICCAI 2026.

IEEE ICMA 2026 Conference

Robotics for Medical and Rehabilitation Applications

Workshop Talk 2

**Synergistic Rehabilitation System Integrating Exoskeleton
and TEAS Based on Continuous sEMG Decoding**

He Li

Assistant Researcher
Institute of Acupuncture and Moxibustion
First Teaching Hospital of Tianjin University of Traditional Chinese Medicine
PhD · Beijing Institute of Technology (2025)



Abstract:

Post-stroke motor recovery requires coordinated central neuroplasticity and peripheral motor execution. Existing devices often provide mechanical assistance or fixed open-loop electrical stimulation separately. This talk presents a synergistic rehabilitation system integrating motor assistance with transcutaneous electrical acupoint stimulation (TEAS) through continuous surface EMG decoding. Based on bilateral rehabilitation, multimodal signals from the healthy limb are used to infer motion intention and extract muscle activation and angular velocity. Two parallel pathways then provide synchronous actuator assistance and dynamically adjust TEAS intensity and frequency. Preliminary tests demonstrate low-latency closed-loop communication and stable multi-terminal control, supporting intelligent and personalized neurorehabilitation.

He Li holds a Ph.D. in Biomedical Engineering from the School of Life Sciences, Beijing Institute of Technology (2025). She is an Assistant Researcher at the Institute of Acupuncture and Moxibustion, First Teaching Hospital of Tianjin University of Traditional Chinese Medicine. Her research covers intelligent rehabilitation and biomedical signal processing, including sEMG-driven upper-limb exoskeletons, cloud-based home telerehabilitation, multi-sensor fusion, and transcutaneous acupoint electrical stimulation. She has published 10 first-author SCI papers in journals including IEEE JBHI, IEEE IoTJ, IEEE TIM, and IEEE RAL, and works to translate rehabilitation technologies into practical personalized home-based solutions.

IEEE ICMA 2026 Conference

Robotics for Medical and Rehabilitation Applications

Workshop Talk 3

Stent Design and Information Sensing for Thrombectomy Procedures

Shengnan Lv

Professor

School of Mechanical Engineering and Automation

Beihang University

National Young Talent



Abstract:

This talk addresses poor adaptability to complex cerebral vasculature and insufficient real-time, radiation-free sensing in minimally invasive thrombectomy. A miniature robot uses a superelastic nitinol mesh stent and differentially controlled pretensioned tendons for programmable radial expansion and axial deflection. A segmented closed-cell topology with an anti-escape structure, together with parametric and multi-objective optimization, supports anti-fracture design. In vitro experiments verify functionality and mechanical robustness. Flexible fiber Bragg grating sensors enable in situ thrombus characterization and three-dimensional vascular reconstruction. Animal experiments demonstrate high accuracy and good MRI compatibility, providing an integrated solution for precise, radiation-free endovascular thrombectomy.

Shengnan Lv is a Professor at the School of Mechanical Engineering and Automation, Beihang University, and a nationally recognized young talent. Her research focuses on deployable space mechanisms and their applications in aerospace and medical engineering. She has published more than 70 papers in leading journals and international conferences, including the International Journal of Mechanical Sciences, Mechanism and Machine Theory, and IEEE Transactions on Mechatronics. Her distinctions include a Best Paper Nomination at the IFToMM World Congress and the Best Paper Award at the IEEE/IFToMM ReMAR International Conference. She serves on the Academic Committee of the National Key Laboratory of Aerospace Mechanisms and the editorial board of The International Journal of Robotics Research (IJRR).

IEEE ICMA 2026 Conference

Robotics for Medical and Rehabilitation Applications

Workshop Talk 4

Deformable Object Manipulation for Home Robots

Yixing Gao

Associate Professor
School of Artificial Intelligence
Jilin University
CAST Young Talents Support Program
IEEE ICRA 2024 New Generation Star Project



Abstract:

Deformable object manipulation is a fundamental capability for next-generation home robots, enabling assistance in garment handling, household organization, and elderly care. Unlike rigid objects, deformable objects exhibit complex geometries and dynamic physical behaviors that challenge robotic perception and manipulation. This talk presents recent advances in robot learning for robust and generalizable deformable object manipulation, including garment perception and grasping under diverse conditions such as low-light scenarios, together with simulation-driven methods for scalable training and evaluation. These advances support reliable and versatile home-robot manipulation in everyday environments.

Yixing Gao is an Associate Professor at the School of Artificial Intelligence, Jilin University, where she leads the Humanoid Robotics and Vision Laboratory. She is a recipient of the 10th Young Talents Support Program of the China Association for Science and Technology and the only female recipient from China in the IEEE ICRA 2024 New Generation Star Project. Admitted to Xi'an Jiaotong University's Special Class for the Gifted Young at age 15, she earned her Ph.D. from Imperial College London and later conducted postdoctoral research there before serving as a Teaching Fellow at the University of Birmingham. Her research interests include embodied intelligence, assistive robotics, computer vision, and human-robot interaction. Her work has been supported by the NSFC Young Scientists Fund, an NSFC-Royal Society cooperation grant, and a Jilin Provincial Key R&D project. She led the IROS 2025 ROMADO workshop and served as General Chair of IEEE CIS-RAM 2026.

IEEE ICMA 2026 Conference

Robotics for Medical and Rehabilitation Applications

Workshop Talk 5

**Exploration of Medical Robotics Research and
Technology Transfer**

Mei Feng

Professor

Jilin University

PhD Supervisor · National-Level Young Talent

Jilin Provincial High-Level Talent



Abstract:

This talk introduces the team's work in medical robotics research and technology transfer. Topics include autonomous surgery for minimally invasive surgical robots, highly dexterous minimally invasive instruments, intelligent navigation for fracture-reduction robots, and the development and transfer of upper- and lower-limb joint rehabilitation robots.

Mei Feng is a Professor and PhD supervisor at Jilin University, a national-level young talent, and a Jilin Provincial High-Level Talent. She serves in the Chinese Association for Artificial Intelligence and the Management Branch of the China Association of Medical Equipment, heads the Jilin Provincial Rehabilitation Assistive Device R&D Studio, and leads a Changchun industry-university-research innovation team. Her research focuses on intelligent medical bionic robots. She has led 32 national and provincial or ministerial projects, published more than 30 first- or corresponding-author papers, edited five monographs, and obtained over 100 national invention patents and related intellectual-property rights, including eight transferred patents. Her awards include the Second Prize of the Jilin Provincial Science and Technology Progress Award, the Gold Award of the Northeast Revitalization Design Award, and the First Prize of the Jilin Provincial Mechanical Industry Science and Technology Award.

IEEE ICMA 2026 Conference

Plenary Talk 1

Human Centered Autonomy

Henrik Christensen, Ph.D., Dr. Techn. h.c.

Distinguished Professor and Director of Robotics

Contextual Robotics Institute

University of California, San Diego

<https://cri.ucsd.edu>



Abstract:

The push for full replacement of human labor is challenged by uncertainty and a lack of structure in our daily lives. A more realistic vision is to consider how automation can be leveraged to empower humans in their daily life, such as work functions, mobility to/from work, and assistance with challenging tasks, such as heavy lifts or long walks. Through designs that are primarily about empowering humans, it is possible to achieve more effective systems. In this presentation, we will discuss multiple approaches to the design of automation that empower people in new ways, do this at a reduced cost of deployment, and achieve significant savings for the overall system. We will both discuss the overall design decisions, the underlying mechanisms/control and give examples of use of such systems in warehousing and in micro mobility. Finally, we will out several opportunities for the future.

Henrik I Christensen is the Qualcomm Chancellor’s Chair of Robot Systems and the director of the Contextual Robotics Institute at UC San Diego. He directs the Cognitive Robotics Laboratory and the Autonomous Vehicles Laboratory. His research focuses on a systems approach to robotics, incorporating a theoretical foundation, solid implementation, evaluation in realistic settings, and translation to real-world applications.

Dr. Christensen has co-founded six companies, including Robust.AI, Intelligent Machines, and Christensen Consulting Group. He also co-founded Robo-Global, an international investment company that was acquired by Vetta Fi in 2022. He is an advisor to multiple venture companies such as InterWoven, Spring Mountain Capital, Calibrate Ventures, and Temasek International.

Henrik has published more than 400 contributions across robotics, computer vision, and AI, and has served on the editorial board of many journals such as Autonomous Robots, IJRR, IEEE Field Robotics. He is the main editor of the US National Robotics Roadmap. He is also an advisor to companies and government agencies across four continents.

IEEE ICMA 2026 Conference

Plenary Talk 2

Industrial Exoskeletons: Health, Safety and Productivity in the Workplace of the Future

Prof. Darwin G Caldwell, FEng FIEEE MAE CEng

Founding Director

Italian Institute of Technology (IIT)

Vice President IEEE RAS (Robotics and Automation Society)

Director, Department of Advanced Robotic IIT

Via Morego 30, 16163 Genoa, Italy

Email: darwin.caldwell@iit.it



Abstract:

In the 18th century Bernardino Ramazzini, in his treatise “De Morbis Artificum Diatriba” (Diseases of Workers), suggested methods to prevent injuries in over 50 work environments. Ensuring worker health and safety is now deeply embedded, yet the World Health Organization estimates that over 1.7 billion people suffer from Work Related

Musculo-Skeletal Diseases (WRMSD). This impacts not only workers in obvious areas such as heavy lifting (Manual Material Handling), but ranges from manufacturing, construction and logistics to office and shop workers and even healthcare professionals. Every year >40% of workers suffer lower back or neck/shoulder pain, making WRMSD the leading cause of work-related health problems. This impacts: workers, employers, and society in general, due to sickness absence, injuries and disability, increased costs, higher employee turnover, and lower productivity. These injuries can have a lifelong debilitating effect. The EU estimates 2% of GDP is lost due to WRMSDs.

This presentation will explore the background to WRMSDs, and the global development of industrial/occupational exoskeletons for manufacturing, transportation systems, construction, logistics, and healthcare. Subsequently, I will focus on exoskeletal and wearable technologies developed at IIT, exploring the factors (hardware, software, HRI, intent recognition etc.) influencing design and effective real-world operation and deployment. Finally, I shall consider the future need and potential of this critical technology.

Prof. Darwin G Caldwell is Founding Director of the Italian Institute of Technology (IIT) in Genoa Italy, and Director of the Dept. of Advanced Robotics (ADVR) at IIT. He has pioneered developments in compliant and variable impedance actuation, Soft and Human Friendly Robotics and the creation of 'softer', safer robots, that draw on developments in materials, mechanisms, sensing, actuation and software. These developments have been fundamental to advances in humanoids, quadrupeds, medical robotics and exoskeletons. Key robots developed by his team include: iCub, a child-sized humanoid robot; COMAN, a controllably compliant humanoid designed to safely interact with people and have more natural (loco)motion; WALK-MAN, a 1.85m tall, 120kg humanoid that competed in the DARPA Robotics Challenge; the HyQ series (HyQ, HyQ2Max, HyQ-Real) of high performance hydraulic quadrupedal robots; and PHOLUS/Centauro, a human-robot symbiotic system capable of robust locomotion and dexterous manipulation in rough terrain and harsh environments. In addition to his research in legged robots, Prof. Caldwell also works extensively to develop wearable and haptic systems including whole body exoskeletons such as the XoSoft, XoTrunk, XoShoulder and XoElbow and in surgical and rehabilitation robotics where his team have developed systems such as the CALM (Computer Aided Laser Microsurgery) systems, the Cathbot, Cathbot-Pro and SVEI (for catheterization and tissue type detection) and the Arbot (Ankle rehabilitation robot).

Prof. Caldwell is or has been an Honorary professor at the Universities of Manchester, Sheffield, Bangor and King's College London in the UK, and Tianjin University and Soochow University in China. He has published over 750 papers, has over 25 patents and has received over 50 awards/nominations at international conferences and events. He is a Fellow of the Royal Academy of Engineering (FREng - British National Academy), the IEEE (FIEEE), a Member (Fellow) of the Academia Europaea, a Fellow of the Asia-Pacific Artificial Intelligence Assoc. (FAAIA) and a Chartered Engineer (CEng). He is Vice President of the IEEE RAS (Robotics and Automation Society).

IEEE ICMA 2026 Conference

Plenary Talk 3

Robotics and Automation in the Microscopic World for Biomedical Innovations

Fumihito Arai

Professor

Department of Bioengineering

Department of Mechanical Engineering

The University of Tokyo

http://www.biorobotics.t.u-tokyo.ac.jp/index_e.html



Abstract:

In scientific research, there is a growing need for manipulation and automation of micro- and nano-scale objects. Particularly in the biomedical field, genetic analysis technology is advancing rapidly, and the objects to be analyzed are now at the single-cell level. For analytical purposes, this scale is frequently employed in scientific research, such as investigating unknown properties of living cells and tissues. It requires precise manipulation techniques that account for interactions with the fluid environment of the sample being analyzed. We are working on robotics to expand capabilities in the microscopic world for biomedical innovations. Micro-nano mechatronics plays a crucial role in enabling new functions. Based on this approach, we investigated new capabilities of integrating robotic and Micro-nano mechatronics and applied them to several tasks. We developed the associated technologies required for automating micro and nano works. Furthermore, microscopic manipulation is also crucial during tissue sampling within the body. For example, tissue sampling within the digestive system may be considered. This is closely related to the non-invasive surgical operations. In this talk, emerging robotic technologies that expand capabilities in the microscopic world, particularly in manipulation and automation at small scales in the biomedical field will be introduced.

Fumihito Arai is a full Professor of the Department of Bioengineering, Department of Mechanical Engineering, at The University of Tokyo, Japan. He is mainly engaging in the research fields of bio-robotics, micro- and nano-robotics, micro- and nano-mechatronics, MEMS, and Biomedical applications. He received a Doctor of Engineering degree from Nagoya University in 1993. Since 1998, he has been an Associate Professor at Nagoya University. Since 2005, he has been a Professor at Tohoku University. Since 2010, he has been a Professor at Nagoya University. Since 2020, he has been a Professor at the Department of Mechanical Engineering at The University of Tokyo.

IEEE ICMA 2026 Conference
Keynote Speech 1
Development of Biomimetic Dynamic Robots

Aiguo Ming, Ph.D.

Professor

Robotics and Mechatronics Lab

Department of Mechanical Engineering and Intelligent Systems

The University of Electro-Communications, Tokyo, Japan

<http://www.rm.mce.uec.ac.jp/ming/>



Abstract:

In this talk I will describe our progress on the development of two types of biomimetic robots: (1) Biomimetic hyperdynamic robots and (2) Soft biomimetic robots.

The first part of the talk will focus on the mechanism and motion control skill commonly used by humans and animals but mostly avoided by conventional robots, such as utilization of joint stop mechanisms and dynamically-coupled driving in hyper dynamic motions. These issues exploit the nonlinear mechanisms and dynamics to realize natural hyperdynamic motions by a smart structure.

In the second part of the talk I will describe our work on how to introduce creatures' structure and propulsion mechanism into soft robots to realize high mobility, efficiency and creature like motions. The main challenge topic is how to design and control the soft robots with considering the synergetic coupling between soft structure and environment (air, water, etc.). I will show our basic approach toward the synergy and some examples of the developed soft biomimetic robots (fast caudal fin propulsion underwater robot, holonomic underwater robot using two-dimensional propulsion, very soft underwater robot, flapping robot with asymmetric and nonlinear structure, etc.).

Aiguo Ming (Member, IEEE) received the Ph.D. degree in precision machinery engineering from The University of Tokyo, Tokyo, Japan, in 1990. He is currently a Professor with the Department of Mechanical Engineering and Intelligent Systems, at The University of Electro-Communications (UEC), Tokyo, Japan. Dr. Ming is an editor of International Journal of mechatronics and Automation and was an editor of the International Journal of Robotics. His current research interests include biomimetic hyperdynamic robotics, soft biomimetic robotics, robotic hands with proximity sensors, and precise gear measurement systems.

IEEE ICMA 2026 Conference

Keynote Speech 2

Energy Harvesting Mechanism of the Oscillating Hydrofoil Tidal Energy Harvesting Device

Xu Jianan, Ph.D.

Professor and Dean

College of Electromechanical Engineering

Harbin Engineering University, China

<http://meec.hrbeu.edu.cn/>



Abstract:

The development and utilization of ocean energy represent one of the most pressing research priorities globally today. This talk will introduce our research progress on the fully passive oscillating hydrofoil tidal energy harvesting device under coupled motion mode. This device offers advantages such as adaptability to low flow velocities, environmental friendliness, and excellent environmental adaptability.

The talk will first outline the current state of research on ocean energy harvesting devices. Building upon this foundation, it will focus on introducing the design philosophy and energy harvesting performance advantages of our proposed fully passive oscillating hydrofoil tidal energy harvesting device. Furthermore, by integrating a novel fluid-structure interaction analysis method we have developed, the report will provide an in-depth analysis of the device's energy harvesting performance and the underlying fluid-structure interaction mechanisms. Experimental results will be presented to demonstrate the device's actual operation.

Xu Jianan, Ph.D., Full Professor. Dean of the College of Mechanical and Electrical Engineering at Harbin Engineering University. Director of the Key Laboratory of Special Ship Auxiliaries and Underwater Equipment under the Ministry of Industry and Information Technology; Chairman of the Ship and Offshore Engineering Branch of the China Industrial Design Association; Member of the National Technical Committee for Marine Standardization. His research focuses on the marine mechatronics system, ocean energy harvesting system, and the wave compensation system.

IEEE ICMA 2026 Conference Forum

World Premium Forum on Industry-Academia-Research Collaboration

Monday, August 3, 2026

11:00 - 12:15

BALLROOM 1, 2F

[Shangri-La Hotel, Changchun](#), Jilin, China

Medical Robotics and its Real-world Applications: State of the Art and Challenge

Organizers:

Shuxiang Guo, SUS tech and Beijing Institute of Technology, China

郭书祥, 南方科技大学讲席教授/北京理工大学特聘教授

工业和信息化部 融合医工系统与健康工程重点实验室主任

IEEE ICMA 国际会议的创始大会主席

Huadong Yu, Jilin University, China,

于化东, 吉林大学教授, 吉林省科技厅原厅长, 长春理工大学原校长

About the Forum:

Medical Robotics is significantly changing the way people live and Medicine and healthcare Style. Robots are being widely employed for personal assistance, healthcare, extreme environment applications, etc. In the 3rd World Premium Forum on Medical Robotics, we assembled a group of Academic professors and Industry leaders, who are the key members of IEEE ICMA Conference, have been pursuing cutting-edge research on medical robotics for universal manipulation, operation surgery and health promotion. From their experience and discoveries, the state of the art in medical robotics and its application will be introduced and presented.

Forum host 论坛主持人

Prof. Shuxiang Guo, SUStech and Beijing Institute of Technology, China

郭书祥

南方科技大学讲席教授/北京理工大学特聘教授

工业和信息化部 融合医工系统与健康工程重点实验室主任

IEEE ICMA 国际会议的创始大会主席

日本工程院院士 / IEEE Fellow

深圳爱博合创医疗机器人有限公司创始人/董事长/首席科学家



Forum panelist 论坛讨论人



Dr. Jian Guo, CEO, Shenzhen Institute of Advanced Biomedical Robot Co., Ltd

郭健 博士，深圳爱博合创医疗机器人有限公司总经理



Dr. Zhiyuan Yan, CEO, Harbin Sagebot Intelligent Medical Equipment Co., Ltd

闫志远 博士，哈尔滨思哲睿智能医疗设备股份有限公司总经理



Dr. Guangming YANG, Co-Founder, Executive Director, Chief Scientific Officer and Senior Vice President, UnionStrong (Beijing) Technology Co., Ltd.

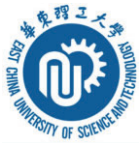
杨光明博士，强联智创（北京）科技股份有限公司 联合创始人，高级副总裁

杭州程天科技发展有限公司



Dr. Qingyu Zhao, Co-Founder, Vice CEO, Hangzhong Chengtian Technology Co., Ltd.

赵晴宇 博士，杭州程天科技发展有限公司 联合创始人、副总经理



Shanghai Shuli Intelligent Technology Co., Ltd.



Dr. Jing Jin, Professor at East China University of Science and Technology, Chief Scientist at Shanghai Shuli Intelligent Technology Co., Ltd.

金晶 博士，华东理工大学 教授，上海术理智能科技有限公司 首席科学家

上海思维境界科技有限公司



Dr. Yitao Huang, Co-founder, CEO, Shanghai MindRealm Technology Co., Ltd.

黄怡涛 博士，上海思维境界科技有限公司 联合创始人、总经理

IEEE ICMA 2026

Program at a Glance

August 2-5, 2026

[Shangri-La Hotel, Changchun](http://www.shangri-la.com/en/), Jilin, China

<http://www.shangri-la.com/en/>

Sunday, August 2, 2026	
13:30 - 18:30	Registration Desk Open
	IEEE Women in Engineering Event
13:30 - 15:00	World Premium Workshops on Mechatronics and Robotics Organized by Prof. Mei Feng, Jilin
16:00 - 16:50	University Keynote Speech 1 (Prof. Aiguo Ming)
16:50 - 17:40	Keynote Speech 2 (Prof. Jianan Xu)
18:00 - 20:00	Reception
Monday, August 3, 2026	
08:30 - 09:00	Opening Ceremony
09:00 - 09:50	Plenary Talk #1 (Prof. Henrik Christensen)
09:50 - 10:40	Plenary Talk #2 (Prof. Darwin G Caldwell)
10:40 - 11:00	Morning Break
11:00 - 12:00	Technical Sessions MA1 (Poster Session)
11:00 - 12:15	Industry-Academia-Research Collaboration Forum
12:00 - 13:30	Lunch Break
13:30 - 15:00	Technical Sessions MP1
15:00 - 15:15	Afternoon Break
15:15 - 16:45	Technical Sessions MP2
17:00 - 18:30	Technical Sessions MP3
Tuesday, August 4, 2026	
08:30 - 09:20	Plenary Talk #3 (Prof. Fumihito Arai)
09:30 - 11:00	Technical Sessions TA1
11:00 - 11:15	Morning Break
11:15 - 12:15	Technical Sessions TA2
12:15 - 13:30	Lunch Break
13:30 - 15:00	Technical Sessions TP1
15:00 - 15:15	Afternoon Break
15:15 - 16:45	Technical Sessions TP2
17:00 - 18:00	Technical Sessions TP3
18:30 - 21:00	Award Banquet in Shangri-La Hotel, Changchun
Wednesday, August 5, 2026	
08:30 - 12:00	Technical Tour

* 15 minutes (Speech: 12 minutes, Q&A:3 minutes) are scheduled for oral presentation including discussions for each paper.

*30 minutes (core time) are scheduled for poster presentation

IEEE ICMA 2026 Technical Program, Sunday, August 2, 2026						
Room	ROOM 1	ROOM 2	ROOM 3	ROOM 4	ROOM 5	ROOM 6
Time	CLIMIA MINATA ROOM	RHOPODENDRON LILY ROOM	WILHAN ROOM	SHEINYANG ROOM	CHANGCHUN ROOM	XIAN ROOM
13:30-18:30						SHANGHAI ROOM
13:30-15:00						
16:00-16:50						
16:50-17:40						
18:00-20:00						
IEEE Women in Engineering Event (World Premium Workshops on Mechatronics and Robotics) at Ballroom 3						
Keynote Speech 1 (Prof. Aiguo Ming) at Ballroom 3						
Keynote Speech 2 (Prof. Jiamu Xu) at Ballroom 3						
Reception at Pre-Function Area						
IEEE ICMA 2026 Technical Program, Monday, August 3, 2026						
Opening Ceremony at Ballroom 1 & Ballroom 2						
08:30-09:00						
09:00-09:50						
09:50-10:40						
10:40-11:00						
11:00-12:00						
11:00-12:15						
12:00-13:30						
13:30-15:00	MP1-1 Intelligent Mechatronics and Application (I)	MP1-2 Intelligent Mechatronics and Application (V)	MP1-3 Control Theory and Application (I)	MP1-4 Modeling, Simulation Techniques and Methodologies (I)	MP1-5 Robot Navigation and Control Algorithm (I)	MP1-6 Medical, Biomedical and Rehabilitation Systems (I)
15:00-15:15	MP2-1 Intelligent Mechatronics and Application (II)	MP2-2 Intelligent Mechatronics and Application (V)	MP2-3 Control Theory and Application (II)	MP2-4 Modeling, Simulation Techniques and Methodologies (II)	MP2-5 Robot Navigation and Control Algorithm (II)	MP2-6 Medical, Biomedical and Rehabilitation Systems (II)
15:15-16:45	MP3-1 Intelligent Mechatronics and Application (III)	MP3-2 Intelligent Mechatronics and Application (VI)	MP3-3 Control Theory and Application (III)	MP3-4 Modeling, Simulation Techniques and Methodologies (III)	MP3-5 Sensor Design and Novel Sensing Systems	MP3-6 Medical, Biomedical and Rehabilitation Systems (III)
17:00-18:30						
IEEE ICMA 2026 Technical Program, Tuesday, August 4, 2026						
08:30-09:20						
09:30-11:00	TA1-1 Signal and Image Processing (I)		TA1-3 Biomimetic Systems	TA1-4 Industrial/Manufacturing Process and Automation (I)	TA1-5 Elements, Structures, and Mechanisms	TA1-6 Invited Session: Computational Intelligence - Theories and
11:00-11:15						
11:15-12:15	TA2-1 Signal and Image Processing (II)		TA2-3 Neuro-Fuzzy and Intelligent Control (I)	TA2-4 Industrial/Manufacturing Process and Automation (II)	TA2-5 Organized session: Biomechanics, Sensing and Bio-Inspired Control in Rehabilitation and Assistive Robotics	TA2-6 Organized session: Theory and Application of Cable-Driven Parallel Robots
12:15-13:30						
13:30-15:00	TP1-1 Mobile Robot System (I)		TP1-3 Intelligent Biomedical Instrument Technology	TP1-4 Modeling, Simulation Techniques and Methodologies (IV)	TP1-5 Manipulator Control and Manipulation (I)	TP1-6 Industrial Manufacturing Process and Automation (III)
15:00-15:15						
15:15-16:45	TP2-1 Mobile Robot System (II)		TP2-3 Control Theory and Application (V)	TP2-4 Modeling, Simulation Techniques and Methodologies (V)	TP2-5 Manipulator Control and Manipulation (II)	TP2-6 Organized session: Inertial Sensor Design and Autonomous Navigation Systems (I)
17:00-18:00	TP3-1 Signal and Image Processing (III)		TP3-3 Neuro,Fuzzy and Intelligent Control (II)	TP3-4 Multiple Robot and Distributed Systems	TP3-5 Organized session: Digital Simulation of Complex Electromechanical Equipment	TP3-6 Organized session: Inertial Sensor Design and Autonomous Navigation Systems (II)
18:30-21:00						
Award Banquet at Grand Ballroom						
IEEE ICMA 2026 Technical Program, Wednesday, August 5, 2026						
Technical Tour						
08:30-12:00						

Monday
August 3, 2026

Morning Sessions

MA1-P Poster Session (Intelligent Mechatronics and Automation)

MA1-P Poster Session (Intelligent Mechatronics and Automation) 1

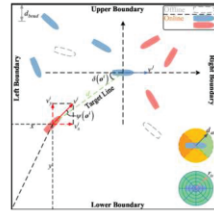
Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (1) 11:00 - 12:00

An LSTM-Enhanced Multi-agent Combat Algorithm Based on MADDPG

Yuxin Zhang, Enjiao Zhao*, Dong Han, Xiaochun Yang, Hong Liang
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Multi-agent combat in a confined area with constrained offensive, defensive, and communication capabilities.
- An LSTM module is integrated into the actor network.
- A mean-field extraction module aggregates local neighbor states and actions.
- Convergence rate improves 7%–11% over state-of-the-art baselines.



Multi-agent combat

MA1-P (2) 11:00 - 12:00

A Novel Reconfigurable Parallel Manufacturing System and Pose Optimization Method

Daqi Hu, Jian Yu, Kaixuan Chen*, Zhe Wang and Yimin Song
School of Mechanical Engineering, Tianjin University,
Tianjin 300350, China

- Development of a Novel Layered Reconfigurable Parallel Machining System
- Establishment of Kinematic and Stiffness Models for the Integrated System
- Proposal of a Task-Oriented Pose Optimization Method
- Simulation Verification and Performance Analysis



Novel reconfigurable manufacturing system

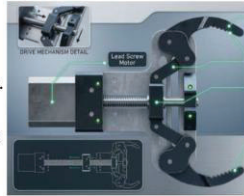
MA1-P (3) 11:00 - 12:00

Stable Grasping Strategy for Robots on Flexible Mesh via Integration of Haptic Sensing and VLM

Zitong Liao, Shengqian Qu, Wenbo Zhou, Congxin Jie,
Chunying Li*, Yang Zhao*, Shuxiang Guo

1. Pen-Tung Sah Institute of Micro-Nano Science and Technology, Xiamen University
2. Advanced Institute for Ocean Research, Southern University of Science and Technology

- Deep-sea cage maintenance: Manual operation is high-risk & inefficient.
- Flexible netting: Highly deformable, unstable grasping & mesh interference.
- Existing climbing robots: Lack specialized state-sensing for compliant substrates.
- Novel pincer gripper + Tactile-VLM Fusion: Secure closed-loop gait control.



The Gripper

MA1-P (4) 11:00 - 12:00

Earth-Loop Oscillation Error Suppression Technology Based on Multi-Threaded Computation

Weisong Zhao; Chao Li; Hongbin Sun; Ping-Huang Zhou
Huazhong Institute of Electro-Optics, Wuhan, China

- The inertial navigation system (INS) is a fully autonomous passive navigation device, which is indispensable in national defense and high-end industrial sectors. During long-duration navigation, sensor bias and initial alignment errors, coupled with the Earth's rotation effect, will induce oscillatory errors, severely degrading the performance of inertial navigation systems.

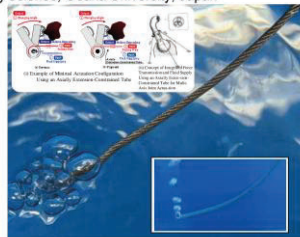


MA1-P (5) 11:00 - 12:00

Axially Extension-Constrained Micro Tube Mechanism for Minimal Actuation via Integrated Force and Fluid Transmission

Kishin MIKAMI, Shinri IKEDA, Shota MIYAKE,
Kazuki ABE, Masahiro WATANABE, Kenjiro TADAKUMA
Graduate School of Engineering Science, Osaka University, Japan

- Proposed an axially extension-constrained fluid supply tube.
- Developed and tested a physical prototype.
- Investigated pressure, length, and flow characteristics.
- Explored applications to pneumatic wire-driven systems.
- Established future directions for minimal robot mechanisms.



Micro Tube Mechanism for Minimal Actuation via Integrated Force and Fluid Transmission

MA1-P (6) 11:00 - 12:00

Modeling and Simulation of Combiner Boxes for Offshore Photovoltaic System

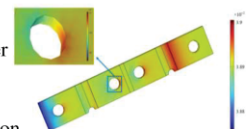
Yibo Zhao¹, Qiang Fu^{1,2*}, Bin Wang³

¹School of Electrical Engineering and Automation, Tianjin University of Technology, Tianjin, 300384, China

²Tianjin Key Laboratory of New Energy Power Conversion, Transmission and Intelligent Control, Tianjin University of Technology

³Research Institute of Offshore Energy and Intelligent Construction, Tianjin University of Technology, Tianjin, 300384, China

- Based on Faraday's law, this study constructed a simulation model of marine atmospheric corrosion dynamics of copper rows of offshore photovoltaic combiner boxes.
- The grounding end is the galvanic corrosion priority anode. The local corrosion of the bolt hole groove is 0.5% faster. The corrosion thickness difference accumulates linearly with time under different humidity.



Anode local current density distribution cloud diagram

MA1-P Poster Session (Intelligent Mechatronics and Automation) 2

Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (7) 11:00 - 12:00

Automated Channel Testing System for Process Control Systems on Offshore Platforms-Design, Implementation, and Performance Evaluation

Hongye Zhao, Bibo Jiang and Yu Song*
CNOOC EnerTech Equipment Technology Co., Ltd
Department of the School of Electrical Engineering and Automation, Tianjin University of Technology
Tianjin, China

- Rapid connection interface with spring-loaded probes for direct DCS terminal access, no manual wiring.
- Java-based automation software: OPC communication, MySQL database, auto-parsing, testing & reporting



Screenshot of the test software GUI

MA1-P (8) 11:00 - 12:00

A Two-Stage Path Planning Method Based on Hybrid A* for Unmanned Vehicles with Multi-Steering Modes

Weijun Ma, Yufei Zhao, YanPeng Dong, Xianyu Qi, Jianyi Zhu, Yaoguang Hu, Yanzi Zhang*
School of Mechanical Engineering, Beijing Institute of Technology
Beijing Institute of Mechanical Equipment, Beijing, China

A two-stage path planning framework is proposed for multi-steering mode (MSM) vehicles to balance path quality and computational efficiency.

- Stage 1: Hybrid A* algorithm generates a kinematically feasible initial path.
- Stage 2: A heading discretisation clustering heuristic extracts candidate diagonal steering segments; a weighted interval scheduling model with greedy optimisation achieves MSM path.

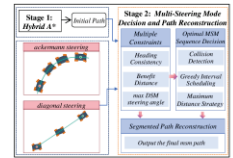


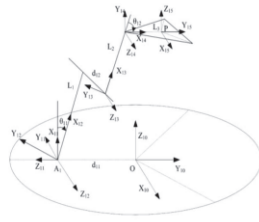
Fig. Overall framework

MA1-P (9) 11:00 - 12:00

Research on Design and Bilateral Servo Control Strategy of 3T Parallel Tele-robot

Ning Yue, Wang Tongjian, Chen Jinshi, Zhu Lihui
School of Mechanical and Aerospace Engineering, Jilin University
Changchun, China

- A 3T parallel tele-robot configuration was designed, which a multi-motor joint drive to improve the operational efficiency of the moving platform.
- Proposed a design criterion for a parallel tele-robot with 3T parallel to enhance the accuracy of kinematics and dynamics calculations.
- Constructed a force-velocity model difference control strategy to improve force feedback performance.



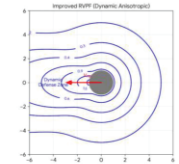
Kinematic Model of Tele-robot

MA1-P (10) 11:00 - 12:00

Dynamic Obstacle Avoidance Planning for Autonomous Driving Based on Relative Velocity Potential Field and Kinematic Constraints

Xuanyi Teng, Xingyun Wu and Shuyi Lu
School of Civil and Transportation Engineering, Hohai University, Nan Jing, Jiang Su, China

- Fuses **relative velocity information** with kinematic constraints to resolve delayed responses in traditional APF methods.
- Introduces a **predictive sensitivity factor** to reshape the potential field into a dynamic defense zone for active risk mitigation.
- Maps potential forces into smooth control variables using a **virtual tangential force strategy** and Ackermann geometry.
- Ensures physically feasible trajectories that strictly adhere to vehicle **wheelbase and steering angle limits**.
- Increases safety distance to **5.02m** in lateral crossing scenarios, where traditional APF algorithms typically fail.



MA1-P (11) 11:00 - 12:00

Underwater-Driven Torus-Type Buoyancy Control Mechanism

Shinri Ikeda, Kishin Mikami, Shota Miyake, Kazuki Abe, Masahiro Watanabe, Kenjiro Tadakuma
School of Engineering Science, Osaka University, Japan

- Highly airtight torus-shaped buoyancy control mechanism.
- A mechanism inspired by magnetic bacteria that minimizes energy waste.
- A simple yet highly effective airtight seal is achieved using an O-ring
- By expanding and contracting through eversion, it maintains a constant cross-sectional area, thereby preventing an increase in fluid resistance.



Underwater-Driven Torus-Type Buoyancy Control Mechanism

MA1-P (12) 11:00 - 12:00

The Title Research on Trajectory Tracking Control of Photovoltaic Panel Cleaning Manipulator Based on Fuzzy PID

Xin Wang, Bo Zhang, Hongyu Gao, Hui Yu, Fang Huang, Yikun Zhang, Kuankuan Wang
Key Laboratory of Robotics and Intelligent Equipment Technology, School of Mechanical Engineering, Inner Mongolia University of Technology, China

- A fuzzy PID controller is proposed for the electro-hydraulic proportional system of photovoltaic cleaning manipulators. MATLAB/Simulink simulations demonstrate improved trajectory tracking accuracy, stability, and disturbance rejection, effectively meeting operational requirements under complex working conditions.



Photovoltaic cleaning manipulators

MA1-P Poster Session (Intelligent Mechatronics and Automation) 3

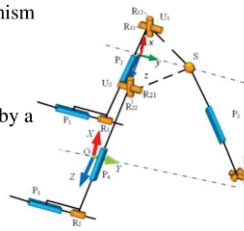
Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (13) 11:00 - 12:00

Kinematic Modeling and Performance Analysis of a Parallel Waist Rehabilitation Mechanism

Xingchao Zhang, Zhaoji Wang, Shuqi Li, Ji Shi, Chang Zhang, Jinghui Wang, Yu Rong
College of Mechanical and Electrical Engineering Hebei Normal University of Science & Technology, Qinhuangdao, China

- A novel 2PRPU+UPS parallel mechanism is proposed, and its inverse position problem is solved using the geometric projection method.
- The reachable workspace is analyzed by a discretization approach
- The kinematic performance of the mechanism is evaluated using linear velocity and angular velocity isotropy indices

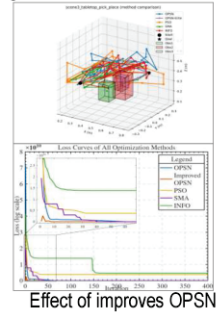


MA1-P (14) 11:00 - 12:00

An Obstacle Avoidance Path Planning Method Based on Improved OPSN for Robotic Arm

Jianhan Fan, Chao Peng*, Jianxiao Zou, Kaiji Liao, Zhennan Fan
School of Automation Engineering, University of Electronic Science and Technology of China
No.2006, Xiyuan Ave. West, Hi-Tech Zone, Chengdu, 611731, Sichuan, China

- This paper addresses constrained 3D obstacle avoidance for robotic arm end-effectors.
- It formulates trajectories as waypoint-based polylines with explicit safety constraints.
- An elite-initialization strategy improves OPSN robustness across repeated optimization restarts.
- Experiments show stronger feasible-solution search, especially in complex narrow-passage scenarios.

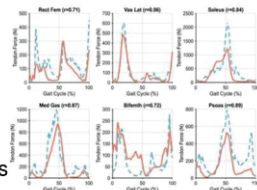


MA1-P (15) 11:00 - 12:00

A Two-Stage Framework for Non-Invasive Muscle Force Estimation in Gait Integrating Kinematic Priors and Dynamic Optimization

Kun Liu, Hongxiang Guo, Xiaodong Huang, Zhaowei Huang and Qincheng Hu,
College of Intelligent Manufacturing and Energy Engineering,
Zhejiang University of Science and Technology, Hangzhou, Zhejiang, China

- Motivation: Poor robustness in dynamic gaits.
- Methodology: Fuses kinematic priors with dynamic optimization.
- Innovation: Hierarchical warm-start accelerates NLP.
- Validation: Artifact correction across multi-speed gaits.
- Impact: Sensor-free model for exoskeleton control.



Correction effect of the two-stage optimization framework on high-frequency computational artifacts.

MA1-P (16) 11:00 - 12:00

The systematic design and implementation of a vertical fish farm based on ESP32-P4

Qiyuan Cheng, Letao Liu*, Zhou Ziling Zhang, Yichen Lü, Fengyi Yang
school of mechanical and electrical engineering, Wuhan Donghu University, China

Background: Currently, aquaculture and farm-based animal farming face challenges such as high water consumption, severe pollution, and low resource utilization efficiency.

Method: The "fish farming" and "agriculture" are integrated through the ESP-P4 motherboard into a multi-layer vertical structure. The lower layer is for aquaculture, the middle layer is for planting, and the top layer is covered with photovoltaic panels.

Result: This structure significantly improves space utilization, achieving "three uses from one plot of land."

Conclusion: It provides a feasible solution for modern intelligent farming that is environmentally efficient, low-carbon and sustainable.

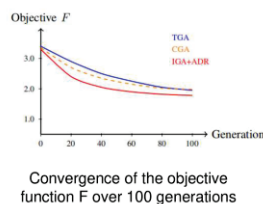


MA1-P (17) 11:00 - 12:00

An Improved Genetic Algorithm with Adaptive Dynamic Rebalancing for Task Allocation of Underwater Multi-Robot Capture Operations

Jipeng Long, Chunying Li, Pengcheng Li, Shuxiang Guo
Artificial Intelligence Institute, Shenzhen University, The Advanced Institute for Ocean Research, Southern University of Science and Technology, The Department of Electronic and Electrical Engineering, Southern University of Science and Technology

- IGA with k-means, elitism & adaptive mutation accelerates convergence and avoids local optima.
- ADR enables online load monitoring and real-time task rebalancing for better fairness.

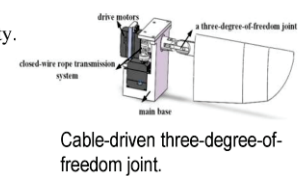


MA1-P (18) 11:00 - 12:00

Design of a Cable-Driven Joint for Turtle-Inspired Amphibious Robots for Offshore Photovoltaic Cable Inspection

Shenyi Wang¹, Fang Huang^{3,4*}, Zekuan Dai¹, Qiang Fu^{1,2*}
1School of Electrical Engineering and Automation, Tianjin University of Technology, Tianjin, China
2Tianjin Key Laboratory of New Energy Power Conversion, Transmission and Intelligent Control, Tianjin University of Technology
3School of Mechanical Engineering, University of Technology, Hohhot 010051, China
4Key Laboratory of Robotics and Intelligent Equipment Technology, Hohhot 010051, China

- A cable-driven joint improves compactness and maneuverability.
- A closed-loop cable system enhances transmission stability.
- NACA 0016 improves hydrodynamic efficiency and propulsion performance.



MA1-P Poster Session (Intelligent Mechatronics and Automation) 4

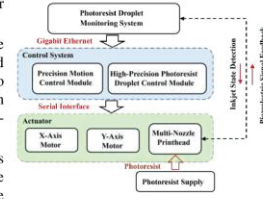
Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (19) 11:00 - 12:00

Development of Real-Time Monitoring System for Stable Photoresist Droplet Jetting

Guanghui Wang¹, Jianzhe Yao¹, Haoran Chang¹, Xiukun Wang¹, Ruifeng Yang¹, Fengchen Zhai¹, Guangquan Tang²
¹Shenyang Ligong University, Shenyang, Liaoning 110159, China
²Liaoning Zhongke Boyan Technology Co., Ltd., Shentu Demonstration Zone, Liaoning 110000, China

- An integrated microdroplet ejection and monitoring system is designed and developed for photoresist jetting in this study.
- A three-dimensional multiple-relaxation-time lattice Boltzmann (3D MRT-LB) model coupled immersed boundary method is employed to investigate the droplet formation process within the piezoelectric ceramic extrusion during on-demand ejection for shear-mode printhead.
- The piezoelectric self-sensing strategy was further introduced to extract jetting-state information from electrical responses of the printhead, enabling real-time identification of representative ejection abnormalities, including bubble entrainment, oblique jetting, and nozzle clogging.



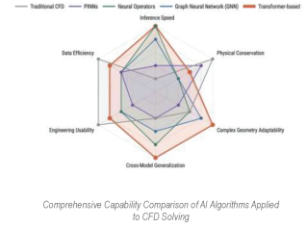
Schematic diagram of the photoresist droplet monitoring system

MA1-P (20) 11:00 - 12:00

A Comprehensive Review of Artificial Intelligence in Automotive Aerodynamic CFD Simulations

Hanyu Zhu, Yeyang Han, Jinke Cui, Aimin Du*
College of Automotive and Energy Engineering, Tongji University, Shanghai, China

- Systematic review of AI across the full automotive aerodynamic CFD pipeline
- AI accelerates every CFD stage: sub-second aerodynamic prediction, automated meshing, and high-fidelity flow reconstruction
- Covers datasets from benchmark models (Ahmed Body, DrivAer) to large-scale multimodal datasets (DrivAerNet++, DrivAerML)
- Analyzes mainstream AI4CFD solving frameworks across PINNs, Neural Operators, GNNs, Transformers, and Scientific Foundation Models
- Identifies key deployment bottlenecks and future directions



IEEE ICMA 2026 | Paper ID: 832081

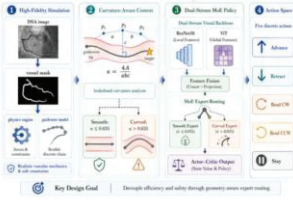
MA1-P (21) 11:00 - 12:00

Curvature Aware Mixture of Experts for Resolving Policy Conflicts in Guidewire Navigation

Shengqian Qu¹, Zitong Liao¹, Wenbo Zhou¹, Congxin Jie¹
Chunying Li^{2*}, Yang Zhao^{1*}, Shuxiang Guo²

¹Pen-Tung Sah Institute of Micro-Nano Science and Technology, Xiamen University
²Advanced Institute for Ocean Research, Southern University of Science and Technology

- Single-policy DRL struggles to balance navigation efficiency and safety.
- This paper introduces a curvature-aware Mixture-of-Experts framework (MoE_PPO).
- Lookahead curvature divides navigation into smooth and curved phases, enabling dynamic expert routing.
- MoE_PPO improves robustness by reducing collisions to 5%–10% and increasing success rates to 82%–85%.



MoE_PPO Methodology

MA1-P (22) 11:00 - 12:00

Two-Stage Reinforcement-Learning-Based Tension Distribution for Cable-Driven Parallel Robots

Haitao Jia¹, Zhehao Li¹, Xinyu Gao¹, Bin Zhang^{1*}, Jinfeng Zhang², Xiang Zhang³, Weiwei Shang¹

¹Department of Automation, University of Science and Technology of China
²State Grid Anhui Electric Power Co., Ltd.

³China Energy Engineering Group Anhui Electric Power Design Institute Co., Ltd.

- A dynamic simulation environment considering parameter uncertainty and cable flexibility is established for cable-driven parallel robots.
- The PPO algorithm is adopted to conduct offline pre-training with a designed multi-objective reward function.
- The SAC-based residual network realizes online learning to eliminate gaps between simulation and practical scenarios.

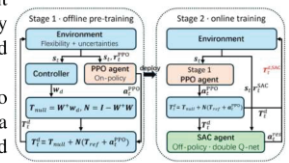


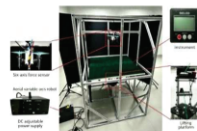
Diagram of the proposed reinforcement algorithm

MA1-P (23) 11:00 - 12:00

TTestbed and Aerodynamic Modeling of Ground-Air Reconfigurable Robot in Underground Pipe Gallery

Yihong Liu, Binghang Tong, Chaoquan Tang, Deen Bai*, Hongwei Tang
School of Mechanical and Electrical Engineering, China University of Mining and Technology, Xuzhou, 221116, China

- Reconfigurable robots are used for pipe gallery inspection, affected by near-ground ground effect.
- A six-DOF testbed is developed to test rotor aerodynamics under varied heights and folding angles.
- Lower height improves rotor thrust greatly; small attitude has little influence on ground effect.
- Larger arm folding enhances ground effect for flight modeling.



Test Bench Architecture

MA1-P (24) 11:00 - 12:00

Kinematic Error Modeling and Compensation for Cable Driven Offshore Photovoltaic Testing Platform

Zihan Wang¹, Fang Huang^{3,4*}, Zekuan Dai¹, Qiang Fu^{1,2*}

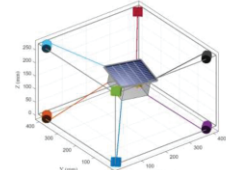
¹School of Electrical Engineering and Automation, Tianjin University of Technology, Tianjin, 300384, China

²Tianjin Key Laboratory of New Energy Power Conversion, Transmission and Intelligent Control, Tianjin University of Technology

³School of Mechanical Engineering, University of Technology, Hohhot 010051, China

⁴Key Laboratory of Robotics and Intelligent Equipment Technology, Hohhot 010051, China

- Cable-driven offshore PV motion simulation.
- Pulley-based cable-length modeling.
- Chebyshev compensation reduces RMS error to 0.26 mm.



offshore photovoltaic testing platform

MA1-P Poster Session (Intelligent Mechatronics and Automation) 5

Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (25) 11:00 - 12:00

A Fault Diagnosis and Localization Method for Distribution Networks Based on APC-SVM and PC-AZOA

Dahua Li¹, Xinru Yang¹, Yu Song¹, Zhongli Bai¹ and Xueying Hu^{2,3}
1.Tianjin University of Technology, Tianjin
2.Tianjin Tianchuan Electrical Equipment Testing Co.Ltd, Tianjin, China
3.Tianjin Electric Science Research Institute Co.Ltd, Tianjin, China

- We propose APC-SVM and PC-AZOA to classify and locate distribution network faults.
- MVMD splits three-phase fault signals, uses energy of each part.
- We add physical rules and use three-phase energy spread to tune SVM.
- Using physical limits, we design PC-AZOA to skip searches and speed up.
- Tests show 98.4% accuracy and <1% error, efficient.



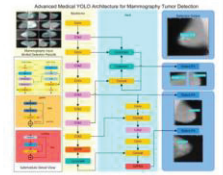
The main architecture

MA1-P (26) 11:00 - 12:00

light-YOLOv26: A Lightweight Object Detector with Enhanced Feature Aggregation for Breast Lesions

Qianru Xin², Qian Zhang¹, Zhentao Yao¹, Weikun Chen¹, Hongwei Li^{1,*}
1School of Automation and Electrical Engineering, Tianjin University of Technology and Education, Tianjin, China
2School of Computer Science and Engineering, Tianjin University of Technology, Tianjin, China

- Fig. 1. The topological architecture of the improved light-YOLOv26 algorithm. The backbone utilizes optimized C3k2 and SPPF modules to minimize computational redundancy, while the neck performs multi-scale feature concatenation to preserve the spatial details of small lesions.



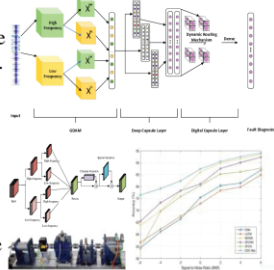
The Advanced Medical YOLO Architecture for Mammography Tumor Detection

MA1-P (27) 11:00 - 12:00

A Group Denoising Capsule Network for Mechanical Fault Diagnosis

Qingyi Wang, Yongchao Li, Feng Ji, Yujin Han, Xinrong Li, Lisha Chen, and Youming Wang
Research and Development Department, Shaanxi Environmental Protection Industry Research Institute Co., Ltd.,
School of Automation, Xi'an University of Posts and Telecommunications
Xi'an, Shaanxi, China

- (1) We propose a Group Denoising Attention Module capable of adaptive weighting diverse frequency features.
- (2) We design a deep capsule layer combined with depthwise separable convolution, enhancing feature expression capabilities.
- (3) We construct a GDCN fault diagnosis model to achieve optimization of denoising and feature extraction.



