2025 第八届 IEEE 国际无人系统大会
特邀专题简介表

特邀专题名称

自主无人系统具身感知、规划与控制

组织者

1. 邵翔宇，副研究员，哈尔滨工业大学

2. 周栋，副研究员，哈尔滨工业大学/香港中文大学

3. 曾祎，教授，哈尔滨工业大学

4. 姚蔚然，副教授，哈尔滨工业大学

5. 于忠良，讲师，重庆大学

6. 孙光辉，教授，哈尔滨工业大学

个人简介

邵翔宇，博士，哈尔滨工业大学航天学院副研究员、硕士生导师。2022 年获哈尔滨工业大学控制理论与工程专业博士学位，攻博期间曾获国家留学基金委资助赴荷兰代尔夫特理工大学联合培养。主要从事空间机器人、软体机器人、滑模控制及分数阶控制等领域的研究。目前已在 Springer 出版英文专著 1 部，在 IEEE/ASME Transactions on Mechatronics、IEEE Robotics and Automation Letters、Aerospace Science and Technology 等国际期刊发表论文 20 余篇，获得哈工大优秀博士学位论文奖，主持国家自然科学基金青年基金、中国博士后特别资助、黑龙江省博士后面上等项目。

周栋，博士，哈尔滨工业大学副研究员。2018 年获哈尔滨工程大学自动化专业学士学位，2023 年获哈尔滨工业大学控制科学与工程学科博士学位，目前是哈尔滨工业大学计算学部博士后，香港中文大学机械自动化工程系荣誉博士后。主要从事空间智能感知、深度强化学习、视觉语言机器人及具身智能等领域的研究，主持国自然青年科学基金 1 项、横向项目 4 项。目前，已在 IEEE Transactions on Aerospace and

Electronic Systems、IEEE Transactions on Instrumentation and Measurement、IEEE Robotics and Automation Letters 等国际权威期刊和会议发表学术论文 20 余篇，申请国家发明专利 10 余项。

曾祎，博士，哈尔滨工业大学航天学院教授、博士生导师，国家级高层次青年人才。分别于 2014 年和 2016 年获哈尔滨工业大学工学学士学位及工学硕士学位，于 2021 年在伦敦国王学院获控制科学与工程博士学位。目前从事自主智能无人系统、网络系统、模糊控制、机器人、多智能体等领域的研究，主持国家自然科学青年基金研究项目等项目。

姚蔚然，博士，哈尔滨工业大学航天学院副教授，博士生导师，中国科协第七届"青年人才托举工程"入选者，中国仿真学会智能无人系统建模与仿真专业委员会委员，中国指挥与控制学会智能控制与系统专业委员会委员。主要研究方向是无人系统自主决策、多机器人任务规划与控制等，共发表论文 30 余篇，出版专著 2 部。曾获国家技术发明二等奖、国家部委技术发明一等奖、哈工大优秀博士论文奖等。主持国家自然基金青年项目、国家部委基金项目、黑龙江省优青项目等，参与国家重点研发计划、自然基金重点项目等。

于忠良，博士，重庆大学弘深青年教师。长期从事智能机器人感知系统应用、视觉-语言大模型应用。作为项目负责人主持军委科技委联合基金项目、入选国家博士后创新人才支持计划等。发表 IEEE Trans 等国际权威期刊论文 10 余篇，担任 IEEE Transactions on Aerospace and Electronic Systems/IEEE Transactions on Neural Networks and Learning Systems 等权威期刊审稿人。

孙光辉，男，博士、教授、博士生导师、国家级高层次青年人才。从事视觉伺服控制系统、柔性航天器及滑模控制理论及应用领域的研究。在 Automatica、IEEE Transactions 系列汇刊、AIAA 系列汇刊等权威期刊发表论文 50 余篇；获授权发明专利 40 余项；主持国家自然科学基金等基金 10 余项，获黑龙江省自然科学一等奖和黑龙江省技术发明一等奖各一项。曾担任 Journal of The Franklin Institute 等期刊客座主编，担任国家自然基金、国家重点研发计划项目、香港科技创新项目等项目评审专家。

特邀专题简介

随着人工智能、机器人技术和传感器技术的深度融合，自主无人系统正逐步突破传统功能边界，向高度智能化、自主化和协同化方向发展。然而，在复杂开放环境中，如何实现系统对多模态异构数据的具身感知、如何在动态不确定性约束下完成实时规划与决策，以及如何通过多层级精准控制实现安全可靠的自主行为，仍是制约技术落地的核心挑战。

本特邀专题邀请以下与“自主无人系统具身感知、规划与控制”主题相关的包含创新思想、概念、新发现、改进以及新应用的原创论文。

- 面向复杂开放环境的多模态具身感知
- 人形机器人运动控制与精细双臂操作
- 软体机器人结构设计、建模与控制
- 无人飞行器主动跟踪、导航与避障
- 异构无人系统多任务决策与博弈对抗
- 集群无人系统协同编队与控制

