

2024 第七届 IEEE 国际无人系统大会 特邀专题简介表

特邀专题名称

广域多任务无人系统协同感知、规划与控制

组织者

1. 邵翔宇，助理教授，哈尔滨工业大学
2. 姚蔚然，副教授，哈尔滨工业大学
3. 周栋，副研究员，哈尔滨工业大学/香港中文大学
4. 李佶桃，副教授，哈尔滨工程大学
5. 田广泰，助理研究员，南方科技大学
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助理教授、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 10 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。



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

自然科学基金青年项目、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、自然科学基金重点项目等。



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机学部博士后，香港中文大学机械自动化工程系荣誉博士后。主要从事空间非合作视觉跟踪、深度强化学习、视觉语言机器人及具身智能等领域的研究，曾获哈工大优秀博士毕业生、哈工大优秀博士论文提名奖、中国宇航学会空天智能挑战赛一等奖等荣誉。目前，已在 IEEE Transactions on Aerospace and Electronic Systems、IEEE Robotics and Automation Letters 等国际权威期刊和会议发表学术论文 10 余篇，申请国家发明专利 6 项。



李佶桃，博士，黑龙江省优青，哈尔滨工程大学机电工程学院副教授、硕士生导师。2021年获哈尔滨工业大学控制科学与工程专业工学博士学位，攻博期间曾获国家留学基金委资助赴南洋理工大学联合培养。主要从事水下机器人故障诊断技术的研究。目前在 IEEE Transactions on Automatic Control, IEEE Transactions on Systems, Man, and Cybernetics: Systems、Ocean Engineering 等国际期刊上发表论文 20 余篇。担任 IEEE 工业电子学会“基于数据的控制与监测”技术委员会委员。



田广泰，博士，南方科技大学系统设计与智能制造学院博士后/助理研究员。2017年获南京理工大学机械电子工程专业学士学位，2022年获哈尔滨工业大学控制理论与工程专业博士学位。主要从事航天器控制、机器人控制、预设性能控制、鲁棒控制以及全驱系统理论等领域的研究。目前已在 IEEE Transaction on Aerospace and Electronic System、International Journal of Robust and Nonlinear

Control、International Journal of Systems Science 等国际期刊发表论文 8 篇，并主持广东省科研项目一项。



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，担任国家自然科学基金、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

随着自动化及人工智能领域技术的突破性发展，无人系统在制造业、农业、安防、医疗等领域的应用价值日益凸显。任务规划、感知与控制是提高无人系统自主决策和智能操作的关键技术。一方面，在无人车、无人机等典型无人系统的控制与决策技术取得一系列发展的同时，以人形机器人、软体机器人为代表的极复杂系统的可靠控制与决策问题亟需新的理论与技术革新。另一方面，多模态异构无人系统的集群智能、广域复杂变任务场景下的自主决策与协同等带来了新的挑战。

本特邀专题邀请以下与“广域多任务无人系统协同感知、任务规划与控制”主题相关的包括新思想、概念、新发现、改进以及新应用的原创论文。

- 广域环境无人系统多任务决策与博弈对抗
- 足式机器人步态规划与控制
- 软体机器人结构设计、建模与控制
- 异构无人系统协同感知与建图
- 多无人系统编队集群
- 面向任务的双臂规划与协同控制

IEEE ICUS 2024
Invited Session Summary

Title of Session

Cooperative Perception, Planning and Control of Wide-area Multi-task Unmanned Systems

Organizers

1. Asst. Prof. Xiangyu Shao

Harbin Institute of Technology, China

2. Assoc. Prof. Weiran Yao

Harbin Institute of Technology, China

3. Assoc. Prof. Dong Zhou

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

4. Assoc. Prof. Jitao Li

Harbin Engineering University, China

5. Asst. Prof. Guangtai Tian

Southern University of Science and Technology, 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 Assistant Professor with the School of Astronautics, Harbin Institute of Technology. His research interests include space robots, soft robots, sliding mode control, and fractional order control.



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.



Dong Zhou received the B.S. degree in Automation from the Harbin Engineering University, Harbin, China, in 2018 and the Ph. D. degree in Control Science and Engineering from the Harbin Institute of Technology, Harbin, China, in 2023. He is currently a postdoc in the Department of Control Science and Engineering, Harbin Institute of Technology. His research interests include space noncooperative object visual tracking, deep reinforcement learning, vision-language robotics and embodied intelligence.



Jitao Li, Ph.D, Outstanding youth of Heilongjiang Province, Associate Professor and Master supervisor in the College of Mechanical and Electrical Engineering of Harbin Engineering University. He received the Ph.D. degree in control science and engineering from the Harbin Institute of Technology, Harbin, China, in 2021. From 2019 to 2020, he was a visiting Scholar at School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. His main research interests include the security of unmanned underwater vehicle. He has published more than 20 international papers, including IEEE Transactions on Automatic Control, IEEE Transactions on Systems, Man, and Cybernetics: Systems、Ocean Engineering. He is a member of the Technical Committee of "Data-based Control and Monitoring" of the IEEE Industrial Electronics Society.



Guangtai Tian, received the bachelor's degree in Mechanical Electronic Engineering from the Nanjing University of Science and Technology in 2017, and the Ph.D. degree in Control Science and Engineering from Harbin Institute of Technology in 2022. He is currently working as a post-doctor with the School of System Design and Intelligent Manufacture, Southern University of Science and Technology. His research interests include spacecraft control, robot control, prescribed performance control, robust control, and fully actuated system theorem.



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*, etc.

Details of Session

With the development of technology in the field of automation and artificial intelligence, the application value of unmanned systems in manufacturing, agriculture, security, medical, et al., has become increasingly prominent. Task planning, perception and control in wide area are key technologies to improve autonomous decision-making and intelligent operation of unmanned systems. While the control and decision-making technologies of typical unmanned systems such as unmanned vehicles and unmanned aerial vehicles have made great developments, the reliable control and decision-making of extremely complex systems represented by humanoid robots and soft robots are in urgent need of new theoretical and technical innovations. Besides, the swarm intelligence of multi-modal heterogeneous unmanned systems, autonomous decision-making and collaboration in wide area and complex variable task scenarios bring new challenges.

This invited session invites original papers of innovative ideas and concepts, new discoveries and improvements, and novel applications relevant to the following

selected topics of “Cooperative perception, mission planning and control of wide-area multi-mission unmanned systems”.

- Multi-task decision making and game confrontation of unmanned systems in wide area environment
- Gait planning and control of bipedal robots
- Mechanical design, modeling and control of soft robots
- Collaborative perception and mapping of heterogeneous unmanned systems
- Multi-unmanned system formation and swarming
- Task-oriented dual-arm planning and cooperative control