MA1-P (28) 11:00 - 12:00

An Improved Multi-agent Combat Strategy Algorithm for Large-scale Swarms Based on Deep Deterministic Policy Gradient

Yuxin Zhang, Enjiao Zhao, Dong Han, Xiaochun Yang, Yinbin Zhao, Hong Liang
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- This paper proposes a mean-field and attention-enhanced DDPG framework for multi-agent swarm combat.
- Builds a realistic constrained swarm-combat environment.
- Enhances DDPG with mean-field and attention mechanisms.
- The improved DDPG shows faster convergence and better scalability in large-scale swarm combat.



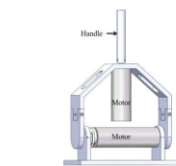
Networks with an attention extraction module

MA1-P (29) 11:00 - 12:00

Development and Evaluation of a Haptic Interaction Device for Vascular Interventional Surgery

Yumeng Liu, Xiaoliang Jin, Aiguo Song, and Lifeng Zhu
State Key Laboratory of Digital Medical Engineering, Jiangsu Key Laboratory of Remote Measurement and Control,
School of Instrument Science and Engineering, Southeast University, Nanjing 210096, China

- Developed a two-DOF haptic interaction device for robot-assisted vascular intervention.
- Experimental results demonstrated accurate and stable force/torque rendering in push-pull and rotation directions.



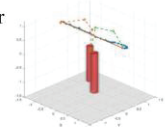
2-DOF Haptic Device Design

MA1-P (30) 11:00 - 12:00

Research on Improved Weighted Smoothed A* Obstacle Algorithm for Offshore Photovoltaic Inspection Robot

Yiran Li¹, Fang Huang^{3,4*}, Zekuan Dai¹, Qiang Fu^{1,2*}
1School of Electrical Engineering and Automation, Tianjin University of Technology, Tianjin, China
2Tianjin Key Laboratory of New Energy Power Conversion, Transmission and Intelligent Control, Tianjin University of Technology
3School of Mechanical Engineering, University of Technology, Hohhot 010051, China
4Key Laboratory of Robotics and Intelligent Equipment Technology, Hohhot 010051, China

- Models three-degree-of-freedom manipulator kinematics accurately.
- Proposes weighted-smoothed A* obstacle-avoidance path planning.
- Reduces time, nodes, and distance.



MA1-P Poster Session (Intelligent Mechatronics and Automation) 6

Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (31) 11:00 - 12:00

Short-term electric load forecasting based on improved black-winged kite algorithm

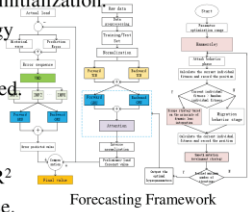
Dahua Li¹, Renfu Zhao¹, Yu Song¹, Zhongli Bai¹ and Xueying Hu^{2,3}

¹Tianjin University of Technology, Tianjin

²Tianjin Tianchuan Electrical Equipment Testing Co.Ltd, Tianjin, China

³Tianjin Electric Science Research Institute Co.Ltd, Tianjin, China

- First, we proposed a prediction model based on the improved Black-winged Kite algorithm.
- Hammersley sequence is used for BKA initialization.
- Introduce a dynamic lens evasion strategy during the BKA migration phase
- Smooth Mutation Development is adopted.
- Introduction of VMD-BiGRU Error Compensation Strategy
- The experimental results show that the R^2 is 99.7%, achieving the best performance.



MA1-P (32) 11:00 - 12:00

Path Tracking Method for Amphibious Robots in Shallow Water Environments

Ding Mingxuan, Yu Anqi, Li Shen, and Wang Gang*

National Key Laboratory of Autonomous Marine Vehicle

Technology, Harbin Engineering University

Heilongjiang, China

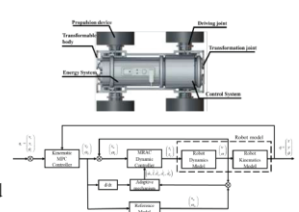
Lu Dake

Yichang Testing Technique Research

Institute

Yichang City, Hubei, China

- A dual-loop control framework based on Model Predictive Control and Model Reference Adaptive Control is designed.
- Integrated platform simulation was conducted via tripartite co-simulation.
- Robot experiments were conducted in actual shallow water environments, verifying the feasibility of the designed controller.



MA1-P (33) 11:00 - 12:00

Structural Design of an Assistive Training Mechanism for Ankle Rehabilitation

Kun Liu, JiaLun He, XiaoDong Huang, QinCheng Hu, ZhaoWei Huang,

College of Intelligent Manufacturing and Energy Engineering,

Zhejiang University of Science and Technology,

Hangzhou, China

- Innovative Design: A hybrid mechanism replicates sit-to-stand transitions and authentic gait.
- Kinematic Modeling: Exact inverse kinematics ensures precise actuator control.
- Structural Validation: Finite element analysis confirms framework safety under a 1500N load.



MA1-P (34) 11:00 - 12:00

FAST-TCN: A Frequency-Aware Spatio-Temporal Network for sEMG-Based Continuous Motion Prediction in Upper Limb Rehabilitation Robotics

Junlin Jiang, Pengcheng Li, Jun Leng, Hanzhe Wang,

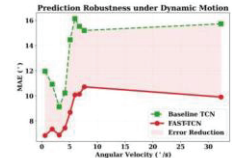
Chunying Li, Mingchao Ding, Bing Wang, Shuxiang Guo

The Department of Electronic and Electrical Engineering, Southern University of Science and

Technology

Shenzhen, Guangdong 518055, China

- We propose FAST-TCN, fusing time-frequency sEMG features.
- It conquers inter-subject jitter, ensuring smooth, highly accurate robotic control.
- This enables safer and more natural human-robot rehabilitation interaction.



MA1-P (35) 11:00 - 12:00

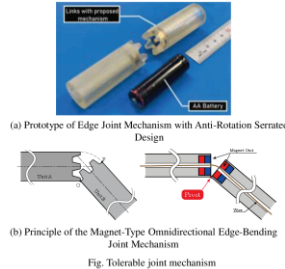
Basic Study of the Tolerable Joint Mechanism for Space Robotic Operations under Unexpected Contact Conditions with Debris

Chiranthan Krishnappa*, Kishin Mikami*, Maira Omar, Kazuki Abe, Masahiro Watanabe,

Josephine Galipon and Kenjiro Tadakuma

Department of System Innovation, Graduate School of Engineering Science, The University of Osaka

- A magnetic omnidirectional edge-bending joint was proposed.
- Passive overload tolerance was achieved through magnetic edge-contact bending.
- Axial rotation suppression methods were investigated.
- A compact prototype was developed and experimentally validated.
- The proposed serrated structure improved rotational stability and increased bending resistance.



MA1-P (36) 11:00 - 12:00

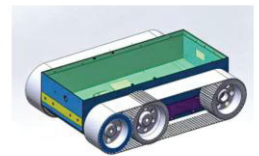
Path Planning and Control Strategy of Offshore Photovoltaic Cleaning Robot

Ce Jiao¹, Qiang Fu^{1,2}

¹School of Electrical Engineering and Automation, Tianjin University of Technology, Tianjin, 300384, China

²Tianjin Key Laboratory of New Energy Power Conversion, Transmission and Intelligent Control, Tianjin University of Technology

- Design of Control System for Cleaning Robots in Complex Marine Environments.
- Speed-position double closed-loop PI control and feedforward compensation mechanism.
- Reciprocating full coverage path planning algorithm.



MA1-P Poster Session (Intelligent Mechatronics and Automation) 7

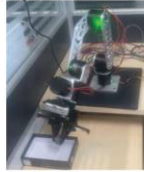
Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (37) 11:00 - 12:00

Motion Smoothing and Continuity Enhancement for Real-World SmoIVLA Deployment on Robotic Arm

Yuzheng Fu^{1,2}, Yanhui Wei^{1,2,3*}, Yongqiang Xie^{1,2}, Chuyang Lin^{1,2}
¹College of Intelligent Science and Engineering, Harbin Engineering University, No.145 Nantong Street, Harbin, China
²Heilongjiang Provincial Key Laboratory of Marine Intelligent Equipment and Instrumentation
³Nanhai Institute of Harbin Engineering University, Sanya, China

- Blend adjacent action chunks with linearly decaying weights to eliminate boundary discontinuities.
- Regularize training by adding first-order, second-order, and continuity loss terms to smooth intra-chunk fluctuations.
- Apply stage-adaptive EMA filtering to suppress execution jitter.



SmoIVLA deployment on robotic arm

MA1-P (38) 11:00 - 12:00

Collaborative Fusion Navigation Framework for AGVs in Narrow Dynamic Environments

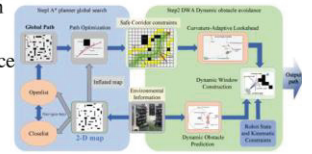
Jie Cai¹, Bumin Meng¹, Yang Hu¹, Yangze Ou², Yaonan Wang³.

¹Institute of Automation and Electronic Information,

²School of Computer Science, Xiangtan University

³Institute of Automation and Electronic Information, Hunan University, Xiangtan, China

- Proposes a collaborative fusion navigation framework for AGVs in narrow dynamic environments.
- Combines trackable global reference generation, corridor-guided local planning, dynamic prediction, and stall suppression.
- Improves navigation robustness, achieving the highest success rate and fewest turning events in comparisons.



Navigation Framework

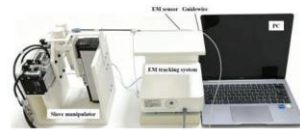
MA1-P (39) 11:00 - 12:00

Design and Evaluation of a Compact Friction-Wheel Vascular Interventional Robotic System

Chong Yang, Shuxiang Guo, Weihao Wu, Haoyu Xie, Chunying Li, Pengcheng Li, Mingchao Ding, and Bin Wang

The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, China

- A novel orthogonal friction-wheel mechanism is proposed to decouple clamping, translation, and rotation, effectively mimicking the clinical hand-twirling motion while eliminating the motion discontinuities found in traditional clamping structures.



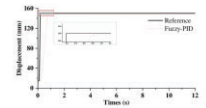
Experimental system

MA1-P (40) 11:00 - 12:00

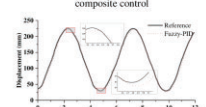
Robustness Improvement of an Electro-Hydraulic Servo System Using ϵ Switching Fuzzy-PID Controller

Wei Shiyi, Mao Wei, Peng Xiwei, Guo Yujie, Li Kecheng
Intelligent Mechatronics and Application, Beijing Institute of Technology, China

- Proposes a threshold-based switching fuzzy-PID strategy: fuzzy logic rapidly overcomes valve dead-zone and friction for large errors, while PID ensures steady-state precision for small errors.
- Co-simulation (AMESim-Simulink) and experimental validation on an electro-hydraulic proportional servo platform.
- Step response (150 mm): settling time 0.3 s, almost zero overshoot, and zero steady-state error.
- Sinusoidal tracking (100 mm, 0.2 Hz): max. tracking error reduced to 2.5 mm and delay to 0.15 s—outperforming traditional PID by 44.4% and 28.6%, respectively.
- Robustness confirmed under varying frequencies (0.2–0.25 Hz) and loads (0–10 kg): max error remains below 3.2 mm with no signal distortion.



Step response (150 mm) under fuzzy-PID composite control



Sinusoidal tracking (100 mm, 0.2 Hz) under fuzzy-PID composite control

MA1-P (41) 11:00 - 12:00

Research on Underwater Vision Technologies for Autonomous Robotic Perception

Zihao Yi, Yueshan Dai, Shuifeng Yu, Ranchao Guo, Guanlin Zhu, Yiming Cheng, Caihou Wang, Yuzhi Ma, Yiyu Yang, and Yi Liu
Harbin Engineering University, Harbin, Heilongjiang, China

- Underwater attenuation, backscattering, and refraction challenge conventional vision algorithms.
- Image processing evolved from CLAHE/DCP to GAN- and Transformer-based architectures.
- 3D reconstruction spans stereo vision, laser scanning, and neural representations (3DGS).
- Multi-sensor fusion SLAM enables robust underwater navigation.

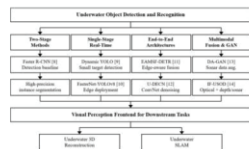


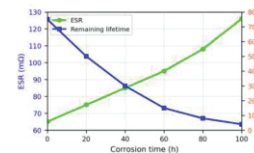
Fig. 1 Taxonomy of underwater object detection methods

MA1-P (42) 11:00 - 12:00

Loss and Lifetime Evaluation of Electrolytic Capacitors in Offshore Photovoltaic Inverters under Salt-Spray Corrosion

Kaixin Liu, ChunJie Wang, Wen Li, Zhihao Wang, Shuo Zhang, and Qi Li
School of Electrical Engineering and Automation, Tianjin University of Technology
Tianjin Key Laboratory of New Energy Power Conversion Transmission and Intelligent Control
Tianjin, China

- Salt-spray corrosion increases ESR and shortens capacitor lifetime.
- A 5% NaCl test is used to build a time-varying ESR model.
- ESR rise is coupled with ripple loss and hotspot temperature.
- An improved Arrhenius-Miner model includes corrosion acceleration.
- Results show higher loss, temperature, and rapid remaining-lifetime reduction.



ESR and Lifetime under Salt-Spray Corrosion

MA1-P Poster Session (Intelligent Mechatronics and Automation) 8

Session Chairs: Lei Ren, Jilin University, Changchun, China
 Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (43) 11:00 - 12:00

Comparison between epilepsy and migraine based on feature fusion and multiple machine learning models using electroencephalogram

Shiqi Li¹, Yao Miao²
 College of Health Science and Environmental Engineering, Shenzhen Technology University
 Shenzhen, China

- Epilepsy and migraine are prone to misdiagnosis due to overlapping clinical manifestations.
- A three-class classification framework based on EEG feature fusion and multiple machine learning models is proposed.
- XGBoost achieves the highest accuracy of 90%, with Hurst exponent identified as the most crucial feature.
- This study provides an effective tool for differential diagnosis, with Hurst exponent as a potential biomarker.



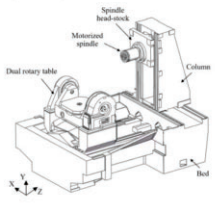
MA1-P (44) 11:00 - 12:00

Design, calibration, and validation of the HDU60 five-axis horizontal machine tool for blisk manufacturing

Jun Lv^{a,b,d}, Yukun Xiao^{c,d,e}, Yuqi Zhou^a, Yun Yang^{c,d}, Guangyan Ge^{a,d}, Zhengchun Du^{a,d,*}
^aState Key Laboratory of Mechanical System and Vibration, School of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai, 200240, China

^bGenertec Machine Tool Engineering Research Institute CO., LTD. Dalian Company, Dalian, 116000, China
^cGenertec Machine Tool Engineering Research Institute CO., LTD., Beijing, 100102, China
^dKey Laboratory for High-end CNC Machine Tools of China General Technology Group, Beijing, 100102, China
^eSchool of Instrument Science and Technology, Xi'an Jiaotong University, Xi'an, 710049, China

- Design: a dual-rotary-table configuration with a rigid "box-in-box" structure for blisk machining
- Calibration: positioning accuracy within 6 μm for linear axes and 6 arcseconds for rotary axes.
- Validation: excellent motion accuracy with all errors significantly below standard limits.



HDU60 five-axis machine tool

MA1-P (45) 11:00 - 12:00

Metaveillance Vehicle for Sensing Ultrasonic Sensors: A Proof-of-Concept for Secure Medical Deployment in Conflict Zones

Vishweswar Eswaran, Piotr Miroslaw Nowak, Lily Kim, Ciel Li, Alexander Vicol, and Steve Mann
 Department of Electrical and Computer Engineering, University of Toronto
 Toronto, Ontario, Canada



ECES16 metaveillance vehicle platform

- RC vehicle senses sensing activity from a safe stand-off distance.
- Modified HC-SR04 analog tap monitors external 40 kHz ultrasound.
- RP2040 verifies chirps with zero-crossing frequency checks.
- ESP32-CAM and GUI provide live remote viewing and control.
- LED/S.W.I.M. feedback shows verified detection events.

ICMA 2026 Digest

MA1-P (46) 11:00 - 12:00

Edge-Accelerated Underwater Object Detection for AUVs: System Design and Deployment Validation

Xueting Liu, Chunying Li, Shuxiang Guo
 The Department of Electronic and Electrical Engineering, Southern University of Science and Technology; The Advanced Institute for Ocean Research, Southern University of Science and Technology; Ministry of Industry and Information Technology, Beijing Institute of Technology

- Proposing an edge-oriented engineering framework to bridge the gap between complex algorithmic design and practical robotic deployment.
- Developing a lightweight, multi-threaded interactive monitoring system based on PyQt5.
- Introducing a finely-grained mixed-precision quantization strategy using TensorRT on the Jetson Orin Nano.



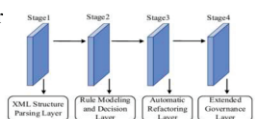
Representative real-time detection results of the deployed WFDA model

MA1-P (47) 11:00 - 12:00

Research on a Rule-Driven Diagnosis and Automatic Refactoring Framework for IEC 61131-3 XML Control Programs

Yifei Li, Hongye Zhao and Yu Song*
 Energy Technology & Services Equipment Technology Co., Ltd.
 Department of the School of Electrical Engineering and Automation, Tianjin University of Technology
 Tianjin, China

- Naming standardization, code quality, module structural safety for full-coverage static diagnosis.
- Accurately extract variables, interfaces and logic for automated defect identification.
- Standardize naming, replace hard codes, complete comments while preserving semantics



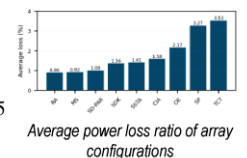
Rule-driven static diagnosis and structured refactoring framework

MA1-P (48) 11:00 - 12:00

Static Reconfiguration of Offshore Floating Photovoltaic Arrays under Wave-Induced Nonuniform Irradiance

Shuo Zhang, Chunjie Wang, Yilun Zhang, Zhihao Wang, and Peng Chen
 School of Electrical Engineering and Automation, Tianjin University of Technology
 Tianjin, China

- A 4x4 OFPV array under wave-induced nonuniform irradiance is investigated.
- SP, TCT, and seven fixed static reconfiguration schemes are compared.
- A regular-wave irradiance input ($T = 5$ s) is used for eight cases with different directions and phase differences.
- RA gives the lowest average power loss ratio, 0.90%, outperforming MS (0.92%) and SD-PAR (1.01%).



MA1-P Poster Session (Intelligent Mechatronics and Automation) 9

Session Chairs: Lei Ren, Jilin University, Changchun, China

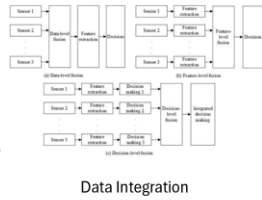
Yi Liu, Harbin Engineering University, China

UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (49) 11:00 - 12:00

Application of Multi-Source Data Fusion Technology in Equipment Fault Diagnosis and PredictionZixin Zhang, Yaohui Zhang, Shuyuan Wei, Weiqi Fan, and Haibo Zhou
Tianjin University of Technology; Masterwork Group Co., Ltd., Tianjin, China

- Single-sensor diagnosis is limited in noise resistance and complex conditions.
- multi-source data fusion for equipment fault diagnosis and prediction.
- It compares data-level, feature-level, decision-level, and multi-level fusion methods.
- Rolling bearings and other rotating machinery are used as typical cases for analysis.



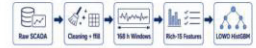
MA1-P (50) 11:00 - 12:00

Cross-Well ESP Failure Prediction Using Gradient Boosting

Mohamed A. Abdullah, Maki K. Habib

Robotics, Control, and Smart Systems, The American University in Cairo, New Cairo, Egypt

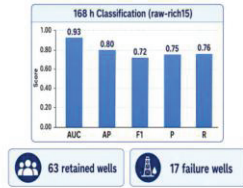
- Leave One Well Out (LOWO) tests generalization to unseen ESP wells, unlike same-well CV.



- SPE E-Challenge Dataset: 63 retained wells; 17 failure wells evaluated.

- 168 h SCADA windows → Rich-15 features

- HistGBM classification reached AUC = 0.93 and F1 = 0.72 at 168 h.



LOWO 168 h metrics

MA1-P (51) 11:00 - 12:00

Analysis and Optimization of Gear Meshing Noise in a New Energy VehicleWang Kairui
School of Robotics Engineering, Hubei University of Technology
Wuhan, China

- 8-hole baseline: 3195.87 Hz first mode approaches 3066.67 Hz mesh frequency at 8000 r/min.

- 4-hole and 4-hole + rib structures are compared via SolidWorks and ANSYS.

- Rib-reinforced design raises first-order frequency to 3557.2 Hz, improving modal safety margin and reducing resonance risk.

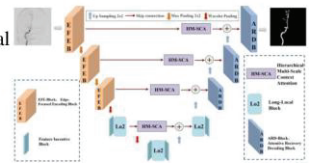


Structural schemes of the gear model

MA1-P (52) 11:00 - 12:00

Accurate Vascular Segmentation via Wavelet-Guided Edge Attention and Multi-Level Feature FusionHuiyin Xu, Shuxiang Guo, Pengcheng Li, Chunying Li, Mingchao Ding, Bing Wang
National Engineering Laboratory for Big Data System Computing Technology, Shenzhen University, Shenzhen, Guangdong, China

- HWEA-UNet: A hybrid framework for vascular segmentation.
- CNN-MLP encoder captures local details and global dependencies.
- Wavelet pooling preserves high-frequency vessel structures.
- Edge-aware attention improves boundary representation.
- Accurate and robust segmentation across multiple vascular datasets.

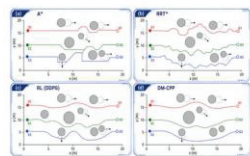


Overview of the proposed HWEA-UNet architecture

MA1-P (53) 11:00 - 12:00

DM-CPP: Diffusion-Based Cooperative Path Planning for Underwater Spherical Multi-Robot Systems in Dynamic Uncertain EnvironmentsHaotian Li, Shuxiang Guo and Chunying Li
National Engineering Laboratory for Big Data System Computing Technology, Shenzhen University, Shenzhen, Guangdong, 518060, China

- Diffusion plans underwater robot paths.
- Model handles dynamic uncertain marine env.
- Outperforms A*, RRT* and RL baselines.
- Smooth safe low-energy cooperative route.

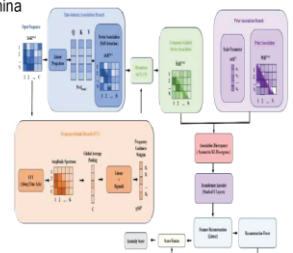


Example paths

MA1-P (54) 11:00 - 12:00

FFT-Based Frequency-Domain Guided Anomaly Transformer for Multivariate Time Series Anomaly DetectionGuoJianping Wu, Yuanxin Gao, Ran Guan, Lei Liu, Jianwei Guo
Beijing Academy of Science and Technology
Beijing, China

- Problem: Time-domain attention struggles with periodic and spectral anomalies.
- Method: FFT-guided Anomaly Transformer with frequency-aware attention.
- Innovation: FFT-guided Anomaly Transformer.
- Results: F1 ↑ 6.69%, AUC = 0.994
- Conclusion: Supports intelligent and long-term network management.



FFT-Anomaly Transformer Architecture

IEEE ICMA 2026 Conference Digest
MA1-P Poster Session (Intelligent Mechatronics and Automation) 10

Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (55) 11:00 - 12:00

Velocity Feedforward PID Control of Guide Vane Adjustment Mechanism in Hydraulic Torque Converters under Strong Load Disturbances

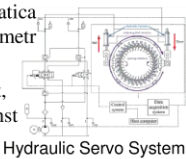
Huanhui Zhou¹, Yuchen Chen¹, Mingqiang Jia², Yuchang Liu², Haoji Song², Liwei Yue³, Xin Wang^{2, 4*}

1. Hangzhou Advance Gearbox Group Co., Ltd, Hangzhou, China, 311203
2. School of Mechanical and Aerospace Engineering, Jilin University, Changchun, China, 130022
3. Jilin Provincial Winter Sports Support Center of the Sports Bureau, Changchun, China, 130000
4. College of Mechanical and Electrical Engineering, Xinjiang Institute of Engineering, Urumqi, China, 830023

*Corresponding author: wangxin_jlu@jlu.edu.cn (X.W.)

A cross-connected double-cylinder design mathematically eliminates the inherent velocity and thrust asymmetry of traditional single-rod hydraulic cylinders.

A velocity feedforward PID strategy ensures robust, high-precision tracking within a $\pm 0.1\%$ error against extreme nonlinear load disturbances.



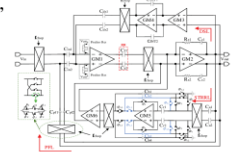
Hydraulic Servo System

MA1-P (56) 11:00 - 12:00

A 5.4- μ A, G Ω -Impedance Chopper-Stabilized Analog Front-End for Wireless Sensors and Wearable Biomedical Devices

Yaoyan Shi, Yuntao Liu*, Yang Yu, Shuo Fang, Lijiang Wang
College of Information and Communication Engineering
Harbin Engineering University
Harbin, China

This paper presents an ultra-low-power, all-analog front-end (AFE) tailored for wireless sensors and wearable biomedical devices. The design centers on a chopper-stabilized capacitively-coupled instrumentation amplifier (CSCCIA) to address stringent power limits, electrode DC offsets (EDOs), and impedance degradation.



Proposed CCIA

MA1-P (57) 11:00 - 12:00

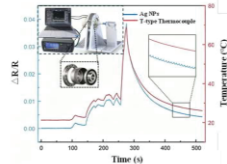
In-situ Conformal Preparation of Ag NPs-based Temperature Sensor on Flexspline of Harmonic Reducer Using EHD Technology

Yi Guo^{1, 2}, Hongyu Chen¹, Ning Wang^{1, 2}, Chunying Li², Shuxiang Guo², Yang Zhao^{1*}

¹ Pen-Tung Sah Institute of Micro-Nano Science and Technology, Xiamen University, Xiamen 361102, China.

² Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China.

- Harmonic reducers are critical transmission components in high-end equipment. Detecting potential thermal damage in real time.
- Propose a method for in-situ fabrication of a Ag NPs-based temperature sensor only using EHD technology.
- The sensor exhibits excellent sensitivity, with a TCR of 827 ppm/ $^{\circ}$ C.



MA1-P (58) 11:00 - 12:00

A Multi-Scale U-Net for Guidewire Segmentation in Vascular Interventional Images

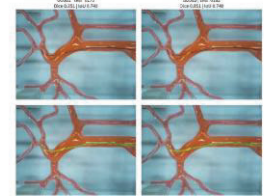
Zixuan Lyu¹, Chong Yang¹, Shuxiang Guo^{1,2*}, Weihao Wu¹, Haoyu Xie¹, Bin Wang³, and Mingchao Ding³

¹ The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China

² The Advanced Institute for Ocean Research, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China

³ The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China

- Guidewire segmentation supports vascular intervention.
- A multi-scale U-Net targets thin, low-contrast guidewires.
- Multi-scale bottleneck captures local and contextual features.
- Dice-BCE loss improves small-structure segmentation.
- Experiments show accurate guidewire extraction.



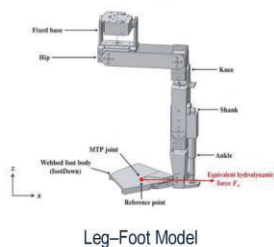
Guidewire Segmentation Results

MA1-P (59) 11:00 - 12:00

Observation-Based Joint-Angle Modeling and Hydrodynamic Gait Verification for a Duck-Inspired Robot

Author: Rongchen Yu, Yan Niu, Shuhui Zhang, Shuxiang Guo, Chunying Li, and Liwei Shi

School of Medical Science and Engineering, Beijing Institute of Technology
Beijing, China



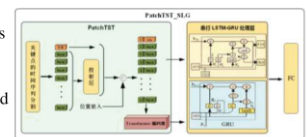
Leg-Foot Model

MA1-P (60) 11:00 - 12:00

Research on Dynamic System Resource Prediction Based on Transformer

Jianwei Guo, Shuaiyuan Feng, Yuanxin Gao, Guan Ran, Liu Lei, Chuhan He, Wenkai Jiang, Zicheng Zhang, Jianping Wu
Beijing Academy of Science and Technology,
Beijing, China

- Problem: Complex long-/short-term dependencies hinder accurate multi-step forecasting.
- Method: PatchTST_SLG uses PatchTST for global patterns + serial LSTM-GRU to smooth predictions.
- Innovation: Serial LSTM-GRU reduces local errors and improves prediction stability.
- Results: Outperforms LSTM, GRU, and PatchTST on Abilene dataset (lower MAE/RMSE).
- Conclusion: Enhances multivariate forecasting for dynamic system resources.



PatchTST_SLG unit structure

MA1-P Poster Session (Intelligent Mechatronics and Automation) 11

Session Chairs: Lei Ren, Jilin University, Changchun, China

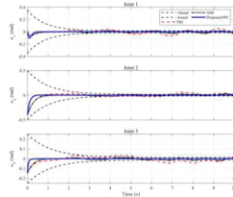
Yi Liu, Harbin Engineering University, China

UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (61) 11:00 - 12:00

Adaptive Anti-Disturbance Tracking Control for a 3-DOF Serial Manipulator With Prescribed Performance ConstraintsJunhan Shao*, Runze Shao,
School of Engineering, Qufu Normal University, Rizhao, Shandong, China

- This paper studies trajectory tracking control of a 3-DOF serial manipulator under disturbances, parameter uncertainties, and nonlinear friction.
- A PPC-embedded adaptive anti-disturbance controller is designed based on nominal dynamics compensation and robust feedback regulation.
- MATLAB simulations with PID and SMC verify bounded tracking errors and prescribed-performance satisfaction.

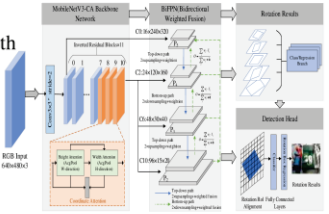


Tracking Errors With Prescribed Performance Bounds

MA1-P (62) 11:00 - 12:00

MCB-Oriented RCNN: A Lightweight Rotated Detector for 6-DoF Grasping in Solid Waste SortingGuanghong Tao, Haoyu Ma, Chenggang Li, Xinyu Zhao
School of Mechatronics Engineering, Shenyang Aerospace University
Shenyang, Liaoning, China

- Problem:** Horizontal boxes introduce noise, hindering depth extraction for 6-DoF grasping.
- Design:** MobileNet-V3 + BiFPN + CA achieves speed without losing localization.
- Compensation:** Feature-level distillation recovers accuracy lost in lightweight model.
- Performance:** 97.16% mAP @ 43 FPS, 74.8% speed gain, 0.74% accuracy drop.



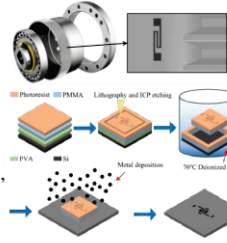
MCB-Oriented RCNN model

MA1-P (63) 11:00 - 12:00

In-situ Integration and Mechatronic Monitoring of Laminated Thin-Film Strain Sensors on Harmonic Drives for Robotic JointsNing Wang^{1,2}, Yi Guo^{1,2}, Wenxuan Wang³, Chunying Li⁴, Shuxiang Guo^{2,4,5} and Yang Zhao^{1,*}

¹Pen-Tung Sah Institute of Micro-Nano Science and Technology, Xiamen University, Xiamen 361102, China
²Advanced Institute for Ocean Research, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China
³Xiamen Golden Egret Special Alloy Co., LTD, Xiamen, 361000, China
⁴Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China
⁵Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergent Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing, 100881, China

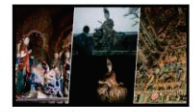
- Problem:** Real-time monitoring of compact harmonic drives is limited by conventional sensors.
- Innovation:** In-situ laminated strain sensors with temperature self-compensation and 3D conformal manufacturing.
- Outcome:** High sensitivity ($GF=2.23$), ultra-low thermal drift ($TCR=1.5$ ppm/ $^{\circ}C$), accurate dynamic strain detection.



MA1-P (64) 11:00 - 12:00

A Study on AI-Empowered Digital Games Driving the Integrated Development of Culture and TourismYing Zhang*, Zhuoran Wang, Junhua Li, Zhigang Kan
Changchun University of Science and Technology,
Changchun, Jilin, China

- 1. This paper focuses on the application of "the integration of digital games and cultural tourism" in Jilin Province, highlighting the challenges faced by industrial cities in the development of the cultural tourism industry and proposing solutions enabled by artificial intelligence. The introduction emphasises that, with the advancement of strategies to integrate the digital economy with cultural tourism, digital games are evolving from mere entertainment products into vehicles for cultural dissemination and tourism experiences.
- 2. The article analyses the constraints facing Jilin's cultural and tourism industry, including an imbalanced industrial structure, a mismatch in consumer demand, inefficient utilisation of resources, and inadequate systemic support, amongst other factors.
- 3. The article proposes strategies for leveraging AI in digital gaming: delving deeply into the core of industrial culture; integrating online and offline experiences by establishing a "game narrative-offline check-in" pathway; drawing on the example of "Black Myth: Wukong" to achieve a closed-loop transition between virtual experiences and on-site tourism, thereby meeting Generation Z's demand for immersion; building a comprehensive ecosystem; and transforming the FAW spirit into an IP, amongst other measures.



Game Scene References in Digital Games

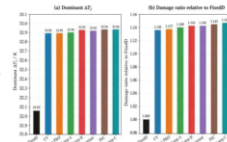


Schematic Diagram of the City AI Tour

MA1-P (65) 11:00 - 12:00

Comparative Study of IGBT Lifetime Damage in Photovoltaic Inverters Under Different MPPT Control MethodsWen Li, ChunJie Wang*, KaiXin Liu, ZhiHao Wang, Shuo Zhang, and Qi Li
School of Electrical Engineering and Automation, Tianjin University of Technology
Tianjin, China

- A PV inverter model is built to analyze MPPT effects on IGBT electrothermal stress.
- Five control cases are compared: fixed duty, P&O, adaptive P&O, INC, and CV.
- Rainflow counting and relative Miner damage are used for thermal-fatigue evaluation.
- MPPT cases raise the damage ratio to 1.136–1.147; CV is the lowest, and fixed-step P&O is the highest.

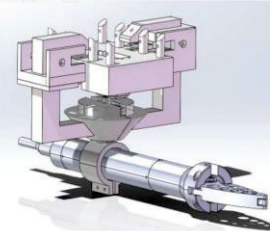


Junction-temperature swing and relative lifetime damage ratio

MA1-P (66) 11:00 - 12:00

Design and Implementation of a 3D-Printed Quick-Release Connection Module and Autonomous Grasping Control System for Underwater UAVsZiyi Zhu, Chunying Li, Shuaixin Peng, Pengcheng Li, Shuxiang Guo
The Department of Electronic and Electrical Engineering, Southern University of Science and Technology,
Shenzhen, Guangdong 518055, China

- This work addresses key limitations in UUV grasping systems (complex setup, high cost, manual dependence).
- A 3D-printed quick-release grasping system with human-in-the-loop control is proposed.
- It achieves IP66 waterproofing, fast response, and 70% autonomous grasping success.



MA1-P Poster Session (Intelligent Mechatronics and Automation) 12

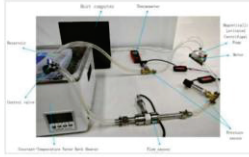
Session Chairs: Lei Ren, Jilin University, Changchun, China
Yi Liu, Harbin Engineering University, China
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (67) 11:00 - 12:00

Mechanical Design and Performance Validation of a Wet Friction Simulation Test Bench for ECMO Supported centrifugal pump

Hao Li, Kesheng Wang, Peipei Zhang *, Yining Lu, Zizhang Lin, Mingzhou Xu, Jinian Li
School of Mechanical and Electrical Engineering
University of Electronic Science and Technology of China
Chengdu, China

- A wet friction simulation test bench for ECMO centrifugal pumps is designed.
- The bench integrates a constant-temperature heating system, pump body, and multi-sensor modules (pressure, flow, temperature) for real-time monitoring.



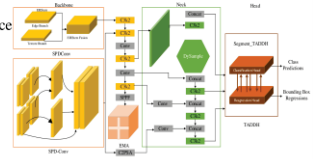
The Performance Test Platform

MA1-P (68) 11:00 - 12:00

Improved YOLOv11 for High-Precision Instance Segmentation in Aircraft Intake Inspection Robots

Guanghong Tao, Chenggang Li, Haoyu Ma, and Yuanjun Yang
School of Mechatronics Engineering, Shenyang Aerospace University
Shenyang, Liaoning, China

- Addressed background interference and blurred edge challenges in robotic intake inspection.
- Proposed a lightweight, high-precision instance segmentation network based on YOLOv11.
- Incorporated EIEstem, SPD-Conv, EMA, DySample, and TADDH to eliminate edge aliasing.
- Achieved 93.76% Precision and 0.7912 mAP@50-95.
- Reduced model parameters by 19.4%, ensuring inference FPS meets real-time edge deployment needs.



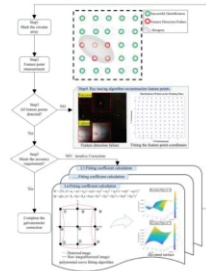
Architecture of the improved YOLOv11 model

MA1-P (69) 11:00 - 12:00

A novel visual galvanometer correction method under non-uniform illumination

Xiufeng Liu, Xiezhong Jiang
Hubei University of Education
Wuhan, China

- Non-uniform illumination causes feature point loss and failure in vision-based galvanometer correction.
- A geometric model and ray tracing are used to reconstruct missing feature points accurately.
- The method reduces max error to 0.03 mm, with average error reduction up to 98.9%



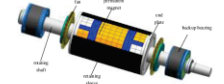
Galvanometer correction reconstruction mechanism

MA1-P (70) 11:00 - 12:00

Failure Mechanism Analysis of Key Rotor Components in High-Speed Permanent Magnet Generators

Zhaojun Cheng, Shan Li, Jiayu Zhang, Yan Ding, Zhi Yang, Xin Liu
Shanghai Marine Equipment Research Institute
Shanghai, China

- Failure mechanism analysis of key components of a high-speed permanent magnet generator rotor.
- Magnetic performance failure of permanent magnets under high temperature and reverse magnetic field of the motor.
- High-temperature creep failure of carbon fiber resin-based sleeve.
- Rotor drop and protective bearing coating failure.



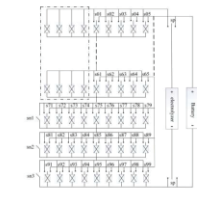
Typical structure of magnetic bearing rotor for high speed permanent magnet generator

MA1-P (71) 11:00 - 12:00

Performance Optimization of a Photovoltaic-to-Electrolyzer Direct-Coupled Hydrogen Production System Based on Photovoltaic Array Reconfiguration

Junli Liu, Chunjie Wang, Qiang Bi, Zhe Xu*
School of Electrical Engineering and Automation, Tianjin University of Technology
Tianjin, China

- Direct PV-electrolyzer coupling reduces cost but suffers from PV-electrolyzer mismatches and energy loss.
- A PSO-based PV array reconfiguration strategy is proposed to align PV MPP with the electrolyzer's polarization curve.
- Simulations show the strategy achieves 99.08% average coupling efficiency, significantly boosting overall and daily system performance.



Photovoltaic Array Switching Matrix

MA1-P (72) 11:00 - 12:00

A portable two-propeller underwater robot that maintains balance by reaction wheels

Guocai Liu, Huiyang Bao, Zebin Li, Jinsi Zhang and Qi Wu
Department of Electrical and Optoelectronic Engineering College, West Anhui University
Luan, Anhui, China

- The robot can move forward, turn, roll, and achieve six-dimensional spatial motion in water
- The robot rolls by utilizing reaction forces.
- The robot has only two thrusters, so its size is compact.
- The robot is compact and low-cost, and can be used as the body of an underwater observation robot.



The two-propeller underwater robot

MA1-P Poster Session (Intelligent Mechatronics and Automation) 13

Session Chairs: Lei Ren, Jilin University, Changchun, China

Yi Liu, Harbin Engineering University, China

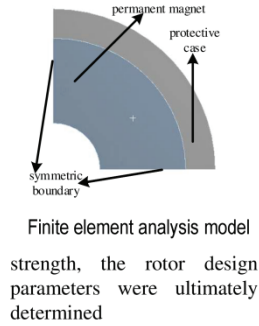
UTC+8(Beijing Time): 11:00 - 12:00, Monday, 3 August 2026

MA1-P (73) 11:00 - 12:00

Strength design of high-speed motor rotor

YAO Jiayi, CHEN Lei, DING Yan, LU Dengjie, ZHOU Guangtao, SUN Wei
Shanghai Marine Equipment Research Institute
Shanghai, China

- Analyzed the advantages and disadvantages of commonly used materials for permanent magnet protective covers;
- Analytical calculation of rotor strength was conducted;
- The accuracy of the finite element calculation was verified through analytical calculation
- By utilizing the finite element method to analyze the impact of varying temperatures, thicknesses, and interference fits on rotor



MA1-P (74) 11:00 - 12:00

Cooperative Perception-Based Energy-Optimal CBF-MPC Control for USV-UAV Systems

Chenglin Dai, Yujie Xu, Mingyu Fu, Zhiguang Feng
College of Intelligent Science and Engineering, Harbin Engineering University, Harbin, Heilongjiang 150001, China

- Propose a USV-UAV cooperative perception strategy for over-the-horizon obstacle detection in complex marine environments.
- Integrate an energy-optimal MPC framework with CBF to ensure both energy efficiency and collision avoidance for USV navigation.
- Achieve stable and energy-saving trajectory tracking under disturbances from wind, currents, and dynamic obstacles.



The USV-UAV collaborative sensing system

Monday

August 3, 2026

Afternoon Sessions

MP1-1 Intelligent Mechatronics and Application (I)
MP1-2 Intelligent Mechatronics and Application (IV)
MP1-3 Control Theory and Application (I)
MP1-4 Modeling, Simulation Techniques and Methodologies (I)
MP1-5 Robot Navigation and Control Algorithm (I)
MP1-6 Medical, Biomedical and Rehabilitation Systems (I)
MP1-7 Vision System, Robotic Vision (I)
MP2-1 Intelligent Mechatronics and Application (II)
MP2-2 Intelligent Mechatronics and Application (V)
MP2-3 Control Theory and Application (II)
MP2-4 Modeling, Simulation Techniques and Methodologies (II)
MP2-5 Robot Navigation and Control Algorithm (II)
MP2-6 Medical, Biomedical and Rehabilitation Systems (II)
MP2-7 Vision System, Robotic Vision (II)
MP3-1 Intelligent Mechatronics and Application (III)
MP3-2 Intelligent Mechatronics and Application (VI)
MP3-3 Control Theory and Application (III)
MP3-4 Modeling, Simulation Techniques and Methodologies (III)
MP3-5 Sensor Design, and Novel Sensing Systems
MP3-6 Medical, Biomedical and Rehabilitation Systems (III)
MP3-7 Vision System, Robotic Vision (III)

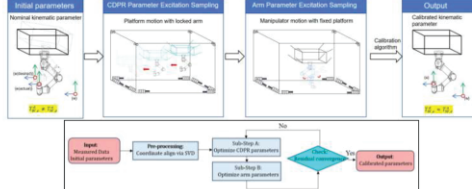
IEEE ICMA 2026 Conference Digest
MP1-1 Intelligent Mechatronics and Application (I)

Session Chairs: Junyu Zhou, Southern University of Science and Technology
 Wenzheng Wu, Jilin University, China
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

MP1-1 (1) 13:30 - 13:45

Kinematic Calibration of Cable-Driven Hybrid Robots via Dual-Space Sampling and Iterative Optimization

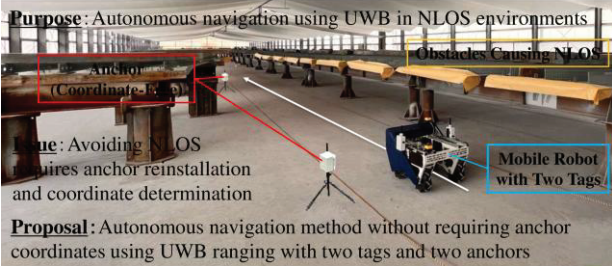
Taiming Guo, Bin Zhang*, Yinan Wu, and Weiwei Shang
 Department of Automation, University of Science and Technology of China
 Hefei, China



- **Analyzed** the sensitivity of kinematic parameters to reduce calibration complexity.
- **Proposed** dual-space sampling and alternating iterative calibration strategy to effectively suppress the parameter compensation.
- **Reduced** the RMSE of CDHRs from 45.7 mm to 12.4 mm.

MP1-1 (3) 14:00 - 14:15

Autonomous Navigation Method Using UWB Ranging without Anchor Coordinates in NLOS Environment



Shuya Nakayama*, Kei Sawai, Rion Omata, Ken'ichi Koyanagi,
 Hiroyuki Masuta, Fengyu Li and Ahmed Almassri
 Department Intelligent Robotics Engineering, Graduate School of Engineering
 Toyama Prefecture University, Imizu, Japan

MP1-1 (5) 14:30 - 14:45

PAAM: Phase-Aware Action Modulation for Force-Guided Policy Augmentation in Contact-Rich Manipulation

Yuliang Shen, Qianyou Zhao, Junlai Li, Duidi Wu, Jie Hu, Jin Qi, Chengan Hong, Jin Ma, and
 Ruilong Du
 Shanghai Jiao Tong University, Shanghai, China; Midea Group, Foshan, China

- Targets premature exits from the tightening phase.
- Recognizes contact phase from recent z-axis torque.
- Corrects ACT actions only when phase conflict occurs.
- Achieves 98.41% phase-recognition accuracy.
- Raises OOD task success from 10% to 80%.



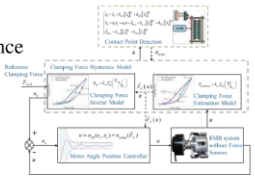
Real-Robot
Nut-Tightening Setup

MP1-1 (2) 13:45 - 14:00

Hysteresis-Compensated Clamping Force Estimation and Fixed-Time Contact Point Detection for Electromechanical Brakes

Junfeng Zhang; Junzhi Zhang; Zihang Yang; Chengkun He; Huiqiang Gao; Yuwei Yang
 School of Vehicle and Mobility, Tsinghua University, Beijing, China

- Proposed sensorless EMB force control framework reduces dependence on force sensors.
- Invertible hysteresis compensation improves force-position mapping.
- FTESO enables rapid and accurate contact point detection.
- HIL experiments verify improved estimation and tracking accuracy.



Sensorless clamping force control
framework.

MP1-1 (4) 14:15 - 14:30

Design and Optimization of a Compact Link Mechanism-based Prosthetic Foot Test Platform

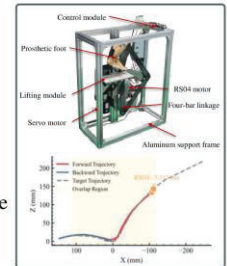
Zhongliang Ren^{1,2}, Haisu Liao³, Yongji Lin³, Fei Gao^{3*}

¹Southern University of Science and Technology, Shenzhen, China.

²Shenzhen University of Advanced Technology, Shenzhen, China.

³Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, Shenzhen, China

- Developed a compact four-bar linkage-based prosthetic foot test platform to reproduce the ankle's kinematics and gait dynamics.
- Mapped amputee gait data into a machine coordinate system and optimized the linkage geometry for trajectory synthesis.
- High trajectory fidelity was achieved in the experimental validation, with 3.337 mm RMSE and 0.9992 Pearson correlation.

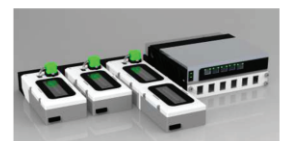


MP1-1 (6) 14:45 - 15:00

Modular PoE-Powered Platform for Parallel Flow Cell Automation and Imaging

Leonard Saur, Marc von Pawlowski, Xiangyu Weng, Moritz Lindmüller, Nathalie Klug, and
 Christian Pylatiuk
 Institute for Automation and Applied Informatics, Karlsruhe Institute of Technology, Germany
 GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany

- Automatic PC device enumeration
- Independent control of 4 parallel channels.
- Real-time imaging and synchronized metadata
- Scalable architecture for AI-assisted microscopy



CAD rendering of the modular
flow-cell platform

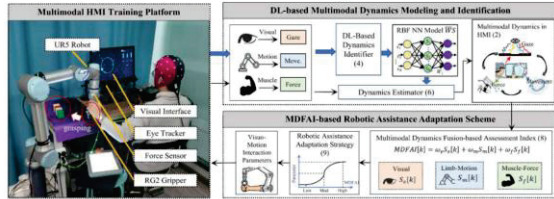
IEEE ICMA 2026 Conference Digest
MP1-2 Intelligent Mechatronics and Application (IV)

Session Chairs: Jingting Zhang, University of Electronic Science and Technology of China
 Phurin Rangpong, Institute of Science Tokyo
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

MP1-2 (1) 13:30 - 13:45

Multimodal Dynamics Modeling and Fusion for HMI in Attention-Motion Training

Jingting Zhang, Jun Wang, and Hong Cheng*
 Center for Robotics, School of Automation Engineering,
 University of Electronic Science and Technology of China, Chengdu, China



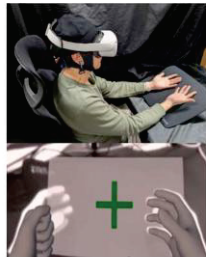
- Human-Machine Interaction (HMI) for motor-cognitive training tasks;
- Multimodal dynamics-driven HMI framework to optimize the interaction and coordination of different interaction modality in the motor and cognitive tasks, for improving training efficacy.

