2026 第九届 IEEE 国际无人系统大会
特邀专题简介表

特邀专题名称

集群具身智能协同决策、规划与控制

组织者

1. 先程鑫，博士后研究员，香港城市大学

2. 刘亚，副教授，西北工业大学

3. 刘永芳，副教授，西北工业大学

4. 赵宇，教授，西北工业大学

个人简介

先程鑫，香港城市大学应用数学系，博士后研究员，中国指挥与控制学会会员,中国自动化学会会员。分别于 2019 年以及 2024 年于西北工业大学获得工学学士及博士学位。主要从事集群智能无人系统协同控制、分布式优化、分布式博弈等方面的研究及应用工作。在国际重要学术期刊和会议发表论文 20 余篇，其中 IEEE 系列汇刊及 Automatica 10 余篇，IEEE TAC 长文 4 篇，ESI 高被引论文 1 篇，授权国家发明专利 1 项。曾获 2022 年 IFAC LSS、2025 年 IEEE ICUS 最佳论文奖，2025 年粤港澳大湾区人工智能与自动化学会优秀论文一等奖。

刘亚，西北工业大学航天学院，副教授，于 2016 年获南京理工大学学士学位，2022 年获西北工业大学博士学位。2022 年入职上海交通大学助理研究员，2024 年 8 月加入西北工业大学航天学院，聘为副教授。长期从事多机器人系统协同规划与控制，及其在空间机器人、无人机集群等领域应用研究。目前共发表学术论文 20 余篇，授权发明专利 10 余项，其中以第一作者身份在 IEEE 汇刊，宇航领域顶刊发表 SCI 论文 10 余篇，高被引论文 1 篇。近五年主持国家自然科学基金、国家重点研发子课题、博士后面上、重点实验室基金及航天院所横向等课题 6 项。

刘永芳，西北工业大学自动化学院，副教授，博士生导师，于 2009 年获东北大学数学系学士学位，2014 年获北京大学工学院力学与工程科学系博士学位。研究方向包括自主智能系统的协同控制、复杂网络分析与综合及其在航空航天工程中的应用。

赵宇，西北工业大学自动化学院，教授、博导，国家优青、陕西省高层次人才，西工大翱翔学者。长期从事集群智能系统协同控制、优化相关研究工作，主持科研项目 10 余项；目前发表学术论文 100 余篇，其中 IEEE 会刊 40 余篇（IEEE TAC 和 Automatica 长文 8 篇），入选 ESI 高被引论文 10 余篇；授权国家发明专利 10 余项。曾获国防科技进步二等奖 1 项，陕西省研究生教育成果奖一等奖 1 项，全国复杂网络最佳论文奖 1 项，陕西省自然科学优秀学术论文奖 2 项，连续入选全球顶尖科学家榜单；2022 年第 16 届 IFAC 复杂系统国际学术会议（IFAC-LSS-2022）大会主席。

特邀专题简介

人工智能技术正经历从单体智能向群体智能的范式转变，多机协同已成为智能系统发展的必然趋势。具身智能体的范畴已突破单一机械臂或移动机器人的局限，逐步向大规模、异构化的无人集群系统（如无人机集群、无人车编队、多机械臂协作系统等）加速演进。近年来，随着大模型、多智能体强化学习、分布式协同控制等技术的突破，集群具身智能在智能制造、低空经济、集群救援、无人作战等领域展现出巨大潜力。本特邀专题旨在汇聚集群具身智能领域中关于协同决策、规划与控制技术的前沿研究成果，探讨如何通过先进的算法和理论框架，解决集群系统在资源分配、任务规划、协同作战等方面的关键问题，推动集群具身智能协同决策、规划与控制技术的理论创新与应用实践。

