

# 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

无人集群系统的智能感知、规划与决策关键技术

### 组织者

1. 邵士亮，副研究员，中国科学院沈阳自动化研究所
2. 江 涛，副教授，重庆大学
3. 张 珩，副研究员，中国科学院软件研究所
4. 李 硕，研究员，浙江大学
5. 王 东，教授，大连理工大学

### 个人简介



**邵士亮**，博士、副研究员，中国科学院沈阳自动化研究所，机器人学国家重点实验室成员，中国自动化学会青年工作委员会委员，中国指挥与控制学会青年工作委员会委员。主要研究方向为地面特种机器人关键技术研究，涉及多机器人协同、环境感知、自主决策、人机协同控制等方面的应用基础研究工作。共发表学术论文 30 余篇，申请发明专利 20 余项，承担/参与国家重点研发计划、国家自然科学基金、创新特区快速响应项目、辽宁省自然科学基金、辽宁省应用基础研究计划项目、国家重点实验室自主课题等 10 余项。



**江涛**，重庆大学自动化学院副教授，入选中国科协青年人才托举工程、重庆市博士后创新人才计划，主持/参与国防科技创新特区项目、国家自然科学基金、科技部重点研发计划、重庆市自然基金项目等 10 余项国家级/省部级重点项目。面向无人系统的控制与自主的关键问题，以第一/通讯作者身份在 IEEE 汇刊等国际权威期刊发表 SCI 论文 10 余篇。瞄准无人系统领域国内/外顶级赛事，于 2017 年和 2020 年获得阿布扎比“世界智能无人系统挑战赛”冠军、于 2017 年“无人争锋”挑战赛冠军、于 2020 年获得“智创杯”前沿挑战赛季军等行业重要挑战赛。



**张珩**，中科院软件研究所副研究员，中科院青促会会员、中科院软件所优青，主要研究包括机器人操作系统关键技术、机器人分布式中间件、三维实时仿真、异构计算和边缘智能等；作为负责人主持国家重点研发计划课题、国家自然科学基金、3项华为和腾讯高校合作课题；并作为骨干研究人员负责并参与10余项工信部揭榜挂帅任务、中科院战略性先导科技A类专项及核高基等国家重大专项课题；在国内外顶级会议和期刊上发表论文30余篇（含TACO、PPoPP、Eurosys、ICS、PACT等），获得10余项发明专利和软件著作权；担任TPDS、JPDC、JSC、《软件学报》等国内外核心期刊审稿人；作为负责人开展3项企业合作项目，参与openEuler、OpenHarmony开源操作系统子模块研发工作。



**李硕**，博士，研究员/博导。分别在西北工业大学获学士与硕士学位、荷兰代尔夫特理工大学获博士学位，并于2020年1月至2021年8月于英国爱丁堡大学担任博士后研究员。2022年2月加入浙江大学控制科学与工程学院、工业控制研究所孙优贤院士、陈积明教授的“网络传感与控制”课题组，聘为“百人计划”研究员，博导。目前的研究方向为微小无人机（群）在不确定环境下的高速飞行、四足机器人和无人机群在不确定环境中的协同探索等。多年来致力于研究计算资源受限下的微小无人机（MAV）自主竞速，2019年开发出72g自主竞速无人机并被包括IEEE Spectrum在内的多家媒体报道。2016年获IROS自主竞速无人机比赛第二名。以第一作者在JFR、RAS、ICRA等发表多篇论文。长期担任JFR、RAL、ICRA、IROS等期刊/会议审稿人。



**王东**，大连理工大学控制科学与工程学院教授，博士生导师，教育部“青年长江学者”，智能控制研究所所长。主要从事多智能体强化学习与博弈对抗、机器人果蔬采摘和多机器人协作方面研究工作。在世界知名学术出版社Springer出版英文专著1部，在Automatica等国内外核心期刊、会议发表和录用论文80余篇，其中，SCI检索和刊源60余

篇，申请和授权发明专利 10 余项，授权软件著作权 4 项。主持国家重点研发计划项目 1 项、JKW 基础加强项目 1 项，国家自然科学基金面上项目 2 项、青年基金项目 1 项，参与多项国家级项目。