MP1-2 (3) 14:00 - 14:15

Enhancing Motor Imagery Performance with Real-time Augmented Reality Feedback

Phurin Rangpong*, Akima Connelly, Zhuohao Zhang, Tohru Yagi
 Transdisciplinary Science and Engineering, Institute of Science Tokyo, Japan

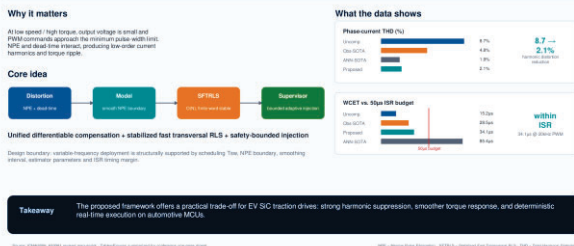
- Real-time visual feedback MI-BCI using Augmented Reality via head-mounted display
- A crossover experiment evaluation, 10 healthy, hand-grasping MI tasks, AR vs Control monitor feedback
- AR showed better training adaptation from first to final training block
- AR enhanced cortical patterns, higher ERD ratios in alpha and beta band in later training blocks



MP1-2 (5) 14:30 - 14:45

Adaptive Compensation of NPE- and Dead-Time-Induced Distortion in Electric Vehicle SiC Traction Inverters

Li Ma et al., Tongji University, G. P. Pulse Technology, JAGCO

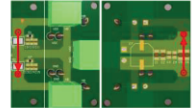


MP1-2 (2) 13:45 - 14:00

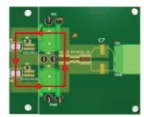
Optimized Power Loop Design for Suppressing Switching Overshoot and Oscillation in GaN-Based Half-Bridge Circuit for Motor Drives

Xi Liu, Hui Li, Yingzhe Wu, Lisheng Wang, Shan Yin, Siyong Luo, Yuxiang Xue, Hengbin Zhang, Yashan Cai, Jinshu Lin, Chen Song and Hongliang Zhang
 School of Aeronautics and Astronautics, University of Electronic Science and Technology of China, Chengdu 611731, China

- Suppresses switching overshoot and oscillation in GaN HEMT half-bridge circuits for motor drives.
- Combines RC-snubber damping with an optimized, compact vertical PCB power loop design.
- Compares the proposed vertical layout against a conventional lateral loop on identical half-bridge platforms.
- Validates improvements through comprehensive analysis of inductive characteristics, time-domain waveforms, and spectra.



Vertical Power Loop



Lateral Power Loop

MP1-2 (4) 14:15 - 14:30

Telekolympographic Swim Gesture Recognition for Teleoperation of Remote or Virtual Boat

Ibrahim Hassan, Varun Seshadri, Li-An Yang, Yuxuan Zhang, Alexander Vicol, and Steve Mann
 Department of Electrical and Computer Engineering, University of Toronto
 Toronto, Ontario, Canada

- Telekolympographic User Interface: Converting swimming gestures to control languages.
- Uses a head-mounted camera and a specialized computer vision pipeline to extract geometric contours from upper-body motions, translating physical strokes into steering and propulsion commands.
- Successfully tested and proven in two distinct environments: a high-fidelity Unity simulation of Toronto's Peter Street Basin, and the low-latency physical operation of a remote-controlled racing boat.



MP1-2 (6) 14:45 - 15:00

The Design of Internet of Things Control Box for Smart Greenhouses in Cold Regions

Jiayi Luan, Liang Zheng*, Weixuan Zheng, Bohong Pei, Yuanchen Dou, Ya Chen
 School of the Electrical and Information Engineering, Jilin Agricultural Science and Technology University, Jilin, China

- A low-cost IoT control box based on PLC and 4G-to-485 module is designed for cold-region greenhouses.
- Improved YOLOv5s realizes accurate crop growth and disease recognition under complex lighting.
- XGBoost multi-feature fusion algorithm achieves early water stress warning for precise irrigation.
- Supports manual, automatic and remote control modes with stable low-temperature operation.
- Field test saves 18.7% energy and 22.1% operating cost for cold-region smart greenhouses.



Smart Greenhouse IoT Control System

IEEE ICMA 2026 Conference Digest
MP1-3 Control Theory and Application (I)

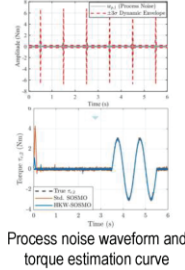
Session Chairs: Haoyu Xie, Southern University of Science and Technology
 Xiufen Ye, Harbin Engineering University
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

MP1-3 (1) 13:30 - 13:45

A Hybrid Kalman-Weighted Sliding Mode Observer for Sensorless Torque Estimation of Robotic Manipulators

Jiawei Sun, Chao Peng*, Jianxiao Zou, Qi Zhou
 School of Automation Engineering, University of Electronic Science and Technology of China
 No.2006, Xiyuan Ave. West, Hi-Tech Zone, Chengdu, 611731, Sichuan, China

- A Kalman-weighted SOSMO is proposed to achieve sensorless estimation of external torque;
- The sliding mode gain S_1 is dynamically adjusted using the posterior covariance $P_{k|k}$;
- To resolve the contradiction between fast response and high chattering in traditional fixed high-gain observers;
- Prove that the observation error converges within a finite time.

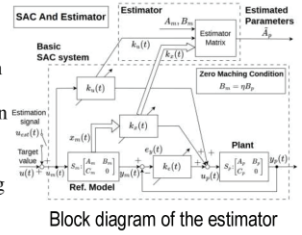


MP1-3 (2) 13:45 - 14:00

Parameter Estimation via Adaptive Gain Convergence to CGT Solutions in Simple Adaptive Control

Toshiaki Kawana, Qingjiu Huang
 Graduate School of Engineering, Kogakuin University
 Tokyo, Japan

- Investigates the relationship between SAC adaptive gains and CGT solutions for SISO ASPR systems.
- Shows that zero matching between the plant and the reference model is a key condition for adaptive-gain convergence.
- Proposes an SAC-based online parameter estimation method using the converged adaptive gains.
- Simulink simulations demonstrate accurate estimation.

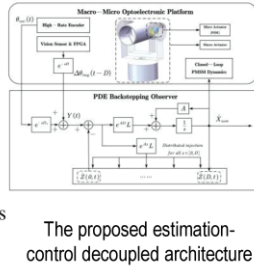


MP1-3 (3) 14:00 - 14:15

A Deterministic PDE Backstepping Observer for Visual Delay Compensation in Optoelectronic Tracking

Ankang Liu, Jianying Zheng, Wenguang Zuo, Xinyu Wang, and Qinglei Hu
 School of Automation Science and Electrical Engineering, Beihang University, Beijing, China

- Proposes a PDE backstepping predictor observer with time-aligned measurement synthesis to compensate for visual tracking delays.
- Eliminates the heuristic noise covariance tuning (Q and R) typically required by standard Kalman filters.
- Achieves over 60% tracking RMSE reduction in semi-physical experiments with robust performance across varying frequencies.

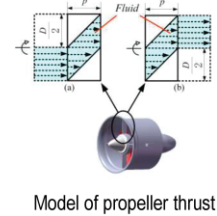


MP1-3 (4) 14:15 - 14:30

FCS-MPC Strategy for Ducted Propellers in Trans-Media Transition

Sisi Liu¹, Liyang Zhang², Taiping Yang³, Shihua Yuan⁴ and Wei Wu⁵
¹Energy and Transportation Domain,
 Beijing Institute of Technology, Zhuhai, Guangdong, China
²School of Mechanical Engineering
 Beijing Institute of Technology, Beijing, China

- Established and experimentally validated a thrust model for ducted propellers in aquatic-aerial trans-media transition.
- Proposed an FCS-MPC-based continuous thrust control strategy, verified by comparative simulations.



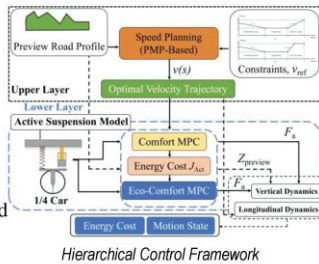
MP1-3 (5) 14:30 - 14:45

Hierarchical Eco-Comfort Control for Preview Active Suspension with Longitudinal Speed Planning

Zhe Yan¹, Aimin Du¹, Yeyang Han¹, and Mingliang Song²

1. School of Automotive and Energy Engineering, Tongji University, Shanghai, China
 2. Pan Asia Technical Automotive Center Co., Ltd., Shanghai, China

- A hierarchical eco-comfort control framework is proposed to balance ride comfort, road holding, travel efficiency, and energy cost.
- The proposed method is evaluated against four baseline strategies under four representative road scenarios.
- Simulation results show reduced energy cost while maintaining ride comfort and road holding.

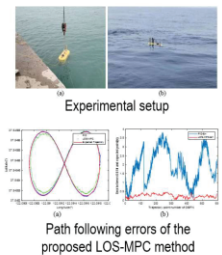


MP1-3 (6) 14:45 - 15:00

LOS-MPC-Based Path Tracking Control of an Ocean Bottom Fly Node With Sea-Trial Validation

Ronghao Zhang, Xiufen Ye, Shuxiang Guo and Chunying Li
 Harbin Engineering University; Southern University of Science and Technology; Beijing Institute of Technology;
 Harbin, Shenzhen, and Beijing, China

- Proposed a real-time LOS-MPC controller for OBFN path tracking.
- Identified surge and yaw models using sea-trial data.
- Integrated LOS guidance with MPC under input constraints.
- Validated the method through heading and figure-eight sea trials.
- Achieved lower tracking errors than the conventional method.



MP1-4 Modeling, Simulation Techniques and Methodologies (I)

Session Chairs: Wenyi Zhang, Harbin Engineering University

Naif Nafea J Alanazi, Central South University

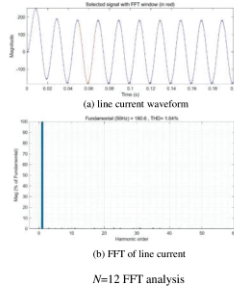
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

MP1-4 (1) 13:30 - 13:45

Two-level Inverter Control Based on Half-Period SHEPWM Method

Wenye Zhang, Jiayang Li, and Jiaxu Guo
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- A half-period SHEPWM method is proposed for two-level inverter control.
- The Beetle Antennae Search Algorithm is used to solve the nonlinear equations.
- MATLAB/Simulink simulations verify the harmonic suppression performance.
- The results show that the proposed method reduces current THD to 1.64% when $N = 12$.

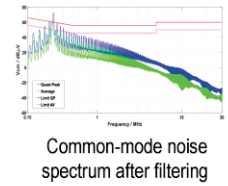


MP1-4 (2) 13:45 - 14:00

Modeling and Suppression of Common-Mode Noise in a Collaborative Robot Joint Drive System

Jiankun Shi and Zhongyuan Zhou
School of Mechanical Engineering, Southeast University
Nanjing, China

- Simscape-based conducted emission model is established.
- Simulation results are verified by measurements.
- Ground-line inductor suppresses common-mode noise.

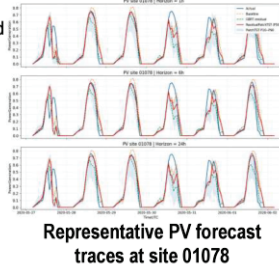


MP1-4 (3) 14:00 - 14:15

Constraint Guided Residual PatchTST With NWP Features for Multi Horizon Probabilistic PV and Wind Power Forecasting

Naif Nafea J. Alanazi, Qi Lei
School of Automation, Central South University
Changsha, Hunan, China

- Constraint guided residual forecasting for multi horizon PV and wind prediction.
- GBRT and Residual PatchTST with NWP, time features, and site information.
- Evaluated at 1 h, 6 h, and 24 h using RMSE, MAE, coverage, and interval width.
- PV RMSE improved from 0.0909 to 0.0798; wind RMSE improved from 0.2574 to 0.1479.

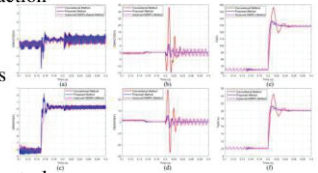


MP1-4 (4) 14:15 - 14:30

Mechanism Analysis and Improvement of Harmonic Current Extraction for Multiple Virtual Winding Systems Under Non-Stationary Conditions

Shuguang Zuo*, Yaohui Gao, Teng Ma
College of Automotive and Energy Engineering, Tongji University
Shanghai, China

- Accurate harmonic current extraction for automotive PMSMs under dynamic operating conditions.
- Revealing transient disturbances caused by fundamental current amplitude mismatch in virtual winding methods..
- Improving dynamic harmonic control through fundamental current reconstruction and pre-cancellation.

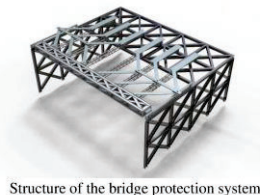


MP1-4 (5) 14:30 - 14:45

Numerical Simulation and Experimental Validation of a Mechatronic Protection System for Railway Bridges

Feiyang Wang, Haotian An, and Yan Zhang
School of Mechanical Engineering, Southeast University
Nanjing, China

- Proposes a modular three-stage protection system for over-height truck impacts on railway bridges.
- Combines a crash beam, energy-absorbing device, support bent frame, guide rail, and a Synchronization Mechanism.
- Validates LS-DYNA simulations with full-scale 20-ton truck crash tests at 60 km/h.
- Achieves about 92% energy absorption at 60 km/h, with peak-stress errors kept within 15%.

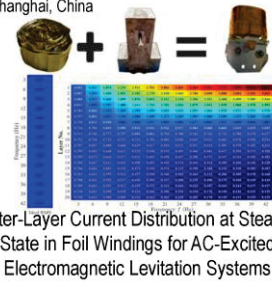


MP1-4 (6) 14:45 - 15:00

Investigation of Frequency-Dependent Resistance Characteristics in Foil Windings for AC-Excited Electromagnetic Levitation Systems

Bowen Jiang, Zaimin Zhong*, Haoqi Yu, Lei Ge, and Xiusen Wang
College of Automotive and Energy Engineering
Tongji University, Shanghai, China

- AC resistance surges $3.78 \times$ DC at 30 Hz.
- Height governs DC-AC loss trade-off.
- Cross-connection balances currents, widens low-resistance band.
- Excess discretization triggers secondary skin effect, limits use.
- FCC-FEA model validated by experiments.



MP1-5 Robot Navigation and Control Algorithm (I)

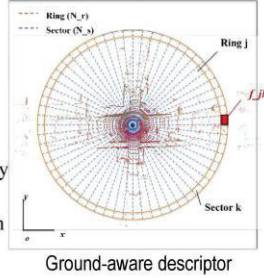
Session Chairs: Xing Liu, Harbin Engineering University
Kartik Vij, International Institute of Information Technology, Hyderabad
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

MP1-5 (1) 13:30 - 13:45

Ground Loop Closure Detection for Substations

Shufeng Tang, Ran He, Xiaodong Guo, Hong Chang, Fang Huang, Xin Wang, Yikuan Zhang
1 Inner Mongolia University of Technology Hohhot, 010051, China
2 Key Laboratory of Robotics and Intelligent Equipment Technology Hohhot, Inner Mongolia 010051, China

- Focuses on substation loop closure detection.
- Uses Patchwork++ for ground segmentation.
- Builds a ground-aware point cloud descriptor.
- Combines Ring Key and Sector Key matching.
- Validated in a substation simulation environment.

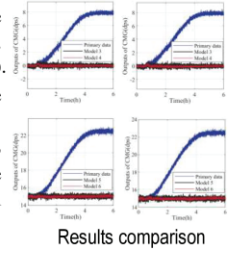


MP1-5 (2) 13:45 - 14:00

An LSTM-based Temperature Drift Errors Precise Estimation Model of Capacitive MEMS Gyroscopes using Stiffness Variation Analysis

Bing Qi^{1,*}, Zili Wang², Qiushuang Gao¹, and Jinbo Cui¹
¹College of Intelligent Systems Science and Engineering, Harbin Engineering University
²School of Electronic Engineering, Heilongjiang University
Harbin, Heilongjiang Province, China

- TDE traceability is achieved by resonance frequency variation of suspension beams, new TCQ obtained (ΔT , ΔT^2 , ΔT^3 , $\Delta T^2 \times T_0$).
- The parameters of the modified model are identified using LSTM.
- Bias stability of CMG is improved by 15% using the modified model. It can estimate more accurate TDE and decouple thermal dependence in complex conditions.



MP1-5 (3) 14:00 - 14:15

TRITON: Trans-media Robust Iterative Trajectory Optimization and Navigation

Jinglei Nie, Senyang Zhao, Chunying Li, Pengcheng Li, Shuxiang Guo
The Department of Electronic and Electrical Engineering, Southern University of Science and Technology
Shenzhen, Guangdong 518055, China

- This paper proposes TRITON. The front-end employs an Amphibious domain-aware search algorithm that incorporates dual-mode kinematics and switching costs to generate a coarse path with precise boundary localization. The back-end introduces an ASRF and a SMC within a nonlinear optimization framework.



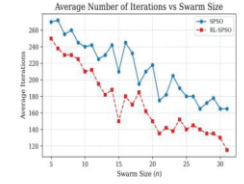
Overview of the TRITON

MP1-5 (4) 14:15 - 14:30

A Centralized PPO Agent-based Particle Swarm Optimization for Multi-UAV Source Seeking

Kartik Vij, Arya Topale, Harikumar Kandath, J. Senthilnath
International Institute of Information Technology, Hyderabad and National University of Singapore, Singapore

- Proposes a centralized PPO-based framework to dynamically tune hyperparameter coefficients for SPSO, APSO, and ARPSO variants.
- Utilizes a unified reward function designed to minimize search time, accelerate convergence, and guide the swarm toward high-signal regions.

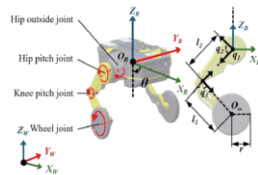


MP1-5 (5) 14:30 - 14:45

Path Planning for Complex Factory Inspection Robots Based on the Improved A* and DWA Fusion Algorithm

Hongyuan Liu, Yuhang Wang, Yue Ma, Bin Li* and Siyu Chen
Tianjin University of Technology, Tianjin, China

- Proposed a hierarchical fusion algorithm combining Improved A* and DWA.
- Enhanced global planning via distance-adaptive heuristics.
- Coupled kinematic and postural constraints of the bipedal robot to ensure dynamic stability.
- Achieved a 40.16% reduction in navigation time in complex dynamic environments.



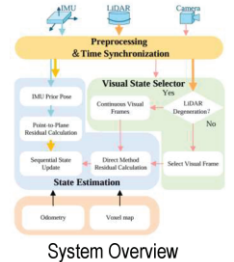
TITA Robot Model

MP1-5 (6) 14:45 - 15:00

Adaptive Degeneracy-Aware LiDAR-Inertial-Visual Odometry with Balanced Accuracy and Efficiency

Heng Zhang, Jianjun Sha, Xinling Wang, Minghui Xu, Haoyu Wang and Xintong Han
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Degeneracy-aware visual update: Adaptively adjusts visual participation based on LiDAR geometric quality to balance accuracy and efficiency.
- Residual-weighted voxel plane estimation: Improves robust local plane modeling and enhances the consistency of LiDAR geometric constraints.



MP1-6 Medical, Biomedical and Rehabilitation Systems (I)

Session Chairs: Linshuai Zhang, Chengdu University of Traditional Chinese Medicine
Fucai Zhao, Changchun University of Science and Technology
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

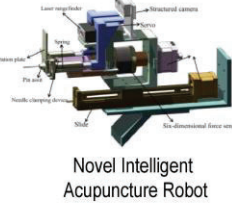
MP1-6 (1) 13:30 - 13:45

Development and Dynamic Simulation of the End-Effector Needling Mechanism for an Acupuncture Robot

Xin Yan^{1*}, Yinglong Li^{1*}, Linshuai Zhang^{1,4*}, Tao Jiang^{1,4*}, Shuoxin Gu^{2,3}, Yujie Zhang¹, Lin Xu¹ and Marcin Grzegorzek⁵

¹ School of Intelligent Medicine, Chengdu University of Traditional Chinese Medicine, Chengdu, Sichuan, China
² School of Automation, Chengdu University of Information Technology, Chengdu, Sichuan, China
³ International Joint Research Center of Robotics and Intelligence System of Sichuan Province, Chengdu, Sichuan, China
⁴ Engineering Research Center of Traditional Chinese Medicine Artificial Intelligence of Sichuan Province, Chengdu, Sichuan, China
⁵ Institute of Medical Informatics, University of Lübeck, Lübeck, Germany

- Structural design of end effector
- Modeling of the Needle Application Mechanism and Needle-Tissue Interaction
- Contact, Cushioning, and Simulation Parameter Settings
- Dynamic Simulation and Driving Force/Torque Analysis Based on ADAMS



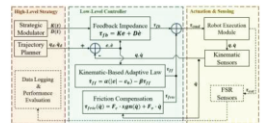
Novel Intelligent Acupuncture Robot

MP1-6 (2) 13:45 - 14:00

A Composite Variable Impedance Control Architecture with Adaptive Feedforward Assistance for Rehabilitation Exoskeletons

Jun Leng, Pengcheng Li, Hanze Wang, Chunying Li, Mingchao Ding, Bing Wang, Shuxiang Guo
The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Guangdong, China

- A composite variable impedance architecture is proposed for rehabilitation exoskeletons, eliminating the need for noisy force-feedback loops by separating trajectory stiffness from active assistance.
- A novel kinematic-driven adaptive law enables robust, sensorless "Assist-As-Needed" (AAN) intervention by modulating feedforward torque based solely on real-time position errors.
- Experiments demonstrate that the decoupled assistance reduces tracking RMSE from 13.77° to 3.12° during simulated weakness, providing 59.6% of the driving torque while maintaining high compliance.



Block diagram of the proposed Composite Variable Impedance Control architecture

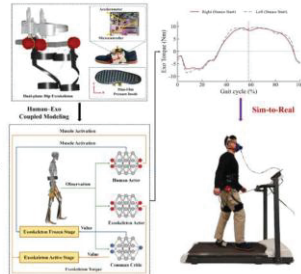
MP1-6 (3) 14:00 - 14:15

A Sim-to-Real Approach towards Optimal Assistance Torque in Hip Exoskeleton with a Coupled Human-Exoskeleton Model

Fanjie Wang^{1,1}, Jiaxing Zhang^{1,2}, Ji Huang¹, Hong Zhang³, Xin Ma⁴, Wen-Ming Chen^{1,1,3}

¹ Institute of Trustworthy Embodied AI, Fudan University, Shanghai, China
² Shanghai World Foreign Language Academy, Shanghai, China
³ Shanghai Innovation Institute, Shanghai, China
⁴ National Center for Orthopedics, Shanghai Sixth People's Hospital, Shanghai, China

- A sim-to-real approach was developed to identify optimal hip exoskeleton assistance torque profiles based on reinforcement learning and musculoskeletal simulation.
- The simulation-learned control strategy demonstrates sim-to-real effectiveness by reducing gait-related muscle activation in simulation and lowering energy expenditure during real-world walking.
- This work bridges musculoskeletal simulation and real-world deployment for walking-assistive exoskeleton control.



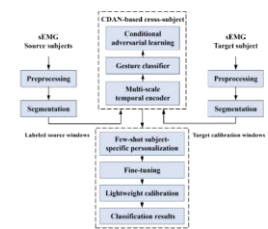
MP1-6 (4) 14:15 - 14:30

Multi-Scale Conditional Domain Adversarial Network for Cross-Subject Stroke sEMG Gesture Recognition

Ye Sun¹, Kexiang Li^{1,1}, Shunming Hong², Chuang Li¹ and Jianhua Zhang³

¹ College of Mechanical and Material Engineering, North China University of Technology, Beijing, China
² Third medical center, The General Hospital of the People's Liberation Army, Beijing, China
³ College of Mechanical Engineering, University of Science and Technology Beijing, Beijing, China

- MS-CDAN targets cross-subject stroke sEMG gesture recognition.
- Multi-scale encoder captures pathological temporal patterns.
- Conditional alignment combines features with gesture probabilities.
- Constrained fine-tuning and temporal aggregation improve adaptation; accuracy 82.54%, F1-score 77.25%.



Overview of the proposed MS-CDAN framework

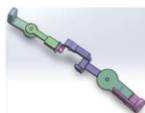
MP1-6 (5) 14:30 - 14:45

Upper Limb Rehabilitation Robot Based on Long Short-Term Memory Network Enhanced Sliding Mode Control

Fucai Zhao, Pengfei Wang, Liang Zheng, Yu Ma

School of Electronic and Information Engineering, Changchun University of Science and Technology,
7089 Weixing Road, Changchun City, Jilin Province, China

1. Against the backdrop of population aging, traditional rehabilitation for post-stroke upper limb hemiplegia suffers from high costs and unstable efficacy. This paper designs a rehabilitation robot combining LSTM and sliding mode control.
2. Upper limb rehabilitation robots are vulnerable to external disturbances, and conventional sliding mode control easily causes chattering, restricting practical application.

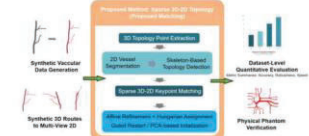


MP1-6 (6) 14:45 - 15:00

A Fast Sparse 3D-2D Topology Feature-Matching Framework for Intraoperative Navigation of Vascular Interventional Robots

Weiwei Wu, Chong Yang, Haoyu Xie, Sheng Cao, Pengcheng Li, Chunying Li, Bin Wang, Mingchao Ding, Shuxiang Guo
The Department of Electronic and Electrical Engineering, Southern University of Science and Technology
Shenzhen, Guangdong 518055, China

- This work proposes an efficient sparse 3D-2D topological feature matching framework to realize intraoperative navigation of vascular interventional robots.



- It extracts topological keypoints from 3D vascular skeletons and 2D segmented angiograms separately, then adopts affine alternating optimization with PCA-based restart to solve matching initialization defects.
- Validations on synthetic vascular data and physical vascular phantoms verify the method balances navigation accuracy, stability and computation speed well.

IEEE ICMA 2026 Conference Digest
MP1-7 Vision System, Robotic Vision (I)

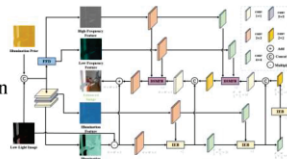
Session Chairs: Zhenao Zhang, Waseda University
 Nuttasorn Aiemseththee, Waseda University
UTC+8(Beijing Time): 13:30 - 15:00, Monday, 3 August 2026

MP1-7 (1) 13:30 - 13:45

DSFD-Net: Dual-Stream Frequency-Decoupled Network for Nighttime Low-Light Image Enhancement

Yilei Huang, Jingyu Li, Haotai Sun, Ruosong Wang, Zhenhai Zhang*
 School of Mechatronical Engineering, Beijing Institute of Technology, Beijing, China

- Propose DSFD-Net, a dual-stream framework for nighttime low-light enhancement.
- Introduce an FFD module for illumination–texture decomposition and noise suppression and design DSMFB for joint frequency and illumination feature fusion.
- Achieve superior results on LOLv1 and LOLv2 datasets.



Pipeline of DSFD-Net

MP1-7 (2) 13:45 - 14:00

TCCP: Target-Centric Cloud-based Perception Framework of Object Geometry

Zhenao Zhang, Yifan Luo, Takafumi Matsumaru, Vibekananda Dutta, Xin He
 Waseda University, Warsaw University of Technology

- Target-centric object geometry acquisition
- Stateless cloud-based computation
- Sparse RGB-D observations with reusable modules
- Pure-inference framework with general-purpose models
- Competitive geometric fidelity with semantic consistency



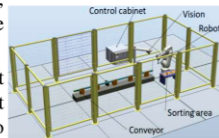
Target Object Geometry

MP1-7 (3) 14:00 - 14:15

Research and design of intelligent defect detection system for magnetic connector

Yaling Tian, Li Jiang*, Jingxi Lei, Chenhui Hua, Chao Ding, Qiang Wang, Wei Wang, Ji Li*
¹School of intelligent manufacturing, Chengdu Technological University
²Chengdu Aeronautic Polytechnic University

- A digital simulation model of the system is constructed on the Robot Studio platform, realizing the virtual verification of the inspection process;
- A real-time image acquisition system is built and the vision algorithm for defect inspection is developed by HALCON to accurately identify appearance defects;
- A user-friendly human-computer interaction interface is designed to form a complete inspection system by programming with HALCON and C#.



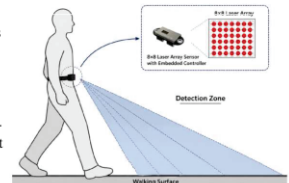
defect detection system

MP1-7 (4) 14:15 - 14:30

Road Condition Recognition Based on Laser Dot Matrix Sensor

Yikun Wang¹, Lingling Chen^{1,2}
¹School of Artificial Intelligence and Data Science Hebei University of Technology
²Intelligent Rehabilitation Device and Detection Technology Engineering Research Centre of the Ministry of Education
 Shijie Guo^{2,3}, Min Wang⁴
³School of Mechanical Engineering Hebei University of Technology
⁴School of General Engineering, Beihang University

- A single 8×8 laser dot matrix sensor collects depth data, with a complete preprocessing pipeline and lightweight DT classifier for rapid prediction.
- The proposed method features high recognition accuracy (99.0% for flat/stairs), sub-2ms real-time inference and superior lightweight performance over SVM/XGBoost.



MP1-7 (5) 14:30 - 14:45

LVR-Draw: A Language-Vision Pipeline for Robotic Drawing with Interactive Scene Verification and Correction

Nuttasorn Aiemseththee¹, Renke Liu¹, Kavé Salamatian², Hideyuki Sawada³
¹Department of Pure and Applied Physics, Waseda University, Tokyo, Japan,
²LISTIC, University Savoie Mont Blanc, Annecy, France,
³Faculty of Science and Engineering, Waseda University, Tokyo, Japan

- Fully local language–vision robotic drawing framework
- Structured scene generation using LLM-based representations
- Interactive multimodal verification and correction of generated drawings
- Deterministic robotic execution preserving LLM-defined drawing order



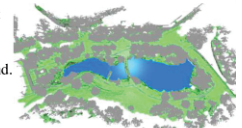
Deterministic robotic drawing execution using a physical robot platform

MP1-7 (6) 14:45 - 15:00

D-WLTS: A LiDAR Point Cloud Water-Land Segmentation Algorithm Based on Delaunay and Multi-Dimensional Topological Constraints

Senyang Zhao, Jinglei Nie, Chunying Li, Shuxiang Guo
 Southern University of Science and Technology, Shenzhen, China

- This work proposes D-WLTS, a LiDAR point cloud water-land segmentation algorithm for amphibious robot perception.
- It builds a 2.5D Delaunay mesh and uses multi-dimensional geometric features to separate water and land.
- KD-Tree and Union-Find are adopted to maintain water integrity and eliminate false positive artifacts (FPA) in complex river scenarios.
- Experimental results achieve high shoreline coincidence and W-IoU, verifying superior robustness and segmentation accuracy.



D-WLTS Water-Land Segmentation Results

IEEE ICMA 2026 Conference Digest
MP2-1 Intelligent Mechatronics and Application (II)

Session Chairs: Alexander Vicol, University of Toronto
 Enze Yan, Beijing Institute of Technology, China
UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-1 (1) 15:15 - 15:30

Submersivity: XR-Guided Garbage Detection with an RC Submarine for Peter Street Basin Cleanup

Chris McGale, Michel A. Herrera Viyella, Chan Park, Daniel Bros, Alexander Vicol, and Steve Mann
 Department of Electrical and Computer Engineering, Department of Mechanical and Industrial Engineering
 University of Toronto, Toronto, Ontario, Canada

Main Contributions

- RC submarine captures underwater video in Peter Street Basin.
- YOLOv8s detects garbage from a 12,177-image dataset.
- COLMAP and ArUco place detections on the basin map.
- Vuzix Smart Swim XR shows target direction, range, and class.
- Spatial guidance supports human-in-the-loop cleanup.

Pipeline: RC submarine capture, YOLOv8 detection, PSB localization, and XR guidance.

One page ICMA 2026 digest prepared from the accepted paper

MP2-1 (2) 15:30 - 15:45

Data-Driven Identification of Flapping Wing Aerodynamic Forces using Covariance Matrix Adaptation Evolution Strategy(CMA-ES)

Jonish Abisheek Joseph, Yash Prashant Adivarekar, Bhamidipati Srinath Dhatre, Harikumar Kandath
 Robotics Research Centre (RRC), IIT Hyderabad, Hyderabad, India.

- In our work, we propose an unsteady aerodynamic force model to predict lift.
- Our model captures the apparent mass effects and aero elastic bending of the wings.
- We are validating our model with our custom-built bat inspired prototype.

Proposed model vs baseline model

MP2-1 (3) 15:45 - 16:00

Perception-Aware Control Barrier Function for Safe Navigation Under Uncertain LiDAR Observation

Kabirat Olayemi, Mien Van, Sean McLoone, Rajeev Kuttly Thomas
 School of Electronics, Electrical Engineering and Computer Science, Queen's University Belfast
 Belfast, United Kingdom

- Developed a Perception-Aware Control Barrier Function (PA-CBF) for safe LiDAR-based navigation.
- Combines LiDAR range and uncertainty-aware range-rate estimation without tracking or maps.
- Introduces a predictive finite-horizon safety mechanism with real-time tractability.
- Provides probabilistic safety guarantees via a quadratic-program safety filter.
- Achieved 99% success rate and 1% collision rate in simulation.

Representative navigation scenario

MP2-1 (4) 16:00 - 16:15

Nonlinear Ultrasonic Frequency Mixing for Microcrack Detection in Metal Components

Qinxue Pan*, Enze Yan, Cong Liu, Lang Xu, and Guangyuan Zhao
 School of Mechanical Engineering, Beijing Institute of Technology
 Beijing, China

- To address the problem of low detection rate of closed micro-cracks in metals by traditional ultrasonic technology, the nonlinear ultrasonic frequency mixing detection technique was adopted.
- Simulation confirmed that the nonlinear coefficient of the mixed signal was positively correlated with the distance of the micro-crack, and the differential frequency component had higher sensitivity.

Fig. 4 Nonlinear ultrasonic testing system

MP2-1 (5) 16:15 - 16:30

Realization of Tactile Sensing Capable of Simultaneously Capturing Force and Texture

Ryo Akiyama, Nachi Mise, Kyohei Terao, Hidekuni Takao
 Graduate School of Science for Creative Emergence, Kagawa University
 Takamatsu, Japan

- Simultaneously measured force, surface roughness, friction force, hardness, and thermal response.
- Achieved a spatial resolution of approximately 2.0 μm .
- Detected depth-dependent tactile responses through multimodal tactile sensing.

MP2-1 (6) 16:30 - 16:45

Uncertainty-Weighted Optimisation for Model-Based Reinforcement Learning

Ting Qiao, Henry Williams, and Bruce MacDonald
 Centre for Automation and Robotic Engineering Science, The University of Auckland
 Auckland, New Zealand

- Optimised a Model-Based Reinforcement Learning algorithm Dyna-Q.
- Down-weight high-uncertainty synthetic transitions.
- Low-variance transition will dominate even when most transitions are precise.
- Benchmarked with simulations and a dexter manipulation task.
- Moderate level of performance gain.

Immersive Weighting

IEEE ICMA 2026 Conference Digest
MP2-2 Intelligent Mechatronics and Application (V)

Session Chairs: Said Al-Abri, Sultan Qaboos University
Yang Yang, Nanjing University of Information Science and Technology
UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-2 (1) 15:15 - 15:30

Design and Analysis of a Separable Tree-Climbing Robot for Forest Pest Control

Luwen Li, Changhong He, and Lina Song
College of Engineering, Ocean University of China
Qingdao, China

- A separable tree-climbing robot is proposed for close-range forest pest control and continuous multi-tree operation.
- The umbilical supply architecture places heavy components on the ground base, reducing the payload of the climbing unit.
- The adaptive climbing and docking mechanisms enable trunk attachment, diameter adaptation, branch crossing, and reliable recovery.



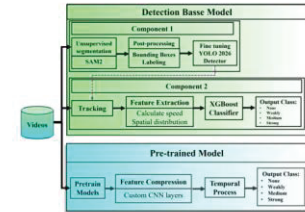
Prototype of the Separable Tree-Climbing Robot

MP2-2 (2) 15:30 - 15:45

Fish Feeding Behavior Classification Using Detection-Based and Pre-trained Models

Sanaz Keshvari¹, Said Al-Abri¹, Hadj Bourdoucen¹, Khalfan Al-Rashdi², and Ali Al-Mabsali²
¹Department of Electrical and Computer Engineering, Sultan Qaboos University, Oman
Directorate General of Fisheries Research, Ministry of Agriculture, Fisheries and Water Resources, Muscat, Oman

- Developed a large-scale underwater video dataset
- Compared detection-based and transfer-learning approaches.
- MobileNetV2 + BiLSTM achieved a 91% F1-score.



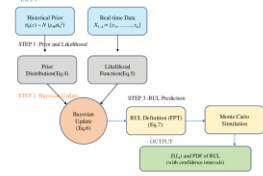
The Overall architecture of the proposed system

MP2-2 (3) 15:45 - 16:00

Accelerated Life Prediction of Antenna Systems via Physics-Informed Bayesian Updating

Pu Jia, Shangci Huang, Changwu Xiong, Yating Yu
School of Mechanical and Electronic Engineering,
University of Electronic Science and Technology of China, Chengdu, 611731, P.R. China

- Small-sample accelerated life prediction under multi-physics loads with right-censored data
- PI-Bayes framework via non-homogeneous Gamma process
- Arrhenius/IPL laws mapped into Gamma shape parameters
- >95% RUL accuracy using only 40% early-stage data
- 60% ADT cycle reduction validated by Weibull reliability



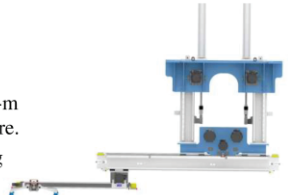
Flowchart of framework

MP2-2 (4) 16:00 - 16:15

Design and Motion Planning of a Speed-Multiplying Transport Robot for Large-Span Material Handling

Zhihao Zhang¹, Tianhao Mi¹, Chuanying Wang², Peng Zhang², Jun Li¹, Kaixuan Chen¹, Tao Sun¹
1. School of Mechanical Engineering, Tianjin University, Tianjin, China
2. State Key Laboratory of Advanced Equipment and Technology for Metal Forming, Jinan, China

- Compact two-stage speed-multiplying robot for large-span stamping transfer.
- Cascaded transmission achieves 8-m coverage within a compact structure.
- IPSO-based time-optimal planning under dynamic constraints.
- 15 strokes/min is achieved over an 8-m transport stroke



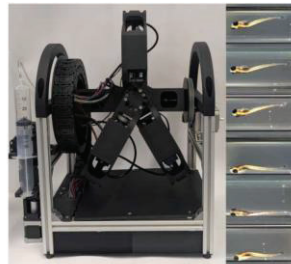
Two-Stage Speed-Multiplying Robot

MP2-2 (5) 16:15 - 16:30

Automated Mechatronic Multi-Camera System for 360° Digitization of Small Specimens

Nathalie Klug¹, Fiona Herrmann¹, Florian Händle¹, Lorenz Wührli¹, Hossein Shirali¹, Markus Kramer¹, Leonard Saur¹, Rudolf Meier², and Christian Pylatiuk¹
¹Institute for Automation and Applied Informatics, Karlsruhe Institute of Technology, Germany
²Institute for Biology, Humboldt University Berlin, Germany

- Three cameras rotate around a specimen inside a fluid-filled glass capillary
- Custom imaging chamber reduces optical distortion
- Automated specimen positioning and imaging reduce digitization time
- User-friendly GUI for system control

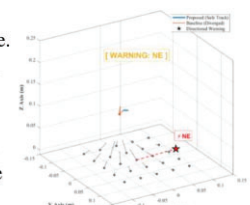


MP2-2 (6) 16:30 - 16:45

A Real-Time Anomaly Detection and Directional Warning Method for Magnetic Surgical Navigation

Miao Zhang¹, Shuxiang Guo^{1,2,3*}, Chunying Li^{2*}, Bin Wang⁴ and Mingchao Ding⁴
1. The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, China
2. Advanced Institute for Ocean Research, Southern University of Science and Technology, Shenzhen, Guangdong, China
3. The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology Beijing Institute of Technology Beijing, China
4. Department of Peripheral Vascular Intervention, Aerospace Center Hospital, School of Life Science, Beijing Institute of Technology

- SVD residual coherence detection, quickly identify magnetic interference.
- The two-dimensional direction alarm based on Residual CoM gives the direction of the interference source.
- Lightweight, closed, sub-millisecond implementation, suitable for real-time surgical navigation.



IEEE ICMA 2026 Conference Digest

MP2-3 Control Theory and Application (II)

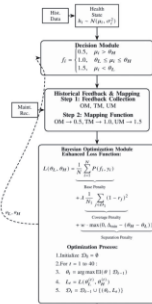
Session Chairs: Haoyu Xie, Southern University of Science and Technology
Jialun Yang, Harbin Engineering University
UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-3 (1) 15:15 - 15:30

Uncertainty-Aware Automated Maintenance Decision-Making for Elevator Mechanic Systems

Zhenkuo Kang, Qicai Zhou, Yao Wang, Jinhai Pan, Xiaoqing Chang, and Jie Chen
School of Mechanical Engineering, Tongji University, Shanghai, China
Shanghai Institute of Special Equipment Inspection and Technical, Shanghai, China

- First uncertainty-aware dual-threshold framework for elevator mechatronic systems.
- Leverages BayFuse-EHA posteriors with historical maintenance records.
- Three-objective Bayesian optimization for threshold calibration.
- 95% CI embedded as safety constraint for boundary control.
- 84.0% accuracy, 0.71 cost index, 0.12 risk index on 100 elevators.

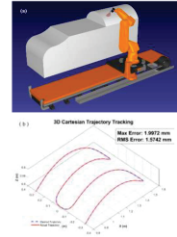


MP2-3 (2) 15:30 - 15:45

Gradient Projection Method for Kinetically Efficient Redundancy Resolution in 7-DOF Spray Painting Systems

Ting Yin, Jianjun Sha, Xianglong Ma, Yifei Zhang, Wenlong Yang and Jianxue Li
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Adaptive damped least-squares with continuous smoothing: Suppresses singular velocity spikes via manipulability-based damping.
- Smooth joint-centering potential: Avoids acceleration jumps and prioritizes low-inertia wrist motions for redundancy.



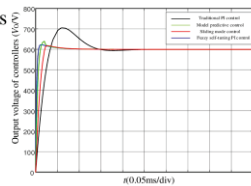
Simulation and spatial trajectory

MP2-3 (3) 15:45 - 16:00

Research on Fuzzy Self-Tuning PI Control Strategy for ISOP Converters

Fanrong Meng, Jialun Yang, Linwei Qu, Lingfei Wang, Qifeng Yan and Shiwei Li
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- ISOP converters for high-voltage high-power use, but traditional PI has slow response and poor robustness.
- A fuzzy self-tuning PI strategy is proposed to adjust parameters based on error and error change rate.
- Simulations show 47% faster response than traditional PI, and better overall performance than MPC and SMC.
- Experiments: 26 ms load step recovery on 180 W platform.



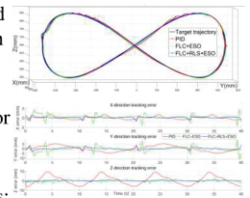
Comparison of output voltage responses

MP2-3 (4) 16:00 - 16:15

Feedback Linearization Control of Hydraulic Cylinder Based on Extended State Observer with Parameter Tracking

Lin Jia, Changzhi Chen, Teng Chen, Xuwen Rong
School of Control Science and Engineering, Shandong University
Jinan, China

- Position-only compound control method for electro-hydraulic servo systems with nonlinearities, time-varying parameters, and unmeasurable states.
- Unified third-order state-space model for linear and rotary actuators, enabling generalized identification and control.
- 5-axis Lissajous trajectory tracking tests: joint RMSE < 0.6 (min 0.08); end-effector mean error 0.901 mm.



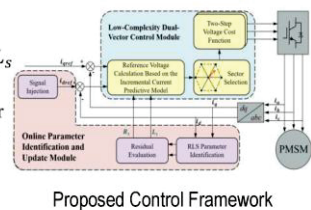
Lissajous Trajectory Tracking Results

MP2-3 (5) 16:15 - 16:30

Low-Complexity Dual-Vector Incremental Predictive Current Control for PMSM with Online Parameter Identification

Yukang Heng, Zihong Yang, Yifei Wu
School of Automation, Nanjing University of Science and Technology
Nanjing, China

- Incremental dual-vector MPCC for PMSM
- d-axis injection-based RLS R_s/L_s identification
- Reference-voltage-guided vector screening and dual-time-domain voltage cost
- Lower THD, ripple, error, and computation time



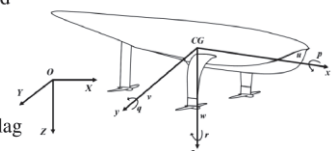
Proposed Control Framework

MP2-3 (6) 16:30 - 16:45

Linear Quadratic Integral Control for Longitudinal Stability of a Fully Submerged Hydrofoil Craft

Liyang Zhang, Wei Wu, Taiping Yang, and Sisi Liu
Beijing Institute of Technology, China

- Normalized DLQI is developed for heave-pitch stabilization under wave disturbances.
- ZOH-based discrete design matches sampled-data implementation with actuator lag and saturation.
- Simulations under limited actuator bandwidth show lower RMS and peak heave-pitch errors.



Heave-Pitch Control Model

MP2-4 Modeling, Simulation Techniques and Methodologies (II)

Session Chairs: Dongcui Wang, Tongji University

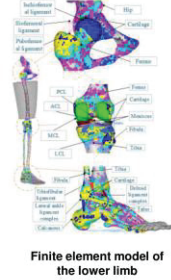
Jiaming Jia, Harbin Engineering University

UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-4 (1) 15:15 - 15:30

Finite Element Analysis of Femoral Impact Responses in Car-to-Pedestrian Collisions for Young and Elderly PopulationsKun Liu, Feng Hu, Xiaodong Huang, Zhaowei Huang and Qingcheng Hu
College of Intelligent Manufacturing and Energy Engineering,
Zhejiang University of Science and Technology, China

- Built young & elderly lower limb FE models from CT data (50th percentile Chinese males).
- Assigned 150 graded bone materials by Hounsfield units; ligaments as springs/shells.
- Validated under quasi-static/dynamic 3-point bending and lateral knee impact against cadavers.
- Elderly model peak femoral stress $\approx 62\%$ – 70% of young model $\rightarrow$ age degradation matters.



MP2-4 (2) 15:30 - 15:45

Application of Sensorless Control with Functional Safety Consideration in New Energy VehiclesDongcui Wang¹, Yuan Zhu¹, and Yuhang Cui²¹School of Automotive Studies, Tongji University, Shanghai, China²Innovation Research and Development Institute, SAIC Motor, Shanghai, China

- Sensorless technology innovates motor sensing system.
- Existing schemes only serve as fault backup.
- Construct segmented control structure for different speeds.
- Add torque safety mechanism to improve precision and safety.

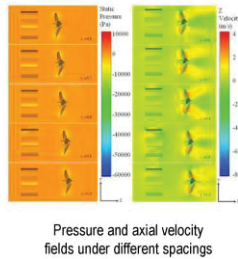


Functional Safety decomposition

MP2-4 (3) 15:45 - 16:00

Hydrodynamic Study of a Coaxial Propulsion System with a Cycloidal-Helical Twin-Screw ConfigurationJiaying Wang, Han Yan, Yuyao Li, Zhixin Xu, Dan Xia*
School of Mechanical Engineering, Southeast University
Nanjing, Jiangsu, China

- Axial performance varies non-monotonically with spacing; 0.8D is the optimal spacing.
- At 0.8D, mean axial thrust reaches 11.279 N, 42.83% higher than the single propeller.
- The axial gain mainly comes from upstream cycloidal-propeller modulation of the downstream inflow, rather than direct axial thrust from the cycloidal propeller.
- Side-force analysis shows that 0.8D also gives the maximum lateral force of 2.792 N and lateral moment of 0.103 N·m, indicating side-thrust and attitude-control potential.



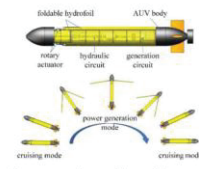
MP2-4 (4) 16:00 - 16:15

Modeling and Simulation of a Fixed-Body AUV-Integrated Hydraulic PTO Wave-Energy Harvester With Generator Load Matching

Jiaming Jia, Yong Zhan, Jianan Xu

College of Mechanical & Electrical Engineering, Harbin Engineering University
Harbin, China

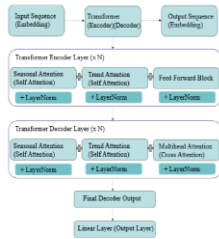
- investigates an integrated hydraulic power take-off (PTO) wave energy generation device equipped with bilateral foldable hydrofoils.
- A coupled hydrodynamic-hydraulic-electrical model is established under the assumption of a fixed main body.



MP2-4 (5) 16:15 - 16:30

Research on the TSM-Transformer Algorithm for Network Traffic ForecastYuanxin Gao, Shuaxuan Feng, Jianping Wu, Lei Liu, Ran Guan, Chuhan He, Jianwei Guo
Beijing Academy of Science and Technology,
Beijing, China

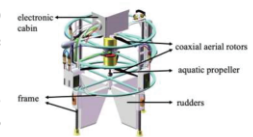
- Problem: Traditional models miss nonlinear long-term traffic patterns.
- Method: TSM-Transformer adds Trend and Seasonal Attention.
- Innovation: Enhanced encoder-decoder fusion enables adaptive feature weighting for better forecasting.
- Results: MAE = 1.2×10^{-3} , RMSE = 2.9×10^{-3} , and $R^2 = 92.1\%$, outperforming ARIMA, GRU, and SVM.
- Conclusion: Supports intelligent and long-term network management.



MP2-4 (6) 16:30 - 16:45

Hydrodynamic Analysis of Coaxial Counter-Rotating Hybrid Aerial Underwater Vehicle in Underwater CruisingQirong Lei, Chunying Li*, Le Huang, Siying Pu, Shuaxin Peng, Pengcheng Li, Shuxiang Guo*
The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, China

- Simulating the 3D flow field under a fixed-rotor condition using CFD based on RANS equations and the SST $k-\omega$ turbulence model.
- Based on the simulation results, simulated drag force increases quadratically and drag coefficient stabilizes at 1.599 with fluctuation of 2.8% in different tested speeds.



The prototype model of the investigated HAUV.

IEEE ICMA 2026 Conference Digest
MP2-5 Robot Navigation and Control Algorithm (II)

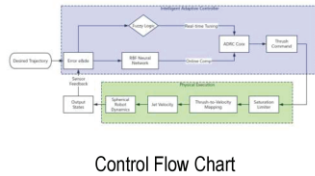
Session Chairs: Peng Fei Wang, Changchun University of Science and Technology
 Yan Gao, Harbin Engineering University
UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-5 (1) 15:15 - 15:30

PSO-Optimized Fuzzy Adaptive RBF-ADRC Control for Amphibious Spherical Robots

Pengfei Wang¹, Lijin Deng^{1*}, Liang Zheng², Fucui Zhao³, Yuke Ma³
 College of Artificial Intelligence, Changchun University of Science and Technology, China

- A PSO-optimized fuzzy adaptive RBF-ADRC is proposed for amphibious spherical robot motion control.
- It combines ADRC disturbance rejection, fuzzy tuning, RBF approximation and PSO optimization.
- Robot model is established; parameters are optimized offline and adjusted online.
- It outperforms PID/ADRC with smoother transients, smaller oscillation and better tracking.

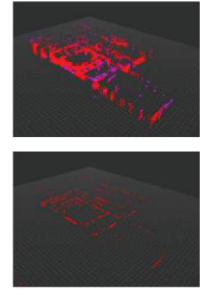


MP2-5 (2) 15:30 - 15:45

Real-Time lidar-IMU Odometry for Wheeled Robots via 3D-to-2D Feature Projection

Weiyang Xu, Fang Jia, Wei Wei, Xinyi Li, Jiaqi Cai
 School of Mechanical Engineering Southeast University, Nanjing Omark Robotics Co. Ltd.