IEEE ICUS 2025
Invited Session Summary

Title of Session

Embodied Perception, Planning and Control of Autonomous Unmanned Systems

Organizers

1. Assoc. Prof. Xiangyu Shao

Harbin Institute of Technology, China

2. Assoc. Prof. Dong Zhou

Harbin Institute of Technology & Chinese University of Hong Kong, China

3. Prof. Yi Zeng

Harbin Institute of Technology, China

4. Assoc. Prof. Weiran Yao

Harbin Institute of Technology, China

5. Asst. Prof. Zhongliang Yu

Chongqing University, China

6. Prof. Guanghui Sun

Harbin Institute of Technology, China

Biosketches of Organizers

Xiangyu Shao received the Ph.D. degree in Control Science and Engineering from the Harbin Institute of Technology, Harbin, China, in 2022. From 2021 to 2022, he was a visiting scholar at Department of Cognitive Robotics, Delft University of Technology, Netherlands. He is currently an Associate Researcher with the School of Astronautics, Harbin Institute of Technology. His research interests include humanoid robots, space robots, soft robots, and control theory. He has published more than 20 research articles in IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Industrial Electronics, IEEE Robotics and Automation Letters, etc.

Dong Zhou received the Bachelor's degree in Automation from Harbin Engineering University in 2018 and the Ph.D. degree in Control Science and Engineering from Harbin Institute of Technology in 2023. He is currently a Postdoctoral Researcher at the School of Computer Science and Technology, HIT, and an Honorary Postdoctoral Fellow in the Department of Mechanical and Automation Engineering,

Chinese University of Hong Kong. His research focuses on spatial intelligent perception, deep reinforcement learning, vision-language robotics, and embodied intelligence. He has led one Youth Science Fund project under the National Natural Science Foundation of China and four industry collaboration projects. To date, he has published over 20 peer-reviewed papers in internationally renowned journals and conferences, including IEEE Transactions on Aerospace and Electronic Systems, IEEE Transactions on Instrumentation and Measurement, and IEEE Robotics and Automation Letters. Additionally, he has filed more than 10 national invention patents.

Yi Zeng received the B.E. degree and M.E degree in control science and control engineering from Harbin Institute of Technology, Harbin, China, in 2014 and 2016, respectively and the Ph.D. degree in Control Sciences and Engineering from King's College London, London, United Kingdom, in 2021. He is currently a professor with the Department of Control Science and Engineering, Harbin Institute of Technology. His research focuses on autonomous intelligent unmanned systems, networked systems, fuzzy control, robotics and multi-agent systems. He is currently serving as the principal investigator for various research projects, including projects funded by the National Natural Science Foundation of China.

Weiran Yao received the Ph.D. degree in Aeronautical and Astronautical Science and Technology from Harbin Institute of Technology (HIT), Harbin, China, in 2020. In 2020, he joined the Department of Control Science and Engineering, HIT as an Assistant Professor, and was then promoted to an Associate Professor in 2021. Yao's research interests include autonomous decision-making of unmanned systems, multi-robot task planning and control, etc. He has published two research monographs and more than 30 research articles. In 2019, He won the first prize of China's a Ministerial Invention Award. In 2020, he won the second prize of China's the State Technological Invention Award. In 2022, he was the winner of the Young Elite Scientist Sponsorship Program by China Association for Science and Technology, and was named the Youth Top-Notch Talent of HIT.

Zhongliang Yu, Hongshen Young Teacher of Chongqing University. He has long been engaged in the application of intelligent robot perception system and the application of visual-linguistic large model. As a project leader, he presided over the joint fund project of Military Science and Technology Commission, and was selected for the Postdoctoral Fellow-ship Program of CPSF. He has published more than 10 papers in international authoritative journals such as IEEE Trans. He serves as a reviewer for IEEE Transactions on Aerospace and Electronic Systems/IEEE Transactions on Neural Networks and Learning Systems.

Guanghui Sun, received the B.S. degree in Automation and the M.S. and Ph.D. degrees in Control Science and Engineering from Harbin Institute of Technology, Harbin, China, in 2005, 2007, and 2010, respectively. He is currently a Professor in the Department of Control Science and Engineering, Harbin Institute of Technology. His research interests include fractional-order systems, nonlinear control systems, visual servo control system, flexible spacecraft, and sliding mode control with its application. He has published more than 50 papers in Automatica, IEEE Trans., AIAA series, et al.

Details of Session

With the deep integration of artificial intelligence, robotics, and sensor technologies, autonomous unmanned systems are progressively breaking through traditional functional boundaries, advancing toward high-level intelligence, autonomy, and collaborative capabilities. However, in complex open environments, critical challenges remain in realizing embodied perception of multimodal heterogeneous data, achieving real-time planning and decision-making under dynamic and uncertain constraints, and ensuring safe and reliable autonomous behaviours through multi-level precise control, all of which hinder the practical deployment of these technologies.

The invited session invites original papers of innovative ideas and concepts, new discoveries and improvements, and novel applications relevant to the following selected topics of “The Embodied Perception, Planning, and Control of Autonomous Unmanned Systems”.

- Multimodal Embodied Perception for Complex Open Environments
- Motion Control and Dexterous Bimanual Manipulation for Humanoid Robots

- Soft-Bodied Robotics: Structural Design, Modeling, and Control
- Active Tracking, Navigation, and Obstacle Avoidance for Unmanned Aerial Vehicles
- Multi-Task Decision-Making and Adversarial Gaming in Heterogeneous Unmanned Systems
- Cooperative Formation and Control of Swarm Unmanned Systems