本特邀专题邀请以下与“集群具身智能协同决策、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。

- 集群具身感知与多模态融合
- 集群具身协同估计
- 集群具身协同决策与控制

- 集群具身优化与博弈
- 集群具身安全与隐私保护
- 集群具身导航与路径规划
- 集群具身数据驱动协同控制

IEEE ICUS 2026
Invited Session Summary

Title Of Session

Cluster-Embodied Intelligent Collaborative Decision-Making, Planning and Control

Organizers

1. Dr. Chengxin Xian

City University of Hong Kong, China

2. Assoc. Prof. Ya Liu

Northwestern Polytechnical University, China

3. Prof. Yongfang Liu

Northwestern Polytechnical University, Xi'an, China

4. Prof. Yu Zhao

Northwestern Polytechnical University, Xi'an, China

Biosketches of Organizers

Chengxin Xian received the B.Eng. degree in Transportation Equipment and Control Engineering and Ph.D. degree in Control Science and Engineering from the School of Automation, Northwestern Polytechnical University, Xi'an, China in 2019 and 2024, respectively. Currently, he is a Post-doctoral Fellow in the Department of Mathematics, City University of Hong Kong, Hong Kong SAR, China. He is the Member of Chinese Command and Control Society, the Member of Chinese Automation Society. His research interests include cooperative control and optimization of clustered unmanned systems and their applications to multi-robot systems. He has published more than 20 papers in important international academic journals and conferences, including more than 10 IEEE Series Transactions and Automatica, 4 IEEE TAC Full papers, 1 ESI highly cited paper. Dr. Xian was awarded the Best Paper Awards of IFAC LSS in 2022, IEEE ICUS in 2025, and the First-class Award of Excellent Paper of Guangdong-Hong Kong-Macao Greater Bay Area Society of Artificial Intelligence and Automation in 2025.

Ya Liu is an Associate Professor with the School of Astronautics, Northwestern Polytechnical University, China. She received her B.Eng. degree from Nanjing University of Science and Technology in 2016 and her Ph.D. degree from Northwestern Polytechnical University in 2022. From 2022 to 2024, she worked at Shanghai Jiao Tong University. She joined Northwestern Polytechnical University in August 2024. Her research interests include cooperative planning and control of multi-robot systems, with applications to space robotics and UAV swarms. She has published more than 20 academic papers and holds more than 10 authorized invention patents. As first author, she has published more than 10 SCI-indexed papers in IEEE Transactions and leading journals in astronautics, including one highly cited paper. In the past five years, she has led six research projects, including grants from the National Natural Science Foundation of China, the National Key R&D Program of China, the China Postdoctoral Science Foundation, key laboratory funds, and aerospace industry partners.

Yongfang Liu received the B.S. degree from the Department of Mathematics, Northeastern University, China, in 2009 and the Ph.D. degree from the Department of Mechanics and Engineering Science, College of Engineering, Peking University, China in 2014, respectively. Currently, she is an Associate Professor in the School of Automation, Northwestern Polytechnical University, Xi'an, China. Her research interests include nonlinear control, optimal control and distributed cooperative control of multi-agent systems

Yu Zhao is a professor and doctoral supervisor at the School of Automation, Northwestern Polytechnical University, a high-level talent of Shaanxi Province, and an Aoxiang Scholar of Northwestern Polytechnical University. He has granted the Excellent Young Scientists Fund of the National Natural Science Foundation of China in 2024. He has been engaged in collaborative control and optimization of multi-agent systems for a long time, and has published more than 100 academic papers, including more than 40 IEEE journals and 8 long articles in IEEE TAC and Automatica. He presided over more than 10 scientific research projects. So far, he has published more than 100 academic papers, including over 40 in IEEE journals (8 long articles in IEEE TAC and Automatica), and more than 10 papers have been selected as ESI highly cited papers. More than 10 national invention patents have been authorized. He has won one second prize for scientific and technological progress in National defense, one first prize for

postgraduate education achievements in Shaanxi Province, one best Paper Award for Complex Networks in China, and two Excellent Academic Paper Awards for Natural Science in Shaanxi Province. He has been continuously included in the list of the world's top scientists. He was a chairman of the 16th IFAC International Conference on Complex Systems (IFAC-LSS-2022) in 2022.

Details of Session

Artificial intelligence technology is undergoing a paradigm shift from individual intelligence to group intelligence, and multi-machine collaboration has become an inevitable trend in the development of intelligent systems. The scope of embodied intelligent agents has broken through the limitations of single robotic arms or mobile robots and is gradually accelerating its evolution towards large-scale, heterogeneous unmanned swarm systems (such as unmanned aerial vehicle swarms, unmanned vehicle platoons, multi-robotic arm collaborative systems, etc.). In recent years, with the breakthroughs in technologies such as large models, multi-agent reinforcement learning, and distributed collaborative control, cluster embodied intelligence has demonstrated great potential in fields such as intelligent manufacturing, low-altitude economy, cluster rescue, and unmanned combat. This invited session aims to gather the cutting-edge research achievements in the field of cluster-embodied intelligent regarding collaborative decision-making, planning and control technologies, and explore how to solve key problems in resource allocation, task planning and collaborative operations of cluster systems through advanced algorithms and theoretical frameworks, promoting theoretical innovation and application practice of collaborative decision-making, planning and control technologies in cluster-embodied intelligent.

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 “Cluster-embodied intelligent collaborative decision-making, planning and control”.

- Embodied perception and multimodal fusion of clusters
- Embodied collaborative estimation of clusters
- Embodied collaborative decision-making and control of clusters
- Embodied optimization and game theory of clusters
- Embodied security and privacy protection of clusters
- Embodied navigation and path planning of clusters
- Embodied data-driven collaborative control of clusters