- Balancing the Robustness of 3D LiDAR SLAM with the Efficiency of 2D LiDAR SLAM.
- Second ordered difference feature extraction.
- Feature projection into a featured 2D point cloud.
- Test on AGV
- Both high efficiency and high robustness achieved, both indoor and outdoor environments



MP2-5 (3) 15:45 - 16:00

Implementing Autonomous Rover Control Using NASA F Prime Framework and YOLO-Based Real-Time Object Detection

Nainika Saha, Shahnam Mirzaei
 Department of Electrical and Computer Engineering, California, USA

- Development and implementation of an autonomous rover control system utilizing NASA F Prime software integrated with machine learning (ML) models
- Two on-device object detectors are evaluated
 - The baseline YOLOv11n convolutional network
 - A newly integrated MediaPipe lightweight neural network pipeline.



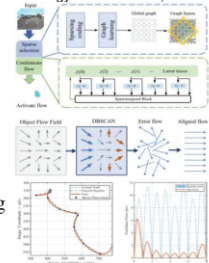
Comprehensive hardware of PiCar-X chassis and parts

MP2-5 (4) 16:00 - 16:15

Asynchronous Visual-Inertial Motion Parsing via Sparse Differential Dynamics for Agile Mobile Platform

Xin Zhao, Peng Peng, Yonghao Lai, Jialiang Jin, Anhu Li, Qigang Wang
 School of Mechanical Engineering, Tongji University

- Addresses asynchronous visual-inertial motion parsing under dominant ego-motion interference.
- NCDE continuously aligns visual features with high-rate IMU controls, robust to jitter and frame loss.
- Sparse graph activation preserves informative motion topology while reducing dense-flow computation.
- Rigidity-constrained parsing separates ego-motion from independent object dynamics.

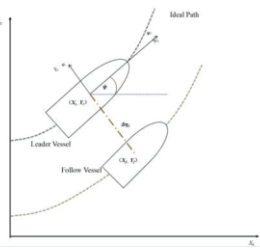


MP2-5 (5) 16:15 - 16:30

FTDO and CISMIC based Dual-vessels Robust Cooperative Path Tracking Control for Deep-sea Mining Operations

Qiushuang Xu, Xiaoyue Zhang*, Zaytsev Valeriy, Zheda Ren, Hui Wang
 The College of Intelligent Systems Science and Engineering
 Harbin Engineering University

- A leader-follower cooperative framework is established considering functional differences between mining and transport vessels to simplify coordination tasks.
- The leader mining vessel adopts PID control for path tracking, while the follower generates expected motion commands based on leader states.
- A finite-time disturbance observer is designed to estimate marine disturbances.
- Constrained integral sliding mode control is applied to achieve tracking control with finite-time error stability under strong disturbances.

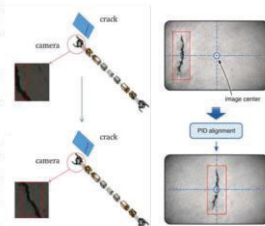


MP2-5 (6) 16:30 - 16:45

PID-Based Visual Servo Alignment for Crack Detection in Pipe Inspection Robots

Yujie Shi, Masato Mizukami, Naohiko Hanajima and Yoshinori Fujihira
 Division of Engineering, Muroran Institute of Technology, Muroran, 27-1 Mizumoto, Muroran 050-8585, Hokkaido, Japan; 24096506@muroran-it.ac.jp

- Small-diameter pipelines limit the camera field of view, making detected cracks difficult to observe clearly.
- A YOLOv5s detector is used to identify the crack region and calculate the image-plane alignment error.
- The alignment error is filtered and converted into actuator input through pixel-to-motor mapping. A PID-based closed-loop controller adjusts the local camera mechanism to move the crack toward the image center.



MP2-6 Medical, Biomedical and Rehabilitation Systems (II)

Session Chairs: Xinming Li, Guangzhou Maritime University
Anyuan Zhang, Changchun University of Science and Technology
UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-6 (1) 15:15 - 15:30

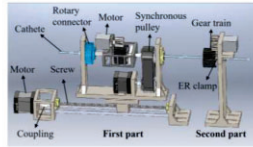
Design and Control of Single-Instrument Master-Slave System for Vascular Interventional Surgery

Xinming Li¹, Ruiwei Liu^{1*}, Haoyu Yang¹, Bingqing Zhu¹, Yixin Dai¹, Kaicheng Zhu¹,
Huiling Huang¹, Yucong Luo¹, Shuxiang Guo²,

¹The School of Intelligent Manufacturing, Guangzhou Maritime University, China

²The Department of Electric and Electrical Engineering, SUSTech, China

- A footprint-reduced and economical robotic platform was designed in this work.
- The overall mass is kept under 6 kg within a pretty compact size envelope by pairing ABS with aluminum alloys.



The designed Single-Instrument System

MP2-6 (2) 15:30 - 15:45

Design and Evaluation of A Hybrid-Actuated Floating-Based Upper-Limb Rehabilitation Robot

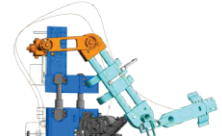
Hanze Wang¹, Pengcheng Li^{1*}, Jun Leng¹, Chunying Li^{1,3}, Mingchao Ding², Bing Wang², Shuxiang Guo^{1,2,3*}

1. Department of Electronic and Electrical, Southern University of Science and Technology, Shenzhen, 518055, China

2. The Aerospace Center Hospital, School of Life Science, and the Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China

3. The Advanced Institute for Ocean Research, Southern University of Science and Technology, Shenzhen 518055, China

- Propose a hybrid-actuated upper-limb rehabilitation robot.
- Design an integrated motor-driven serial-support chain module.
- Verify the feasibility through simulation.



Upper-Limb Rehabilitation Robot

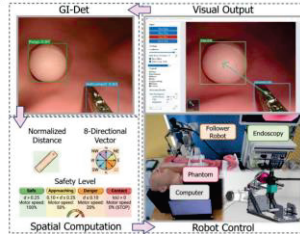
MP2-6 (3) 15:45 - 16:00

GI-Det: Joint Polyp-Instrument Detection and Motion Guidance for Endoscopic System

Tianjun Yang, Guang Feng, Siyang Zuo*

Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education,
Tianjin University, Tianjin, China

- A unified framework for joint polyp-instrument detection with real-time motion guidance for endoscopic manipulation.
- DSConvUp and GateAtt, two encoder blocks that improve detection accuracy with less than 3% parameter overhead.
- A motion guidance algorithm that produces normalized distance, directional vectors, and safety classification from bounding boxes.
- A high-fidelity upper gastrointestinal (UGI) phantom dataset for hardware validation of endoscopic detection and control.



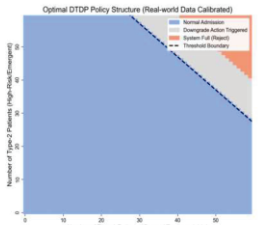
MP2-6 (4) 16:00 - 16:15

Data-Driven Automated Admission Control for Hospital Bed Allocation: A Dynamic Threshold Policy

Beibei Yuan, Qiang Su

Dept. of Industrial Engineering and Management, Tongji University
Shanghai, China

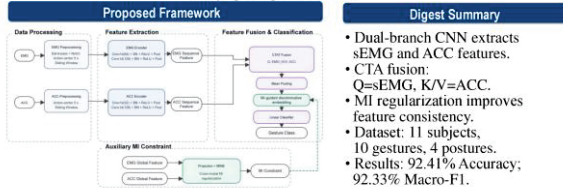
- Proposed an MDP-based Dynamic Threshold Downgrading Policy (DTDP) calibrated with real-world CDC NHAMCS data.
- The optimal policy features a strict monotonic switching curve to eliminate human triage biases.
- DTDP reduces total penalty costs by 42.4% and eliminates 87.5% of catastrophic high-risk rejections compared to FCFS.



MP2-6 (5) 16:15 - 16:30

A Multimodal Gesture Recognition Framework Using sEMG and ACC Signals with Cross-Temporal Attention and Mutual Information Regularization

Haowen Zheng, Yan Wu, Anyuan Zhang
Department of Computer Science and Technology, Changchun University of Science and Technology
Chaoyang, Changchun, Jilin, China

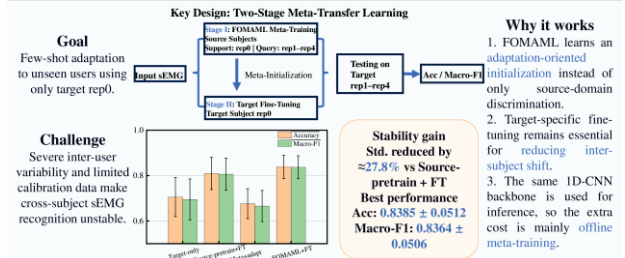


- Digest Summary**
- Dual-branch CNN extracts sEMG and ACC features.
 - CTA fusion: $Q=sEMG, K/V=ACC$.
 - MI regularization improves feature consistency.
 - Dataset: 11 subjects, 10 gestures, 4 postures.
 - Results: 92.41% Accuracy; 92.33% Macro-F1.

MP2-6 (6) 16:30 - 16:45

A Two-Stage Meta-Transfer Learning Framework for Cross-Subject sEMG Gesture Recognition

Ying He, Qi Li, Anyuan Zhang* Changchun University of Science and Technology Jilin China



IEEE ICMA 2026 Conference Digest
MP2-7 Vision System, Robotic Vision (II)

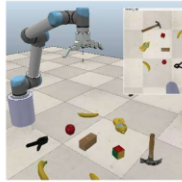
Session Chairs: Yining Shang, Beijing Institute of Technology
 Zhigang Yang, Harbin Engineering University
UTC+8(Beijing Time): 15:15 - 16:45, Monday, 3 August 2026

MP2-7 (1) 15:15 - 15:30

Research on Object Servo Grasping for Robotic Arms Based on IBVS-SAC

Shenglun Xu, Lingtao Yu*, Yuansong He
 College of Mechanical and Electrical Engineering, Harbin Engineering University
 Harbin, Heilongjiang Province, China

- A robotic arm object grasping method based on visual servoing and reinforcement learning.
- Utilizes image color and depth information along with convolutional neural networks to achieve precise prediction of the target object category and grasping pose for the robotic arm.
- Reinforcement learning is employed to train the robotic arm to autonomously make decisions for stable grasping of the target object.



Simulation environment acquisition experiment

MP2-7 (2) 15:30 - 15:45

UFE-DETR: Small Object Detection Model for Complex Underwater Environment

Fengxu Guan, Zhigang Yang, Jiaqi Zhu, Xilong Yu, Yuzhu Zhang
 College of Intelligent Systems and Engineering, Harbin Engineering University
 Harbin, China

- Proposes UFE-DETR to enhance detection of small targets in complex underwater environments.
- Introduces MDAFM module to boost the backbone's ability to extract multi-scale detail features.
- Integrates HiLo attention mechanism to improve identification of small objects.
- Designs SFEM to strengthen interaction and fusion between shallow-level details and high-level semantics.
- Achieves 3.6% improvement in mAP@75.



UFE-DETR structure diagram

MP2-7 (3) 15:45 - 16:00

Enhancing Computer Vision Model Generalization in Warehouse Facilities

Ruiliang Liu, Tina Dongxu Li, Joshua Migdal, Ken Meszaros, Trevor Dardik
 Amazon, USA

- Traditional CV deployment requires repetitive data collection, annotation, and retraining at each warehouse, which is resource-intensive.
- We train solely in a laboratory for fork anomaly detection, using optimal camera placement, strategic triggering, model selection, and ensemble to generalize across facilities.
- This eliminates on-site annotation and retraining, reducing deployment to just camera mounting and inference.



Lab Fork Annotation

MP2-7 (4) 16:00 - 16:15

CardiffNav: A GNSS-centric Multisensory Dataset for Robust Localisation in Diverse and Challenging Environments

Shun Liu, Yixin Chen, Rhys Pullin, Zekun Ning, Raphael Grech, and Ze Ji
 School of Engineering, Cardiff University, UK
 College of Mechanical and Electrical Engineering, Hohai University, China

- **Advanced Sensors:** 128-channel LiDAR, vision suite (RGB/stereo/event), and <5cm RTK ground truth.
- **Measurement-Level GNSS:** Synchronized multi-constellation phase observables and raw IF signals.
- **Continuous Trajectories:** Captures seamless transitions across open-sky, urban canyons, and tunnels.



Scene Overview

MP2-7 (5) 16:15 - 16:30

YOLOv8n-CWE: An Improved Object Detection Method for Elderly Homecare Service Robots

Siyu Chen, Yuhang Wang, Yue Ma, Bin Li*, Hongyuan Liu and Jiaqi Zhu
 Tianjin Key Laboratory for Advanced Mechatronic System Design and Intelligent Control,
 School of Mechanical Engineering, Tianjin University of Technology, Tianjin 300384, China

- Mitigates YOLOv8n degradation amid complex home variables (scale, clutter, occlusion, lighting).
- Integrates CA and proposes WCA-BiFPN for adaptive multi-scale feature fusion.
- Adopts EIoU loss to refine bounding box regression for occluded objects.
- Achieves 69.80% mAP@50(+4.64%) at 35.5 FPS, outperforming peer detectors.



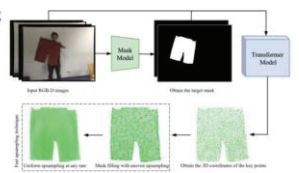
Structure of the proposed YOLOv8n-CWE model

MP2-7 (6) 16:30 - 16:45

Real-time Dense 3D Reconstruction of Non-rigid Objects for Robotic Manipulation: A Mask-constrained Two-stage Fast Upsampling Framework from a Single RGB-D Stream

Zhiqi Cai, Xiaofei Liu, Shuohan Li, Xing Li, and Wanfeng Shang
 School of Artificial Intelligence, Shenzhen University
 Shenzhen, China

- A mask-constrained two-stage upsampling pipeline: graph-based non-uniform hole-filling plus arbitrary-scale uniform resampling; simple, fast, and resistant to background artifacts.
- A lightweight Transformer to predict 3D keypoints aligned with depth.
- Robust reconstruction under fast motion/topology change and consumer depth holes/noise; suitable for deformable manipulation.



Overview of the 3D reconstruction algorithm

IEEE ICMA 2026 Conference Digest
MP3-1 Intelligent Mechatronics and Application (III)

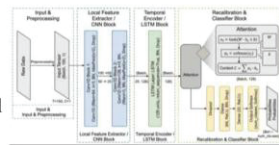
Session Chairs: Shuguang Zuo, Tongji University
 Yang Li, Harbin Engineering University
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-1 (1) 17:00 - 17:15

Fault Detection in Unbalanced Data of Brushed DC Motor Worm and Helical Gears for Automotive Applications Based on CNN-LSTM-Attention

Shuguang Zuo*, Ye Cui, Yuhao Zhang
 College of Automotive and Energy Tongji University
 Shanghai, China

- Built a test bench and collected multi-state gear fault data for automotive brushed DC motors.
- Sampling-point segmentation of raw signals to expand effective fault samples and enrich temporal features.
- CNN-LSTM-Attention architecture designed for high-precision fault detection, validated on the imbalanced dataset.



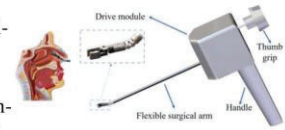
CNN-LSTM-ATT Model
Architecture

MP3-1 (2) 17:15 - 17:30

Design and Implementation of a Handheld Multi-Joint Surgical Instrument based on U-joint Transmission

Haiyuan Li¹, Xiaoyu Shen¹, Mingyang Leng¹, Tao Li²
 1. School of Intelligent Engineering and Automation,
 Beijing University of Posts and Telecommunications, Beijing, China
 2. Department of Otolaryngology-Head and Neck Surgery,
 Peking University Third Hospital, Beijing, China

- Development of a Handheld Multi-Joint Continuum Device for Transnasal Hemostasis
- Design of a U-Joint-Based Tendon-Driven Mechanism for Simplified Robotic Control



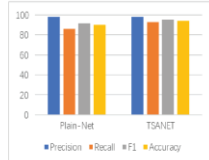
A Handheld Multi-Joint
Surgical Instrument

MP3-1 (3) 17:30 - 17:45

Spatio-Temporal Tube Self-Attention Mechanism for Quality Assessment of Skiing Actions

Xiaodan Cong¹, Ming Yang², Lianwu Guan², and Changjiang Song¹
 1. Institute of Intelligent Manufacturing, Heilongjiang Academy of Sciences, Harbin, China
 2. College of Intelligent Systems Science and Engineering, Harbin Engineering University, Harbin, China

- A lightweight OpenPose improved by CSP-Darknet53, to reduce the number of parameters and computational cost while maintaining keypoint detection accuracy.
- A tube self-attention network adopts SiamMask to generate spatio-temporal tube regions and performs sparse self-attention feature aggregation, improved the evaluation accuracy.
- A outdoor skiing action dataset, fusing pose and spatio-temporal features for multimodal scoring, provides a technical solution for intelligent skiing training.



Comparison of
evaluation accuracy by
different networks

MP3-1 (4) 17:45 - 18:00

Design and Simulation-Based Flight Validation of a Synchronous Morphing Quadrotor

JunYu Zhou, Chunying Li, Pengcheng Li, and Shuxiang Guo
 The Department of Electronic and Electrical Engineering, Southern University of Science and Technology
 Shenzhen, China

- Single-Actuator Design: A synchronous gear mechanism drives all 4 arms, minimizing weight and complexity.
- 28% Size Reduction: Dynamically shrinks from 280mm to 202mm to navigate confined spaces.
- Zero CoM Shift: Strict mechanical symmetry ensures absolute balance during mid-air transformations.
- Robust Control: PX4 framework handles time-varying inertia, surviving 5.0 Nm extreme pulse disturbances.



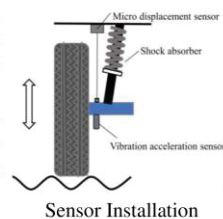
Morphing Quadrotor

MP3-1 (5) 18:00 - 18:15

Typical Road Condition Recognition Using Machine Learning and Vehicle Dynamic Response for Intelligent Driving

Yipan Cheng, Guang He, Junyu Han, De Cai, Zhenhai Zhang
 School of Mechatronical Engineering, Beijing Institute of Technology
 Beijing, China

- This paper proposes a road condition recognition method using vehicle dynamic responses and machine learning.
- The results are analyzed with detailed comparisons of 8 traditional machine learning models and 1 deep learning model



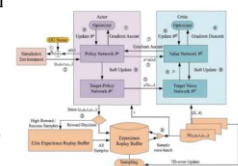
Sensor Installation

MP3-1 (6) 18:15 - 18:30

Research on MADDPG-Driven Collision-Free Encirclement Strategy for Multi-Underwater-Agent Systems in Unknown Environments

Juan Li, Yang Li, and Honghan Zhang
 Intelligent Science and Engineering, Harbin Engineering University
 Harbin, China

- Focus on collision-free encirclement of multi-underwater-agents in unknown environments.
- Improve MADDPG with elite replay for sparse-reward convergence.
- Propose adaptive formation strategy to avoid obstacle conflicts.
- Simulations verify better performance than baseline algorithms.



EP-MADDPG network
structure diagram

MP3-2 Intelligent Mechatronics and Application (VI)

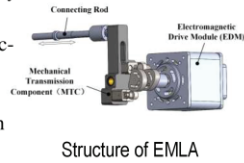
Session Chairs: Eryong Zhang, Harbin Engineering University
Hanze Wang, Southern University of Science and Technology
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-2 (1) 17:00 - 17:15

Development and control experiments of low-impact high-frequency variable-stroke reciprocating linear actuator

Eryong Zhang, Yong Lu, Fengshuo He, Lixian Miao, Binlong Li and Xiaoliang Hui
College of Power and Energy Engineering, Harbin Engineering University
Harbin, China

- High-frequency linear actuators are key components in industrial equipment.
- A linear actuator with electromagnetic-mechanical coupling is designed and developed.
- This actuator feature low impact, high operating frequency, and high positioning accuracy.



MP3-2 (2) 17:15 - 17:30

A Real-Time-Constrained Evaluation Framework for Path Planning in Conveyor-Side Robotic Sorting under RT-Thread Systems

Yi Yuan, Qi Xin, Lianghua Yun, Jiawen Han
School of Mechanical Electronic and Control Engineering, Beijing Jiaotong University
Beijing, China

- Proposed a real-time evaluation framework for conveyor-side robotic sorting.
- Compared A*, RRT and RRT* under RT-Thread timing constraints.
- Results show RRT achieves the best deadline satisfaction and runtime stability.



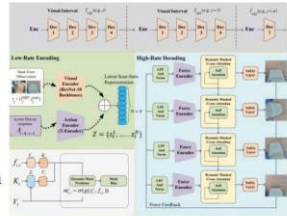
Conveyor-Side Robotic Sorting Scenario

MP3-2 (3) 17:30 - 17:45

The Force-Guided Contact-Aware Imitation Learning for Robotic Ultrasound Scanning on ICMA 2026

Xiaobao Ni, Leren Xue, ..., and Jiyong Tan
Shenzhen Institute for Advanced Study, Shenzhen, China
College of Software Henan Normal University, Xinxiang, China

We propose an asynchronous multi-rate imitation learning framework that explicitly separates low-ratescan-state encoding from high-rate force-guided local refinement, achieving superior contact stability and image consistency in continuous robotic ultrasound scanning compared to single-rate baselines.



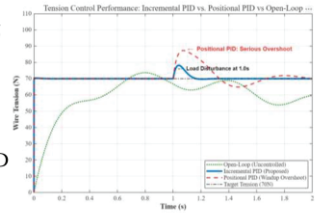
Overview of the proposed method

MP3-2 (4) 17:45 - 18:00

Digitally Integrated Modular DWS-WEDM Compound Wire-Cutting System with Active Tension Control

Hongyu Chen, Shaozhe Guo, and Yueqiang Li
Dundee International Institute, Central South University
Changsha, China

- Integrated DWS and WEDM into one modular wire-cutting platform.
- Reduced reclamping errors using a shared wire-path and rotary fixture.
- Developed an incremental PID controller for active tension regulation.
- Rejected a 10 N disturbance within about 100 ms.



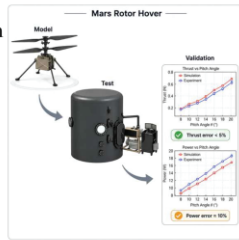
Tension Disturbance Rejection Performance

MP3-2 (5) 18:00 - 18:15

Hover Performance Modeling and Experimental Validation of a Single Rotor for Mars Helicopter

Bo Huang, Pengyue Zhao, Liang Qiao, Shuhan Peng, and Zongquan Deng
State Key Laboratory of Robotics and System, Harbin Institute of Technology
Harbin, China

- A corrected blade-element/momentum model was established to predict single-rotor hover performance under Martian atmospheric conditions.
- Hover experiments were conducted in a low-density CO₂ chamber using a seesaw-type test rig.
- The model showed good agreement with experiments: thrust error below 5% and power error about 10%.



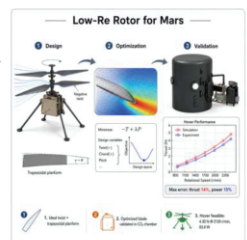
Hover Test and Validation

MP3-2 (6) 18:15 - 18:30

Aerodynamic Design and Performance of a Low-Reynolds-Number Rotor for Mars Helicopters

Lukai Wang, Bo Huang, Liang Qiao, Shuhan Peng, Pengyue Zhao, Zongquan Deng
State Key Laboratory of Robotics and System, Harbin Institute of Technology
Harbin, China

- A theoretical method was developed for the twist and trapezoidal planform of a low-Re Mars rotor.
- The CFD simulations were used to optimize blade geometry under Martian atmospheric conditions.
- The CO₂ chamber hover tests were conducted to validate the optimized rotor performance.
- The rotor achieved hover feasibility at 4.30 N, 2130 r/min, and 83.8 W.



Low-Re Rotor for Mars

IEEE ICMA 2026 Conference Digest
MP3-3 Control Theory and Application (III)

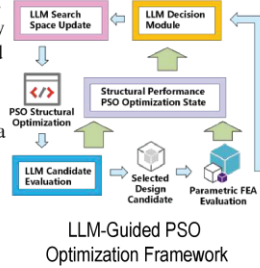
Session Chairs: Kamal Mohamed El Sadeek, The American University in Cairo
 Jozef Ritonja, University of Maribor
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-3 (1) 17:00 - 17:15

LLM-Assisted PSO for Structural Lightweight Optimization of Robotic Manipulators

Jingyun Shi, Jianping Dou*, Zhanghao Ni, and Zhuotao Feng
 School of Mechanical Engineering, Southeast University
 Nanjing, China

- An LLM-assisted PSO framework is proposed, where the LLM adaptively adjusts design variable bounds based on PSO and FEA feedback.
- On the 10-bar truss benchmark, LLM-PSO reached 5060.96 lb with a standard deviation of 8.44, and competes with recent PSO methods.
- For the 6-DOF manipulator, it achieved mass reductions of 8.05% (total) and 68.15% (variable).

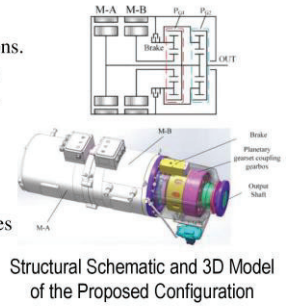


MP3-3 (2) 17:15 - 17:30

A systematic optimal design approach of dual-motor coupling drive system

Haodong Wan, Wei Wu*, and Shihua Yuan
 School of Mechanical Engineering, Beijing Institute of Technology, Beijing, China

- A D-matrix framework generates and screens DMCDs configurations.
- Circulating-power configurations are eliminated by screening rules.
- AHP-weighted PSO is used for multi-objective parameter optimization.
- Ten feasible configurations are obtained, and promising candidates are identified.

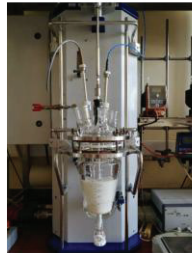


MP3-3 (3) 17:30 - 17:45

Adaptive Control of Batch Fermentation Processes Using MRAC-Based Approach

Jožef Ritonja
 Faculty of Electrical Engineering and Computer Science, University of Maribor
 Maribor, Slovenia

- Batch fermentation is a nonlinear and time-varying process.
- Conventional control is often insufficient under uncertainties.
- Closed-loop regulation via bioreactor temperature is applied.
- MRAC-ASPR-based adaptive control is implemented.
- CO₂ concentration successfully tracks reference trajectory
- Robust performance under model uncertainty was achieved.



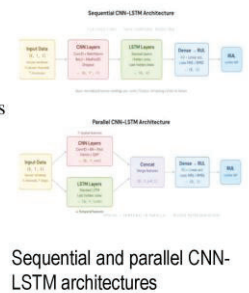
Batch Bioreactor

MP3-3 (4) 17:45 - 18:00

Predictive Maintenance: A Bayesian Optimization Approach for Hybrid CNN-LSTM Models

Maki K. Habib and Kamal Mohamed
 Dept. of Mechanical Engineering, The American University in Cairo, Egypt

- Bayesian is applied to tune both sequential and parallel CNN-LSTM architectures on the N-CMAPSS DS05 dataset.
- The optimized parallel model achieves RMSE = 6.79, outperforming the sequential model at RMSE = 7.57, with both showing substantial gains over their manual baselines.
- Architectural design determines how well Bayesian optimization exploits temporal information.



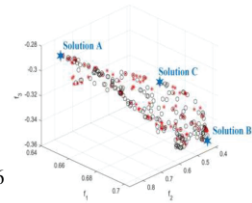
Sequential and parallel CNN-LSTM architectures

MP3-3 (5) 18:00 - 18:15

A Three-Objective Optimization for Fuel Cell-Metal Hydride System Cold Start Using MOPSO Algorithm

Fengxiang Chen¹, Hao Zhang and Yuansheng Li
 College of Automotive and Energy Engineering, Tongji University;
 SAIC General Power Technology (Shanghai) Co., Ltd.
 Shanghai, China

- A Kriging-assisted MOPSO framework is proposed to optimize FC-MH system cold start at -5 °C.
- A dynamic thermo-fluid model with fuzzy control ensures stable 60 °C temperature tracking.
- The 3D Pareto front reveals trade-offs: time-optimal hydrogen desorption in 656 s, or energy-efficient 0.415 kWh consumption.
- The research guides thermal management for distributed hydrogen storage.



Pareto front with representative optimal solutions

MP3-3 (6) 18:15 - 18:30

Design of the Wrist Rehabilitation Control System Based on a Parallel Exoskeleton

Ruijie He¹, Shuxiang Guo^{2*}, He Li³, Qian Tang¹, Bin Wang¹, Mingchao Ding²
¹ The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergent Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China
² The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong 518055, China
³ The Department of Peripheral Vascular Intervention, Aerospace Center Hospital, School of Life Science, Beijing Institute of Technology, Beijing 100081, China
 * Corresponding author: guoshuxiang@bit.edu.cn

- In order to resolve axis misalignment of serial wrist rehabilitation exoskeletons and inconsistent adaption to stroke patients' staged rehabilitation needs, this paper develops a 3-DOF household parallel wrist rehabilitation system based on 6-UCU Stewart platform with active and passive training modes.
- Passive training uses predefined trajectories whereas active training adopts bilateral rehabilitation.
- Measured indices prove favorable control accuracy: passive motion averages MAE=6.481°, RMSE=7.624°, R²=0.924; active motion averages MAE=1.162°, RMSE=1.248°, R²=0.990. Uniform error distribution confirms system reliability and clinical feasibility.

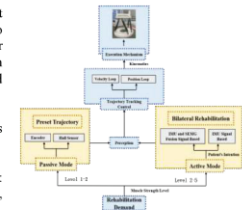


Fig.1 Overall Design Scheme

MP3-4 Modeling, Simulation Techniques and Methodologies (III)

Session Chairs: Qirong Lei, Southern University of Science and Technology

Mingyu Fu, Harbin Engineering University

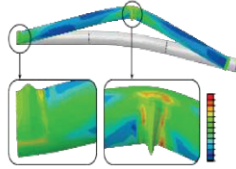
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-4 (1) 17:00 - 17:15

Investigation on Buckling Failure of Natural Gas Pipeline with Internal Pressure

Hao Zhang, Fuyang Wu, Xiaofei Chen and Zhibo Guo
College of Pipeline and Civil Engineering, China University of Petroleum (East China)

- The wrinkles induced by vertical loads are distributed at the opposite positions of the section. These two kinds of loads are excluded as the reasons for pipe buckling.
- Axial compressive loads can result in two pipe bucklings, with the wrinkle locations and heights consistent with the practical case. The geometrically nonlinear response of the structure shows a typical buckling feature.



Pipeline Buckling by External Axial Loads

MP3-4 (2) 17:15 - 17:30

Design, Numerical Simulation, and Full-Scale Testing of a Multi-Stage Flexible Bridge Anti-Collision Device

Haojian An, Feiyang Wang, Yan Zhang*
School of Mechanical Engineering, Southeast University
Nanjing, China

- A flexible anti-collision device integrating a double-parallel mechanism and multi-stage aluminum tubes.
- Converts asymmetric, off-center impacts into a coordinated global response.
- Progressive collapse of the aluminum tubes absorbs 85%-90% of vehicle kinetic energy.
- Dynamic response confirmed via LS-DYNA simulations and 30-60 km/h full-scale crash tests.
- Modular design prevents direct bridge damage and enables rapid component replacement.



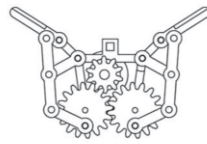
Application scenario of the proposed bridge protection system

MP3-4 (3) 17:30 - 17:45

Design and Kinematic Simulation of a Butterfly-Inspired Flapping-Wing System Driven by a Single-Motor Multi-Linkage Mechanism

Yuansheng Rao, Zhongtian Zhang, Bing Li, Yong Wang, Wanbo Ren, and Qianyu Chen
Chongqing Jiaotong University, Chongqing, China;

- Single motor drives dual symmetric flapping outputs.
- Stephenson III six-bar converts rotation to wing oscillation.
- Snapback kinematics: fast upstroke and slow downstroke.
- ADAMS verifies smooth velocity, acceleration, and trajectory.
- Beat ratio ≈ 1.57 ; angle range $+62^\circ$ to -57° .



Single-motor multi-linkage mechanism and kinematic model

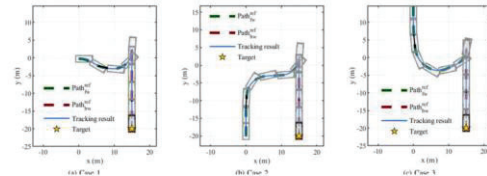
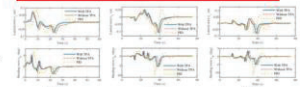
MP3-4 (4) 17:45 - 18:00

Precise Docking of Articulated Vehicles Using a Virtual Corridor and Model Predictive Control

Yunfei Zhang¹, Zongxuan Li¹, Qiaobin Liu², Hongjing Chu^{1,*}, Bingzhao Gao¹ | College of Automotive and Energy Engineering, Tongji University, Shanghai, China | School of Mechanical & Automotive Engineering, South China University of Technology, Guangzhou, China

- Precise docking requires stricter terminal accuracy than general reverse parking.
- Hybrid A* with a virtual docking corridor generates docking-compatible paths.
- Terminal point attraction improves the final stopping accuracy.

$$J = \sum_{k=0}^{N_p-1} (e_k^T Q e_k + u_k^T R u_k + p e^2) + e_{N_p}^T P e_{N_p} + \xi_{N_p}^T P \xi_{N_p}$$



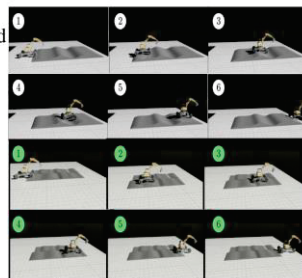
MP3-4 (5) 18:00 - 18:15

Research on All-Terrain Adaptive Active Control of a Specialized Wheel-Legged Chassis

Hongyan Zhang¹, Xinyan Gao¹, Peng Yang¹, Yuhang Zheng¹, Haodong Zhu¹, Tao Ni², Lingtao Huang^{1,*}

¹School of Mechanical and Aerospace Engineering, Jilin University
²School of Vehicle and Energy, Yanshan University

- Develops an all-terrain adaptive control framework for wheel-legged chassis.
- Combines MPC and WBC to support autonomous posture regulation and terrain adaptation.
- Enhances stability, safety, and real-time response in complex environments such as rescue and exploration.



Experimental Simulation Results

MP3-4 (6) 18:15 - 18:30

Optimal Path Following Control For DP Vessel with RBFNN-based Adaptive Dynamic Programming

Yujie Xu, Yuanye Ding, Mingyu Fu, Zhiguang Feng
College of Intelligent Science and Engineering, Harbin Engineering University, Harbin, Heilongjiang 150001, China

Propose an optimal trajectory tracking control strategy for dynamic positioning vessels, combining backstepping with RBF neural network-based adaptive dynamic programming (ADP). Employ the SFLOS guidance algorithm to generate desired heading/velocity signals, and design an online HJB approximating critic network to achieve optimal control under input saturation. Validate that the proposed strategy enables rapid, accurate path tracking with smooth control inputs, stable critic weights, and strong robustness to complex marine disturbances.



RBF-ADP-Based Ship Trajectory Tracking Control

IEEE ICMA 2026 Conference Digest
MP3-5 Sensor Design, and Novel Sensing Systems

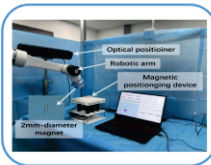
Session Chairs: Yonggan Yan, Beijing Jiaotong University
 Prasetya Hutomo Sulaksono, Waseda University
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-5 (1) 17:00 - 17:15

Permanent Magnet-Based Passive Magnetic Pose Estimation for Cerebrovascular Interventions

Zhanfa Ding, Shan Jiang, Zhiyong Yang, Ruiqi Chen, Zeyang Zhou*
 Mechanical Engineering Department, Tianjin University, Tianjin City, China

- A tetherless passive magnetic architecture using micro-magnets to eliminate cabling constraints and enable extreme miniaturization for neurointerventional devices.
- An attitude estimation algorithm integrating ellipsoidal calibration and nonlinear least-squares optimization to maximize spatial accuracy and convergence speed.
- A real-time multi-source error compensation mechanism leveraging hardware-software correction to effectively suppress background magnetic interference.

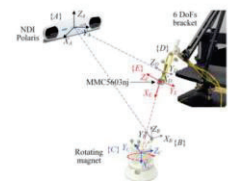


MP3-5 (2) 17:15 - 17:30

Rotating Magnetic Beacon-based Spatial Disturbance Magnetic Field Decoupling Method for a Micro-Magnetometer

Yonggan Yan¹, Haikuo Shen^{1*}, Shaodan Zhi¹, Qian Pu¹, Yancai Xiao¹, and Shuxiang Guo²
¹ The School of Mechanical, Electronic and Control Engineering, Beijing Jiaotong University, Beijing 100044, China
² The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong 518055, China

- The paper proposes a spatial disturbance magnetic field decoupling method for a micro magnetometer based on a moving magnetic beacon.
- It utilizes the reverse symmetry of the spatial magnetic field and the programmable motion characteristics of the rotating magnetic beacon.
- The experiment results show that the proposed method can decouple external disturbance magnetic fields online.



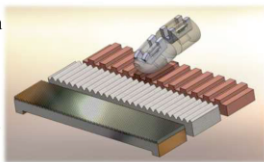
The positioning system

MP3-5 (3) 17:30 - 17:45

Analysis of Vibrational Characteristics During Contact with Surfaces of Different Geometries Using Sensor-Embedded Dummy Finger

Fengyu Li
 Department of Intelligent Robotics, Toyama Prefectural University
 Imizu, Toyama, Japan

- A dummy finger replicating the size and mechanical compliance of human finger with embedded flexible thin-film sensors for contact detection.
- Support Vector Machine-based classification model was employed to classify different contact conditions based on extracting representative vibration features.



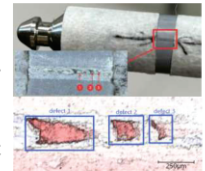
A Sensor-Embedded Dummy Finger

MP3-5 (4) 17:45 - 18:00

OCT-Based In-situ Inspection of Surface Scratches in Nuclear Fuel Rod Manufacturing

Lang Xu¹, Bixia Wang¹, Yingjian Wang¹, Hang Wei², Yaoyu Ding¹
¹School of Automation Engineering, University of Electronic Science and Technology of China
 Chengdu, China
²Department of Computer Science, Hong Kong Baptist University, Kowloon Tong, Hong Kong

- **System:** In-situ fiber-coupled OCT for nuclear fuel rod micro-scratch inspection.
- **Method:** Single-interface extraction via Gaussian fitting to suppress metallic noise.
- **Performance:** Achieved 0.5 μm axial and 5.52 μm lateral resolutions.
- **Validation:** Sub-2 μm depth measurement error verified against confocal microscopy.

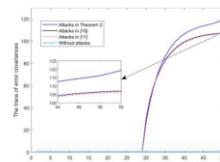


MP3-5 (5) 18:00 - 18:15

Optimal Linear Deception Attacks for Maximizing the Remote Terminal Estimation Error in Networked Control Systems

Hongwei Fang, Zixuan Han, Zhiyu Xi
 School of Automation Science and Electrical Engineering, Beihang University
 Beijing, China

- An optimal linear deception attack is designed to maximize the terminal estimation error.
- Attack stealthiness is evaluated using the Kullback-Leibler divergence.
- An analytical solution is derived by solving the optimization problem.
- Numerical simulations are conducted to verify the effectiveness of the proposed attack strategy.



The trace of error covariances when system is under different attacks

MP3-5 (6) 18:15 - 18:30

A Dynamic Magnetic Haptic Sensor and Its Evaluation Under Varying Surface Patterns and Stroking Velocities

Prasetya Hutomo W. SULAKSONO Hideyuki SAWADA
 Department of Pure and Applied Physics, Graduate School of Advanced Science and Engineering, WASEDA University

- Proposed the dynamic magnetic haptic sensor.
- Utilized magnetic repulsion force to achieve spring-like behavior.
- Tested various surface patterns and stroking velocities.
- Sensor output verified the theoretical model
- When traversing within a triangular surface pattern, it exhibited the highest linearity ($R^2 = 0.951$), SNR (25.85 dB), and stable operation up to a stroking velocity of 34.38 cm/s.



MP3-6 Medical, Biomedical and Rehabilitation Systems (III)

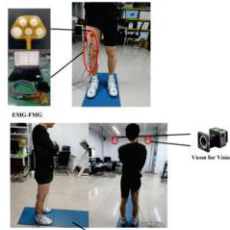
Session Chairs: Chaoyang Shi, Tianjin University
 Chengzhi Hu, Southern University of Science and Technology
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-6 (1) 17:00 - 17:15

Knee Joint Angle Estimation Based on EMG-FMG Fusion Temporal Convolutional Network

Xulong Lu, Lingling Chen, Min Wang, and Shijie Guo
 Hebei University of Technology
 Intelligent Rehabilitation Device and Detection Technology Engineering Research Centre of the Ministry of Education
 Tianjin, China

- A prediction algorithm was developed based on bimodal EMG-FMG fusion.
- An attention-based TCN model was constructed to map muscle signals to joint angles.
- The algorithm mitigated signal drift, achieving an R^2 of 0.984 with 41.7% error reduction.

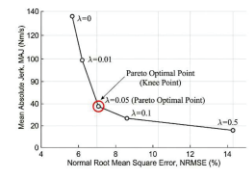


MP3-6 (2) 17:15 - 17:30

Pareto Optimization of Accuracy and Smoothness in Neuromechanical Intention Prediction via a Joint Loss Function

Kun Liu, Junchi Huang, Zhaowei Huang, Xiaodong Huang, Qincheng Hu
 College of Intelligent Manufacturing and Energy Engineering, Zhejiang University of Science and Technology, Hangzhou, Zhejiang, China

- A joint loss with kinematic smoothness prior is proposed, adding an adaptive regularization penalty based on the first-order derivative of predicted torque during backpropagation.
- Scanning λ on multi-subject gait data quantifies the Pareto front between NRMSE and mean absolute jerk.
- At the Pareto optimal configuration, the model substantially reduces torque jerk without sacrificing tracking accuracy, preserves sEMG anticipatory features

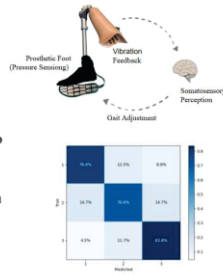


MP3-6 (3) 17:30 - 17:45

A Closed-Loop Vibrotactile Feedback System for Prosthetic Leg Based on Plantar Pressure Sensing

Xinyu Pei, Ji Huang, Fanjie Wang, Zitao Zhu, Xin Ma and Wen-Ming Chen
 Institute of Trustworthy Embodied AI, Fudan University
 Shanghai, China

- Prosthetic users often lack real-time sensory feedback during gait.
- A wearable closed-loop vibrotactile feedback system is proposed to provide intuitive tactile perception.
- A COP-based spatial mapping strategy is developed to convert plantar pressure distribution into spatially distributed vibration stimuli.
- Experimental results demonstrate an average vibration recognition accuracy of 79.3%.

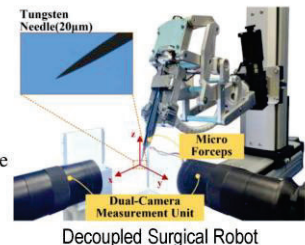


MP3-6 (4) 17:45 - 18:00

Kinematic Calibration and Error Compensation of a Decoupled Surgical Robot for Microanastomosis

Shuai Ao, Houyu Jin, Dunfa Long, Yiyang Chen, Shaoan Chen and Chaoyang Shi*
 School of Mechanical Engineering, Tianjin University
 Tianjin, China

- A dedicated microanastomosis robot adopts a decoupled architecture with a three-axis translational stage and a dual-triangular RCM mechanism.
- LM-based calibration and active compensation reduce dynamic spatial trajectory tracking error by 91.2% to 55 μ m.

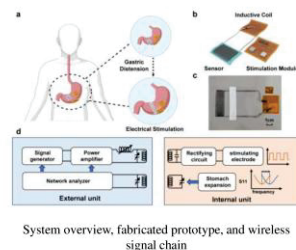


MP3-6 (5) 18:00 - 18:15

A Wireless Bioelectronic Patch for Gastric Sensing and Stimulation

Xuran Ma, Yuanqing Dong, Tanyong Wei, and Chengzhi Hu*
 Southern University of Science and Technology; Tianjin University; Hubei University of Technology
 Shenzhen, Tianjin, and Wuhan, China

- Integrated soft patch for gastric distension sensing and electrical stimulation
- ~62 MHz LC strain sensor (S11 readout) and 1.72 MHz rectifier-based stimulation module
- Verified 5-10 V delivery over 5-6.5 cm and 7.04 MHz frequency shift over 0-55.6% distension



MP3-6 (6) 18:15 - 18:30

Core Microbial Species Screening in Acetate Anaerobic Fermentation Based on Granger Causality and RF-RFE

Yutong Yang
 Beijing University of Chemical Technology
 Beijing, China

- Microbial screening supports acetate fermentation analysis.
- Granger causality pre-screened ASVs, then RF-RFE refined the selection.
- Reduced 1850 ASVs to 115 candidates, finally 9 key ASVs.
- Selected taxa relate to gas conversion, fermentation, and acetate formation.



Feature importance of the optimal 9-ASV subset

IEEE ICMA 2026 Conference Digest
MP3-7 Vision System, Robotic Vision (III)

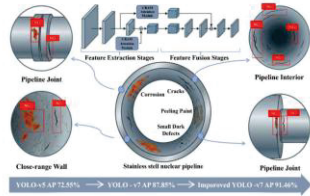
Session Chairs: Weikun Chen, Tianjin University of Technology and Education
 Dingzhong Tan, Harbin Engineering University
UTC+8(Beijing Time): 17:00 - 18:30, Monday, 3 August 2026

MP3-7 (1) 17:00 - 17:15

Engineering Application of Improved YOLO-v7 for Inner-Wall Defect Detection in Nuclear Power Plant Pipelines

Yingjun Shen¹, Dingzhong Tan², Wenguang Zhang³, Yanqiu Zhang⁴, Jinglin Yuan⁴
¹College of Mechanical and Electrical Engineering, Harbin Engineering University
 Heilongjiang Province, China

- Propose an Improved YOLO-v7 model for inner-wall defect detection in nuclear power plant pipelines.
- Introduce the CBAM attention mechanism to enhance channel and spatial feature representation.
- Expand the limited industrial dataset using rotation, flipping, brightness adjustment, Mosaic, and Mixup augmentation.
- Achieve 91.46% AP, improving the original YOLO-v7 by 3.61% while maintaining real-time detection performance.

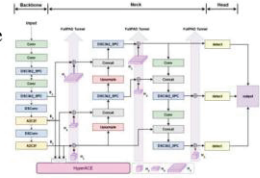


MP3-7 (2) 17:15 - 17:30

SPConv-YOLO: A Small Object Detection Method for Microscopic Blood Cell Images Enhanced by Shifted Pinwheel Convolutions

Peisong Qi¹, Ziyang Liu¹, Zhengyu Bai¹, Weikun Chen¹, Hongwei Li^{1*}
¹School of Automation and Electrical Engineering, Tianjin University of Technology and Education, No. 1310 Dagou South Road, Hexi District, Tianjin 300222, China

- Propose SPConv-YOLOv13 with DSC3k2_SPConv module for accurate small platelet detection in blood cell images.
- Achieve 3.9% mAP@0.5 and 7.4% platelet AP@0.5 improvements over baseline YOLOv13.
- Provide an efficient lightweight solution for small object detection in medical imaging.



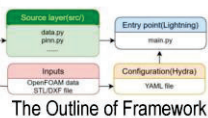
SPConv-YOLOv13 network architecture

MP3-7 (3) 17:30 - 17:45

A Modular Physics-Informed Neural Network Framework Based on PyTorch Lightning and Hydra

Ningning Peng^{1,3}, Shuxiang Guo^{2,3,4}, and Chunying Li²
¹Department of Mechanical Engineering, University of Hong Kong, Hong Kong SAR, China
²The Advanced Institute for Ocean Research, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China
³The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China
⁴The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China

- Composable Plugin Architecture for PINNs.
- Direct CAD/CFD Software Integration.
- Configuration-Driven Experimentation via PyTorch Lightning and Hydra.
- Extensible Embedding and Loss balancing methods.



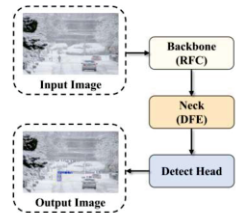
The Outline of Framework

MP3-7 (4) 17:45 - 18:00

DFE-RFC: Degradation-Robust Feature Network for Object Detection in Adverse Weather

Haotai Sun, Jingyu Li, Yilei Huang, Junyu Han, Yi Tang, De Cai, Zhenhai Zhang^{*}
 School of Mechatronic Engineering, Beijing Institute of Technology
 Beijing, China

- Propose Degradation Feature Enhancement (DFE) module to effectively enhance degraded edges, textures, and local structures.
- Propose Robust Feature Compression (RFC) method to significantly reduce information loss during downsampling.
- Integrate DFE and RFC modules into YOLOv8s for adverse weather detection and outperform on DAWN dataset.



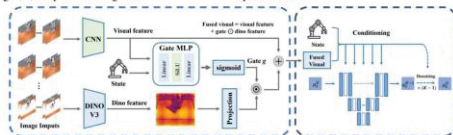
The Main Framework of DFE-RFC

MP3-7 (5) 18:00 - 18:15

Lightweight Gated Residual Late Fusion for Frozen Vision Priors

Junlai Li¹, Qianyu Zhao¹, Duidi Wu¹, Yuliang Shen¹, Xiaohui Xu², Haibo Xiong², Senyou Shi³, Jinyang Li¹, Jin Qi¹, Jie Hu¹
¹School of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai, China
²Shanghai U-EASTAR Electromechanical Co., Ltd., Shanghai, China
³School of Computer Science, The University of Sydney, Sydney, Australia

- Problem:** Vision-only diffusion policies suffer from weak visual representations.
- Proposed Method:** Gated Residual Late Fusion (GRLF) injects frozen DINOv3 priors into CNN features without modifying the diffusion backbone.
- Key Results:** +25.4% success rate improvement, 57.7% faster convergence, Only 1× training cost
- Insight:** Adaptive gates gradually shift from pretrained priors to task-specific representations.



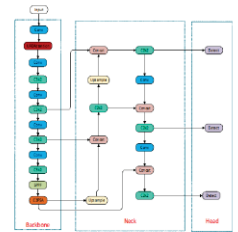
MP3-7 (6) 18:15 - 18:30

UFOAttention-YOLOv11 for Wind Turbine Blade Defect Detection

Xiaodong Guo^{1,2}, Ruiyang Cheng^{1,2}, Hong Chang^{1,2}, Fang Huang^{1,2}, Kuangkuang Wang^{1,2}, Xiyue Liang^{1,2}, Jie Chen^{1,2}

¹ School of Mechanical Engineering, University of Technology, Hohhot 010051, China
² Key Laboratory of Robotics and Intelligent Equipment Technology, Hohhot 010051, China

- This study focuses on wind turbine blade defect detection.
- UFOAttention is added to YOLOv11 to enhance defect features.
- The model is tested on seven blade defect categories.
- The proposed method improves mAP@0.5 from 0.878 to 0.895.



UFOAttention-YOLOv11 Network Structure

Tuesday

August 4, 2026

Morning Sessions

TA1-1 Signal and Image Processing (I)

TA1-3 Biomimetic Systems

TA1-4 Industrial, Manufacturing Process and Automation (I)

TA1-5 Elements, Structures, and Mechanisms

TA1-6 Organized session: Computational Intelligence - Theories and Applications

TA1-7 Actuator Design, and Novel Actuator Systems

TA2-1 Signal and Image Processing (II)

TA2-3 Neuro, Fuzzy, and Intelligent Control (I)

TA2-4 Industrial, Manufacturing Process and Automation (II)

TA2-5 Organized session: Biomechanics, Sensing and Bio-inspired Control in Rehabilitation and Assistive Robotics

TA2-6 Organized session: Theory and Application of Cable-Driven Parallel Robots

TA2-7 Organized session: Additive Manufacturing Technology for Electromechanical Equipment Materials

IEEE ICMA 2026 Conference Digest
TA1-1 Signal and Image Processing (I)

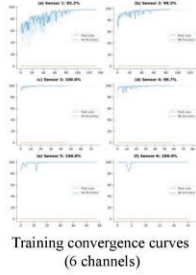
Session Chairs: Lei Zhang, Harbin Engineering University
 Xiuzhi He, Jilin University
UTC+8(Beijing Time): 09:30 - 11:00, Tuesday, 4 August 2026

TA1-1 (1) 09:30 - 09:45

Empirical Study on Aero-Engine Bearing Fault Diagnosis Using Single-Channel LG-SSMNet

Lei Zhang, Zhengyi Ren
 College of Mechanical and Electrical Engineering, Harbin Engineering University
 Harbin, China

- Investigated single-channel deep feature extraction for aero-engine bearing fault diagnosis.
- Proposed LG-SSMNet: multi-scale CNN + Mamba + stabilization.
- Key results: Acceleration channels >99.6%; Displacement Channel 91.31%.
- Explored the feasibility of single-channel diagnosis.

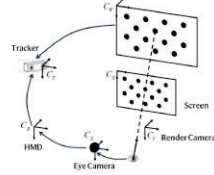


TA1-1 (3) 10:00 - 10:15

Interaction-Free Dynamic Calibration via Binocular Eye Tracking for Robust Virtual-Real Alignment in Surgical Navigation

Shuangying Wang, Shan Jiang*, Zhiyong Yang, Punan Wang, Zeyang Zhou
 Mechanical Engineering Department, Tianjin University, Tianjin City, China

- An automated and user-adaptive calibration framework for OST-HMD virtual-real alignment.
- A binocular gaze-driven mapping model linking eye motion, external tracking, and off-axis projection.
- A dynamic wear-drift compensation method for robust surgical navigation under headset slippage.

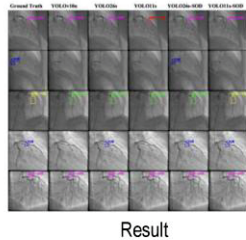


TA1-1 (5) 10:30 - 10:45

Severity-aware Ordinal Decoupling for Multi-level Coronary Stenosis Detection in X-ray Angiography

Bingzhi Shen¹, Shuxiang Guo^{1,2*}, Yonggan Yan¹, Hongchen Ren³, Jintao Luo¹, Bin Wang³, Mingchao Ding³
¹ School of Life-Science and the Key Laboratory of Convergent Biomedical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, The Aerospace-Center Hospital, Beijing Institute of Technology, Beijing, 100081, China
² The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China
³ The Department of Peripheral-Vascular Intervention, Aerospace Center Hospital, School of Life Science, Beijing Institute of Technology, Beijing, 100081, China

- 1) an interval-supervised continuous severity branch that models clinical stenosis labels as relaxed ranges rather than isolated class centers;
- 2) a quality-adaptive gate that restricts auxiliary supervision to reliable matched positives;
- 3) a lightweight CDF-EMD regularizer that softly shapes the class distribution while leaving the host detector's native loss unchanged.



TA1-1 (2) 09:45 - 10:00

DG-SSR: Dual-Granularity Structured Scene Retrieval for Autonomous Driving

Nan Jiang¹, Tongxuan Xu², Yujin Wang¹, Tianyi Wang³,
 Hongqing Chu¹, Wei Tian¹, Bingzhao Gao¹
¹ College of Automotive and Energy Engineering, Tongji University, Shanghai, China
² Shanghai Guanghua Cambridge International School, Shanghai, China
³ Department of Civil, Architectural, and Environmental Engineering, The University of Texas at Austin, Austin, TX, USA

- **Dual-granularity fusion:** Combines local cross-attention with global context for precise long-tail retrieval.
- **Parameter-free attention:** Decoupled architecture achieves 0.812 milliseconds per query, which is 182 times faster than BLIP.
- **Adaptive Negative Injection and Soft-NCE loss:** Mitigate color bias and reduce false positive matches.
- **Higher Accuracy:** Attains 33.06% mean Precision at 5 on nuScenes, outperforming CLIP (16.48%) and BLIP (23.88%).

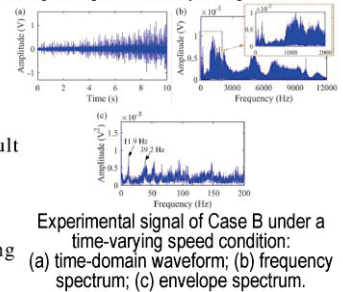


TA1-1 (4) 10:15 - 10:30

Multi-scale Demodulation for Extracting Early Fault Features of Mechanical Components Under Time-varying Speed Operations

Jieli Li, Zhaojun Yang, Xiuzhi He*
 Key Laboratory of CNC Equipment Reliability, Ministry of Education,
 School of Mechanical and Aerospace Engineering, Jilin University, Changchun China

- Stabilizes angular-domain signals to suppress speed-caused frequency smearing.
- Adopts coarse-to-fine order-band screening for layered denoising and fault demodulation.
- Achieves high-precision full-spectrum early fault diagnosis with outstanding noise robustness.



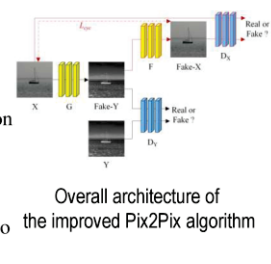
TA1-1 (6) 10:45 - 11:00

Visible-to-Infrared Ship Image Generation via Improved Pix2Pix for Unmanned Surface

Xiaonan Hou, Li Su
 Department of Intelligent Science and Engineering, Harbin Engineering University
 Harbin, China

Hua Guo
 China Energy Shipping Co., Ltd
 Beijing, China

- Address the scarcity of maritime infrared ship images for USV perception.
- Propose an improved Pix2Pix for visible-to-infrared image generation
- Integrate feature fusion, attention, and multi-scale discrimination.
- Build a 4,000-pair dataset and generate realistic infrared images to boost maritime detection.



Session Chairs: Mingxuan Bu, Harbin Engineering University

Xiaoyu Wang, Amphibious Robotics Co. Ltd.

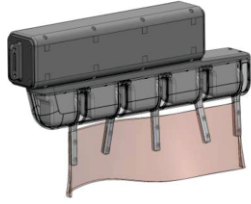
UTC+8(Beijing Time): 09:30 - 11:00, Tuesday, 4 August 2026

TA1-3 (1) 09:30 - 09:45

Design and Experiment of a Modular Underwater Robot with Undulating Fin Propulsion

Zhengxuan Wang, Yuyao Li, Zhixin Xu, and Dan Xia*
School of Mechanical Engineering, Southeast University
Nanjing, Jiangsu, China

- Detailed design conducted for a modular underwater robot with undulating fin propulsion.
- A variable parameter study performed to analyze the influence of the frequency and amplitude on the thrust and velocity of the individual module.
- Further investigations into the propulsion performance of various modular configurations discussed.



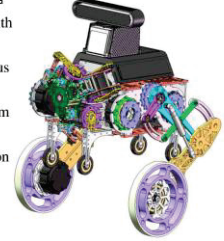
The Modular Underwater Robot

TA1-3 (2) 09:45 - 10:00

A Wheeled Bipedal Robot Capable of Autonomous Docking

Mingxuan Bu, Mingyang Zhang, Guangxin Ma, Yiming Yang,
Shuchen Tao, Ming Liu, Tianrun Han, Huiming Xing, Yong Gao
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Heilongjiang Province, China

- A reconfigurable wheeled bipedal robot is proposed with dual locomotion modes.
- A 6-DOF three-arm parallel gimbal enables autonomous docking and serves as a waist joint.
- Kinematic models of wheel-leg and docking mechanism are established.
- ArUco vision and Kalman filter provide pose estimation for docking control.
- Experiments validate the robot design and successful autonomous docking.

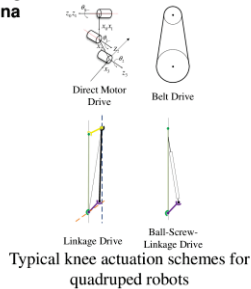


TA1-3 (3) 10:00 - 10:15

A Trajectory-Mapping-Based Evaluation Method for Quadruped Robot Knee Transmission Schemes

Kun Zhang, Zhaoyang Cai*, Xiaoping Zhou, Lei Zhang, Leihong Xu
Beijing University Of Civil Engineering And Architecture
Beijing, China

- Unified transmission models for four distinct knee mechanisms enabling fair cross-scheme comparison.
- Trajectory mapping from joint to motor side using reinforcement-learning-generated gaits.
- Multi-metric evaluation with peak torque, speed, continuous load, and area-ratio indicators.



Typical knee actuation schemes for quadruped robots

TA1-3 (4) 10:15 - 10:30

ASR-SDM: An Amphibious Snake-like Robot with Screw-Drive Mechanism for Heterogeneous Operation Environments

Xiaoyu Wang, Keke Liu and Wenlei Zhang
College of Integrated Circuits, Taiyuan University of Technology
Taiyuan, China

- Proposed the ASR-SDM with omnidirectional amphibious locomotion.
- Developed a robust screw-drive system with active self-rotation control.
- Enhanced reliability through a 2-DoF joint and waterproof structure.

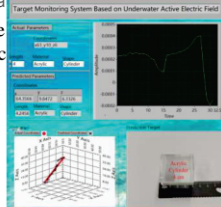


TA1-3 (5) 10:30 - 10:45

A Joint Underwater Target Localization and Recognition System Based on Bionic Active Electrosensing and Deep Learning

Meijiang Hou, Jiegang Peng*
School of Automation Engineering, University of Electronic Science and Technology of China
Chengdu, Sichuan, China

- Bio-inspired active electrosensing: dipole-like electrode array establishes quasi-static electric field, 2D receiving array captures voltage signals from 24 target types in 3D space.
- Voltage amplitude curves treated as image-like signals; large dataset collected from controlled 3D space for multi-parameter learning.
- 2D CNN simultaneously trains position/size regression and material/shape classification, mimicking biological adaptive learning.
- Real-time field test: MAEs for x, y, z localization: 3.82, 2.94, 2.88 cm; length MAE: 0.32 cm; material & shape accuracies: 83.8% and 85.6%.

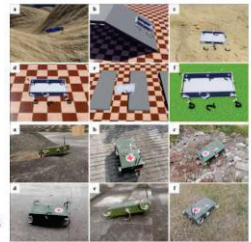


TA1-3 (6) 10:45 - 11:00

Continuity-Aware CPG Locomotion Control for a Jointless Hexapod Robot

Lequn Fu, Yibin Liu, and Shiqi Li
School of Mechanical Science and Engineering, Huazhong University of Science and Technology
Wuhan, China

- Cyclic C1 trigonometric mapping removes velocity jumps and keeps commanded acceleration bounded.
- Physical demonstrations on slopes, gravel, grass, obstacles, and stairs show the same controller works across multiple terrain conditions without retuning.
- Duty-factor-modulated CPG enables tripod, wave, and stair gaits within a single controller.



Multi-terrain demonstrations

TA1-4 Industrial, Manufacturing Process and Automation (I)

Session Chairs: Qirong Lei, Southern University of Science and Technology

Ting Lan, Ningbo University

UTC+8(Beijing Time): 09:30 - 11:00, Tuesday, 4 August 2026

TA1-4 (1) 09:30 - 09:45

A Credibility-Aware Multi-Source Decision-Level Fusion Framework for Performance Evaluation of Submersible PumpsShifeng Yu, Mingjian Lu, Xinrong Hu, Min Tang, Xuming Wang
Wuhan University of Technology | Shanghai Changxing Ocean Laboratory | EAST LAKE LABORATORY**1. Research Background**

Performance evaluation of submersible pumps in early development stages is often hindered by limited physical experimental data and high uncertainty across heterogeneous data sources.

2. Core Method

This paper proposes a credibility-aware multi-source decision-level fusion framework. The framework integrates simulation data, experimental measurements, and prior information, and introduces a quantitative credibility assessment mechanism for heterogeneous data sources. Furthermore, an improved D-S evidence fusion strategy is adopted to mitigate overconfidence under high-conflict conditions.

3. Key Results & Conclusion

A case study shows that the traditional D-S method gives an overly optimistic result (0.9860), while the proposed framework with the modified Yager combination rule yields a more conservative and realistic value (0.8576), consistent with physical test criteria. The method offers a practical and risk-aware approach for performance evaluation under small-sample and high-uncertainty conditions and can also be applied to other mechatronic systems.



Multi-Source Data Fusion Evaluation Framework

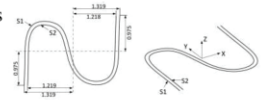
TA1-4 (2) 09:45 - 10:00

Geometric Characterization of Dynamic Control Errors in Five-Axis Machine Tools via Mini S-Shaped RTCP Test

Qicheng Ding, Chenhui Hua, Wei Wang, Xingjun Gao, Lihui Zhang, Hao Ai, Shuwen Sui, Guodong Yang

School of Mechanical Engineering, Chengdu Technological University
School of Mechanical and Electrical Engineering, University of Electronic Science and Technology of China
Chengdu, Sichuan province, China

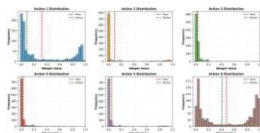
- Mini S-shaped RTCP trajectory scales the standard S-shaped tool path to 1/100 for efficient non-machining dynamic accuracy evaluation
- Servo position gain deficiencies, feed rate and initial setup position are systematically simulated on an AC-type five-axis machine
- Predictable TCP error geometry and symmetry support dynamic error decoupling and targeted servo parameter tuning



TA1-4 (3) 10:00 - 10:15

A Comparative Study of Bayesian Contextual Bandits for Real-Time Warehouse Sorter OptimizationTina Dongxu Li, Mouhacine Benosman, Ken Meszaros, Trevor Dardik
Amazon.com, USA

- Formulated sorter diversion as Context-Action-Reward problem with emulator-based cold-start solution
- Compared LR+GDO, XGB+BO, and Bayesian Contextual Bandits (BCB)
- BCB achieved 2.03% reward uplift over baseline
- Millisecond inference with Thompson Sampling enables closed-loop online adaptation

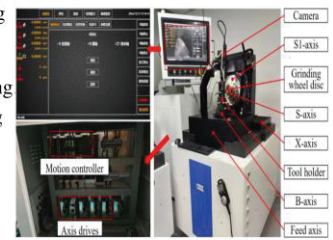


BCB Action Histogram

TA1-4 (4) 10:15 - 10:30

A Study on Key Technologies for Machining Non-Circular Arc Tool Tip Profiles of Single-Crystal Diamond Using the Enveloping Method with a Disc-Shaped Grinding WheelDanni Kong, Fengqi Liu, Xiufeng Liu
Huazhong University of Science and Technology
Wuhan, China

- A two-axis linked enveloping method with a disc-shaped wheel is proposed for non-circular diamond tool grinding
- A rotation-feed axis mapping model is built to generate nanoscale-precision machining trajectories.
- Experiments reduce tool tip waviness from 130 nm to 40 nm, achieving tens-of-nanometer accuracy.



Single-Crystal Diamond Grinding Machine

TA1-4 (5) 10:30 - 10:45

Online Depalletizing and 3D Bin Packing via Constraint-Aware Heuristics for Suction GripperYucheng Wang¹, Haoyu Zhang¹, Ting Lan^{1*}¹Faculty of Electrical Engineering and Computer Science, Ningbo University, Ningbo, China

- Addresses online depalletizing and 3D bin packing through joint optimization of picking and placement sequences.
- Introduces constraint-aware heuristics considering suction gripper reachability and end-effector interference during operations.
- Uses MCTS with state evaluation and forward simulation to overcome greedy decision-making limitations.
- Experiments show superior performance and robust generalization across container sizes, item types, and quantities.

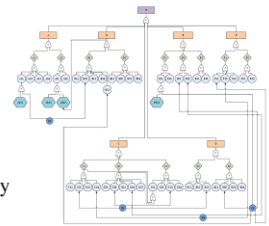


Depalletizing and palletizing

TA1-4 (6) 10:45 - 11:00

Failure Modes Analysis of High-Speed Permanent Magnet Generator RotorZhaojun Cheng, Jiayi Yao, Jiayu Zhang, Jing Chen, Wei Sun, Shan Li
Shanghai Marine Equipment Research Institute
Shanghai, China

- Reliability analysis methods and procedures for high-speed permanent magnet generator rotor.
- Fault description, cause analysis, and qualitative analysis based on rotor fault tree.
- Failure mode, effects, and criticality analysis (FMECA) of the rotor, providing suggestions for design and process improvements.



Fault tree of rotor for high speed permanent magnet generator

IEEE ICMA 2026 Conference Digest
TA1-5 Elements, Structures, and Mechanisms

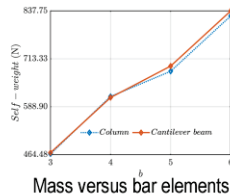
Session Chairs: Yongyue Yu, Southern University of Science and Technology
 Zahra Golsorkhi, The University of Osaka
UTC+8(Beijing Time): 09:30 - 11:00, Tuesday, 4 August 2026

TA1-5 (1) 09:30 - 09:45

Prestress and Shape Finding of Tensegrity Tower Using Minimum Mass Constrained Optimization

Ani Luo, Angelo Vumiliya, and Heping Liu
 College of Mechanical and Electrical Engineering, Harbin Engineering University
 Harbin, China

- The study implements a bilevel optimization strategy that concurrently defines optimum prestress and shape under boundary constraints.
- The objective function in both optimization stage explicitly aims to minimize the total structural mass, calculated at the threshold of element failure.
- The findings dispute the assumption that increasing the bar elements inherently reduce mass, proving that the optimum mass is strictly governed by geometry, prestress and serviceability limit of the structure.



TA1-5 (2) 09:45 - 10:00

Design and Dynamic Control of a Bionic Tricopter with a Five-Link Variable Wingspan

Yongyue Yu, Chunying Li, Pengcheng Li, Shuxiang Guo
 The Department of Electronic and Electrical Engineering, Southern University of Science and Technology
 Shenzhen, China

- A novel gannet-inspired bionic tricopter is proposed with a five-link variable wingspan mechanism.
- This structural design allows the UAV to actively reduce its lateral footprint by 66%.
- An optimized polar-coordinate inverse kinematics solution is developed.
- High-fidelity Gazebo SITL simulations validated that the platform successfully maintains 6-DOF stability.



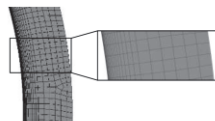
Bionic Tricopter

TA1-5 (3) 10:00 - 10:15

Temperature field analysis of high power density permanent magnet motor

YAO Jiayi, YANG Zhi, ZHANG Jiayu, CHEN Lei, LU Dengjie, SUN Wei
 Shanghai Marine Equipment Research Institute
 Shanghai, China

- This article introduces a compressor structure and electromagnetic design scheme, with a focus on analyzing windage wear and other general losses.
- Through finite element analysis, it was found that under high-pressure carbon dioxide conditions, the windage and friction loss of the rotor was greater than the results calculated using empirical formulas.
- The paper has completed the



Numerical analysis grid division analysis of the motor temperature field.

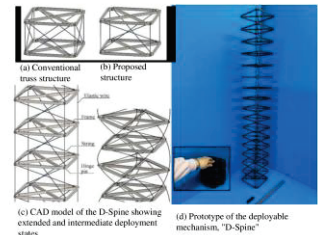
- The flow rate of cooling water has been preliminarily determined to provide a reference for subsequent cooling design.

TA1-5 (4) 10:15 - 10:30

A Compact, Lightweight Coilable Deployable Mechanism with High Lateral Stiffness

Chiranthan Krishnappa, Zahra Golsorkhi, Masahiro Watanabe, Kenjiro Tadakuma
 Department of System Innovation, Graduate School of Engineering Science, The University of Osaka, Osaka, Japan

- Proposed a coilable deployable structure called D-Spine with anisotropic stiffness
- Designed to have low torsional stiffness and high bending, shear, and compression stiffness
- Performed shear, bending, compression, and torsion tests to evaluate structural behavior

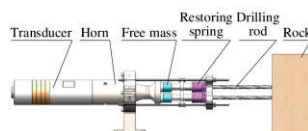


TA1-5 (5) 10:30 - 10:45

Analysis and Experimental Study of LC Matching Networks for an Ultrasonic Harpoon Drill

Yuheng Wang, Qiquan Quan*, and Guodong Li
 School of Mechatronics Engineering, Harbin Institute of Technology
 Harbin, China

- An ultrasonic harpoon drill is proposed to enhance the attachment and anchoring capability on small-body surfaces.
- A single piezoelectric transducer is used to drive two drill assembly components for impact fragmentation of rock.
- With the matching network parameters ($L_m = 312 \mu\text{H}$, $C_m = 229 \text{ nF}$), drilling rates can be achieved 4.4 and 4.7 mm/min.



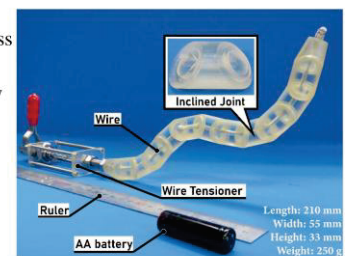
Ultrasonic Harpoon Drill

TA1-5 (6) 10:45 - 11:00

Inclined Joint Variable Stiffness Linear Mechanism

Shubo YANG, Shota MIYAKE, Kazuki ABE, Masahiro WATANABE, Kenjiro TADAKUMA
 Graduate School of Engineering Science, The University of Osaka, Japan

- Inclined-joint variable stiffness linear mechanism
- Flexible-to-rigid switching by wire tension
- Hybrid locking using friction and inclined-surface support
- Higher holding force in a compact posture-support structure



Inclined Joint Variable Stiffness Linear Mechanism

TA1-6 Organized session: Computational Intelligence - Theories and Applications

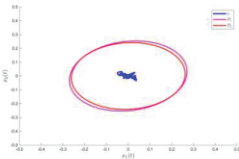
Session Chairs: Yan Shi, Shandong Jianzhu University, China
 Weihao Wu, Southern University of Science and Technology
UTC+8(Beijing Time): 09:30 - 11:00, Tuesday, 4 August 2026

TA1-6 (1) 09:30 - 09:45

Reachable Set Control Based on Designing Asynchronous Controller for Continuous Delayed Markov Jump Systems

Qingzheng Guo, Zhiguang Feng, Jiayi Zhang, Guowei Zhao, Yujie Xu, and Depeng Zeng
 College of Intelligent Systems Science and Engineering, Harbin Engineering University
 Harbin, China

- The mathematical model of continuous delayed Markov jump systems with an asynchronous controller is established.
- By choosing a Lyapunov-Krasovskii functional and applying the integral inequality, a sufficient condition is given.
- Based on the linear matrix inequality, the asynchronous controller parameters are determined in different situations.
- The numerical example in the form of simulation is provided.



Bounding ellipsoid of reachable state and state trajectory of Markov jump system with controller

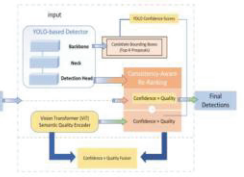
TA1-6 (2) 09:45 - 10:00

CQ-Rank: Consistency-Quality-Aware Re-ranking for Robust Traffic Sign Detection under Adverse Conditions

Shuo Pan¹, Yongchao Liu¹, Mangle Zhang¹, Lili Song^{1,2}
¹School of Computer and Artificial Intelligence, Shandong Jianzhu University
 Jinan, Shandong, China

²Computational Intelligence Center, School of Computer and Artificial Intelligence, Shandong Jianzhu University, Jinan, Shandong, China

- Confidence-IoU correlation fails under adverse conditions.
- Construct a candidate box quality re-estimation model fusing confidence, foreground prob, and background suppression prob.
- On the degraded TT100K dataset, the proposed method increases mAP@0.5 from 0.730 to 0.800.



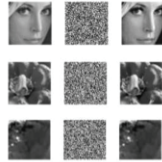
CQ-Rank

TA1-6 (3) 10:00 - 10:15

Image encryption based on heat flow cryptosystem and D-A structure

Jin Li^{1,2}, Xiaoning Su³, Wanjun Song¹
¹School of Science, Shandong Jianzhu University,
²Computational Intelligence Center, School of Computer Science and Technology, Shandong Jianzhu University,
 No. 1000 Fengming Road, Lingang Development Zone, Jinan, China
³College of Science, North China University of Science and Technology,
 Tangshan 063210, P. R. China

- An image encryption algorithm combining the heat flow cryptosystem and D-A structure is proposed.
- Dual encryption is achieved through barycentric interpolation, modulo-XOR diffusion, and Arnold transformation.
- The algorithm exhibits high security and strong anti-attack performance, outperforming comparison methods.



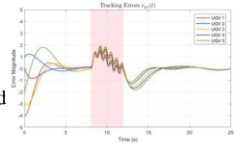
Original, encrypted and decrypted images

TA1-6 (4) 10:15 - 10:30

Resource-Aware Asymmetric Event-Triggered Resilient Cooperative Control for Heterogeneous Multi-Agent Systems

Junjie Huang, Zufeng Li, Jiarui Fan, Huiyan Zhang
 School of Mechanical Engineering, Chongqing Technology and Business University,
 Chongqing, 400067, China

- Motivation: Addressing constrained communication and external disturbances in heterogeneous multi-agent systems.
- Proposed Method: Proposing an asymmetric resource-aware event-triggered strategy. It utilizes non-uniform gains to shift recovery burdens to high-resource nodes, protecting constrained followers.
- Conclusion: Rigorously proving bounded convergence and Zeno-free behavior via Lyapunov



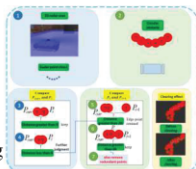
Tracking Errors

TA1-6 (5) 10:30 - 10:45

Obstacle Modeling and State Estimation for Mobile Robots Toward Real-World Deployment of Non-Reciprocal ORCA

Shaoxin Sun, Jiaxin Wu, Lishuai Yu, Lin Mei, Lin Zhang
 School of Automation, Chongqing University, Chongqing 400044, China

- Problem: Non-reciprocal ORCA requires known obstacle states, which are rarely available directly from raw sensors.
- Modeling & Classification: Generates circular primitives from LiDAR and distinguishes static/dynamic obstacles using visual priors.
- Estimation: Uses cluster-level Kalman filtering to estimate motion states, providing unified inputs (position, radius, velocity) to ORCA.
- Results: Experiments demonstrate improved representation quality, trajectory smoothness, and avoidance efficiency in real-world scenarios.



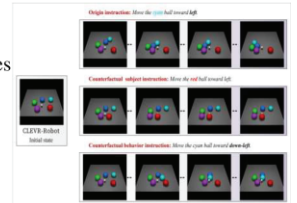
obstacle generation and redundant-circle removal

TA1-6 (6) 10:45 - 11:00

CoPL: Counterfactual Offline Policy Learning via Large Language Models

Maosen Zeng, Yunan Liu
 Computational Intelligence Center (CIC), School of Computer Science and Artificial Intelligence,
 Shandong Jianzhu University

- CoPL augments offline RL data with counterfactual state-action trajectories.
- A grounded Qwen model rewrites goals and generates behaviorally distinct rollouts.
- Invalid rollouts are repaired and filtered before policy learning.
- CoPL improves unseen-task generalization, e.g., 17.2% $\rightarrow$ 26.8%



The Counterfactual Trajectory on CLEVR-Robot CF-Easy.

TA1-7 Actuator Design, and Novel Actuator Systems

Session Chairs: Kenjiro Tadakuma, The University of Osaka
He Li, First Teaching Hospital of Tianjin University of Traditional Chinese
Medicine **UTC+8(Beijing Time): 09:30 - 11:00, Tuesday, 4 August 2026**

TA1-7 (1) 09:30 - 09:45

Research on dynamic modeling and speed control of subsea valve electric actuators

Wenlong Zhang, Peng Jia, Huailiang Zheng, Gang Wang, Xiangyu Wang, and Feihong Yun
College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin 150001, China

- Built a dynamic model for the actuator transmission system under subsea load variations.
- Proposed improved ADRC with VFF-RLS online rotational-inertia identification.
- Reduced speed fluctuation by ~64% and achieved recovery within 0.05 s under abrupt load.
- Verified valve opening/closing on an test bench; max position error within 2.75 mm.



Subsea valve electric actuator test bench

Control strategy: ADRC + VFF-RLS online parameter identification

TA1-7 (2) 09:45 - 10:00

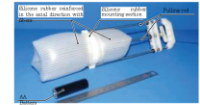
Axially Extension-Constrained Toroidal Balloon Mechanism, Application as a Shape Adaptive Gripper and a Cell Sheet Transfer Device for the Inner Surfaces of Tubular Tissues

Kishin MIKAMI¹, Shohei INOMATA², Hikaru TETSUI²,
Shota MIYAKE¹, Kazuki ABE¹, Masahiro WATANABE¹,
Kenjiro TADAKUMA^{1,2}

1: School of Engineering Science, Osaka University, Japan

2: Graduate School of Information Sciences, Tohoku University, Japan

- Axially reinforced toroidal balloon mechanism
- Fiber-reinforced silicone suppressing axial elongation
- Stable tip eversion with preserved radial expansion
- Improved grasping adaptability and force transmission



Overview of the First Mechanical Prototype Model Based on the Proposed Torus Configuration

TA1-7 (3) 10:00 - 10:15

Mechanical Design of a Circular Cross-Section Crawler with High Coverage Ratio for Continuous Omnidirectional Locomotion

Kishin MIKAMI¹, Shinnosuke NONAKA², Yusuke SETO³,
Yuki SOMA³, Kenjiro TADAKUMA¹, Kan YONEDA²

1: School of Engineering Science, Osaka University, Japan

2: Advanced Robotics, Chiba Tech., Japan

3: Fujita Corporation, Japan

- High-coverage omnidirectional crawler
- Singularity-free continuous locomotion
- Interference-free alternating crawler design
- 78% coverage ratio verified



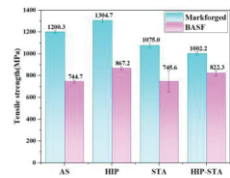
Overview of the High-Coverage Circular Cross-Section Crawler

TA1-7 (4) 10:15 - 10:30

Effect of Post-Processing on Defects and Properties of 17-4PH Stainless Steel Produced by Metal Extrusion Additive Manufacturing

Xiangyu Yuan, Weixiao Pan, Yi Wen, Rao Fu, Gongshuo Wang, Fuji Wang
School of Mechanical Engineering, Dalian University of Technology
Dalian, China

- MEAM 17-4PH stainless steel components were prepared using BASF Ultrafuse and Markforged commercial filaments.
- HIP improved tensile strength and impact absorbed energy in both material systems.
- Maximum properties reached 1304.7 MPa and 8.20 J for Markforged; 867.2 MPa and 9.03 J for BASF.



Results of tensile tests

TA1-7 (5) 10:30 - 10:45

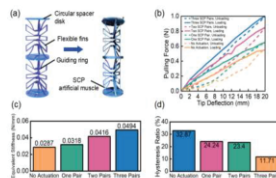
A Soft Manipulator Driven by Antagonistic Supercoiled Polymer Artificial Muscles for Bending and Stiffness Modulation

Yang Yang^{1,2}, Rongxia Lin¹, Haowei Liu¹, and Pei Jiang²

¹ Nanjing University of Information Science and Technology, Nanjing, China

² University of Chongqing, Chongqing, China

- Variable-stiffness soft manipulator with antagonistic SCP muscles.
- Double-strand SCP muscles in a Flex-16 compliant structure.
- Temperature regulation enables coordinated electro-thermal actuation.
- Experiments show higher stiffness, lower hysteresis, and better load capacity.



Prototype and Variable-Stiffness Performance

TA1-7 (6) 10:45 - 11:00

Architecture Design of a Synergistic Rehabilitation System Integrating Motor Assistance and TEAS based on Continuous sEMG Decoding

He Li^{1,2,3}, Shuxiang Guo^{4,5}, Hanzhe Wang⁴, Ruijie He⁵, Jiangwei Shi^{1,2,3}

1. First Teaching Hospital of Tianjin University of Traditional Chinese Medicine, Tianjin 300381, China.

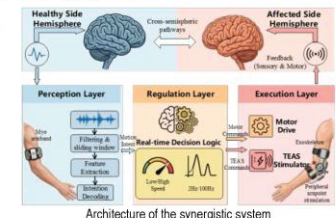
2. National Clinical Research Center for Chinese Medicine, Tianjin 300381, China.

3. Tianjin Key Laboratory of Acupuncture and Moxibustion, Tianjin 300381, China.

4. Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong 518055, China

5. Key Laboratory of Convergence Biomedical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China.

- **Existing limitations:** The isolated mechanical assistance or open-loop electrical stimulation cannot achieve precise synergy between neuromodulation and motor support.
- **Proposed architecture:** Based on cross-hemispheric neuroplasticity, the system decodes motion intentions from healthy-limb multimodal signals (muscle activation, angular velocity).



Architecture of the synergistic system

- **Dual-path intervention:** (a) Feedforward actuator provides physical assistance to the affected side; (b) dynamic mapping converts activation/velocity into TEAS intensity/frequency for targeted neuromodulation.
- **Preliminary results:** The system enables low-latency closed-loop data flow and stable multi-terminal control, offering a robust framework for intelligent neurorehabilitation devices.

IEEE ICMA 2026 Conference Digest

TA2-1 Signal and Image Processing (II)

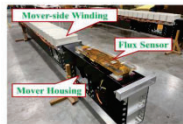
Session Chairs: Weikun Chen, Tianjin University of Technology and Education
Qing Zhang, Harbin Engineering University
UTC+8(Beijing Time): 11:15 - 12:15, Tuesday, 4 August 2026

TA2-1 (1) 11:15 - 11:30

Stator Magnetic Field Orientation Method for Doubly-Fed Linear Motors Based on Flux Sensor

Haoqi Yu, Zaimin Zhong, Hong Chen, Bowen Jiang and Xiusen Wang
College of Automotive and Energy Engineering, Tongji University
Shanghai, China

- Real-time stator magnetic field orientation for doubly-fed linear motors based on a flux sensor.
- Improved Clarke transformation and PLL for orthogonal signal construction and phase tracking.
- Adaptive phase-angle compensation for sensor asymmetry and magnetic field imbalance suppression.
- Complex-coefficient filter for positive-sequence back-EMF extraction and harmonic suppression.

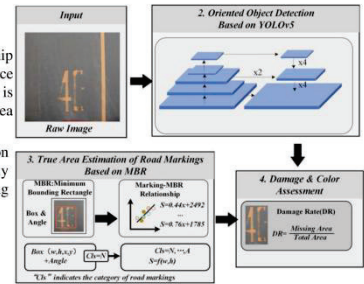


TA2-1 (2) 11:30 - 11:45

Pavement Marking Damage Assessment Method Based on Oriented Object Detection

Zheng Wang, Ryojun Ikeura*, Soichiro Hayakawa and Zhiliang Zhang
Department of Faculty of Engineering, Mie University
Tsu Mie, Japan

- A mathematical relationship between road surface performance and minimum bounding rectangle is proposed to achieve complete area assessment.
- A multi-scale feature detection head is proposed for accurately detecting the minimum bounding rectangle of road markings.

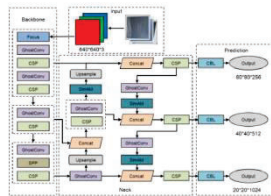


TA2-1 (3) 11:45 - 12:00

A lightweight YOLOv5 network for defect detection of photovoltaic silicon wafers

Weikun Chen¹, Lihui Jin², Baoqi Zhang², Bin Yang¹, Rui Zhang², Meng Li², Hao Luan^{1*}
¹School of Automation and Electrical Engineering, Tianjin University of Technology and Education, Tianjin, China.
²TIANJIN HUANBO SCIENCE AND TECHNOLOGY CO.,LTD, Tianjin, China.

- **Algorithm Innovation:** The study proposes a lightweight, YOLOv5-based defect detection algorithm for ultra-thin silicon wafers, optimized with GhostNet and the SimAM attention mechanism.
- **Practical Performance:** The improved algorithm achieves a strong balance between high detection accuracy and fast processing speeds, making it highly suitable for real-world automated production lines.



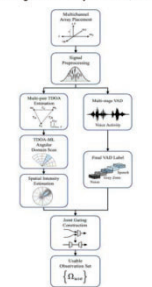
The structure of the proposed YOLOv5 network.

TA2-1 (4) 12:00 - 12:15

Low-SNR Sound Source Localization via Joint VAD Gating and Multi-Pair TDOA-ML

Xiaodong Liu, Qing Zhang, Bolong Chen, Pengkun Zhuang, Wenhui Wang, and Ziqiang Zheng
College of Intelligent Science and Engineering, Harbin Engineering University Harbin, China

- Low-SNR noise causes noise-attraction errors and unstable DOA outputs in small-aperture microphone arrays.
- A five-element 3-D cross microphone array is used for dominant speech direction estimation.
- Multi-pair TDOA-ML scanning generates frame-level DOA candidates and directional-strength cues.
- Multilevel VAD gating and directional-strength screening remove noise-dominated and unreliable frames.
- DOA-PDF fusion improves final azimuth and elevation estimation under babble, pink, and white noise.



Proposed framework

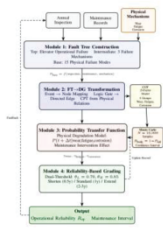
IEEE ICMA 2026 Conference Digest
TA2-3 Neuro,Fuzzy,and Intelligent Control (I)

Session Chairs: Haoyu Xie, Southern University of Science and Technology
 Xianglong Ma, Harbin Engineering University
UTC+8(Beijing Time): 11:15 - 12:15, Tuesday, 4 August 2026

TA2-3 (1) 11:15 - 11:30

Physics-Informed Fault Tree to Directed Graph Transformation for Elevator Operational Reliability Assessment and Maintenance Optimization

Zhenkuo Kang, Qicai Zhou, Yao Wang, Jinhai Pan, Xiaoqing Chang, Jie Chen
 School of Mechanical Engineering, Tongji University, Shanghai, China
 Shanghai Institute of Special Equipment Inspection and Technical Research, Shanghai, China



- Three-source probability fusion
- FT-DG transformation with Archard/S-N/Power-law models via CPTs
- Differentiated CCF analysis with mechanism-specific β factors
- 44% MAPE reduction and 40% cost savings on 10 elevators

TA2-3 (2) 11:30 - 11:45

Design and Adaptive Fuzzy Variable Admittance Control of A Wrist Rehabilitation Robot Based on A 3R Spherical Linkage

Zeyi Huang¹, Guo Qizhou¹, Qinglei Wang¹, Houyu Jin¹, Zhi-Qiang Zhang^{2*} and Chaoyang Shi^{1*}
¹School of Mechanical Engineering, Tianjin University, Tianjin, China
²School of Electronic and Electrical Engineering, University of Leeds, Leeds, UK

- A 3R spherical linkage-based wrist rehabilitation robot system with force and sEMG sensors enables 3-DOF wrist rehab and multimodal HRI.
- Compared with the fixed admittance controller the proposed controller increases muscle activation by 5.88% of the full-scale range.



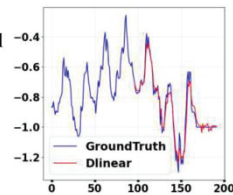
Wrist Rehabilitation Robot

TA2-3 (3) 11:45 - 12:00

DTFNet: Dual-stage LSTM-Transformer fusion architecture for time series prediction

Xianglong Ma, Jianjun Sha, Xinling Wang, Ting Yin, Wenlong Yang and Yifei Zhang
 College of Intelligent Systems Science and Engineering, Harbin Engineering University
 Qingdao, China

- Dual-stage architecture combines LSTM (local) and Transformer (global), overcoming their individual limitations.
- Cross-stage Feature Calibration (CFC) module aligns LSTM and Transformer features for better propagation.
- Hierarchical Multi-Head Self-Attention (HMSA) with progressive windows captures multi-scale patterns efficiently.



Prediction by DTFNet

TA2-3 (4) 12:00 - 12:15

LLM-Driven Low-Code Task Orchestration for Agile Flexible Manufacturing in Mass Customization

Yanping Deng¹ and Jinze Yu^{2,*} (*Corresponding author)
¹Waseda University, Tokyo, Japan
²State Key Lab. of Massive Personalized Customization System and Technology, Qingdao, China

- Problem: programming robot task workflows for agile changeover still needs ROS/PLC experts (\$15k-150k, 3-12 month cycles), blocking minute-level reconfiguration in mass customization.
- Domain-aware generation: manufacturing prompts + strict JSON schema turn natural language into executable subtasks (auto/manual/hybrid) with a behavior-tree skeleton.
- Generate-validate-feedback loop: dual-layer validation (rule-based checks + LLM semantic review) auto-injects failures for regeneration; a standardized 7-tool MCP chain bridges the LLM planner to the MES.
- Results: 98.9% subtask coverage & safety recall on 87 tasks; 72% zero-shot BT validity (Claude Haiku) vs ~67% fine-tuned baseline; feedback loop recovers coverage 18%→100%; MCP 100% (15/15) end-to-end.
- Impact: operational at the State Key Lab.; full natural-language → deployed behavior-tree pipeline runs in < 60 s vs. hours of manual coding.

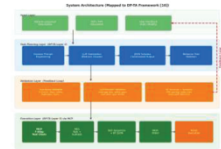


Fig. 1. Four-layer architecture: NL input → LLM planning → dual-layer validation → MCP execution to MES.

TA2-4 Industrial, Manufacturing Process and Automation (II)

Session Chairs: Takuya Kiyokawa, The University of Osaka

Xiaodong Wang, University of Alberta

UTC+8(Beijing Time): 11:15 - 12:15, Tuesday, 4 August 2026

TA2-4 (1) 11:15 - 11:30

Enhance Powder Grinding in Laboratory Automation via Robot Manipulator driven by Offline-to-Online Reinforcement Learning

Wentao Rao, Jiamin Wang, Weiwei Shang, Fei Zhang, Tingqi Zhao, Liubo Kong, Yi Lu
Department of Automation, University of Science and Technology of China
Hefei, China

- A vision-based evaluation framework to evaluate grinding performance in powder-grinding process.
- A heuristic strategy for dataset collection.
- Improving training efficiency through offline-to-online reinforcement learning.



Robotic Powder Grinding

TA2-4 (2) 11:30 - 11:45

Soft Regrasping Tool Inspired by Jamming Gripper

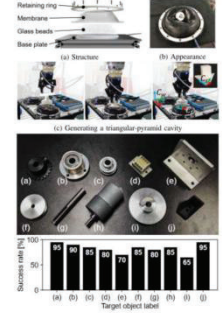
Takuya Kiyokawa¹, Zhengtao Hu², Weiwei Wan¹, and Kensuke Harada^{1,3}

¹Department of Systems Innovation, Graduate School of Engineering Science, The University of Osaka, Toyonaka, Osaka, Japan

²School of Mechatronic Engineering and Automation, Shanghai University, Shanghai, China

³Industrial Cyber-physical Systems Research Center, The National Institute of Advanced Industrial Science and Technology (AIST), Tokyo, Japan

- A jamming-inspired soft jig creates adaptable cavities for robotic regrasping.
- A triangular-pyramid tool stamps the membrane to form stable placement spaces.
- The stamping depth is optimized to balance placement stability and gripper access.
- After dropping, parts settle into the cavity and can be regrasped with less uncertainty.
- Drop tests with 10 mechanical parts achieved over 80% success for most objects.
- The same jig body can be reused for different parts by changing the cavity shape.

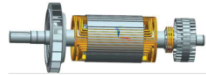


TA2-4 (3) 11:45 - 12:00

Research on Generator Assembly Directed Graph and Sub-Assembly Division Method Based on Assembly Correlation Matrix

Wei Sun, Zhi Yang, Jiayu Zhang, Chenbo Sui, Wan Li, Yan Ding
Shanghai Marine Equipment Research Institute (SMERI)
Shanghai, China

The complex structure and numerous assembly constraints coupling of marine generators make it difficult to divide sub-assemblies for assembly process planning, and there are strong subjectivity issues. Therefore, a generator assembly directed graph construction and sub-assembly division method based on correlation matrix is proposed.



Generator rotor assembly

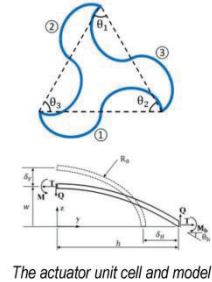
TA2-4 (4) 12:00 - 12:15

Thin-Sheet Piezoelectric Actuators: Modelling of Electromechanical Behaviour

Mostafa Alizadeh, Xiaodong Wang

Department of Mechanical Engineering, University of Alberta
Edmonton, Canada

- Modelling Piezoelectric thin-sheet actuators under large deformation.
- Developing new formulation and models for the coupled response of curved actuator systems as building blocks of advanced material systems.
- Simulation and prediction of nonlinear electromechanical response and multiple response modes of piezoelectric actuators.



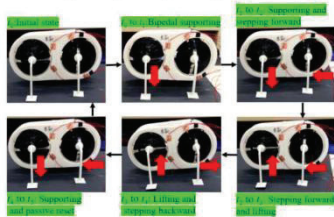
TA2-5 Organized session: Biomechanics, Sensing and Bio-inspired Control in Rehabilitation and Assistive Robotics

Session Chairs: Keyi Wang, Harbin Engineering University, China
Wujing Cao, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences **UTC+8(Beijing Time): 11:15 - 12:15, Tuesday, 4 August 2026**

TA2-5 (1) 11:15 - 11:30

Design of bionic joints with single-cone dielectric elastomer and motion performance of quadrupedal bionic robot

Tao Xiong, Lingtao Yu*, Zhenxu Wei, Huaying Yuan, Sichen Ou
College of Mechanical and Electrical Engineering, Harbin Engineering University
145 Nantong Street, Harbin, Heilongjiang Province, China



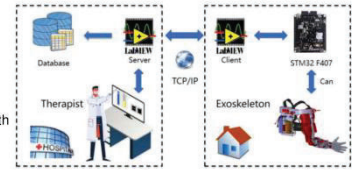
Motion of a quadrupedal bionic robot during a cycle

TA2-5 (2) 11:30 - 11:45

Design of a Novel Remote Operation Interface for Upper Limb Tele-rehabilitation

Zhilong Li, Yi Liu, Shuqi Li, Yiming Cheng, Caihou Wang
1 College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin 150001, China
2 College of Intelligent Systems Science and Engineering, Harbin Engineering University, Harbin 150001, China

- Remote operation interface for home-based upper-limb rehabilitation.
- TCP/IP-based real-time control and status monitoring between therapist and patient sides.
- Lightweight 3-DOF upper-limb exoskeleton platform.
- LabVIEW-based visual panel with control, monitoring, emergency stop, and data recording.
- Experimental validation of tracking accuracy, communication delay, and safety protection.



Overview of the System

TA2-5 (3) 11:45 - 12:00

Adaptive Single-Drive Knee Rehabilitation Robot with Sensorless Interaction

Mei Feng, Xiang Chen, Chao Han, Haoju Li, Xiuquan Lu*, Dong He, Bowen Hou, Dingzheng Zhang
School of Mechanical and Aerospace Engineering, Jilin University
Changchun, China

- Lightweight single-drive robot for supine training with fully adjustable thigh, shank, and foot lengths.
- Proposed sensorless torque estimation and gravity compensation via motor current for low-cost, sensor-free monitoring.
- Unified admittance control enables passive, assistive, and resistive modes without hard switching, validated with high accuracy ($R=0.954$).



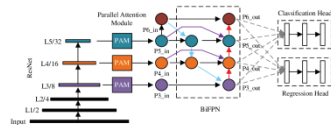
The Knee Rehabilitation Robot

TA2-5 (4) 12:00 - 12:15

Attention-RetinaNet for Mass Detection in Mammography

Yingbo Ma, Lingtao Yu, Yongqiang Xia, Tao Xiong, Yanchong Xue
College of Mechanical and Electrical Engineering, Harbin Engineering University
Heilongjiang Province, China

- A parallel channel-spatial attention module is proposed to enhance mass features, suppress glandular background interference, and reduce the missed detection rate of hard samples.
- BiFPN is adopted to replace the traditional FPN for more efficient multi-scale feature fusion, improving the detection ability for masses of different sizes.



Attention-RetinaNet Network

TA2-6 Organized session: Theory and Application of Cable-Driven Parallel Robots

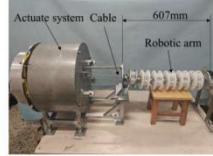
Session Chairs: Han Yuan, Harbin Institute of Technology, Shenzhen, China
 Bin Zhang, University of Science and Technology of China
UTC+8(Beijing Time): 11:15 - 12:15, Tuesday, 4 August 2026

TA2-6 (1) 11:15 - 11:30

A Cable-driven Continuum Robotic Arms System

Yuxin Jie, Yujia Wang*, Xinbei Lv, Haotian Wu, Wenbo Lv
 Intelligent of Mechanical System Engineering, Harbin Engineering University
 Harbin, China

- System Design of Continuum Robotic Arm Prototype
- Motion Planning of Continuum Manipulator



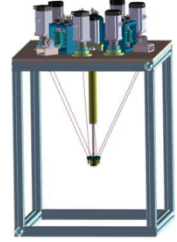
Prototype of the continuum robotic arm

TA2-6 (2) 11:30 - 11:45

Design, Modeling, and Adaptive Robust Control of a Novel Rigid-Flexible Coupled Parallel Robot

Xiaolong Hu, Sen Qian, Shuai Shao, Yong Liu, and Bin Zi
 School of Mechanical Engineering, Hefei University of Technology
 Hefei, China

- Designed a novel rigid-flexible coupled parallel robot that physically eliminates the dynamic drift errors of the cables.
- An AST-NFTSMC robust control method is employed to significantly mitigate the sliding mode chattering problem.
- Experimental validation (vs. PID/CSMC): Trajectory tracking MAE and RMSE reduced by 42.93%/62.85% and 31.59%/55.88%, respectively.



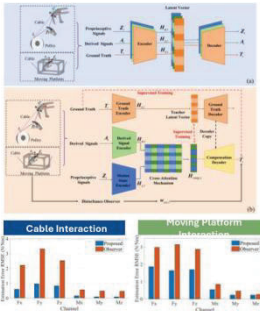
The RFC-CDPR

TA2-6 (3) 11:45 - 12:00

Unified Interaction Force Estimation Under Multiple Contact Modes for Cable-Driven Parallel Robots

Xinyu Gao, Zhehao Li, Xuchun Zhang, Yi Lu, Bin Zhang*, Weiwei Shang
 University of Science and Technology of China, Hefei, China

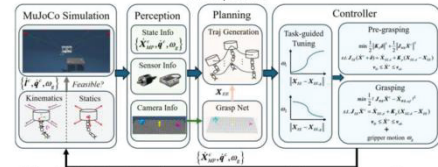
- **Challenge:** MP/cable contacts cause heterogeneous force transmission and mode-dependent model mismatch.
- **Framework:** A unified model-data fusion estimator handles multiple contact modes without explicit switching.
- **Method:** A disturbance observer is combined with attention-guided residual compensation.
- **Features:** Tension and disturbance-derived cues enable implicit mode-aware estimation.
- **Results:** Real-robot tests show higher force accuracy and reliable mode identification.



TA2-6 (4) 12:00 - 12:15

Unified Simulation of Task-Guided Coordination for Cable-Driven Hybrid Robots

Yinan Wu, Zhehao Li, Taiming Guo, Bin Zhang*, and Weiwei Shang
 Department of Automation, University of Science and Technology of China
 Hefei, China



- A unified MuJoCo framework enables perception-planning-control simulation for CDHRs.
- Task-guided coordination improves CDHR tracking accuracy by weighting platform and manipulator motions.
- The proposed method reduces EE position error by 51.2% and 35.4% in the pre-grasping and grasping phases, respectively.

TA2-7 Organized session: Additive Manufacturing Technology for Electromechanical Equipment Materials

Session Chairs: Guiwei Li, Jilin University, China

Siyao Chen, Jilin University

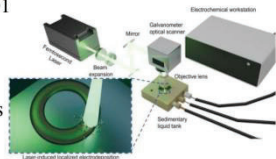
UTC+8(Beijing Time): 11:15 - 12:15, Tuesday, 4 August 2026

TA2-7 (1) 11:15 - 11:30

Effect of Additives on the Surface Quality of Metal Micropatterns in Femtosecond Laser-Induced Electrochemical Deposition

Jianyuan Chen, Wanfei Ren, Hanhan Wei, Jinkai Xu
Changchun University of Science and Technology, Changchun, China

- Optimal additive thresholds: SPS 0.01 g/L, PEG 2 g/L, tartrate 0.05 mol/L.
- Synergistic mechanism: PEG-Cl⁻ inhibits non-laser zones; laser-induced SPS→MPS accelerates locally; tartrate buffers Cu²⁺; pH 1.0 suppresses stray deposition.
- Optimal Ra = 0.214 μm; sharp-edged complex micropatterns successfully fabricated.



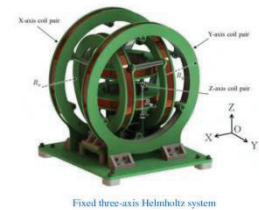
Schematic diagram of the FSLI-LED experimental setup and deposition process.

TA2-7 (2) 11:30 - 11:45

Design and Simulation of a Three-Axis Helmholtz Coil System for Conical Rotating Magnetic Fields in Helical Microrobot Actuation

Xian Jing, Haojie Wang, Zhenyan Zhu, and Jieqiong Lin
School of Mechatronic Engineering, Changchun University of Technology, Changchun, China

- Fixes low-frequency magnetization-axis misalignment.
- Compensated three-axis Helmholtz coil system.
- Conical fields via dual sinusoids plus axial bias.
- Achieves ~20 mm workspace (<1% error); 1 Hz/45° field validated.



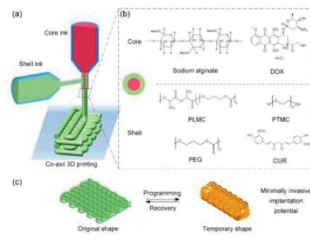
Fixed three-axis Helmholtz system

TA2-7 (3) 11:45 - 12:00

Coaxial 4D Printing of Dual-Drug-Loaded Core-Shell Shape Memory Polymer Scaffolds

Xue Wan¹, Tongxiang Deng², Shuai Chen², Wen Liu³, Siyao Chen^{1*}
1. Jilin University, 2. Harbin Institute of Technology, 3. NingboTech University, China

- One-step coaxial DIW printing
- Stable core-shell morphology
- High shape fixity/recovery
- Programmable shape recovery
- Magnetically driven actuation



Coaxial 4D-Printed Core-Shell SMP Scaffold

TA2-7 (4) 12:00 - 12:15

Optimization of Powder Spreading Mechanism and Motion Control for Binder Jetting Additive Manufacturing Equipment

Changjun Han^{1,*}, Jiyong Chen¹, Yongqiang Yang¹, Shiqin Zhang² and Zhiqin Lei²
¹ South China University of Technology, Guangzhou, China
² Laseradd Technology (Guangzhou) Co., Ltd, Guangzhou, China

- Upgraded powder spreading and motion control systems for improved powder adaptability and multi-axis synchronization.
- Designed a top-feeding system with two-stage reservoir, ultrasonic sieving, and in-situ curing for simultaneous deposition and compaction.
- Proposed a layer-wise data-driven printhead path algorithm to eliminate idle travel and improve efficiency.



BJAM powder spreading mechanism

Tuesday

August 4, 2026

Afternoon Sessions

TP1-1 Mobile Robot System (I)

TP1-3 Intelligent Biomedical Instrument Technology

TP1-4 Modeling, Simulation Techniques and Methodologies (IV)

TP1-5 Manipulator Control and Manipulation (I)

TP1-6 Industrial, Manufacturing Process and Automation (III)

TP1-7 Human-System Interaction and Interface

TP2-1 Mobile Robot System (II)

TP2-3 Control Theory and Application (IV)

TP2-4 Modeling, Simulation Techniques and Methodologies (V)

TP2-5 Manipulator Control and Manipulation (II)

TP2-6 Organized session: Inertial Sensor Design and Autonomous Navigation Systems (I)

TP2-7 Organized session: Robotics and Embodied Intelligence

TP3-1 Signal and Image Processing (III)

TP3-3 Neuro, Fuzzy, and Intelligent Control (II)

TP3-4 Multiple Robot and Distributed Systems

TP3-5 Organized session: Digital Simulation of Complex Electromechanical Equipment

TP3-6 Organized session: Inertial Sensor Design and Autonomous Navigation Systems (II)

TP3-7 Organized session: Material Service Testing Technology and Equipment

IEEE ICMA 2026 Conference Digest

TP1-1 Mobile Robot System (I)

Session Chairs: Junyu Zhou, Southern University of Science and Technology
Huang Le, Southern University of Science and Technology
UTC+8(Beijing Time): 13:30 - 15:00, Tuesday, 4 August 2026

TP1-1 (1) 13:30 - 13:45

Design and Achievement of the intelligent warehousing through multiple mobile robots

Cheng Zhang
Independent Researcher

- Our model has successfully achieved the whole process of warehousing.
- Our model with multiple batches is much better on cost compared to the traditional methods with only one batch.
- As we have our robotic car, we are possible to produce more robotic cars to use our model in entity in reality in the future work.



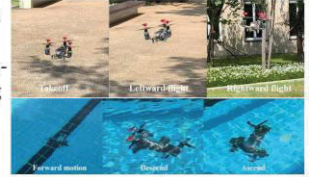
The Robotic car

TP1-1 (2) 13:45 - 14:00

Design and Implementation of a Multimodal Amphibious Vehicle with Visual-Inertial SLAM for Intelligent Fisheries Monitoring

Le Huang, Chunying Li, Qirong Lei, Shuaixin Peng, Siying Pu, Pengcheng Li, Shuxiang Guo
Southern University of Science and Technology
Shenzhen, China

- A novel multimodal amphibious vehicle is developed to realize seamless air-water-surface cross-medium movement, overcoming the mobility limitations of traditional drones and ROVs.
- An integrated system integrates VI-SLAM, vision and spectral sensing for comprehensive aquaculture monitoring.



Key frames from the outdoor aerial flight and underwater navigation tests demonstrating the robot platform's stable maneuverability.

TP1-1 (3) 14:00 - 14:15

Design and Implementation of a Solar-Powered Water-Air Cross-Medium Autonomous Surface Robot

Siying Pu, Chunying Li, Le Huang, Qirong Lei, Pengcheng Li, Shuxiang Guo
The Department of Electronic and Electrical Engineering,
Southern University of Science and Technology Shenzhen, China

- A novel saucer-shaped cross-medium robot is proposed, supporting both surface mobility and underwater locomotion.
- The 8-thruster over-actuated design achieves full 6-DOF controllability with N-1 fault tolerance.
- Multi-sensor fusion and vision-based perception enable autonomous navigation and obstacle avoidance.
- The design is validated through simulation, showing strong potential for environmental monitoring tasks.



Cross-medium Floating Platform Robot

TP1-1 (4) 14:15 - 14:30

UWB Positioning Environment Setup for Mobile Robots with Anchor Height Alignment and Coordinate Determination

• Issue

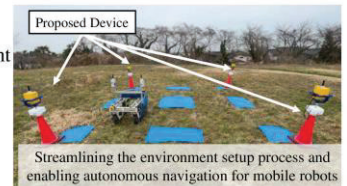
Time required to setup the UWB positioning environment

• Purpose

Reducing UWB positioning environment setup time

• Propose

The device that streamlines the environment setup process



Experimental Environment

Takeru Sunakawa*, Kei Sawai, Rion Omata, Ken'ichi Koyanagi,
Hiroyuki Masuta, Fengyu Li and Ahmed Almassri
Department of Intelligent Robotics Engineering, Graduate School of Engineering
Toyama Prefectural University, Imizu, Japan

TP1-1 (5) 14:30 - 14:45

Hybrid PID–Boundary-Layer SMC for Step Position Tracking of an Over-Actuated ROV

Qiaochu Chen¹ and Shuxiang Guo^{1,2,3,*} and Chunying Li^{2,*}

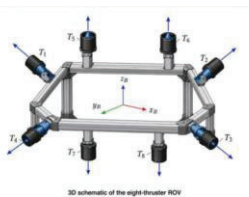
¹Department of Electronic and Electrical Engineering Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China

²The Advanced Institute for Ocean Research Southern University of Science and Technology, Shenzhen, Guangdong, 518055, China

³The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing, 100081, China*

Corresponding authors: guo.shuxiang@sustech.edu.cn, lcy@sustech.edu.cn

- The ROV employs eight thrusters to generate six generalized forces.
- The proposed controller combines a nominal PID term with a boundary-layer SMC compensation term.
- All controllers were tested under the same ROV model, disturbance condition, allocation method, and actuator limits.



3D schematic of the eight-thruster ROV

TP1-1 (6) 14:45 - 15:00

A Dual-Graph Spatio-Temporal Network for Urban Rail Transit Ridership Prediction

Chaohan Zhong, Jiayu Shao*
School of Automation, Southeast University
Nanjing, Jiangsu Province, China

- DSGN forecasts station-level MBTA ridership from the past 6 hours to the next 3 hours.
- Decoupled encoding handles ridership signals and time covariates separately.
- Dual-graph fusion combines physical rail topology with learned passenger-flow dependencies.
- Temporal attention pooling highlights key historical steps such as rush-hour peaks.
- Best MBTA accuracy: MAE 34.67, WMAPE 18.60%, R² 0.931; model size 0.20M.

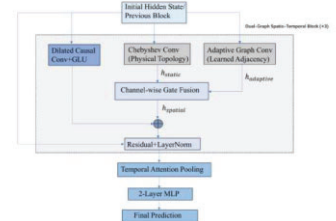


Fig. 1. Architecture of the proposed DSGN

TP1-3 Intelligent Biomedical Instrument Technology

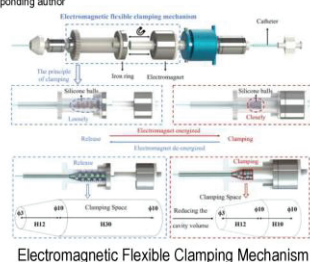
Session Chairs: Xianqiang Bao, Southeast University
Zizhang Lin, University of Electronic Science and Technology of China **UTC+8(Beijing Time): 13:30 - 15:00, Tuesday, 4 August 2026**

TP1-3 (1) 13:30 - 13:45

A Novel Electromagnetic Flexible Clamping Mechanism for Vascular Interventional Surgery Robot

Jintao Luo¹, Shuxiang Guo^{1,2}, Binghui Shen¹, Yonggan Yan¹, Bin Wang³, Mingchao Ding³
 1. The School of Life Science and the Key Laboratory of Convergent Medical Engineering System and Healthcare Technology,
 Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China
 2. The Department of Electronic and Electrical Engineering, Southern University of Science of Science and Technology,
 Shenzhen, Guangdong 518055, China
 3. The School of Mechanical, Electronic and Control Engineering, Beijing Jiaotong University, Beijing 100044, China
 4. The Department of Peripheral Vascular Intervention, Aerospace Center Hospital, Beijing 100081, China
 E-mails: jintao_luo@bit.edu.cn & guo_shuxiang@sustech.edu.cn

- An electromagnetic flexible clamping mechanism and a vascular interventional surgical robot system based on this mechanism.
- The robot can not only meet the delivery force and torque requirements of surgery but also achieve adaptive and non-destructive clamping of catheters and guidewires of various sizes.



TP1-3 (3) 14:00 - 14:15

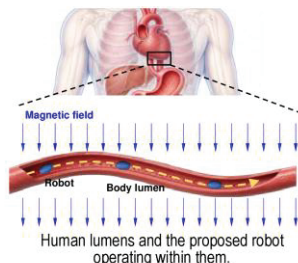
Conceptual Design and Preliminary Simulation of a Miniature Magnetically Controlled Soft Robot for Biomedical Intraluminal Applications

Xiangqiang Bao¹ and Aiguo Song²

¹ School of Artificial Intelligence, Southeast University, Nanjing, China

²School of Instrument Science and Engineering, Southeast University, Nanjing, China

- Luminal diagnosis and therapy offer minimal invasiveness and rapid recovery.
- This study proposes a Miniature Magnetically Controlled Soft Robot actuated by external magnetic fields.
- Its design, fabrication, force analysis, and locomotion mechanism are presented, with deformation performance evaluated by simulations.



TP1-3 (5) 14:30 - 14:45

Design of a Dry-Friction Test Rig for the Ball-Bushing Pair in an ECMO Centrifugal Pump

Zizhang Lin, Kesheng Wang, Peipei Zhang *, Yining Lu, Hao Li, Mingzhou Xu, Jinian Li
School of Mechanical and Electrical Engineering
University of Electronic Science and Technology of China
Chengdu, China

- A dedicated dry-friction test rig for ECMO centrifugal pump ball-bushing pairs is developed.
- It adopts a vertical layout, uses motor-leadscrew PID closed-loop loading, and measures temperature via non-contact infrared camera, providing a reliable experimental platform for relevant tribological research.



Dry-friction Test Rig

TP1-3 (2) 13:45 - 14:00

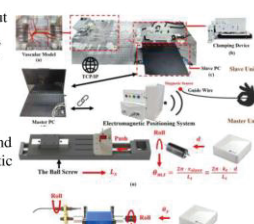
A Magnetic Sensing-Based Master-Side System for Vascular Interventional Surgical Robots

Haoyu Xie¹, Chong Yang¹, Shuxiang Guo^{1,2*}, Weihao Wu¹, Pengcheng Li¹, Chunying Li²

1. The Department of Electronic and Electrical Engineering

Southern University of Science and Technology, Shenzhen, Guangdong 518055, China

- ① **Non-Contact Magnetic Sensing for Master-Side Input**
The guidewire itself serves as the direct operative input, with electromagnetic positioning capturing real-time 2-DOF pose without mechanical contact or damping.
- ② **Systematic Master-to-Slave Motion Mapping:**
A kinematic mapping framework based on ball screw and gear transmission relations converts master-side magnetic measurements into slave-side servo motor commands, with calibration ensuring consistency across actuation cycles.



- ③ Validated Performance Translational and rotational mapping accuracies reach 99.2% and 98.6%, with a 90.0% task success rate and 76.2 s mean completion time in vascular phantom navigation.

VIS Platform & Transform Rule

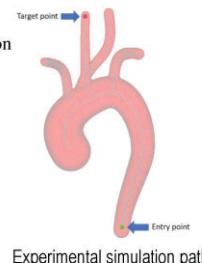
TP1-3 (4) 14:15 - 14:30

An Elastic Memory Path Guidance-based Navigation System for Vascular Interventional Robots

Mingyu Zou, Shuxiang Guo, Sheng Cao, Jian Guo, Jian Wang

Key Laboratory of Convergence Biomedical Engineering System and Healthcare Technology,
The Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing,
100081, China

- A master-follower simulation framework was developed integrating a real vascular intervention robot master manipulator with the SOFA platform.
- An Elastic Memory Path (EMP) guidance method is proposed that reuses historically successful physical interaction trajectories as visual navigation references.
- The results demonstrate that EMP significantly outperforms Vascular Centerline Guidance and No Guidance.



Experimental simulation path

TP1-3 (6) 14:45 - 15:00

A Lightweight Upper Limb Intention Recognition Method
Based on sEMG-IMU Fusion and PCA

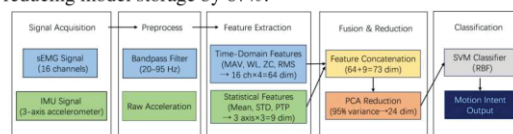
Qian Yang¹, Shuxiang Guo^{1,2*}, Ruijie He¹, He Li¹, Mingchao Ding³, Bin Wang³

1. The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergence Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology, Beijing 100081, China
2. The Department of Electronic and Electrical Engineering, Southern University of Science and Technology, Shenzhen, Guangdong 518055, China

3. The Department of Peripheral Vascular Intervention, Aerospace Center Hospital, School of Life Science, Beijing Institute of Technology, Beijing 100081, China

* Corresponding author: quoshuxiang@bit.edu.cn

- Fuses sEMG time-domain and IMU statistical features to enhance wrist motion recognition accuracy.
- PCA compresses fused features from 73 to 24 dimensions, reducing model storage by 67%.



The Framework of the proposed lightweight intention recognition method

TP1-4 Modeling, Simulation Techniques and Methodologies (IV)

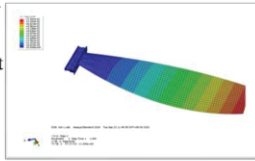
Session Chairs: Niansong Zhang, Nanjing University of Science and Technology
Shaona Wang, Shanghai Open University Qingpu Branch
UTC+8(Beijing Time): 13:30 - 15:00, Tuesday, 4 August 2026

TP1-4 (1) 13:30 - 13:45

Local Stiffness Modeling Method for ThinWalled Blades Based on Abaqus Secondary Development

Niansong Zhang, Yongjie Yin, Long Wu, Aimin Wang and Yan Ge
Department of Mechanical Engineering Nanjing University of Science and Technology

- Proposes local stiffness modeling for thin-walled engine blades.
- Uses Abaqus secondary development for automated stiffness analysis.
- Blade stiffness decreases significantly from root toward tip.
- Identifies low-stiffness zones to guide machining deformation control.



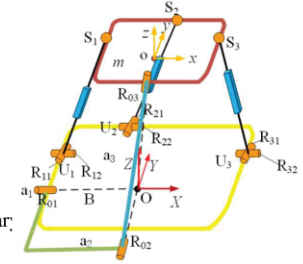
Blade stiffness contour plot

TP1-4 (2) 13:45 - 14:00

Optimal Dimensional Design of a Waist Rehabilitation Parallel Mechanism

Xingchao Zhang, Ji Shi, Shuqi Li, Zhaoji Wang, Jinghui Wang, Chang Zhang, Yu Rong
College of Mechanical and Electrical Engineering Hebei Normal University of Science & Technology, Qinhuangdao, China

- A Parallel Mechanism with three rotational
- The structural parameters are optimized and designed based on kinematic performance of the mechanism.
- The structural parameters are optimized by using the limited normalization method and the ternary plot.

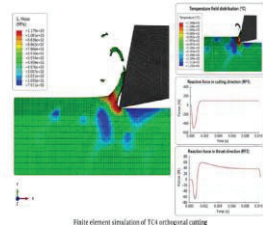


TP1-4 (3) 14:00 - 14:15

Finite Element Analysis of Thermo-Mechanical-Damage Coupled Behavior in Orthogonal Cutting of TC4 Titanium Alloy

Shaona Wang
Shanghai Open University Qingpu Branch,
Shanghai 201700, P.R. China

- Establishes 2D coupled thermo-mechanical-damage FE model.
- Simulates TC4 chip formation via Johnson–Cook model.
- Reveals tip stress concentration and SDEG evolution.
- Shows thermal localization in shear zone and interface.
- Predicts $RF1/RF2$ forces for load analysis.



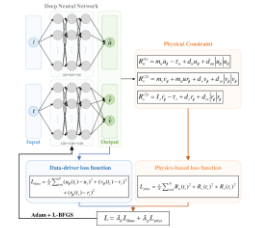
Finite element simulation of TC4 orthogonal cutting

TP1-4 (4) 14:15 - 14:30

AUV Dynamics Model Identification via Informative Maneuvering Samples and Stepwise Grey-Box PINN

Meng Luo, Xiufen Ye, Shuxiang Guo, Chunying Li, Xinhua Zhao
College of Intelligent Systems Science and Engineering, Harbin Engineering University, China
Advanced Institute for Ocean Research, Southern University of Science and Technology, China

- Proposed informative sample construction and stepwise grey-box PINN framework
- Compared LS, full-coupled and stepwise PINN under unified MPC evaluation
- Achieved RMSE reduction from 1.233m to 0.451m in curved-path tracking



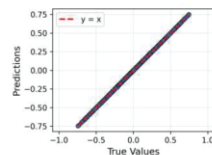
The Grey-Box PINN Framework

TP1-4 (5) 14:30 - 14:45

A Dual-Network-Based Deep Neural Network for Permanent Magnet Magnetic Field Prediction

Xuelong Zhang, Lingtao Yu*, Huaying Yuan, Sichen Ou, Jialin He
Harbin Engineering University
Harbin, Heilongjiang, P. R. China

- FEM is slow, and single-network DNNs fail at magnet-air interface discontinuities.
- A dual-network framework is proposed to separately model air and magnet domains.
- Axisymmetric simplification, equal-volume constraint, and scale invariance optimize the dataset.
- The model achieves an R^2 near 0.999, enabling fast inverse design.



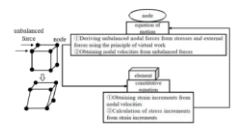
Air Region Radial Magnetic Field Component

TP1-4 (6) 14:45 - 15:00

Numerical Simulation of Ground Subsidence and Pipeline Deformation Induced by Coal Mine Goafs

Hongchao Hu, Jinguo Wang, Zixiong Li, Jianbing Zhao and Shichang Liang
China Coal Yulin Energy & Chemical Co., Ltd

- Coal mine goafs cause ground subsidence and buried pipeline deformation, threatening operational safety. Key mining parameters include height, depth and working face width, all affecting subsidence severity and pipeline response.
- Greater mining height and shallower depth lead to more severe pipeline settlement. Mining width mainly expands deformation scope, with limited impact on peak values. Sensitivity ranks: height > depth > width.



Basic calculation principle

IEEE ICMA 2026 Conference Digest

TP1-5 Manipulator Control and Manipulation (I)

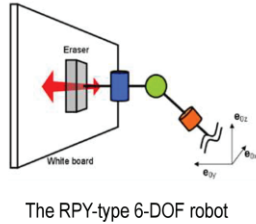
Session Chairs: Yuan Yang, Northwestern Polytechnical University
Kaisei Hosoyama, Kogakuin University
UTC+8(Beijing Time): 13:30 - 15:00, Tuesday, 4 August 2026

TP1-5 (1) 13:30 - 13:45

Dynamic Impedance Control of a 6 DOF Robot Arm

Kaisei Hosoyama, Qingjiu Huang
Electrical Engineering and Electronics Program, Graduate School of, Kagawa University
Kogakuin, Japan

- Problem & Method: Conventional fixed impedance lacks robustness — proposed dynamic impedance adapts M_d , D_d , K_d to joint states via hybrid position/force control.
- Result: MATLAB/Simulink simulation of 6-DOF RPY arm confirms stable, precise wall-wiping on inclined surfaces



TP1-5 (2) 13:45 - 14:00

Research on Optimization of Depth-Keeping Control for Underwater Vehicles Based on Six-Parameter PSO Fuzzy PID Control Method

Chenglong Wen, Shengya Zhao, Shuxiang Guo, Chunying Li and Kaiben Yu
Shandong University of Science and Technology, Qingdao, China

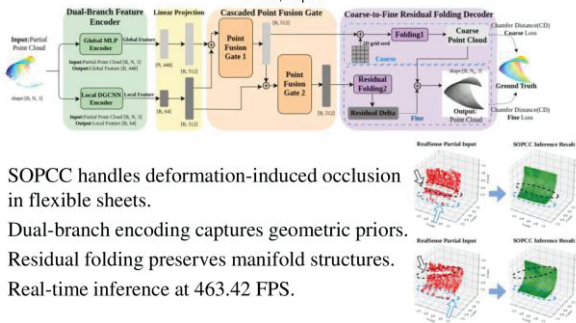
- To improve the capability of traditional PID control systems in handling nonlinear and time-varying disturbances in underwater depth control.
- Six-parameter PSO optimizes fuzzy PID, reducing empirical tuning dependence.
- Settling time drops 27.5%, while overshoot decreases by over 70%.



TP1-5 (3) 14:00 - 14:15

SOPCC: Deformation-Aware Point Cloud Completion for Flexible Sheet-Like Objects

Xuantong Li, Zejing Zhao, Chaowen Shen, Cheng Ju, Akio Namiki
Graduate School of Science and Engineering, Chiba University
Chiba, Japan

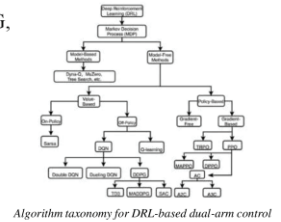


TP1-5 (4) 14:15 - 14:30

Deep Reinforcement Learning-Based Intelligent Control Algorithm for Dual-Arm Robots

Yulong Shi, Xiangxu Sun, Shengli Zhou, Wentong Xu, and Haibo Zhou
Tianjin University of Technology; Tianjin SIASUN Robot & Automation Co., Ltd.
Tianjin, China

- Reviews PPO, MAPPO, MADDPG, and SAC for dual-arm robot control.
- Compares quantitative metrics: success rate, convergence, collision, force error, and transfer.
- Provides algorithm selection guidance and future trends for safe and deployable bimanual control.

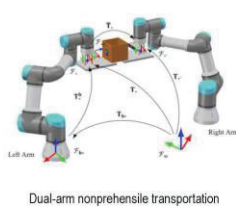


TP1-5 (5) 14:30 - 14:45

Vision-Based Predictive Control for Dual-Arm Nonprehensile Transportation

Chang Liu, Yuan Yang, Panfeng Huang, and Aiguo Song
School of Instrument Science and Engineering, Southeast University, Nanjing, China
School of Astronautics, Northwestern Polytechnical University, Xi'an, China

- Dual-arm robots can hardly handle deformable or complex objects by grasping-based manipulation.
- A predictive control is adopted to optimize dual-arm motions on the move under kinematic constraints.
- A direct visual servoing scheme minimizes relative motion between the end effectors and the object.

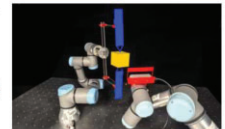


TP1-5 (6) 14:45 - 15:00

A Hardware-in-the-Loop Testbed for On-Orbit Capture of Noncooperative Targets

Hexin Zhang, Minrui Wang, Yuan Yang, Panfeng Huang, and Aiguo Song
School of Instrument Science and Engineering, Southeast University, Nanjing, China
School of Astronautics, Northwestern Polytechnical University, Xi'an, China

- For active debris removal, the reliable capture of noncooperative targets is a critical challenge in space robotics.
- A ground experimental setup validates capture strategies for noncooperative space targets.
- The hardware-in-the-loop platform bridges simulation and experiments.



A hardware-in-the-loop testbed for on-orbit capture.

TP1-6 Industrial, Manufacturing Process and Automation (III)

Session Chairs: Jia Huang, Jilin University

Weihao Wu, Southern University of Science and Technology

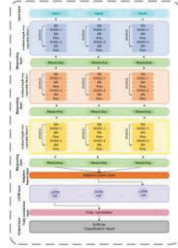
UTC+8(Beijing Time): 13:30 - 15:00, Tuesday, 4 August 2026

TP1-6 (1) 13:30 - 13:45

Fault diagnosis of rotating machinery based on integrated model and multi-source information fusion

Wei Luo¹, Jia Huang², Lijuan Yu³ and Hao Huang⁴
Department of Mechanical and Aerospace Engineering, Jilin University
Changchun, China

- Proposes an end-to-end integrated model (IDDSRN + adaptive fusion + LSTM) for rotating machinery fault diagnosis.
- Uses triple-channel multi-source information fusion to fully decouple channel and spatial correlations.
- Adaptive fusion layer dynamically assigns branch weights, removing redundant features and enhancing coupling information.



The architecture of the proposed integrated model

TP1-6 (2) 13:45 - 14:00

Attention-BiGRU-Based Machining Quality Prediction for Hole Features

Niansong Zhang*, Xianglin Wang, Yan Ge*, Aimin Wang, Yingjie Zhao
Nanjing University of Science and Technology, Nanjing, China;

- Predicts final hole diameter deviation in multi-process hole machining Use
- Uses hole-level context and operation route-chain parameters
- BiGRU captures forward and backward dependencies between operations
- Test set: MAE 10.32 μm , RMSE 16.49 μm , 97.5% within tolerance

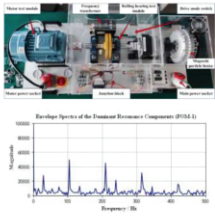


Hole machining

TP1-6 (3) 14:00 - 14:15

Physics-Informed Optimization of Quality Factors in Resonance-based Sparse Signal Decomposition for Motor Bearing Fault Diagnosis

Jian Li¹, Fei Chen¹, Binbin Xu^{1*}, Yanan Ding¹, Zhuocheng Zhong¹, Yun Cao¹, Wei Luo²
¹Sino-German College of Intelligent Manufacturing, Shenzhen Technology University
Shenzhen, China
²School of Mechanical and Aerospace Engineering, Jilin University
Changchun, China



- Embed bearing spring-damping model into RSSD loss function for physics-constrained quality factor optimization.
- Enable end-to-end training via truncated unrolling and gradient approximation.
- Outperform empirical RSSD and GA methods with only 5%~13% computational time.

TP1-6 (4) 14:15 - 14:30

MSDAT-Net-Based Health Indicator Modeling Approach for Planetary Roller Screw

Baobao Qi^{1,2,3,4}, Sheng Kang^{1,2,3}, Zhifeng Liu^{1,2,3,4}, Chuanhai Chen^{1,2,3}, Lijuan Yu^{1,2,3}, Zhiqiang Xiong^{1,2,3}, Changjun Wu⁵, Jigui Zheng⁶, Yaxing Guo⁶

¹School of Mechanical and Aerospace Engineering, Jilin University, Renmin Street, Changchun, Jilin Province, China
²Key Laboratory of CNC Equipment Reliability, Ministry of Education, Jilin University, Renmin Street, Changchun, Jilin Province, China
³Jilin Provincial Key Laboratory of Design, Manufacturing and Reliability of High-end CNC Equipment, Jilin University, Renmin Street, Changchun, Jilin Province, China
⁴Shandong Key Laboratory of High-grade Multi-axis Compound CNC Machine Tool, Mishai Street, Weifang, Shandong Province, China
⁵College of Mechanical and Electrical Engineering, Zhengzhou University of Light Industry, Zhengzhou, Henan Province, China
⁶Beijing Institute of Precision Mechatronics and Controls, Beijing, China

- This paper proposes a novel health indicator construction method based on Multi-Source Data Adaptive Fusion Network with Temporal and Channel Attention (MSDAT-Net).
- Channel and temporal attention mechanisms are introduced to enhance degradation-sensitive features and achieve adaptive multi-source information fusion.
- Experimental results show that the proposed method outperforms traditional deep learning models, achieving a comprehensive score of 0.8800 in terms of monotonicity, correlation and robustness.



Planetary Roller Screw

TP1-6 (5) 14:30 - 14:45

Research on Health Assessment of Nuclear Power RCV Pumps Based on Physics-Informed NTKAN

Hebin Ren, JiQiang Li, YuLong Meng, Xinxin Xing, Wei Fu, and Xiaohu Yang
Suzhou Thermal Engineering Institute Co., Ltd & Harbin Engineering University
Suzhou & Harbin, China

- Proposes a physics-informed nonlinear temporal Kolmogorov-Arnold network (NTKAN) tailored for RCV pumps.
- Constructs a surrogate feature system mapping unobservable anomalies via multi-source operational variables.
- Achieves 0.887 AUC on real-world datasets, enabling reliable early warning for seal ring bolt fractures.



Overall Architecture of Physics-Informed NTKAN for Nuclear Power RCV Pump Monitoring

TP1-6 (6) 14:45 - 15:00

Crack Control by Re-Scan in Fe-Based Metallic Glass Fabricated by Selective Laser Melting

Aodu Zheng, Wenzheng Wu, Guiwei Li
School of Mechanical and Aerospace Engineering, Jilin University
Changchun, China

- Fe-based metallic glasses are strong but crack-prone during selective laser melting.
- Re-scan remelts the surface to reduce residual stress.
- Laser power and scanning speed jointly determine microcrack number and distribution.
- Moderate re-scan power narrows microcracks, whereas excessive power promotes microcrack widening.



SLM-Fabricated Fe-Based Metallic Glass Samples with Re-Scan

IEEE ICMA 2026 Conference Digest
TP1-7 Human-System Interaction and Interface

Session Chairs: Riko Fukimbara, Waseda University
 Keyi Wang, Harbin Engineering University, China
UTC+8(Beijing Time): 13:30 - 15:00, Tuesday, 4 August 2026

TP1-7 (1) 13:30 - 13:45

**A Wireless Leader-Follower Vascular
Interventional Robot with Graded
Vibrotactile Force Feedback**

Ruiqi Chen, Shan Jiang*, Zhiyong Yang, Zhanfa Ding, Zeyang Zhou*

Mechanical Engineering Department, Tianjin University, Tianjin City, China

- Wireless leader-follower architecture for zero-radiation vascular intervention.
- Threshold-based graded vibrotactile feedback driven by a fiber-optic FBG guidewire.
- Multi-threaded control with structural compensation and anti-spike filtering.
- Sub-millimeter tracking: 0.1942 mm feed and 0.6026° rotation RMSE; 100% danger-zone trigger rate.



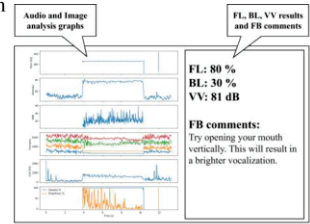
Vascular Interventional Robot

TP1-7 (2) 13:45 - 14:00

**Personal Voice Training System for Chorus with
Audio and Visual Information**

Riko Fukimbara, Takafumi Matsumaru, Vibekananda Dutta, Xin He
 Graduate School of Information, Production and Systems
 Waseda University Kitakyushu, Japan

- Individual voice training system for an amateur chorus
- Input: Singing video recording
- Feedback:
 - Audio and Image graphs
 - FL(False ratio)
 - BL(Brightness Level)
 - VV(Vocal Volume)
- 62.5% of participants showed improvement



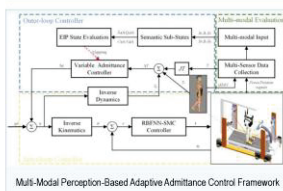
Voice Training System

TP1-7 (3) 14:00 - 14:15

**Multimodal Perception-Based Adaptive Admittance Control
for Cable-Driven Lower Limb Rehabilitation Robot**

Yanzhuo Wang¹, Keyi Wang¹, Lan Wang¹, Yi Liu¹, and Yi Yuan²

¹College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin, Heilongjiang, China
²Joint Department, Ningbo No.2 Hospital, Ningbo, Zhejiang, China



- Multimodal MPAAC framework for CDLLRR control.
- EIP fusion identifies active, passive, and spastic states.
- State mapping enables adaptive admittance regulation.
- RBFNN-SMC improves tracking accuracy and safety.

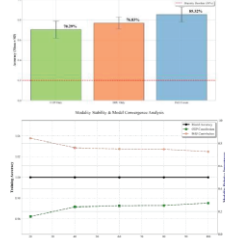
ICMA 2026

TP1-7 (4) 14:15 - 14:30

**A Multimodal Fusion Framework For Abnormal Posture
Recognition Based on Plantar Pressure and Kinematic Sensing**

Churan Tao, Shanjuan Liu, Lin Wang, Qinxue Pan, Liwei Shi, Qi Zhang
 School of Medical Science and Engineering, Beijing Institute of Technology, China

- Quantified fusion gain via modality-level ablation: Full fusion (85.32%) outperforms COP-only (70.29%) and IMU-only (76.83%), with a gain of +8.49% over the best single modality.
- First quantitative attribution of modality contributions: Random forest importance shows IMU accounts for 72.6% and COP for 27.4%, providing a data-driven basis for sensor selection.
- Subject-independent validation (GroupKFold/LOOCV) avoids overestimation; establishes clinical small-sample baseline of 56.76% (N=37, 3 classes).



TP1-7 (5) 14:30 - 14:45

**A Curvature-Based Force-Feedback Virtual
Reality Training System for Vascular
Interventional Surgery Robots**

Yining Shang, Shuxiang Guo, Sheng Cao, Jian Guo, Jian Wang

Key Laboratory of Convergence Biomedical Engineering System and Healthcare Technology, The Ministry of Industry and Information Technology, Beijing Institute of Technology, China

- A manipulator-driven VR training system was developed for vascular interventional surgery.
- Curvature-based force-feedback is continuously calculated to provide realistic resistance perception.
- Vascular trauma is quantified using a novel metric, Cumulative Trauma Work, based on interaction intensity.
- The system enables intuitive spatio-temporal trauma visualization and effective preoperative risk evaluation.



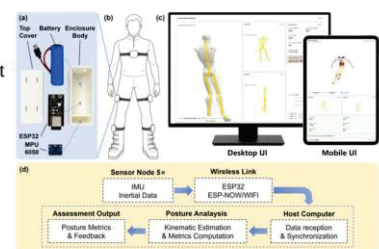
Curvature-Based Force-Feedback
Virtual Reality Training System

TP1-7 (6) 14:45 - 15:00

**A Wearable IMU System for Real-Time Skiing
Posture Monitoring and Motion Feedback**

Zihe Wang[†], Yuetian Yu[†], Suqi Wang, Tiancheng Liu, and Chengzhi Hu^{*}
 Southern University of Science and Technology
 Shenzhen, China

- Five-node wearable IMU system for skiing posture monitoring
- Nodes mounted on boot cuffs, thighs, and chest
- ESP32 gateway supports desktop and mobile visualization
- Interpretable indicators for A-frame and backseat-like posture
- Validated through angle, static posture, and treadmill skiing experiments



Overview of the skiing posture monitoring system

IEEE ICMA 2026 Conference Digest

TP2-1 Mobile Robot System (II)

Session Chairs: Tian-Yun Huang, Peking University
Junyu Zhou, Southern University of Science and Technology
UTC+8(Beijing Time): 15:15 - 16:45, Tuesday, 4 August 2026

TP2-1 (1) 15:15 - 15:30

Design of a Novel Quasi-Direct Drive Wheel Module and the Semi-Parametric External Torque Iterative Estimation Algorithm

Zekang Gao¹, Sheng Bao¹, Yujie Tian¹, Yating Zhu¹, Zhengtao Hu¹, Mahmoud Magdy², Liang Du¹, and Jianjun Yuan¹
¹Shanghai Key Laboratory of Intelligent Manufacturing and Robotics, Shanghai University, Shanghai, China ²Mechanical Engineering Department, The British University in Egypt, Cairo, Egypt

- A novel quasi-direct drive (QDD) wheel module is designed for highly dynamic robotic applications.
- A semi-parametric external torque iterative estimation algorithm is proposed for accurate force decoupling.
- The method achieves high-precision sensorless contact force estimation without relying on external force sensors.
- Experimental results validate the effectiveness and robustness of the proposed integrated system.

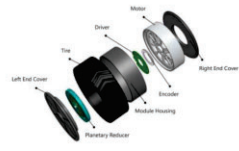


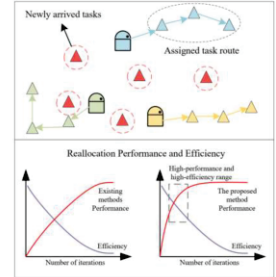
Fig. 1. Exploded view of the proposed quasi-direct drive wheel module.

TP2-1 (2) 15:30 - 15:45

Fast Convergent Distributed Task Reallocation Method for Dynamic Multi-Agent Systems

Qi Zhou, Chao Peng*, Chuan Xie, Jianxiao Zou, Jiawei Sun
School of Automation Engineering, University of Electronic Science and Technology of China
No.2006, Xiyuan Ave. West, Hi-Tech Zone, Chengdu, 611731, Sichuan, China

- A fast convergent task allocation method is proposed for dynamic multi-agent systems;
- A greedy search algorithm is designed to estimate task importance with limited information.
- A task ownership priority is introduced to reduce conflicts and iteration counts.
- Simulations verify fewer iterations and improved allocation performance.



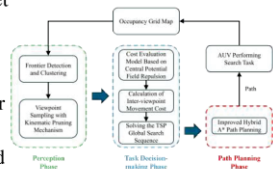
Multi-agent system Reallocation

TP2-1 (3) 15:45 - 16:00

Efficient Autonomous Target Search for AUV in Unknown Environments Based on a Hierarchical Planning Architecture

Juan Li, Shuai Ting Wu and Hong Han Zhang
College of Intelligent Science, Harbin Engineering University
Harbin, China

- Propose a hierarchical decoupled planning framework for AUV target search
- At global level: a central potential field cost function with kinematic pruning enables periphery-to-center exploration
- At local level: develop an improved Hybrid-A* algorithm generates smooth trajectories complying with non-holonomic constraints.



TP2-1 (4) 16:00 - 16:15

Dynamics Simulation and Analysis of a Self-Propelled Pipeline Robot for In-Pipe Inspection of Urban Gas Pipelines

Minghan Wang¹, Jiliang Wang², Xiaohua Chen¹, Zhiyong Ren¹, and Tian-Yun Huang^{2,*}

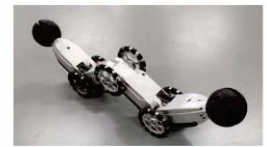
¹School of Mechanics and Engineering Science, Peking University

Beijing, China

²School of Advanced Manufacturing and Robotics, Peking University

Beijing, China

- A self-propelled pipeline robot is proposed to overcome the limitations of tethered robots.
- Its wheeled modular design is optimized via SolidWorks modeling and ADAMS simulation.
- Experiments confirm stable traversal of vertical and T-branch pipes using posture adjustment.
- This work offers a feasibility reference for urban gas pipeline inspection robots.



A self-propelled pipeline robot

TP2-1 (5) 16:15 - 16:30

An Optimised Path Planning Method for Smooth Insect-Robot Interaction

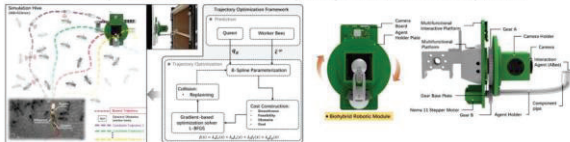
Honghao Pan¹, Hang Wang¹, Yu-Hsiang Su¹, Junyan Hu¹, Martin Stefanec², Ali Emre Turgut³, Tomáš Krajník⁴, Farshad Arvin¹

¹Biohybrid Robotics Lab, Department of Computer Science, Durham University, UK

²Department of Zoology, Institute of Biology, University of Graz, Austria

³Mechanical Engineering Department, Middle East Technical University, 06800 Ankara, Turkey

⁴Artificial Intelligence Centre, Faculty of Electrical Engineering, Czech Technical University, Czechia



- A dedicated biohybrid robotic bee platform with a task oriented mechanical structure for safe and controllable close-proximity interaction in crowded hive environments.
- A trajectory planning framework that jointly optimises motion smoothness, kinematic feasibility, dynamic obstacle avoidance, and goal tracking, enabling biologically compatible robot motion.

TP2-1 (6) 16:30 - 16:45

A Robust Hybrid Gesture Recognition Framework for Real-Time Human-Robot Interaction

Chuyu Guo
College of Engineering, Boston University
Boston, the United States

- Monocular RGB gesture control for real-time HRI.
- Compact 13-D geometric hand representation.
- Hybrid rule-based and SVM classification.
- Confidence fusion with temporal safety filtering.
- 96.6% user-independent accuracy on LIMO robot.



Real Robot Deployment

IEEE ICMA 2026 Conference Digest

TP2-3 Control Theory and Application (IV)

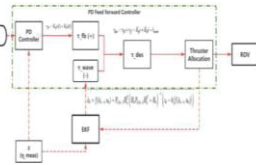
Session Chairs: Haoyu Xie, Southern University of Science and Technology
Jing Zhou, Zhejiang University
UTC+8(Beijing Time): 15:15 - 16:45, Tuesday, 4 August 2026

TP2-3 (1) 15:15 - 15:30

A Kalman Filter-Based Anti-Disturbance Algorithm for ROVs

Shaolin Peng¹, Le Huang¹, Chunying Lu^{2*}, Qing Lei¹, Zhi Zhu¹, Pengchen Li¹, Shuang Guo^{1,2,3*}
1. Department of Electronic and Electrical Engineering Southern University of Science and Technology Shenzhen, Guangdong, 518055, China.
2. The Advanced Institute for Ocean Research Southern University of Science and Technology Shenzhen, Guangdong, 518055, China.
3. The Aerospace Center Hospital, School of Life Science and the Key Laboratory of Convergent Medical Engineering System and Healthcare Technology, Ministry of Industry and Information Technology, Beijing Institute of Technology Beijing, 100081, China
4. State Key Laboratory of Ocean Sensing, ZJU-Hangzhou Global Scientific and Technological Innovation Center, Zhejiang University, Hangzhou, 311215, China

- The Extended Kalman Filter (EKF) algorithm is employed to predict wave disturbances, thereby facilitating proactive pre-processing for future wave conditions.
- A PD feedback algorithm with fast response and low computational complexity is utilized to generate compensatory torques, thereby enabling proactive intervention against wave disturbances



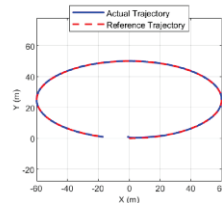
The Algorithm Process

TP2-3 (3) 15:45 - 16:00

Underactuated USV Fixed-Time Trajectory Tracking using Neural Network and Sliding Mode Control

Hengrui Zhou, Li Su
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Use Center-of-gravity shift Technique to reformulate the tracking error.
- Use an RBFNN to handle external disturbances.
- Minimum Learning Parameter method.
- Fixed-time sliding-mode control strategy.



Trajectory Tracking Result

TP2-3 (5) 16:15 - 16:30

Robust PMSM Speed Regulation Under Full-State Constraints

Ziqi Bai*, Wenhai Qi
School of Engineering
Qufu Normal University Rizhao, China

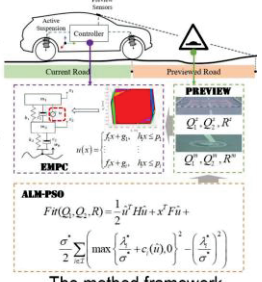
- A frequencydecomposition disturbance observer (CFDDO) that guarantees predefined estimation error bounds.
- A performanceadaptive GPC scheme that embeds prescribed performance requirements into the cost function and prediction model.
- A cascaded HOCBF framework that enforces safety constraints while preserving desired performance characteristics

TP2-3 (2) 15:30 - 15:45

A Weight Optimization Method for Vision-based Active Suspension Preview Control

Shijie Zhao, Junzhi Zhang, and Runze Song
State Key Laboratory of Intelligent Green Vehicle and Mobility, Tsinghua University
Beijing, China

- An augmented Lagrangian fitness function is derived to convert constrained weight optimization into an unconstrained problem.
- The augmented Lagrangian method-based PSO framework for suspension weight optimization is established.
- The weight optimizer is integrated into a vision-based preview control architecture.



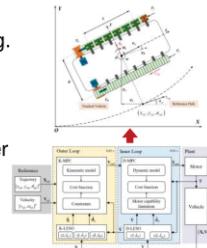
The method framework

TP2-3 (4) 16:00 - 16:15

MPC with Kinematic-Dynamic Dual-ESO for Trajectory Tracking of Tracked Vehicles

Xiaohan Ma, Shihua Yuan, Wei Wu *, and Jingyang Wang
Energy and Transportation Domain, Beijing Institute of Technology
Zhuhai, P. R. China

- Cascaded MPC framework for tracked vehicle trajectory tracking.
- Kinematic-Dynamic Dual-ESO estimates slips and terrain disturbances.
- Outer K-LESO corrects drift; inner D-LESO suppresses torque disturbance.
- Proposed method reduces RMSE/ITAE by over 73% vs. conventional MPC-ADRC.



System Overview

TP2-3 (6) 16:30 - 16:45

Research on Trans-medium Strategies for Quadrotor Aerial-underwater Vehicles Based on immersion ratio and Active Attitude Adjustment

Abstract:When an aerial underwater vehicle crosses the air-water interface, changes in the medium and immersion depth can lead to issues such as vehicle instability. Inclined water entry exacerbates the imbalance during the process. This study addresses the challenge of adapting a quadrotor aerial underwater vehicle model to two different medium during inclined water entry. A coupled model based on the immersion ratio is proposed, and active attitude adjustment is employed to compensate for the instability caused by variations in forces and torques during water entry, enabling the quadrotor to cross the air-water boundary with a stable attitude. A sliding mode controller is designed to handle the nonlinear control problems inherent in the trans-medium process. The quadrotor's crossing of the air-water boundary is simulated using MATLAB. The proposed control strategy enables the robot to achieve satisfactory height tracking performance and desired attitude in simulations. It completes the assigned task within the specified time and effectively mitigates the abrupt lift changes induced by medium switching.

TP2-4 Modeling, Simulation Techniques and Methodologies (V)

Session Chairs: Ziqi Wei, Dalian University of Technology

Liwei Shi, Beijing Institute of Technology

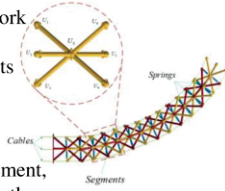
UTC+8(Beijing Time): 15:15 - 16:45, Tuesday, 4 August 2026

TP2-4 (1) 15:15 - 15:30

Active Vibration Control of Cable-Driven Tensegrity Continuum Manipulators Using Nonlinear Model Predictive Control

Ziqi Wei, Binbin Cao, Mingdong Chen, Chaozhong Yang, and Zhiqin Cai*
School of Mechanics and Aerospace Engineering, Dalian University of Technology
Dalian, Liaoning 116024, China

- An NMPC-based vibration control framework is developed by incorporating end-effector vibration states and cable tension constraints into a unified predictive optimization formulation.
- The proposed method achieves effective vibration suppression under initial displacement, impulse, and periodic excitations, significantly reducing end-effector oscillation, tracking error, tip velocity, and system vibration energy.

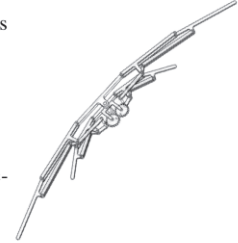


TP2-4 (2) 15:30 - 15:45

Design and Analysis of a Bio-Inspired Manta Ray Pectoral-Fin Flapping Mechanism

Chunde Chen, Yan Niu, Chengrun Wu, Shuxiang Guo, Chunying Li, Liwei Shi
School of Medical Science and Engineering, Beijing Institute of Technology, Beijing, China

- Inspired by manta ray locomotion, this paper presents a biomimetic pectoral-fin flapping mechanism using a serially coupled four six-bar linkage.
- A kinematic model is established to derive position, velocity, and acceleration relationships, and a static-analysis framework evaluates load-bearing characteristics. The work offers a theoretical foundation for manta-ray-inspired underwater robots.



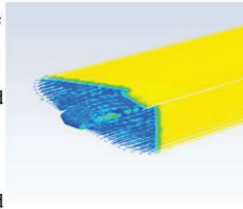
The Pectoral-Fin Flapping Mechanism

TP2-4 (3) 15:45 - 16:00

Hydrodynamic Characteristics and Transient Flow Field Analysis of a Manta Ray-inspired Robot in Steady Inflow

Yan Niu, Chengrun Wu, Chunying Li, Shuxiang Guo, Liwei Shi
School of Medical Science and Engineering, Beijing Institute of Technology, Beijing, China

- Conduct a CFD simulation to analyze the hydrodynamic performance of a bio-inspired manta ray robot.
- Characterize its hydrodynamic forces and visualizes the surrounding transient flow field.
- Elucidate the essence of the pectoral fin flapping propulsion in manta ray-inspired robots from the perspective of flow field mechanisms.



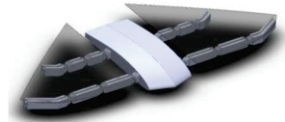
Hydrodynamics of manta-inspired robot

TP2-4 (4) 16:00 - 16:15

Design and Mechanical Analysis of a Cable-Driven Manta Ray-Inspired Robot

Chengrun Wu, Yan Niu, Chunying Li, Shuxiang Guo, Liwei Shi
School of Medical Science and Engineering, Beijing Institute of Technology, Beijing, China

- Propose cable-driven rigid-flexlexic manta robot with rolling joints, centralizing actuation to cut tip inertia and sealing risks.
- Model 2D wing profile via exponential/power functions, derive underactuated kinematics under piecewise constant curvature assumption.
- ANSYS static analysis confirms 0.46mm max deformation, 4.6146MPa von Mises stress under 6.473N axial load, validating reliability.



Manta Ray-Inspired Robot

TP2-4 (5) 16:15 - 16:30

Method of Ultrasonic Inspection for Scale Thickness in Titanium Alloy Seawater Pipelines

Yuhong Huang¹, Zhuofu Lin², Enze Yan², Qinxue Pan^{2,3}, Lang Xu⁴, Ran Liao¹, Jiahui Sun¹
¹Shanghai Marine Equipment Research Institute
²School of Mechanical Engineering, Beijing Institute of Technology
³Key Laboratory of Space Metrology Technology, State Administration for Market Regulation
⁴China Academy of Aerospace Aerodynamics

- The problem of overlapping ultrasonic echoes of thin scale on titanium alloy seawater pipelines, which cannot be solved by traditional methods for simultaneously measuring wall thickness and scale thickness, has been addressed.
- A portable ultrasonic thickness measurement system was established, and the ISTA sparse deconvolution algorithm was used to separate the aliased interface echoes.

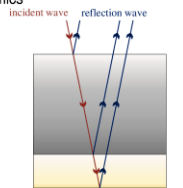


Fig.1 Schematic of ultrasonic echo overlap in thin scale layer

TP2-4 (6) 16:30 - 16:45

Design of a Lightweight Hip Exoskeleton Based on Cycloidal Joint Actuators

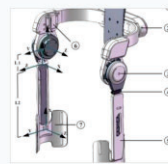


Fig. 1: Overall Structure of the Lightweight Hip Exoskeleton

Executive Summary [This study presents an innovative lightweight hip exoskeleton that achieves high comfort and efficient walking assistance by employing a Cycloidal Quasi-Direct Drive (QDD) joint. The modular design, featuring high torque density and superior backdrivability, offers new insights for the development of next-generation assistive robots.]

Modular Body Structure
An L-shaped back and hip support structure provides a compact and lightweight design, ensuring high torque density and superior backdrivability for seamless human-robot interaction.

Core: Cycloidal QDD Joint
Integrates a frameless motor, reducer, and driver, achieving high torque density and superior backdrivability for seamless human-robot interaction.

Dynamic Modeling & Matching
Based on Lagrange's equations, formulated the joint model across full cycles to achieve precise motion tracking, minimizing the risk of human-robot collision.

310g
Peak Torque Density

14.31 Nm
Peak Torque Density

46.16 Nm/kg
Peak Torque Density

9:1
Reduction Ratio

Key Innovation
High Torque Density & Human-Machine Compatibility

Fig. 2: Prototype of the Cycloidal QDD Joint Module
The physical prototype integrates all core components, demonstrating a compact and highly integrated design that is crucial for real-world application.

Fig. 3: Prototype of the Cycloidal QDD Joint Module
The physical prototype integrates all core components, demonstrating a compact and highly integrated design that is crucial for real-world application.

IEEE ICMA 2026 Conference Digest

TP2-5 Manipulator Control and Manipulation (II)

Session Chairs: Kaima Shimomura, Chuo University
Xiaoming Liu, Beijing Institute of Technology
UTC+8(Beijing Time): 15:15 - 16:45, Tuesday, 4 August 2026

TP2-5 (1) 15:15 - 15:30

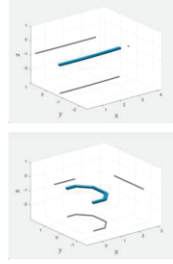
Stability Analysis of Modular Autonomous Underwater Vehicle during Static Configuration Transformation

Taiming Wang¹, Yanhui Wei^{1,2}, Chunguang Xia¹

¹Nanhai Institute, Harbin Engineering University, Sanya, China

²College of Intelligent Systems Science and Engineering, Harbin Engineering University, Harbin, China

- Studied static stability of modular AUV in I-shape to C-shape transformation.
- Proposed 5 stability indicators and a composite Stability Index (SI).
- Analyzed influences of T_{delay} and T_{rise} by parametric simulations.
- Obtained optimal timing parameters for stable and efficient transformation.



Modular AUV configurations: I-shape and C-shape

TP2-5 (2) 15:30 - 15:45

Task-Oriented Multi-Objective Optimization of a Redundant Manipulator for TBM Cutter Replacement

Xinglong Wang, Zixin Gao, Zhengtao Hu, Mahmoud Magdy,

Sheng Bao, Liang Du, and Jianjun Yuan
School of Mechatronic Engineering and Automation, Shanghai University
Shanghai Robotics Institute, Shanghai, China

- Task-oriented optimization of an 8-DOF TBM cutter-replacement manipulator.
- NSGA-II embeds IK feasibility, joint limits, fixed orientation, and collision constraints while optimizing μd , τ_0 , and ξ .
- Results: collision-free poses 2.31%→28.24%; valid task points 1.54%→16.05%.



NSGA-II Optimization and TOPSIS Selection Workflow

TP2-5 (3) 15:45 - 16:00

Proposal of a Position-Force Switching Process for Automating Non-Routine Grinding Using a Collaborative Robot: Experimental Verification of Low-Stiffness Compliance for Stable Finishing

Kaima Shimomura · Shogo Sakurai · Norikazu Suzuki · Manabu Okui · Chuo University · Kobe University

Key finding: low-stiffness compliance absorbs displacement error and stabilizes finishing — validating distinct roles: roughing = high stiffness, finishing = low stiffness.

1 Background & Challenges

Position Control

- Targets exact cut depth
- Path error → force swings

Force Control

- Stable contact force
- Inefficient on protrusions

Challenge: manual weld bead removal is hazardous, and constant-pressure machining is inefficient at removing protrusions.
Goal: combine position and force control in one switching process for efficient machining.

2 Proposed Method: Switching Process

STEP 1 High Stiffness: Roughing Grinding (position ctrl, constant depth)

STEP 2 Model Est. → **STEP 3** Low Stiffness: Finishing Grinding (force ctrl, constant pressure)

Finishing conditions computed offline from Step-1 data

$$\Delta F = \frac{K \cdot K_p}{(K + K_p)} \cdot \epsilon$$
lower $K \Rightarrow$ lower force variation ΔF

3 Experiment & Evaluation

Evaluated by 4 + 1 metrics
Constant pressure performance (K)
1. Shape profile accuracy (RMS, R)
2. Tool-displacement decomposition (linearcrossfeed)
3. Surface roughness (Ra, Rz)
4. Grinding force variation (CV, Fz)

Position-tracking performance (1)
• Spring deflection ΔS (average, metric)

5 N/mm → low stiffness
20 N/mm → higher stiffness

4 Main Results & Conclusion

Metric	5 N/mm (low)	20 N/mm (high)
Surface roughness Rz [μm]	15.0 ✓	22.5
Force variation CV [%]	19.2 ✓	27.5
Shape RMS residual [μm]	39.9 ✓	44.9
Tracking rate force/crossfeed	20.7 ✓	12.8
Spring deflection ΔS [μm]	0.125	0.392 ✓

5 N/mm wins every finishing-quality metric; 20 N/mm only tracks position better → role division confirmed (rough = high K, finish = low K).

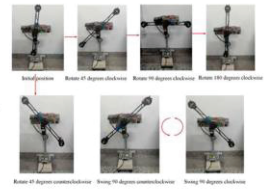
TP2-5 (4) 16:00 - 16:15

Development of an Infrared Point Source Rotating Target Simulator and Its Associated Algorithm

Kuiyu Li*, Zhuo Wang, Bo Zhang, Hongwen Ma

College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin, 150001, PR China

- A parabolic transition interpolation algorithm is implemented on STM32, smoothing acceleration boundaries to effectively eliminate rigid impacts and residual vibrations.
- FFT analysis confirms that spectral energy at the critical 4.5 Hz resonance frequency is attenuated by 15 dB; the system achieves stable 60° /s rotation with a steady-state angular error under $\pm 0.05^\circ$.



Missile Guidance System Test Platform

TP2-5 (5) 16:15 - 16:30

Rotatable Micro-Tweezers with Automated Alignment for Assembling Operations at the Microscale

Mengchu Dai¹, Longzhe Huang¹, Jichao Pang¹, Zhuo Chen¹, Yan Chen¹, Qiang Huang^{1,2}, Tatsuo Arai^{1,3}, Xiaoming Liu^{1,4}

¹School of Mechatronics Engineering, Beijing Institute of Technology, Beijing, China

²Thrust of Robotics and Autonomous Systems, The Hong Kong University of Science and Technology, Guangzhou, China

³Center for Neuroscience and Biomedical Engineering, The University of Electro-Communications, Tokyo, Japan

⁴School of Medical Engineering, Beijing Institute of Technology, Zhuhai, China

- A multi-angle micro-assembly system with rotatable micro-tweezers enabling arbitrary-angle grasping and placement of micro-modules.
- Dual-motor end-effector with independent rotation and open/close control, coordinated with a Z-axis rotary stage.
- Real-time visual servo compensation suppresses parasitic tip displacement caused by end-effector rotation axis misalignment.
- YOLOv26-based real-time tip detection drives a closed-loop PID controller that reduces rotational parasitic displacement by up to 80%.
- Validated by precision assembly of a 300 μm bevel micro-gear onto a 90 μm shaft.



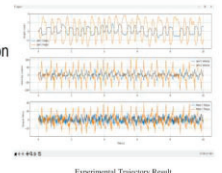
Integrating Predictive Sampling and Diffusion Policy for Adaptive Control in Simulated Robotic Arms

Arjun Radhakrishnan
Department of Robotics and Automation
Rajalakshmi Engineering College,

Chennai, India

- Predictive Sampling generates feasible motion trajectories

- Diffusion Policy smooths actions and reduces torque noise



TP2-6 Organized session: Inertial Sensor Design and Autonomous Navigation Systems (I)

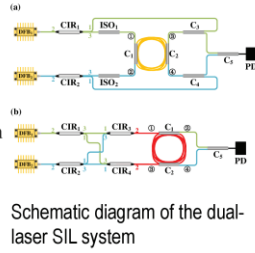
Session Chairs: Weihao Wu, Southern University of Science and Technology
Zhongxing Gao, Harbin Engineering University, China
UTC+8(Beijing Time): 15:15 - 16:45, Tuesday, 4 August 2026

TP2-6 (1) 15:15 - 15:30

All-Optical Reciprocal Dual-Laser Self-Injection Locking for Resonant Optical Gyroscopes

Ting Jin, Liu Yang*, Ying Wang, Xu Cheng
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Operating entirely based on an all-optical feedback mechanism, requiring no high-speed electronic control circuitry.
- Offering significant advantages in device compactness and integration complexity.
- Providing a reliable, high-stability light-source solution for on-chip integrated resonant optical gyroscopes.

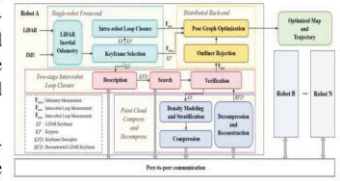


TP2-6 (2) 15:30 - 15:45

Lightweight LiDAR Collaborative Mapping with Point Cloud Map Compression and Recovery

Yujia Wu, Xiaofeng Li, Hanxuan Zhang* and Yulong Huang
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Design a lightweight LiDAR collaborative mapping framework to reduce point cloud transmission volume while sustain mapping accuracy and global consistency.
- Adopt an octree-based compression strategy to reduce map transmission volume while preserving point cloud geometric features.



TP2-6 (3) 15:45 - 16:00

A Gravity-Matching Navigation Algorithm Based on Relative Gravity Changes

Yu Jia, PingHuang Zhou, Yu Peng, Shibo Wang, Haoran Sun, Ruihua Yang
Huazhong Institute of Electro-Optics, Wuhan, China

- A relative-gravity-change-based matching algorithm is proposed to suppress the effect of marine gravimeter drift on underwater gravity navigation
- Shipborne tests achieve a positioning accuracy of better than 0.25 nautical miles (RMS) within the gravity-matching adaptation zone. Accuracy improves by 24% compared to TERCOM algorithms



TP2-6 (4) 16:00 - 16:15

A Static-Base Astronomical-Inertial Integrated Navigation Algorithm in the Earth Frame

Longhe Yang, Shenghui Liu, Qinru Chen, Pinghuang Zhou, Yu Peng, and Xiaohong Li
Huazhong Institute of Electro-Optics, Wuhan, China

- A static-base astronomical-inertial integrated navigation algorithm in the Earth frame is proposed to improve the compensation efficiency of INS position and gyroscope errors.
- Simulation results show that the proposed method can accurately estimate and compensate gyroscope errors, improving positioning accuracy by approximately one order of magnitude.

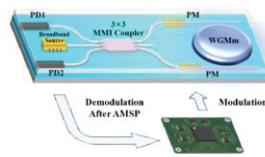


TP2-6 (5) 16:15 - 16:30

Closed-Loop Resonant Micro-Optic Gyroscope Based on 3 × 3 Coupler Structure

Chenlong Xu, Liu Yang*, and Junjie Shang
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Combining the high precision of optical gyroscopes with the excellent SWaP (Size, Weight, and Power) potential of chip-scale integration.
- Adopts an ultra-high-Q Whispering Gallery Mode microcavity as the core sensing element.
- Meeting the miniaturization and integration requirements of small UAVs, AUVs and other high-dynamic carriers.

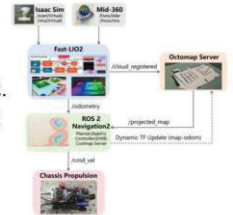


TP2-6 (6) 16:30 - 16:45

Simulation and Implementation of a 3D LiDAR SLAM and Autonomous Navigation System Based on Isaac Sim and Fast-LIO2

Jinyang Li1, Yi Liu1*, Ranchao Guo1, Guanlin Zhu2, and Yiming Cheng2
1College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin 150001, China
2College of Intelligent Systems Science and Engineering, Harbin Engineering University, Harbin 150001, China

- We propose a complete autonomous navigation framework for indoor semi-structured environments that integrates Isaac Sim, Fast-LIO2, Octomap, and Nav2.
- Experiments in simulation (Isaac Sim) and on a real Mecanum robot with Livox Mid-360 validate consistent sim-to-real navigation performance.



IEEE ICMA 2026 Conference Digest
TP2-7 Organized session: Robotics and Embodied Intelligence

Session Chairs: Mei Feng, Jilin University, China
 Haoji Song, Jilin University
UTC+8(Beijing Time): 15:15 - 16:45, Tuesday, 4 August 2026

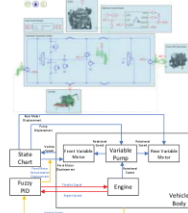
TP2-7 (1) 15:15 - 15:30

Research on Collaborative Control Strategy of Engine and HST for Agricultural Harvesting Machinery Based on Fuzzy Logic

Song Haoji^{1,2}, Xie Jichen^{1,2}, Wang Zhongshan³, Li Guangyu³, Wang Xin^{1,2*}

1. School of Mechanical and Aerospace Engineering, Jilin University, Changchun, China, 130022
 2. National Key Laboratory of Automotive Chassis Integration and Bionics, Jilin University, Changchun, China, 130025
 3. Jilin Agricultural Machinery Research Institute, Changchun, China, 130022
- *Corresponding author: wangxin_jlu@jlu.edu.cn (X.W.)

- Pioneered a hierarchical dual-closed-loop collaborative control architecture for the engine and HST.
- Designed a fuzzy PID engine speed controller with a dead zone, reducing drop by 37.5%.
- Adopted "state machine plus fuzzy displacement fine-tuning" hybrid control to smooth shifting oscillations.



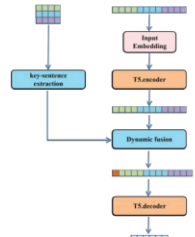
TP2-7 (2) 15:30 - 15:45

Dynamic Fusion and Semantic Consistency Enhanced Summarization for Multi-turn Elderly Chinese Dialogue

Tuo Wang, Li Su

Department of College of Intelligent Systems Science and Engineering, Harbin Engineering University
 Harbin, Heilongjiang, China

- Aging society demands lightweight dialogue summarization for elderly companion robots.
- Dynamic fusion & semantic consistency for elderly Chinese multi-turn dialogue summarization.
- ElderDialogSum-5K: 5,000-sample Chinese elderly dialogue summarization dataset.
- ROUGE-L 48.24%, outperforms baselines; $25\times$ higher parameter efficiency.



Overall architecture of the proposed model

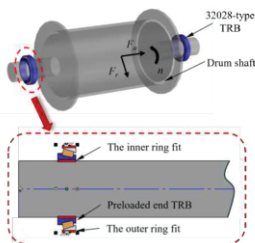
TP2-7 (3) 15:45 - 16:00

Low-Temperature Stiffness Analysis of Bearings for Polar Scientific Research

Fankai Kong, Ruiting Xia, Jian Wang, Chongyang Nie, and Lijie Liu

College of Mechanical and Electrical Engineering, Harbin Engineering University
 Harbin, China

- The effects of fit, rotational speed, and viscosity on low-temperature TRB stiffness are analyzed for a polar scientific research winch.
- Increasing inner-ring interference reduces stiffness temperature sensitivity.
- Bearing fit accuracy is more critical than lubricant selection for polar winch design (apparent viscosity effect on TRB stiffness $<5\%$). The drum shaft system simulation model

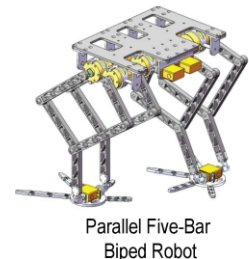


TP2-7 (4) 16:00 - 16:15

Motion Control of a Parallel Five-Bar Biped Robot Using Virtual Model Control

Bowen Ji, Yuye Yang, Hongbo Niu, Yaru Nan, Jiangwan Yu, Tao Bai, Huiming Xing
 Harbin Engineering University, Harbin, China

- Designed parallel five-bar legs and rigid-flexible feet for low inertia.
- Derived complete kinematics and Jacobian matrix via D-H method.
- Optimized link parameters to maximize the robot's workspace.
- Proposed a compliant gait strategy using Virtual Model Control (VMC).
- Validated dynamic walking and disturbance rejection in Webots.



Parallel Five-Bar Biped Robot

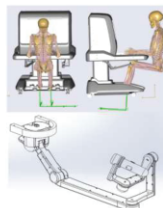
TP2-7 (5) 16:15 - 16:30

Ergonomics-Oriented Optimization of Master Console Layout and Manipulator Configuration for Minimally Invasive Surgical Robots

Xiuquan Lu¹, Yiguang Si¹, Mei Feng^{1*}, Haoju Li¹, Chao Han¹, Bowen Hou¹, Dong He²

1. School of Mechanical and Aerospace Engineering, Jilin University, China
2. College of Electronic Science and Engineering, Jilin University, China

- Ergonomic console optimization.
- AnyBody-based human-console coupling analysis.
- Workspace-constrained master manipulator design.
- PSO-based manipulator-link optimization.
- Muscle-load and workspace validation.



Master Console and Manipulator Optimization

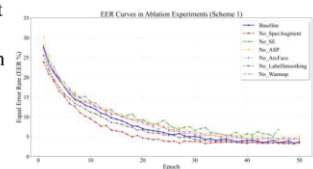
TP2-7 (6) 16:30 - 16:45

Rethinking SpecAugment in Short-Utterance Speaker Recognition for Exoskeleton Control

Juan Du¹, Hongxia Chu¹, Jiayu Zhang², Xintian Yu¹, and Dan Wang¹

- ¹College of Electrical and Information Engineering, Heilongjiang Institute of Technology, Harbin, China
- ²Hangzhou RoboCT Technology Development Co., Ltd. Hangzhou, China

- Revealing the negative effect of SpecAugment on short-utterance speaker recognition
- Cross-dataset and cross-architecture consistent validation
- Augmentation-free optimization scheme for edge deployment of exoskeleton robots



ECAPA-TDNN+ArcFace: EER comparison in ablation

IEEE ICMA 2026 Conference Digest
TP3-1 Signal and Image Processing (III)

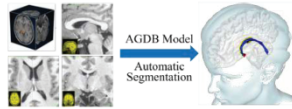
Session Chairs: Qi Dai, Kyoto University
Yingshuo Liang, China Mobile Communications Group Liaoning Co.,
Ltd. **UTC+8(Beijing Time): 17:00 - 18:00, Tuesday, 4 August 2026**

TP3-1 (1) 17:00 - 17:15

A dual-branch decision model guided by anatomical priors for automatic segmentation of the mammillary bodies and the fornix

Linghao Sun, Yusuke Kyuragi, Naoya Oishi, Lichang Yao, Zhilin Zhang, Jinglong Wu, Xiujun Li, Qi Dai
Changchun University of Science and Technology, Changchun, China
Shenzhen University of Advanced Technology, Shenzhen, China

- Precision joint segmentation for mammillary bodies and fornix
- Embedding anatomical prior constraints to address missed detections and fiber breaks
- Lightweight, efficient and high precision
- Facilitate early quantitative diagnosis of neurological diseases



Method	Parameter	FLOPs	Dice
FCN	29.51 M	754.05 G	0.637 ± 0.030
Trans U-net	110.10 M	1.06 T	0.697 ± 0.089
U-NET	5.89 M	290.77 G	0.847 ± 0.020
U-NET++	1.68 M	666.13 G	0.838 ± 0.013
Ours	1.61 M	265.71 G	0.854 ± 0.009

TP3-1 (2) 17:15 - 17:30

Fault-Predictive and Load-Aware Ultra-Multi-Hop Chain Network for Mine Communication

Bin Li, Yingshuo Liang, Shi Dong, Lu Yin
China Mobile Group Liaoning Co., Ltd.,
shenyang China

- Unmanned mining requires ultra-multi-hop underground networks, but traditional ones suffer rate decay, failure vulnerability, and load bottlenecks. We propose a topology optimization using dual-band full-duplex, LSTM-driven self-healing with cross-hop multipath redundancy, proportional-fair scheduling, and environment-aware frequency hopping. In a 5-km testbed, it achieves 69% rate at 20 hops, 92-ms recovery, and 0.25% packet loss under interference, meeting unmanned mining demands.



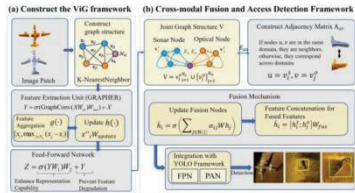
Chain Network Device

TP3-1 (3) 17:30 - 17:45

Cross-Modal Graph Neural Networks for Efficient Sonar Target Detection

Jier Xi^{1,2}, Xiufen Ye¹, Shuxiang Guo^{2,3}, Chunying Li²
¹College of Intelligent Systems Science and Engineering
Harbin Engineering University
²Advanced Institute for Ocean Research
Southern University of Science and Technology
³Department of Electronic and Electrical Engineering
Southern University of Science and Technology
Correspondence: yexiufen@hrbeu.edu.cn

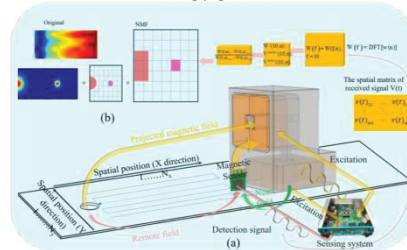
- A cross-modal feature calibration and graph modeling framework is proposed to enable effective feature transfer from optical images to sonar images.
- A VIG-YOLOv7 detection architecture is designed using Grapher and FFN modules to model local feature nodes and accurately identify sonar debris regions.
- An efficient online training and recognition strategy is developed, achieving 82.3% mAP@0.5 with 1K samples/30min versus 88.2% mAP requiring 20K samples/8h for CNNs.



TP3-1 (4) 17:45 - 18:00

Physics-Informed NMF for Near and Remote Field Electromagnetic Sensing in Nondestructive Testing

Zhaohu Yu, Bin Gao, and Guiyun Tian
School of Automation Engineering, University of Electronic Science and Technology of China
Chengdu, China
School of Electrical and Electronic Engineering, Chongqing University of Technology, Chongqing
Chongqing, China



The near and remote sensing

IEEE ICMA 2026 Conference Digest

TP3-3 Neuro,Fuzzy,and Intelligent Control (II)

Session Chairs: Ye Cui, Tongji University
Guanqiao Huang, Jilin University
UTC+8(Beijing Time): 17:00 - 18:00, Tuesday, 4 August 2026

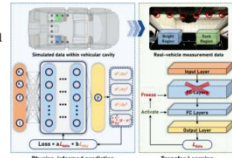
TP3-3 (1) 17:00 - 17:15

Physics-Informed Sound Propagation Prediction with Application to In-vehicle Sound Zoning

Ye Cui, Xu Li*

College of Automotive and Energy Tongji University
Shanghai, China

- Physics-informed input design – Incorporates reverberation time as an additional input feature to guide neural network learning of sound propagation in vehicle cavities.
- PINN with hybrid loss – Combines data-driven MSE loss with Helmholtz equation residual as a physics-based constraint.
- Balances cost and accuracy – Reduces experimental labor and computational expense while preserving high sound zoning quality in reverberant environments.



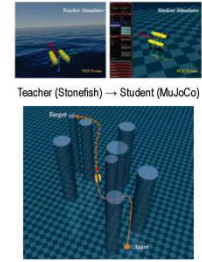
Physics-informed propagation prediction for reverberant cavities.

TP3-3 (2) 17:15 - 17:30

Deep Hydro-Sim: Structured Residual Hydrodynamics for the RL-Based AUV Control

Ruihan Wu, Chunying Li, Shuxiang Guo, Qirong Lei, and Le Huang
Southern University of Science and Technology
Shenzhen, China

- Hybrid Stonefish-to-MuJoCo simulator distills underwater hydrodynamics into a fast RL engine.
- Residual forces are learned from 857K samples of 6-DOF AUV motion by a physics-informed MLP.
- Open-loop replay: surge velocity RMSE drops 44%.
- SAC training: Baseline MLP diverges; PhysicsFeature-MLP trains stably.
- Aggregate offline R² is not sufficient: coupled angular fidelity matters most.



Teacher (Stonefish) → Student (MuJoCo)

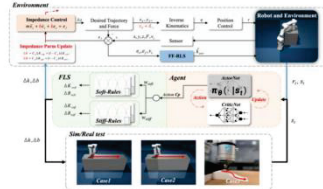
Navigation in cluttered scenes

TP3-3 (3) 17:30 - 17:45

Hierarchical Fuzzy Reinforcement Learning for Variable Impedance Control of Robotic Manipulators

Kairong Zeng, Chao Peng*, Qian Xiong, Guixian Zhang, Wenhui Song
School of Automation Engineering, University of Electronic Science and Technology of China
*Corresponding author: pengchao@uestc.edu.cn

- An HFRL-VIC framework is proposed, which reduces the action-space complexity of high-level reinforcement learning, while low-level fuzzy regulation provides bounded and rule-guided impedance adjustment.
- An FF-RLS-based stiffness estimator is incorporated into the policy state to provide environment-related information for adaptive impedance adjustment.
- The proposed method is validated in simulation under different unknown-stiffness contact conditions, where it achieves better tracking accuracy, transient response, and robustness than baseline methods.



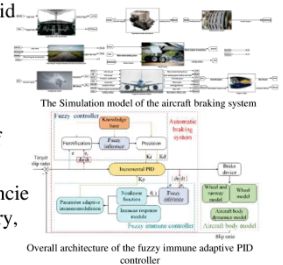
TP3-3 (4) 17:45 - 18:00

Aircraft Anti-Skid Brake Control Strategy Based on Fuzzy Immune Adaptive PID

Feimeng Diao^{1,2}, Dongyan Shi¹, Feng Gu², Changliang Lin², Guanqiao Huang^{3,*}, YiRan Tao³, ZhaoYe Peng³, Xin Wang^{3,*}

- College of Mechanical Engineering, Harbin Engineering University, Harbin, 150001, China;
- AVIC Harbin Aircraft Industry Group Co., Ltd, Harbin, 150060, China
- School of Mechanical and Aerospace Engineering, Jilin University, Changchun, 130022, China

- *Corresponding author: wangxin_jlu@jlu.edu.cn (X.W.) huanggg25@mails.jlu.edu.cn (GQ.H.)
- A fuzzy immune adaptive PID anti-skid braking control strategy is proposed.
- A dynamic model of aircraft ground taxiing and simulation systems for different runways were established, achieving full-condition self-tuning of control parameters.
- This strategy achieves braking efficiency of 95.31%, 94.51%, and 95.60% on dry, wet, and ice tracks respectively.



IEEE ICMA 2026 Conference Digest
TP3-4 Multiple Robot and Distributed Systems

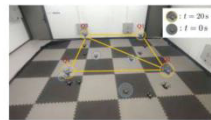
Session Chairs: Tao Chen, Harbin Engineering University
 Minxing Zhang, Harbin Engineering University
UTC+8(Beijing Time): 17:00 - 18:00, Tuesday, 4 August 2026

TP3-4 (1) 17:00 - 17:15

Bearing-Based Formation Tracking: Anti-Unwinding Robust Funnel Control for Quadrotor Swarms

Yancheng Yan, Hongjing Liang*, and Tieshan Li
 School of Automation Engineering, University of Electronic Science and Technology of China
 Chengdu, China

- This work investigates the bearing-based formation tracking problem of quadrotor swarms.
- We develop a novel bearing-based funnel control scheme to address this problem, guaranteeing both transient and steady-state behaviors for the entire control process.
- We construct an anti-unwinding funnel attitude controller to track the desired attitude.



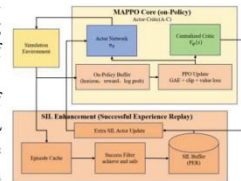
Time-lapse perspective view

TP3-4 (2) 17:15 - 17:30

Cooperative Encirclement of Surface USVs in Unknown Environments via Improved MAPPO

Huayan Zhang, Liting Liu, and Liheng Chen
 Control Science and Engineering, Harbin Engineering University
 Harbin, Heilongjiang Province, China

- Introducing the replay of successful experiences in Self-Imitation Learning (SIL) to address the problem of reward sparsity.
- By employing a dual mechanism of MAPPO online optimization and SIL historical experience extraction, the convergence speed and data utilization efficiency of the algorithm are improved.



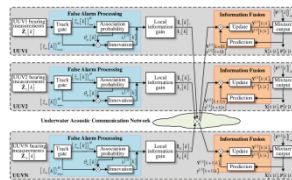
SIL-MAPPO Model

TP3-4 (3) 17:30 - 17:45

IMM-PDA-UIF Fusion Estimation for Multi-UUV Bearing-Only Target Tracking

Qi Qi, Tao Chen, Yanjie Pan, Wenkai Kong
 College of Intelligent Systems Science and Engineering, Harbin Engineering University
 Harbin, China

- A fusion estimation method is proposed to address the multi-UUV BOT problem under complex conditions.
- The superiority of the method is validated under simulation conditions that reflect real-world scenarios.
- Experimental data are used to validate the effectiveness of the method.



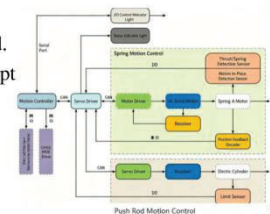
Framework of multi-UUV fusion estimation

TP3-4 (4) 17:45 - 18:00

Design of a control system for a material rotary receiving device

Wei Fu, Minxing Zhang, Ping Wang, Shuwang Liu And Yuhui Bi
 Department of Mechanical Engineering, Harbin Engineering University, China

- Use ONLY PowerPoint file, no other file formats will be accepted.
- Use Arial Narrow fonts of size 36pt in bold face for the paper title and size 20pt regular for the authors, affiliations, city and country.
- Include one picture/graph of your work with >300 dpi resolution.
- Use no more than 5 bullet points, using Time New Roman fonts of size 24pt.



Block diagram of the motion control system for the material receiving device

TP3-5 Organized session: Digital Simulation of Complex Electromechanical Equipment

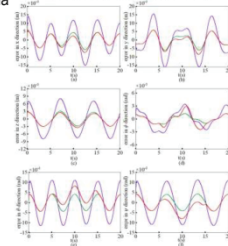
Session Chairs: Xuefei Li, Jilin University, China
Yongyue Yu, Southern University of Science and Technology
UTC+8(Beijing Time): 17:00 - 18:00, Tuesday, 4 August 2026

TP3-5 (1) 17:00 - 17:15

Integrated SMB-IEID Compensation for a Servo-Driven Shipborne Stewart Platform Under Wave and External-Load Disturbances

Lingtao Huang, Zhao Zhang, Kuangqi Chen and Hongyan Zhang
School of Mechanical and Aerospace Engineering, Jilin University
Changchun, China

- Integrated model of servo-driven shipborne Stewart platform.
- SMB rejects wave-induced base motion.
- IEID compensates eccentric-load disturbances.
- Verified under 3-DOF and 6-DOF disturbances.
- SMB-IEID keeps errors near the no-load baseline.



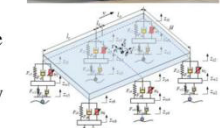
Tracking errors under 6-DOF compound disturbances

TP3-5 (2) 17:15 - 17:30

Prescribed Performance Control of Active Suspension for Three-Axle Vehicles Considering Uncertain Dynamics

Wenbin Liu and Mingde Gong
School of Mechanical Engineering, Yanshan University
Qinhuangda, China

- The dynamic model of the emergency rescue vehicle is established.
- The extended state observer is designed to estimate the disturbances.
- The FTPPF is constructed to guarantee the control accuracy.
- Simulation and real vehicle tests verify the effectiveness and superiority.



The Emergency Rescue Vehicle

TP3-5 (3) 17:30 - 17:45

Digital Twin Full-Process Visualization and Assurance System for Aerial Bombs

XiaoShuai Zhang, Ziyuan Yang, Jiong Qian, Wei Fu*, Yang Li, Sihui Shen
1. Harbin Engineering University
College of Mechanical And Electrical Engineering
2. China Ordnance Industry Group Aviation Ammunition Research Institute Co., Ltd

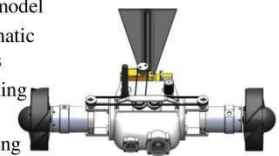
- To address the challenge of real-time stress monitoring in the full logistics support process for aerial bombs, this paper proposes an integrated support solution combining deep learning agent models with digital twins.
- Design differentiated neural network architectures for four typical operating conditions, and achieve high-precision stress prediction across multiple scenarios through dedicated data strategies.

TP3-5 (4) 17:45 - 18:00

Modeling and Motion Control of a Wheel-Propeller Amphibious Robot

Ke Wang, Ningyu Zhang, Kaitong Chai, Lijun Yu, Huiming Xing
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- Establish the on-land motion model based on the differential drive model
- Construct the underwater kinematic model based on hydrodynamics
- Realize on-land trajectory tracking via dual-loop ADRC
- Control underwater heading using backstepping with integral limiting
- Achieve underwater depth control by dual-loop ADRC with dynamic limiting function



Wheel-Propeller Amphibious Robot

TP3-6 Organized session: Inertial Sensor Design and Autonomous Navigation Systems (II)

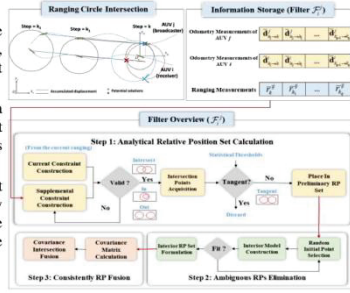
Session Chairs: Liu Yang, Harbin Engineering University, China
Weihaio Wu, Southern University of Science and Technology
UTC+8(Beijing Time): 17:00 - 18:00, Tuesday, 4 August 2026

TP3-6 (1) 17:00 - 17:15

A Scalable and Consistent Underwater Relative Localization Framework for AUV Swarms Based on Multiple Asynchronous Ranging Circle Intersection

Chao Xue, Kefan Chen, Tianyu Wang, Sizhe Zeng, Zongyou Tan and Yulong Huang*
College of Intelligent Systems Science and Engineering, Harbin Engineering University
Harbin, China

- An engineering feasible relative localization framework is proposed, which is scalable and can well adapt to changes of AUV members.
- The proposed framework has a natural robustness advantage against underwater communication delays and packet losses.
- The proposed framework has great advantages in estimation accuracy and consistency under the same computational load and storage space conditions.



TP3-6 (2) 17:15 - 17:30

Study on a Home-Based Elbow Rehabilitation Robot Integrating a Dual-Link Mechanism and Customized Collaborative Strategy

Xiuquan Lu¹, Yiguang Si¹, Mei Feng^{1*}, Chao Han¹, Haoju Li¹,
Bowen Hou¹, Dong He², Xinyue Yan³

1. School of Mechanical and Aerospace Engineering, Jilin University, China

2. College of Electronic Science and Engineering, Jilin University, China

3. Rehabilitation Therapeutics, School of Nursing, Jilin University, Changchun, China

- Home-based elbow rehabilitation robot.
- Dual-link parallel drive mechanism.
- Adjustable human-robot joint alignment.
- Angle-based assist-as-needed control.
- Verified motion and torque response.



Elbow Rehabilitation Robot

TP3-6 (3) 17:30 - 17:45

Multi-Beam Forward-Looking Sonar Target Detection Based on RHDWT-YOLOv11

Ziyang Hu, Xing Liu, and Yan Gao

College of Mechanical and Electrical Engineering, Harbin Engineering University
Harbin, China

- RHDWT-YOLOv11 for multi-beam forward-looking sonar target detection.
- Haar DWT preserves low-frequency contours and high-frequency edge details.
- Residual branch provides semantic compensation during feature compression.
- Compared with YOLOv11n, RHDWT-YOLOv11n improves mAP@50 by 4.52% and mAP@50:95 by 4.27% on the UATD dataset.

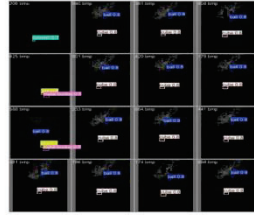


Fig. RHDWT-YOLOv11 visual detection results

TP3-6 (4) 17:45 - 18:00

Prompted to Explore: Training-Time-Only LLM Proposals for Sample-Efficient Pushing Grasping Policies

Meiyuan Gong, Yan Gao, Ze Ji
Cardiff University / Harbin Engineering University / Hohai University

- Sparse-reward SAC tends to overuse grasping and underexplores pushing in cluttered tabletop manipulation.
- We propose a training-time-only LLM proposer that generates push/grasp primitives from a compact scene prompt.
- During early training, validated LLM actions are mixed with SAC actions through an annealed guidance schedule.
- After the guidance window, training and evaluation use SAC alone, with no LLM at test time.
- Sparse-reward SAC tends to overuse grasping and underexplores pushing in cluttered tabletop manipulation.

Method	Success rate (%) ↑	Avg. steps ↓
LLM+SAC + reward shaping	89.5	2.66
LLM+SAC + PPO gate	78.5	4.23
SAC + reward shaping (no LLM)	68.0	3.45

LLM guidance improves early training efficiency and final task success.

TP3-7 Organized session: Material Service Testing Technology and Equipment

Session Chairs: Jianhai Zhang, Jilin University, China

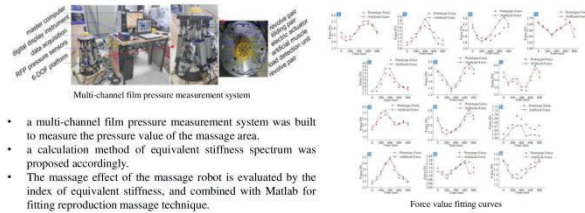
Zhichao Ma, Jilin University

UTC+8(Beijing Time): 17:00 - 18:00, Tuesday, 4 August 2026

TP3-7 (1) 17:00 - 17:15

Study of a Bionic Flexible Massage Robot Evaluated by Equivalent Surface Stiffness

Jiakai Li, Zhichao Ma, Jiaqi Yan, Hongwei Zhao, Luquan Ren
School of Mechanical and Aerospace Engineering, Jilin University
Changchun, China



- a multi-channel film pressure measurement system was built to measure the pressure value of the massage area.
- a calculation method of equivalent stiffness spectrum was proposed accordingly.
- The massage effect of the massage robot is evaluated by the index of equivalent stiffness, and combined with Matlab for fitting reproduction massage technique.

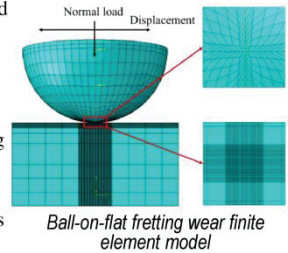
TP3-7 (2) 17:15 - 17:30

Ball-on-Flat Wear Modeling and Evolution of Contact Stress in Fretting Wear

Huashuo Jing¹, Qiang Liu¹, Yanxin Song², Qian Li¹, and Xiuzhi He^{1, *}

¹Key Laboratory of CNC Equipment Reliability, Ministry of Education,
School of Mechanical and Aerospace Engineering, Jilin University, Changchun China
²Shenyang Aircraft Corporation, Shenyang China

- Establishing a 3D ball-on-flat fretting wear model with improved Archard law and UMESHMOTION-ALE coupling.
- Verifying that fretting wear eliminates initial stress concentration, with non-fretting peak stress 5–8× higher.
- Confirming that contact stress rises with load and concentrates with increasing amplitude.

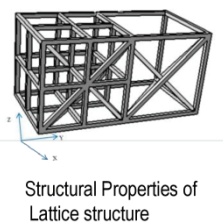


TP3-7 (3) 17:30 - 17:45

Study on the Performance of SLM Ti6Al4V Material and Structural Properties

Dongsen Ye, Zhongzhen Zhang*, Enquan Liang, Xingbei Liu, Zhaochen Li, Pinzhang Chen
Department of Material Engineering
Shanghai Aircraft Design and Research Institute
No. 5188 Jinke Road, Pudong New Area, Shanghai, China

- Study performance of SLM titanium alloy;
- Thin-walled parts are weaker than standard samples;
- Larger samples show better mechanical properties;
- 45° orientation has optimal overall performance;
- Correction factors are required for structural design.



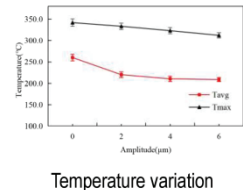
TP3-7 (4) 17:45 - 18:00

Improvement in Cutting Performance and Surface Quality of TC18 Titanium Alloy via Ultrasonic-Assisted Vibration Peripheral Milling under Dry Cutting Conditions

Xiangyou Xue^{1,2}, Dongyan Shi¹

¹College of Mechanical and Electrical Engineering,
Harbin Engineering University, Harbin, 150001, China
²Shenyang Aircraft Corporation, Shenyang, 110000 China

- Dry ultrasonic milling experiments are carried out on forged TC18 titanium alloy.
- Increased vibration amplitude effectively lowers forces and temperature.
- The surface roughness of machined material drops by up to 34.9 percent totally.



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Cui, Jinke	MA1-P	Ding, Mingchao	MP2-6
Cui, Ye	MP3-1	Ding, Mingchao	TA1-1
Cui, Ye	TP3-3	Ding, Mingchao	TP1-3
Cui, Yuhang	MP2-4	Ding, Mingchao	TP1-3
-D-		Ding, Mingchao	TP1-3
Dai, Chenglin	MA1-P	Ding, Mingxuan	MA1-P
Dai, Mengchu	TP2-5	Ding, Qicheng	TA1-4
Dai, Qi	TP3-1	Ding, Yan	MA1-P
Dai, Yixin	MP2-6	Ding, Yan	MA1-P
Dai, Yueshan	MA1-P	Ding, Yan	TA2-4
Dai, Zekuan	MA1-P	Ding, Yanan	TP1-6
Dai, Zekuan	MA1-P	Ding, Yaoyu	MP3-5
Dai, Zekuan	MA1-P	Ding, Yuanye	MP3-4
Dardik, Trevor	MP2-7	Ding, Zhanfa	MP3-5
Dardik, Trevor	TA1-4	Ding, Zhanfa	TP1-7
Deng, Lijin	MP2-5	Dong, Shi	TP3-1
Deng, Tongxiang	TA2-7	Dong, YanPeng	MA1-P
Deng, Yanping	TA2-3	Dong, Yuanqing	MP3-6
Deng, Zongquan	MP3-2	Dou, Jianping	MP3-3

Dou, Yuanchen	MP1-2	Fu, Mingyu	MA1-P
Du, Aimin	MA1-P	Fu, Mingyu	MP3-4
Du, Aimin	MP1-3	Fu, Qiang	MA1-P
Du, Juan	TP2-7	Fu, Qiang	MA1-P
Du, Liang	TP2-1	Fu, Qiang	MA1-P
Du, Liang	TP2-5	Fu, Qiang	MA1-P
Du, Ruilong	MP1-1	Fu, Qiang	MA1-P
Du, Zhengchun	MA1-P	Fu, Rao	TA1-7
Dutta, Vibekananda	MP1-7	Fu, Wei	TP3-4
Dutta, Vibekananda	TP1-7	Fu, Wei	TP3-5
-E-		Fu, Wei	TP1-6
Eswaran, Vishweswar	MA1-P	Fu, Yuzheng	MA1-P
-F-		Fujihira, Yoshinori	MP2-5
Fan, Jianhan	MA1-P	Fukimbara, Riko	TP1-7
Fan, Jiarui	TA2-6	-G-	
Fan, Weiqi	MA1-P	Galipon, Josephine	MA1-P
Fan, Zhennan	MA1-P	Gao, Bin	TP3-1
Fang, Hongwei	MP3-5	Gao, Bingzhao	MP3-4
Fang, Shuo	MA1-P	Gao, Bingzhao	TA1-1
Feng, Guang	MP2-6	Gao, Fei	MP1-1
Feng, Mei	TA2-5	Gao, Hongyu	MA1-P
Feng, Mei	TP3-6	Gao, Huiqiang	MP1-1
Feng, Mei	TP2-7	Gao, Qiushuang	MP1-5
Feng, Shuaixuan	MP2-4	Gao, Xingjun	TA1-4
Feng, Shuaiyuan	MA1-P	Gao, Xinyan	MP3-4
Feng, Zhiguang	MA1-P	Gao, Xinyu	MA1-P
Feng, Zhiguang	MP3-4	Gao, Xinyu	TA2-6
Feng, Zhiguang	TA1-6	Gao, Yan	TP3-6
Feng, Zhuotao	MP3-3	Gao, Yan	TP3-6
Fu, Lequn	TA1-3	Gao, Yaohui	MP1-4
		Gao, Yong	TA1-3

Gao, Yuanxin	MA1-P	Guo, Ranchao	MA1-P
Gao, Yuanxin	MA1-P	Guo, Ranchao	TP2-6
Gao, Yuanxin	MP2-4	Guo, Rong	MP1-2
Gao, Zekang	TP2-1	Guo, Shaozhe	MP3-2
Gao, Zixin	TP2-5	Guo, Shijie	MP3-6
Ge, Guangyan	MA1-P	Guo, Shijie	MP1-7
Ge, Lei	MP1-4	Guo, Shuxiang	MA1-P
Ge, Yan	TP1-4	Guo, Shuxiang	MA1-P
Ge, Yan	TP1-6	Guo, Shuxiang	MA1-P
Golsorkhi, Zahra	TA1-5	Guo, Shuxiang	MA1-P
Gong, Meiyuan	TP3-6	Guo, Shuxiang	MA1-P
Gong, Mingde	TP3-5	Guo, Shuxiang	MA1-P
Grech, Raphael	MP2-7	Guo, Shuxiang	MA1-P
Grzegorzek, Marcin	MP1-6	Guo, Shuxiang	MA1-P
Gu, Feng	TP3-3	Guo, Shuxiang	MA1-P
Gu, Shuoxin	MP1-6	Guo, Shuxiang	MA1-P
Guan, Fengxu	MP2-7	Guo, Shuxiang	MA1-P
Guan, Lianwu	MP3-1	Guo, Shuxiang	MA1-P
Guan, Ran	MA1-P	Guo, Shuxiang	MA1-P
Guan, Ran	MP2-4	Guo, Shuxiang	MP3-1
Guo, Chuyu	TP2-1	Guo, Shuxiang	MP2-2
Guo, Hongxiang	MA1-P	Guo, Shuxiang	MP1-3
Guo, Hua	TA1-1	Guo, Shuxiang	MP3-3
Guo, Jian	TP1-3	Guo, Shuxiang	MP2-4
Guo, Jian	TP1-7	Guo, Shuxiang	MP1-5
Guo, Jianwei	MA1-P	Guo, Shuxiang	MP3-5
Guo, Jianwei	MA1-P	Guo, Shuxiang	MP1-6
Guo, Jianwei	MP2-4	Guo, Shuxiang	MP1-6
Guo, Jiayu	MP1-4	Guo, Shuxiang	MP2-6
Guo, Qingzheng	TA1-6	Guo, Shuxiang	MP2-6
Guo, Qizhou	TA2-3	Guo, Shuxiang	MP1-7

Guo, Shuxiang	MP3-7	Habib, Maki K	MP3-3
Guo, Shuxiang	TA1-1	Habib, Maki K.	MA1-P
Guo, Shuxiang	TP1-1	Han, Changjun	TA2-7
Guo, Shuxiang	TP1-1	Han, Chao	TA2-5
Guo, Shuxiang	TP1-1	Han, Chao	TP3-6
Guo, Shuxiang	TP3-1	Han, Chao	TP2-7
Guo, Shuxiang	TP1-3	Han, Dong	MA1-P
Guo, Shuxiang	TP1-3	Han, Dong	MA1-P
Guo, Shuxiang	TP1-3	Han, Jiawen	MP3-2
Guo, Shuxiang	TP1-3	Han, Junyu	MP3-1
Guo, Shuxiang	TP2-3	Han, Junyu	MP3-7
Guo, Shuxiang	TP3-3	Han, Tianrun	TA1-3
Guo, Shuxiang	TP1-4	Han, Xintong	MP1-5
Guo, Shuxiang	TP2-4	Han, Yeyang	MA1-P
Guo, Shuxiang	TP2-4	Han, Yeyang	MP1-3
Guo, Shuxiang	TP2-4	Han, Yujin	MA1-P
Guo, Shuxiang	TA1-5	Han, Zixuan	MP3-5
Guo, Shuxiang	TP1-5	Hanajima, Naohiko	MP2-5
Guo, Shuxiang	TA1-7	Händle, Florian	MP2-2
Guo, Shuxiang	TP1-7	Hao, Sun	TA2-6
Guo, Taiming	MP1-1	Harada, Kensuke	TA2-4
Guo, Taiming	TA2-6	Hassan, Ibrahim	MP1-2
Guo, Xiaodong	MP1-5	Hayakawa, Soichiro	TA2-1
Guo, Xiaodong	MP3-7	He, Changhong	MP2-2
Guo, Yaxing	TP1-6	He, Chengkun	MP1-1
Guo, Yi	MA1-P	He, Chuhan	MA1-P
Guo, Yi	MA1-P	He, Chuhan	MP2-4
Guo, Yujie	MA1-P	He, Dong	TA2-5
Guo, Zhibo	MP3-4	He, Dong	TP3-6
Guo, Zizhao	MP3-2	He, Dong	TP2-7
-H-		He, Fengshuo	MP3-2

He, Guang	MP3-1	Hu, Qincheng	MA1-P
He, Jialin	TP1-4	Hu, Qincheng	MA1-P
He, Jialun	MA1-P	Hu, Qincheng	MP2-4
He, Ran	MP1-5	Hu, Qincheng	MP3-6
He, Ruijie	MP3-3	Hu, Qinglei	MP1-3
He, Ruijie	TP1-3	Hu, Xiaolong	TA2-6
He, Ruijie	TA1-7	Hu, Xinrong	TA1-4
He, Xin	MP1-7	Hu, Xueying	MA1-P
He, Xin	TP1-7	Hu, Xueying	MA1-P
He, Xiuzhi	TA1-1	Hu, Yang	MA1-P
He, Xiuzhi	TP3-7	Hu, Yaoguang	MA1-P
He, Ying	MP2-6	Hu, Zhengtao	TP2-1
He, Yuansong	MP2-7	Hu, Zhengtao	TA2-4
Heng, Yukang	MP2-3	Hu, Zhengtao	TP2-5
Herrmann, Fiona	MP2-2	Hu, Ziyang	TP3-6
Hong, Chengan	MP1-1	Hua, Chenhui	MP1-7
Hong, Shunming	MP1-6	Hua, Chenhui	TA1-4
Hosoyama, Kaisei	TP1-5	Huang, Bo	MP3-2
Hou, Bowen	TA2-5	Huang, Bo	MP3-2
Hou, Bowen	TP3-6	Huang, Fang	MA1-P
Hou, Bowen	TP2-7	Huang, Fang	MA1-P
Hou, Meijiang	TA1-3	Huang, Fang	MA1-P
Hou, Xiaonan	TA1-1	Huang, Fang	MA1-P
Hu, Chengzhi	MP3-6	Huang, Fang	MP1-5
Hu, Chengzhi	TP1-7	Huang, Fang	MP3-7
Hu, Daqi	MA1-P	Huang, Guanqiao	TP3-3
Hu, Feng	MP2-4	Huang, Hao	TP1-6
Hu, Hongchao	TP1-4	Huang, Huiling	MP2-6
Hu, Jie	MP1-1	Huang, Ji	MP1-6
Hu, Jie	MP3-7	Huang, Ji	MP3-6
Hu, Junyan	TP2-1	Huang, Jia	TP1-6

Huang, Junchi	MP3-6	Hui, Xiaoliang	MP3-2
Huang, Junjie	TA2-6	Hutomo, Prasetya	MP3-5
Huang, Le	MP2-4	- -	
Huang, Le	TP1-1	IKEDA, Shinri	MA1-P
Huang, Le	TP1-1	IKEDA, Shinri	MA1-P
Huang, Le	TP2-3	Ikeura, Ryojun	TA2-1
Huang, Le	TP3-3	INOMATA, Shohei	TA1-7
Huang, Lingtao	MP3-4	-J-	
Huang, Lingtao	TP3-5	Ji, Bowen	TP2-7
Huang, Longzhe	TP2-5	Ji, Feng	MA1-P
Huang, Panfeng	TP1-5	Ji, Ze	MP2-7
Huang, Panfeng	TP1-5	Ji, Ze	TP3-6
Huang, Qiang	TP2-5	Jia, Fang	MP2-5
Huang, Qingjiu	MP1-3	Jia, Haitao	MA1-P
Huang, Qingjiu	TP1-5	Jia, Jiaming	MP2-4
Huang, Shangci	MP2-2	Jia, Lin	MP2-3
Huang, Tian-Yun	TP2-1	Jia, Mingqiang	MA1-P
Huang, Xiaodong	MA1-P	Jia, Peng	TA1-7
Huang, Xiaodong	MA1-P	Jia, Pu	MP2-2
Huang, Xiaodong	MP2-4	Jia, Yu	TP2-6
Huang, Xiaodong	MP3-6	Jiang, Bibo	MA1-P
Huang, Yilei	MP1-7	Jiang, Bowen	MP1-4
Huang, Yilei	MP3-7	Jiang, Bowen	TA2-1
Huang, Yuhong	TP2-4	Jiang, Junlin	MA1-P
Huang, Yulong	TP2-6	Jiang, Li	MP1-7
Huang, Yulong	TP3-6	Jiang, Nan	TA1-1
Huang, Zeyi	TA2-3	Jiang, Pei	TA1-7
Huang, Zhaowei	MA1-P	Jiang, Shan	MP3-5
Huang, Zhaowei	MA1-P	Jiang, Shan	TA1-1
Huang, Zhaowei	MP2-4	Jiang, Shan	TP1-7
Huang, Zhaowei	MP3-6		

Jiang, Tao	MP1-6	Kiyokawa, Takuya	TA2-4
Jiang, Wenkai	MA1-P	Klug, Nathalie	MP1-1
Jiang, Yongxin	TP1-4	Klug, Nathalie	MP2-2
Jiang, Zhenlin	MP1-2	Kong, Danni	TA1-4
Jiao, Ce	MA1-P	Kong, Fankai	TP2-7
Jie, Congxin	MA1-P	Kong, Liubo	TA2-4
Jie, Congxin	MA1-P	Kong, Wenkai	TP3-4
Jie, Yuxin	TA2-6	Koyanagi, Ken'ichi	MP1-1
Jin, Houyu	MP3-6	Koyanagi, Ken'ichi	TP1-1
Jin, Houyu	TA2-3	Krajník, Tomáš	TP2-1
Jin, Jialiang	MP2-5	Kramer, Markus	MP2-2
Jin, Lihui	TA2-1	Krishnappa, Chiranthan	MA1-P
Jin, Ting	TP2-6	Krishnappa, Chiranthan	TA1-5
Jin, Xiaoliang	MA1-P	Kyuragi, Yusuke	TP3-1
Jing, Huashuo	TP3-7	-L-	
Jing, Xian	TA2-7		
Jinshi, Chen	MA1-P	Lai, Yonghao	MP2-5
Joseph, Jonish Abisheck	MP2-1	Lan, Ting	TA1-4
Ju, Cheng	TP1-5	Lei, Jingxi	MP1-7
-K-		Lei, Liu	MA1-P
		Lei, Qi	MP1-4
Kairui, Wang	MA1-P	Lei, Qirong	MP2-4
Kamal, Mohamed	MP3-3	Lei, Qirong	TP1-1
Kan, Zhigang	MA1-P	Lei, Qirong	TP1-1
Kandath, Harikumar	MP2-1	Lei, Qirong	TP2-3
Kandath, Harikumar	MP1-5	Lei, Qirong	TP3-3
Kang, Sheng	TP1-6	Lei, Zhiqin	TA2-7
Kang, Zhenkuo	MP2-3	Leng, Jun	MA1-P
Kang, Zhenkuo	TA2-3	Leng, Jun	MP1-6
Kawana, Toshiaki	MP1-3	Leng, Jun	MP2-6
Keshvari, Sanaz	MP2-2	Leng, Mingyang	MP3-1
Kim, Lily	MA1-P	Li, Anhu	MP2-5

Li, Bin	MP1-5	Li, Chunying	TP1-1
Li, Bin	MP2-7	Li, Chunying	TP1-1
Li, Bin	TP3-1	Li, Chunying	TP1-1
Li, Bing	MP3-4	Li, Chunying	TP3-1
Li, Binlong	MP3-2	Li, Chunying	TP1-3
Li, Chao	MA1-P	Li, Chunying	TP2-3
Li, Chenggang	MA1-P	Li, Chunying	TP3-3
Li, Chenggang	MA1-P	Li, Chunying	TP1-4
Li, Chuang	MP1-6	Li, Chunying	TP2-4
Li, Chunying	MA1-P	Li, Chunying	TP2-4
Li, Chunying	MA1-P	Li, Chunying	TP2-4
Li, Chunying	MA1-P	Li, Chunying	TA1-5
Li, Chunying	MA1-P	Li, Chunying	TP1-5
Li, Chunying	MA1-P	Li, Ciel	MA1-P
Li, Chunying	MA1-P	Li, Dahua	MA1-P
Li, Chunying	MA1-P	Li, Dahua	MA1-P
Li, Chunying	MA1-P	Li, Fengyu	MP1-1
Li, Chunying	MA1-P	Li, Fengyu	MP3-5
Li, Chunying	MA1-P	Li, Fengyu	TP1-1
Li, Chunying	MA1-P	Li, Guangyu	TP2-7
Li, Chunying	MA1-P	Li, Guiwei	TP1-6
Li, Chunying	MP3-1	Li, Guodong	TA1-5
Li, Chunying	MP2-2	Li, Haiyuan	MP3-1
Li, Chunying	MP1-3	Li, Hao	MA1-P
Li, Chunying	MP2-4	Li, Hao	TP1-3
Li, Chunying	MP1-5	Li, Haoju	TA2-5
Li, Chunying	MP1-6	Li, Haoju	TP3-6
Li, Chunying	MP1-6	Li, Haoju	TP2-7
Li, Chunying	MP2-6	Li, Haotian	MA1-P
Li, Chunying	MP1-7	Li, He	MP3-3
Li, Chunying	MP3-7	Li, He	TP1-3

Li, He	TA1-7	Li, Pengcheng	MA1-P
Li, Hongwei	MA1-P	Li, Pengcheng	MA1-P
Li, Hongwei	MP3-7	Li, Pengcheng	MA1-P
Li, Hui	MP1-2	Li, Pengcheng	MA1-P
Li, Ji	MP1-7	Li, Pengcheng	MA1-P
Li, Jiakai	TP3-7	Li, Pengcheng	MP3-1
Li, Jian	TP1-6	Li, Pengcheng	MP2-2
Li, Jianxue	MP2-3	Li, Pengcheng	MP2-4
Li, Jiayang	MP1-4	Li, Pengcheng	MP1-5
Li, Jieli	TA1-1	Li, Pengcheng	MP1-6
Li, Jin	TA1-6	Li, Pengcheng	MP1-6
Li, Jingyu	MP1-7	Li, Pengcheng	MP2-6
Li, Jingyu	MP3-7	Li, Pengcheng	MP1-7
Li, Jinian	MA1-P	Li, Pengcheng	TP1-1
Li, Jinian	TP1-3	Li, Pengcheng	TP1-1
Li, Jinyang	MP3-7	Li, Pengcheng	TP1-3
Li, Jinyang	TP2-6	Li, Pengcheng	TP3-3
Li, JiQiang	TP1-6	Li, Pengcheng	TA1-5
Li, Juan	MP3-1	Li, Qi	MA1-P
Li, Juan	TP2-1	Li, Qi	MA1-P
Li, Jun	MP2-2	Li, Qi	MP2-6
Li, Junhua	MA1-P	Li, Qian	TP3-7
Li, Junlai	MP1-1	Li, Shan	MA1-P
Li, Junlai	MP3-7	Li, Shan	TA1-4
Li, Kecheng	MA1-P	Li, Shen	MA1-P
Li, Kexiang	MP1-6	Li, Shiqi	MA1-P
Li, Kuiyu	TP2-5	Li, Shiqi	TA1-3
Li, Luwen	MP2-2	Li, Shiwei	MP2-3
Li, Meng	TA2-1	Li, Shuohan	MP2-7
Li, Pengchen	TP1-1	Li, Shuqi	MA1-P
Li, Pengchen	TP2-3	Li, Shuqi	TP1-4

Li, Shuqi	TA2-5	Li, Zhehao	TA2-6
Li, Tao	MP3-1	Li, Zhehao	TA2-6
Li, Tieshan	TP3-4	Li, Zhilong	TA2-5
Li, Tina Dongxu	MP2-7	Li, Zixiong	TP1-4
Li, Tina Dongxu	TA1-4	Li, Zongxuan	MP3-4
Li, Wan	TA2-4	Li, Zufeng	TA2-6
Li, Wen	MA1-P	Liang, Enquan	TP3-7
Li, Wen	MA1-P	Liang, Hong	MA1-P
Li, Xiang	TP2-4	Liang, Hong	MA1-P
Li, Xiaofeng	TP2-6	Liang, Hongjing	TP3-4
Li, Xiaohong	TP2-6	Liang, Shichang	TP1-4
Li, Xing	MP2-7	Liang, Xiyue	MP3-7
Li, Xinming	MP2-6	Liang, Yingshuo	TP3-1
Li, Xinrong	MA1-P	Liao, Haisu	MP1-1
Li, Xinyi	MP2-5	Liao, Kaiji	MA1-P
Li, Xiujun	TP3-1	Liao, Ran	TP2-4
Li, Xu	TP3-3	Liao, Yujie	MP2-6
Li, Xuanton	TP1-5	Liao, Zitong	MA1-P
Li, Yang	MP3-1	Liao, Zitong	MA1-P
Li, Yang	TP3-5	Lihui, Zhu	MA1-P
Li, Yifei	MA1-P	Lijing, Wang	MA1-P
Li, Yinglong	MP1-6	Lin, Changliang	TP3-3
Li, Yiran	MA1-P	Lin, Chuyang	MA1-P
Li, Yongchao	MA1-P	Lin, Jieqiong	TA2-7
Li, Yuansheng	MP3-3	Lin, Jinshu	MP1-2
Li, Yueqiang	MP3-2	Lin, Rongxia	TA1-7
Li, Yuyao	MP2-4	Lin, Yongji	MP1-1
Li, Yuyao	TA1-3	Lin, Zhuofu	TP2-4
Li, Zebin	MA1-P	Lin, Zizhang	MA1-P
Li, Zhaochen	TP3-7	Lin, Zizhang	TP1-3
Li, Zhehao	MA1-P	Lindmüller, Moritz	MP1-1

Liu, Ankang	MP1-3	Liu, Shun	MP2-7
Liu, Chang	TP1-5	Liu, Shuwang	TP3-4
Liu, Cong	MP2-1	Liu, Sisi	MP1-3
Liu, Fengqi	TA1-4	Liu, Sisi	MP2-3
Liu, Guocai	MA1-P	Liu, Tiancheng	TP1-7
Liu, Haowei	TA1-7	Liu, Wen	TA2-7
Liu, Heping	TA1-5	Liu, Wenbin	TP3-5
Liu, Hongyuan	MP1-5	Liu, Xi	MP1-2
Liu, Hongyuan	MP2-7	Liu, Xiaodong	TA2-1
Liu, Junli	MA1-P	Liu, Xiaofei	MP2-7
Liu, Kaixin	MA1-P	Liu, Xiaoming	TP2-5
Liu, Kaixin	MA1-P	Liu, Xin	MA1-P
Liu, Keke	TA1-3	Liu, Xing	TP3-6
Liu, Kun	MA1-P	Liu, Xingbe i	TP3-7
Liu, Kun	MA1-P	Liu, Xiufeng	MA1-P
Liu, Kun	MP2-4	Liu, Xiufeng	TA1-4
Liu, Kun	MP3-6	Liu, Xueting	MA1-P
Liu, Lei	MA1-P	Liu, Yi	MA1-P
Liu, Lei	MP2-4	Liu, Yi	TA2-5
Liu, Letao	MA1-P	Liu, Yi	TP2-6
Liu, Lijie	TP2-7	Liu, Yi	TP1-7
Liu, Liting	TP3-4	Liu, Yibin	TA1-3
Liu, Meiqin	TP2-3	Liu, Yihong	MA1-P
Liu, Ming	TA1-3	Liu, Yong	TA2-6
Liu, Qiang	TP3-7	Liu, Yongchao	TA1-6
Liu, Qiaobin	MP3-4	Liu, Yuchang	MA1-P
Liu, Renke	MP1-7	Liu, Yufeng	TP2-4
Liu, Ruiliang	MP2-7	Liu, Yumeng	MA1-P
Liu, Ruiwei	MP2-6	Liu, Yunan	TA2-6
Liu, Shanjian	TP1-7	Liu, Zhifeng	TP1-6
Liu, Shenghui	TP2-6	Liu, Ziyang	MP3-7

Long, Dunfa	MP3-6	Lyu, Zixuan	MA1-P
Long, Jipeng	MA1-P	-M-	
Lu, Dake	MA1-P	Ma, Guangxin	TA1-3
Lu, Dengjie	MA1-P	Ma, Haoyu	MA1-P
Lu, Dengjie	TA1-5	Ma, Haoyu	MA1-P
Lu, Mingjian	TA1-4	Ma, Hongwen	TP2-5
Lu, Shuyi	MA1-P	Ma, Jin	MP1-1
Lu, Xiuquan	TA2-5	Ma, Li	MP1-2
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Lu, Xulong	MP3-6	Ma, Xianglong	MP2-3
Lu, Yi	TA2-4	Ma, Xianglong	TA2-3
Lu, Yi	TA2-6	Ma, Xiaohan	TP2-3
Lu, Yining	MA1-P	Ma, Xin	MP1-6
Lu, Yining	TP1-3	Ma, Xin	MP3-6
Lu, Yong	MP3-2	Ma, Xuran	MP3-6
Luan, Hao	TA2-1	Ma, Yingbo	TA2-5
Luan, Jiayi	MP1-2	Ma, Yue	MP1-5
Luo, Ani	TA1-5	Ma, Yue	MP2-7
Luo, Jintao	TA1-1	Ma, Yuke	MP2-5
Luo, Jintao	TP1-3	Ma, Yuke	MP1-6
Luo, Meng	TP1-4	Ma, Yuzhi	MA1-P
Luo, Siyong	MP1-2	Ma, Zhichao	TP3-7
Luo, Wei	TP1-6	MacDonald, Bruce	MP2-1
Luo, Wei	TP1-6	Magdy, Mahmoud	TP2-1
Luo, Yifan	MP1-7	Magdy, Mahmoud	TP2-5
Luo, Yucong	MP2-6	Mann, Steve	MA1-P
Lv, Jun	MA1-P	Mann, Steve	MP2-1
Lv, Wenbo	TA2-6	Mann, Steve	MP1-2
Lv, Xinbei	TA2-6	Mao, Wei	MA1-P
Lv, Yichen	MA1-P	Masuta, Hiroyuki	MP1-1

Masuta, Hiroyuki	TP1-1	Nan, Yaru	TP2-7
Matsumaru, Takafumi	MP1-7	Ni, Tao	MP3-4
Matsumaru, Takafumi	TP1-7	Ni, Xiaobao	MP3-2
McGale, Chris	MP2-1	Ni, Zhanghao	MP3-3
McLoone, Sean	MP2-1	Nie, Chongyang	TP2-7
Mei, Lin	TA2-6	Nie, Jinglei	MP1-5
Meier, Rudolf	MP2-2	Nie, Jinglei	MP1-7
Meng, Bumin	MA1-P	Ning, Zekun	MP2-7
Meng, Fanrong	MP2-3	Niu, Hongbo	TP2-7
Meng, YuLong	TP1-6	Niu, Yan	MA1-P
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Meszaros, Ken	TA1-4	Niu, Yan	TP2-4
Mi, Tianhao	MP2-2	Niu, Yan	TP2-4
Miao, Lixian	MP3-2	NONAKA, Shinnosuke	TA1-7
Miao, Yao	MA1-P	Nowak, Piotr Miroslaw	MA1-P
Migdal, Joshua	MP2-7	-O-	
MIKAMI, Kishin	MA1-P	Oishi, Naoya	TP3-1
MIKAMI, Kishin	MA1-P	OKUI, Manabu	TP2-5
Mikami, Kishin	MA1-P	Olayemi, Kabirat	MP2-1
MIKAMI, Kishin	TA1-7	Omar, Maira	MA1-P
MIKAMI, Kishin	TA1-7	Omata, Rion	MP1-1
Mirzaei, Shahnam	MP2-5	Omata, Rion	TP1-1
Mise, Nachi	MP2-1	Ou, Sichen	TP1-4
MIYAKE, Shota	MA1-P	Ou, Sichen	TA2-5
MIYAKE, Shota	MA1-P	Ou, Yangze	MA1-P
MIYAKE, Shota	TA1-5	-P-	
MIYAKE, Shota	TA1-7	Pan, Honghao	TP2-1
Mizukami, Masato	MP2-5	Pan, Jinhai	MP2-3
-N-		Pan, Jinhai	TA2-3
Nakayama, Shuya	MP1-1	Pan, Qinxue	MP2-1
Namiki, Akio	TP1-5		

Pan, Qinxue	TP2-4	Pullin, Rhys	MP2-7
Pan, Qinxue	TP1-7	Pylatiuk, Christian	MP1-1
Pan, Shuo	TA1-6	Pylatiuk, Christian	MP2-2
Pan, Weixiao	TA1-7	-Q-	
Pan, Yanjie	TP3-4	Qi, Baobao	TP1-6
Pang, Jichao	TP2-5	Qi, Bing	MP1-5
Park, Chan	MP2-1	Qi, Jin	MP1-1
Pawlowski, Marc von	MP1-1	Qi, Jin	MP3-7
Pei, Bohong	MP1-2	Qi, Peisong	MP3-7
Pei, Xinyu	MP3-6	Qi, Qi	TP3-4
Peng, Chao	MA1-P	Qi, Wenhai	TP2-3
Peng, Chao	MP1-3	Qi, Xianyu	MA1-P
Peng, Chao	TP2-1	Qian, Jiong	TP3-5
Peng, Chao	TP3-3	Qian, Sen	TA2-6
Peng, Jiegang	TA1-3	Qiao, Liang	MP3-2
Peng, Ningning	MP3-7	Qiao, Liang	MP3-2
Peng, Peng	MP2-5	Qiao, Ting	MP2-1
Peng, Shuaixin	MA1-P	Qu, Linwei	MP2-3
Peng, Shuaixin	MP2-4	Qu, Shengqian	MA1-P
Peng, Shuaixin	TP1-1	Qu, Shengqian	MA1-P
Peng, Shuaixin	TP2-3	Quan, Qiquan	TA1-5
Peng, Shuhan	MP3-2	-R-	
Peng, Shuhan	MP3-2	Radhakrishnan, Arjun	TP2-5
Peng, Xiwei	MA1-P	Ran, Guan	MA1-P
Peng, Yu	TP2-6	Rangpong, Phurin	MP1-2
Peng, Yu	TP2-6	Rao, Wentao	TA2-4
Peng, Zhaoye	TP3-3	Rao, Yuansheng	MP3-4
Pu, Qian	MP3-5	Ren, Hebin	TP1-6
Pu, Siying	MP2-4	Ren, Hongchen	TA1-1
Pu, Siying	TP1-1	Ren, Luquan	TP3-7
Pu, Siying	TP1-1		

Ren, Wanbo	MP3-4	Shang, Weiwei	TA2-6
Ren, Wanfei	TA2-7	Shang, Weiwei	TA2-6
Ren, Zheda	MP2-5	Shang, Yining	TP1-7
Ren, Zhengyi	TA1-1	Shao, Jiayu	TP1-1
Ren, Zhiyong	TP2-1	Shao, Junhan	MA1-P
Ren, Zhongliang	MP1-1	Shao, Runze	MA1-P
Ritonja, Jožef	MP3-3	Shao, Shuai	TA2-6
Rong, Xuewen	MP2-3	Shen, Bingzhi	TA1-1
Rong, Yu	MA1-P	Shen, Bingzhi	TP1-3
Rong, Yu	TP1-4	Shen, Chaowen	TP1-5
-S-		Shen, Haikuo	MP3-5
		Shen, Miaozhang	MP2-2
Saha, Nainika	MP2-5	Shen, SiHui	TP3-5
SAKAIRI, Shogo	TP2-5	Shen, Xiaoyu	MP3-1
Salamatian, Kavé	MP1-7	Shen, Yingjun	MP3-7
Saur, Leonard	MP1-1	Shen, Yuliang	MP1-1
Saur, Leonard	MP2-2	Shen, Yuliang	MP3-7
Sawada, Hideyuki	MP3-5	Shi, Chaoyang	MP3-6
Sawada, Hideyuki	MP1-7	Shi, Chaoyang	TA2-3
Sawai, Kei	MP1-1	Shi, Dongyan	TP3-3
Sawai, Kei	TP1-1	Shi, Dongyan	TP3-7
Senthilnath, J.	MP1-5	Shi, Feng	MP1-2
Seshadri, Varun	MP1-2	Shi, Ji	MA1-P
SETO, Yusuke	TA1-7	Shi, Ji	TP1-4
Sha, Jianjun	MP2-3	Shi, Jiangwei	TA1-7
Sha, Jianjun	MP1-5	Shi, Jiankun	MP1-4
Sha, Jianjun	TA2-3	Shi, Jingyun	MP3-3
Shang, Junjie	TP2-6	Shi, Liwei	MA1-P
Shang, Wanfeng	MP2-7	Shi, Liwei	TP2-4
Shang, Weiwei	MA1-P	Shi, Liwei	TP2-4
Shang, Weiwei	MP1-1	Shi, Liwei	TP2-4
Shang, Weiwei	TA2-4	Shi, Liwei	TP2-4

Shi, Liwei	TP1-7	Stefanec, Martin	TP2-1
Shi, Senyou	MP3-7	Su, Li	TA1-1
Shi, Yaoyan	MA1-P	Su, Li	TP2-3
Shi, Yujie	MP2-5	Su, Li	TP2-7
Shi, Yulong	TP1-5	Su, Qiang	MP2-6
Shi, Yunde	TP2-4	Su, Xiaoning	TA1-6
SHIMOMURA, Kaima	TP2-5	Su, Yu-Hsiang	TP2-1
Shirali, Hossein	MP2-2	Sui, Chenbo	TA2-4
Si, Yiguang	TP3-6	Sui, Shuwen	TA1-4
Si, Yiguang	TP2-7	Sulaksono, Winnyarto	MP3-5
SOMA, Yuki	TA1-7	Sun, Haoran	TP2-6
Song, Aiguo	MA1-P	Sun, Haotai	MP1-7
Song, Aiguo	TP1-3	Sun, Haotai	MP3-7
Song, Aiguo	TP1-5	Sun, Hongbin	MA1-P
Song, Aiguo	TP1-5	Sun, Jiahui	TP2-4
Song, Changjiang	MP3-1	Sun, Jiawei	MP1-3
Song, Chen	MP1-2	Sun, Jiawei	TP2-1
Song, Haoji	MA1-P	Sun, Linghao	TP3-1
Song, Haoji	TP2-7	Sun, Shaoxin	TA2-6
Song, Lili	TA1-6	Sun, Tao	MP2-2
Song, Lina	MP2-2	Sun, Wei	MA1-P
Song, Mingliang	MP1-3	Sun, Wei	TA1-4
Song, Runze	TP2-3	Sun, Wei	TA2-4
Song, Wanjun	TA1-6	Sun, Wei	TA1-5
Song, Wenhui	TP3-3	Sun, Xiangxu	TP1-5
Song, Yanxin	TP3-7	Sun, Ye	MP1-6
Song, Yimin	MA1-P	Sunakawa, Takeru	TP1-1
Song, Yu	MA1-P	SUZUKI, Norikazu	TP2-5
Song, Yu	MA1-P	-T-	
Song, Yu	MA1-P	TADAKUMA, Kenjiro	MA1-P
Song, Yu	MA1-P	TADAKUMA, Kenjiro	MA1-P

Tadakuma, Kenjiro	MA1-P	Turgut, Ali Emre	TP2-1
Tadakuma, Kenjiro	TA1-5	-V-	
TADAKUMA, Kenjiro	TA1-5	Valeriy, Zaytsev	MP2-5
TADAKUMA, Kenjiro	TA1-7	Van, Mien	MP2-1
TADAKUMA, Kenjiro	TA1-7	Vicol, Alexander	MA1-P
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Tan, Dingzhong	MP3-7	Vicol, Alexander	MP1-2
Tan, Jiyong	MP3-2	Vij, Kartik	MP1-5
Tan, Zongyou	TP3-6	Viyella, Michel A. Herrera	MP2-1
Tang, Chaoquan	MA1-P	Vumiliya, Angelo	TA1-5
Tang, Guangquan	MA1-P	-W-	
Tang, Hongwei	MA1-P	Wan, Haodong	MP3-3
Tang, Min	TA1-4	Wan, Weiwei	TA2-4
Tang, Shufeng	MP1-5	Wan, Xue	TA2-7
Tang, Yi	MP3-7	Wang, Aimin	TP1-4
Tao, Churan	TP1-7	Wang, Aimin	TP1-6
Tao, Guanghong	MA1-P	Wang, Bin	MA1-P
Tao, Guanghong	MA1-P	Wang, Bin	MA1-P
Tao, Shuchen	TA1-3	Wang, Bin	MA1-P
Tao, YiRan	TP3-3	Wang, Bin	MP2-2
Teng, Xuanyi	MA1-P	Wang, Bin	MP3-3
Terao, Kyohei	MP2-1	Wang, Bin	MP1-6
TETSUI, Hikaru	TA1-7	Wang, Bin	TA1-1
Thomas, Rajeem Kutty	MP2-1	Wang, Bin	TP1-3
Tian, Guiyun	TP3-1	Wang, Bin	TP1-3
Tian, Wei	TA1-1	Wang, Bin	TP1-3
Tian, Yaling	MP1-7	Wang, Bing	MA1-P
Tian, Yujie	TP2-1	Wang, Bing	MA1-P
Tong, Binghang	MA1-P	Wang, Bing	MP1-6
Tongjian, Wang	MA1-P	Wang, Bing	MP2-6
Topale, Arya	MP1-5		

Wang, Bixia	MP3-5	Wang, Jiaying	MP2-4
Wang, Caihou	MA1-P	Wang, Jiliang	TP2-1
Wang, Caihou	TA2-5	Wang, Jinghui	MA1-P
Wang, Chuanying	MP2-2	Wang, Jinghui	TP1-4
Wang, ChunJie	MA1-P	Wang, Jinguo	TP1-4
Wang, ChunJie	MA1-P	Wang, Jingyang	TP2-3
Wang, Chunjie	MA1-P	Wang, Jun	MP1-2
Wang, Chunjie	MA1-P	Wang, Ke	TP3-5
Wang, Dan	TP2-7	Wang, Kesheng	MA1-P
Wang, Dongcui	MP2-4	Wang, Kesheng	TP1-3
Wang, Fanjie	MP1-6	Wang, Keyi	TP1-7
Wang, Fanjie	MP3-6	Wang, Kuangkuang	MP3-7
Wang, Feiyang	MP1-4	Wang, Kuankuan	MA1-P
Wang, Feiyang	MP3-4	Wang, Lan	TP1-7
Wang, Fuji	TA1-7	Wang, Lin	TP1-7
Wang, Gang	MA1-P	Wang, Lingfei	MP2-3
Wang, Gang	TA1-7	Wang, Lisheng	MP1-2
Wang, Gongshuo	TA1-7	Wang, Lukai	MP3-2
Wang, Guanghui	MA1-P	Wang, Min	MP3-6
Wang, Hang	TP2-1	Wang, Min	MP1-7
Wang, Hanze	MA1-P	Wang, Minghan	TP2-1
Wang, Hanze	MP1-6	Wang, Minrui	TP1-5
Wang, Hanze	MP2-6	Wang, Ning	MA1-P
Wang, Hanze	TA1-7	Wang, Ning	MA1-P
Wang, Haojie	TA2-7	Wang, Pengfei	MP2-5
Wang, Haoyu	MP1-5	Wang, Pengfei	MP1-6
Wang, Hui	MP2-5	Wang, Ping	TP3-4
Wang, Jiamin	TA2-4	Wang, Punan	TA1-1
Wang, Jian	TP1-3	Wang, Qiang	MP1-7
Wang, Jian	TP1-7	Wang, Qigang	MP2-5
Wang, Jian	TP2-7	Wang, Qinglei	TA2-3

Wang, Qingyi	MA1-P	Wang, Xuming	TA1-4
Wang, Ruosong	MP1-7	Wang, Yanzhuo	TP1-7
Wang, Shaona	TP1-4	Wang, Yao	MP2-3
Wang, Shenyi	MA1-P	Wang, Yao	TA2-3
Wang, Shibo	TP2-6	Wang, Yaonan	MA1-P
Wang, Shuangying	TA1-1	Wang, Yikun	MP1-7
Wang, Suqi	TP1-7	Wang, Ying	TP2-6
Wang, Taiming	TP2-5	Wang, Yingjian	MP3-5
Wang, Tianyi	TA1-1	Wang, Yong	MP3-4
Wang, Tianyu	TP3-6	Wang, Youming	MA1-P
Wang, Tuo	TP2-7	Wang, Youye	MP3-2
Wang, Wei	MP1-7	Wang, Yucheng	TA1-4
Wang, Wei	TA1-4	Wang, Yuhang	MP1-5
Wang, Wenhui	TA2-1	Wang, Yuhang	MP2-7
Wang, Wenxuan	MA1-P	Wang, Yuheng	TA1-5
Wang, Xianglin	TP1-6	Wang, Yujia	TA2-6
Wang, Xiangyu	TA1-7	Wang, Yujin	TA1-1
Wang, Xiaodong	TA2-4	Wang, Zhaoji	MA1-P
Wang, Xiaoyu	TA1-3	Wang, Zhaoji	TP1-4
Wang, Xin	MA1-P	Wang, Zhe	MA1-P
Wang, Xin	MA1-P	Wang, Zheng	TA2-1
Wang, Xin	MP1-5	Wang, Zhengxuan	TA1-3
Wang, Xin	TP3-3	Wang, Zhihao	MA1-P
Wang, Xin	TP2-7	Wang, ZhiHao	MA1-P
Wang, Xinglong	TP2-5	Wang, Zhihao	MA1-P
Wang, Xinling	MP1-5	Wang, Zhongshan	TP2-7
Wang, Xinling	TA2-3	Wang, Zhuo	TP2-5
Wang, Xinyu	MP1-3	Wang, Zhuoran	MA1-P
Wang, Xiukun	MA1-P	Wang, Zihan	MA1-P
Wang, Xiusen	MP1-4	Wang, Zihe	TP1-7
Wang, Xiusen	TA2-1	Wang, Zili	MP1-5

WATANABE, Masahiro	MA1-P	Wu, Jianping	MP2-4
WATANABE, Masahiro	MA1-P	Wu, Jiabin	TA2-6
Watanabe, Masahiro	MA1-P	Wu, Jinglong	TP3-1
Watanabe, Masahiro	TA1-5	Wu, Long	TP1-4
WATANABE, Masahiro	TA1-5	Wu, Qi	MA1-P
WATANABE, Masahiro	TA1-7	Wu, Ruihan	TP3-3
Wei, Hang	MP3-5	Wu, Shuai Ting	TP2-1
Wei, Hanhan	TA2-7	Wu, Wei	MP1-3
Wei, Shiyi	MA1-P	Wu, Wei	MP2-3
Wei, Shuyuan	MA1-P	Wu, Wei	MP3-3
Wei, Tanyong	MP3-6	Wu, Wei	TP2-3
Wei, Wei	MP2-5	Wu, Weihao	MA1-P
Wei, Yanhui	MA1-P	Wu, Weihao	MA1-P
Wei, Yanhui	TP2-5	Wu, Weihao	MP1-6
Wei, Zhenxu	TA2-5	Wu, Weihao	TP1-3
Wei, Ziqi	TP2-4	Wu, Wenzheng	TP1-6
Wen, Chenglong	TP1-5	Wu, Xingyun	MA1-P
Wen, Yi	TA1-7	Wu, Yan	MP2-6
Weng, Xiangyu	MP1-1	Wu, Yifei	MP2-3
Williams, Henry	MP2-1	Wu, Yinan	MP1-1
Wu, Changjun	TP1-6	Wu, Yinan	TA2-6
Wu, Chengrun	MA1-P	Wu, Yingzhe	MP1-2
Wu, Chengrun	TP2-4	Wu, Yujia	TP2-6
Wu, Chengrun	TP2-4	Wühl, Lorenz	MP2-2
Wu, Chengrun	TP2-4	-X-	
Wu, Duidi	MP1-1	Xi, Jier	TP3-1
Wu, Duidi	MP3-7	Xi, Zhiyu	MP3-5
Wu, Fuyang	MP3-4	Xia, Chunguang	TP2-5
Wu, Haotian	TA2-6	Xia, Dan	MP2-4
Wu, Jianping	MA1-P	Xia, Dan	TA1-3
Wu, Jianping	MA1-P	Xia, Ruiting	TP2-7

Xia, Yongqiang	TA2-5	Xu, Leihong	TA1-3
Xiao, Yancai	MP3-5	Xu, Lin	MP1-6
Xiao, Yukun	MA1-P	Xu, Minghui	MP1-5
Xie, Chuan	TP2-1	Xu, Mingzhou	MA1-P
Xie, Haoyu	MA1-P	Xu, Mingzhou	TP1-3
Xie, Haoyu	MA1-P	Xu, Qiushuang	MP2-5
Xie, Haoyu	MP1-6	Xu, Shenglun	MP2-7
Xie, Haoyu	TP1-3	Xu, Tongxuan	TA1-1
Xie, Jichen	TP2-7	Xu, Weiyang	MP2-5
Xie, Yongqiang	MA1-P	Xu, Wentong	TP1-5
Xie, Zhijiang	MA1-P	Xu, Xiaohui	MP3-7
Xin, Qi	MP3-2	Xu, Yujie	MA1-P
Xin, Qianru	MA1-P	Xu, Yujie	MP3-4
Xing, Huiming	TA1-3	Xu, Yujie	TA1-6
Xing, Huiming	TP3-5	Xu, Zhe	MA1-P
Xing, Huiming	TP2-7	Xu, Zhixin	MP2-4
Xing, Xinxin	TP1-6	Xu, Zhixin	TA1-3
Xiong, Changwu	MP2-2	Xue, Chao	TP3-6
Xiong, Haibo	MP3-7	Xue, Leren	MP3-2
Xiong, Qian	TP3-3	Xue, Xiangyou	TP3-7
Xiong, Tao	TA2-5	Xue, Yanchong	TA2-5
Xiong, Tao	TA2-5	Xue, Yuxiang	MP1-2
Xiong, Zhiqiang	TP1-6	-Y-	
Xu, Binbin	TP1-6	Yagi, Tohru	MP1-2
Xu, Chenlong	TP2-6	Yan, Enze	MP2-1
Xu, Huiyin	MA1-P	Yan, Enze	TP2-4
Xu, Jianan	MP2-4	Yan, Han	MP2-4
Xu, Jinkai	TA2-7	Yan, Jiaqi	TP3-7
Xu, Lang	MP2-1	Yan, Qifeng	MP2-3
Xu, Lang	MP3-5	Yan, Xin	MP1-6
Xu, Lang	TP2-4	Yan, Xinyue	TP3-6

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Yan, Yonggan	MP3-5	Yang, Xiaochun	MA1-P
Yan, Yonggan	TA1-1	Yang, Xiaochun	MA1-P
Yan, Yonggan	TP1-3	Yang, Xiaohu	TP1-6
Yan, Zhe	MP1-3	Yang, Xinru	MA1-P
Yang, Bin	TA2-1	Yang, Yang	TA1-7
Yang, Chaozhong	TP2-4	Yang, Yiming	TA1-3
Yang, Chong	MA1-P	Yang, Yiyu	MA1-P
Yang, Chong	MA1-P	Yang, Yongqiang	TA2-7
Yang, Chong	MP1-6	Yang, Yuan	TP1-5
Yang, Chong	TP1-3	Yang, Yuan	TP1-5
YANG, Fengyi	MA1-P	Yang, Yuanjun	MA1-P
Yang, Guodong	TA1-4	Yang, Yun	MA1-P
Yang, Haoyu	MP2-6	Yang, Yutong	MP3-6
Yang, Jialun	MP2-3	Yang, Yuwei	MP1-1
Yang, Li-An	MP1-2	Yang, Yuye	TP2-7
Yang, Liu	TP2-6	Yang, Zhaojun	TA1-1
Yang, Liu	TP2-6	Yang, Zhi	MA1-P
Yang, Longhe	TP2-6	Yang, Zhi	TA2-4
Yang, Ming	MP3-1	Yang, Zhi	TA1-5
Yang, Peng	MP3-4	Yang, Zhigang	MP2-7
Yang, Qian	MP3-3	Yang, Zhiyong	MP3-5
Yang, Qian	TP1-3	Yang, Zhiyong	TA1-1
Yang, Ruifeng	MA1-P	Yang, Zhiyong	TP1-7
Yang, Ruihua	TP2-6	Yang, Zihang	MP1-1
YANG, Shubo	TA1-5	Yang, Zihong	MP2-3
Yang, Taiping	MP1-3	Yang, ZiYuan	TP3-5
Yang, Taiping	MP2-3	Yao, Jianzhe	MA1-P
Yang, Tianjun	MP2-6	Yao, Jiayi	MA1-P
Yang, Wenlong	MP2-3	Yao, Jiayi	TA1-4
Yang, Wenlong	TA2-3	Yao, Jiayi	TA1-5

Yao, Lichang	TP3-1	Yu, Shifeng	TA1-4
Yao, Zhentao	MA1-P	Yu, Shuifeng	MA1-P
Ye, Dongsen	TP3-7	Yu, Xilong	MP2-7
Ye, Xiufen	MP1-3	Yu, Xintian	TP2-7
Ye, Xiufen	TP3-1	Yu, Yang	MA1-P
Ye, Xiufen	TP1-4	Yu, Yating	MP2-2
Yi, Zihao	MA1-P	Yu, Yongyue	TA1-5
Yin, Lu	TP3-1	Yu, Yuetian	TP1-7
Yin, Shan	MP1-2	Yu, Zhaohu	TP3-1
Yin, Ting	MP2-3	Yuan, Beibei	MP2-6
Yin, Ting	TA2-3	Yuan, Huaying	TP1-4
Yin, Yongjie	TP1-4	Yuan, Huaying	TA2-5
YONEDA, Kan	TA1-7	Yuan, Jianjun	TP2-1
Yu, Anqi	MA1-P	Yuan, Jianjun	TP2-5
Yu, Haoqi	MP1-4	Yuan, Jinglin	MP3-7
Yu, Haoqi	TA2-1	Yuan, Shihua	MP1-3
Yu, Hui	MA1-P	Yuan, Shihua	MP3-3
Yu, Jialu	TP2-4	Yuan, Shihua	TP2-3
Yu, Jian	MA1-P	Yuan, Xiangyu	TA1-7
Yu, Jiangwan	TP2-7	Yuan, Yi	MP3-2
Yu, Jinze	TA2-3	Yuan, Yi	TP1-7
Yu, Kaiben	TP1-5	Yue, Liwei	MA1-P
Yu, Lijuan	TP1-6	Yue, Ning	MA1-P
Yu, Lijuan	TP1-6	Yun, Feihong	TA1-7
Yu, Lijun	TP3-5	Yun, Lianghua	MP3-2
Yu, Lingtao	MP2-7	Yuntao, Liu	MA1-P
Yu, Lingtao	TP1-4	-Z-	
Yu, Lingtao	TA2-5	Zeng, Depeng	TA1-6
Yu, Lingtao	TA2-5	Zeng, Kairong	TP3-3
Yu, Lishuai	TA2-6	Zeng, Maosen	TA2-6
Yu, Rongchen	MA1-P	Zeng, Sizhe	TP3-6

Zhai, Fengchen	MA1-P	Zhang, Huayan	TP3-4
Zhan, Yong	MP2-4	Zhang, Huiyan	TA2-6
Zhang, Anyuan	MP2-6	Zhang, Jianhua	MP1-6
Zhang, Anyuan	MP2-6	Zhang, Jiaxing	MP1-6
Zhang, Baoqi	TA2-1	Zhang, Jiayi	TA1-6
Zhang, Bin	MA1-P	Zhang, Jiayu	MA1-P
Zhang, Bin	MP1-1	Zhang, Jiayu	TA1-4
Zhang, Bin	TA2-6	Zhang, Jiayu	TA2-4
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IEEE ICMA 2027

2027 IEEE International Conference on Mechatronics and Automation August 8-11, 2027, Takamatsu, Japan



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Call for Papers



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The 2027 IEEE International Conference on Mechatronics and Automation (ICMA 2027) will take place in Takamatsu, Kagawa, Japan from August 8 to August 11, 2027. The IEEE ICMA 2027 will be held in a hybrid format, including simultaneous on-site and cloud meetings. Located in Takamatsu, Kagawa, Japan. Takamatsu is a small city located at Sikoku which is the smallest island in 4 main islands of Japan. Shikoku contains a lot of temples including Zentsu-ji, where one of the most famous Buddhists, Kukai, was born. As the host city of ICMA 2027, Takamatsu not only provides the attendees with a great venue for this event, but also an unparalleled experience in the Japanese history through several historical architectures. You are cordially invited to join us at IEEE ICMA 2027 in Takamatsu. The objective of ICMA 2027 is to provide a forum for researchers, educators, engineers, and government officials involved in the general areas of mechatronics, robotics, automation and sensors to disseminate their latest research results and exchange views on the future research directions of these fields.

The topics of interest include, but not limited to the following:

- Intelligent mechatronics, robotics, biomimetics, automation, control systems,
- Opto-electronic elements and Materials, laser technology and laser processing
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- Teleoperation, telerobotics, haptics, and teleoperated semi-autonomous systems
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Organized Sessions: Proposals with the title, the organizers, and a brief statement of purpose of the session must be submitted to an OS Chair by April 10, 2027.

Tutorials & Workshops: Proposals for tutorials and workshops that address related topics must be submitted to one of the Tutorial/Workshop Chairs by May 1, 2027.

Important Dates:

April 10, 2027

May 1, 2027

May 15, 2027

June 1, 2027

Full papers and organized session proposals

Proposals for tutorials and workshops

Notification of paper and session acceptance

Submission of final papers in IEEE PDF format



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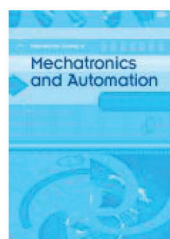
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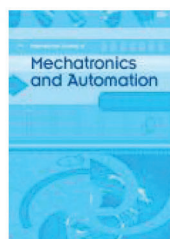
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Program at a Glance

August 2-5, 2026

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Sunday, August 2, 2026	
13:30 - 18:30	Registration Desk Open IEEE Women in Engineering Event
13:30 - 15:00	World Premium Workshops on Mechatronics and Robotics Organized by Prof. Mei Feng, Jilin University
16:00 - 16:50	Keynote Speech 1 (Prof. Aiguo Ming)
16:50 - 17:40	Keynote Speech 2 (Prof. Jianan Xu)
18:00 - 20:00	Reception
Beijing Time	Monday, August 3, 2026
08:30 - 09:00	Opening Ceremony
09:00 - 09:50	Plenary Talk #1 (Prof. Henrik Christensen)
09:50 - 10:40	Plenary Talk #2 (Prof. Darwin G Caldwell)
10:40 - 11:00	Morning Break
11:00 - 12:00	Technical Sessions MA1 (Poster Session)
11:00 - 12:15	Industry-Academia-Research Collaboration Forum
12:00 - 13:30	Lunch Break
13:30 - 15:00	Technical Sessions MP1
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17:00 - 18:30	Technical Sessions MP3
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11:15 - 12:15	Technical Sessions TA2
12:15 - 13:30	Lunch Break
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15:00 - 15:15	Afternoon Break
15:15 - 16:45	Technical Sessions TP2
17:00 - 18:00	Technical Sessions TP3
18:30 - 21:00	Award Banquet in Shangri-La Hotel, Changchun
Beijing Time	Wednesday, August 5, 2026
08:30 - 12:00	Technical Tour

* 15 minutes (Speech: 12 minutes, Q&A:3 minutes) are scheduled for oral presentation including discussions for each paper.

*30 minutes (core time) are scheduled for poster presentation