### 特邀专题简介

智能无人集群系统可以是指由一定数量的同类或者异构无人系统、控制系统及人机交互界面组成，利用信息交互与反馈、激励与响应，实现相互间行为协同，适应动态环境，共同完成特定任务的智能联合系统。无人系统目前按照平台分为无人机、无人车、无人船、无人潜航器、空间机器人、海洋机器人、极地机器人等。对于无人集群系统，环境感知是无人系统与外界环境信息交互的关键环节，通过传感器对无人系统作业环境进行动态感知，基于感知的环境信息，无人系统根据作业任务做出合适的决策、控制和行动。如何利用智能化方法，赋能无人系统环境感知与识别、同步定位与建图、自主导航与避障、决策与控制、路径规划与轨迹跟踪等关键技术是当前无人集群系统领域在学术界和工业界关注的热点。

本特邀专题邀请以下与“无人集群系统的智能感知、规划与决策关键技术”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。另外，把能代表该研究领域前沿水平的观点、论文及其研究成果等进行系统的分析、总结和推论，提出未来发展趋势等的综述性论文。

- 无人系统的环境感知与识别
- 无人系统的同步定位与建图
- 无人系统的自主导航与避障
- 无人系统的决策与控制
- 无人系统的路径规划与轨迹跟踪

**IEEE ICUS 2024**  
**Invited Session Summary**

**Title of Session**

Key Technologies for Intelligent Perception, Planning and Decision Making in  
Multi-Unmanned Systems

**Organizers**

**1. Prof. Shiliang Shao**

Shenyang Institute of Automation (SIA), Chinese Academy of Sciences, China

**2. Prof. Tao Jiang**

Chongqing University, China

**3. Prof. Heng Zhang**

Institute of Software Research, Chinese Academy of Sciences, China

**4. Prof. Shuo Li**

Zhejiang University, China

**5. Prof. Dong Wang**

Dalian University of Technology, China

**Biosketches of Organizers**



**Shiliang Shao** is an Associate Researcher at the State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences. He is also a member of the Youth Working Committee of the Chinese Association of Automation and the Youth Working Committee of the Chinese Society of Command and Control. His primary research focus is on the key technologies of ground special robots, involving applied fundamental research in robot environment perception, robot autonomous decision-making, and human-robot cooperative control. He has published over 30 academic papers and has filed more than 20 invention patents. Dr. Shao has been involved in over 10 projects, including the National Key Research and Development Program, the National Natural Science Foundation of China, the Innovative Special Zone Rapid Response Project, the Natural Science Foundation of Liaoning Province, the Applied Basic Research Program of Liaoning Province, and autonomous projects of the State Key Laboratory.



**Tao Jiang** is an Associate Professor at the School of Automation, Chongqing University. He was selected for the China Association for Science and Technology's Youth Talent Support Program and the Chongqing Postdoctoral Innovation Talents Program. He has led or participated in over 10 national/provincial-level key projects, including the Defense Science and Technology Innovation Special Zone Project, the National Natural Science Foundation, the Key Research and Development Program of the Ministry of Science and Technology, and the Chongqing Natural Science Foundation. Focusing on the control and autonomy of unmanned systems, he has published over 10 SCI papers in internationally recognized journals such as IEEE Transactions. In the field of unmanned systems, he has achieved significant recognition, winning the championship in the Abu Dhabi "World Intelligent Unmanned Systems Challenge" in 2017 and 2020, the championship in the 2017 "Unmanned Combat" Challenge, and the third place in the "Intelligence Cup" Frontier Challenge in 2020, among other important industry competitions.



**Heng Zhang**, Associate Researcher of Institute of Software Research (ISR), Chinese Academy of Sciences (CAS), Member of CAS Youth Promotion Association, Excellent Youth of ISR, CAS. His main research includes key technologies of robot operating system, distributed middleware for robots, 3D real-time simulation, heterogeneous computing and edge intelligence, etc.; he has presided over the topics of the National Key Research and Development Program (KRDP), the National Natural Science Fund (NSF), and 3 Huawei and Tencent university projects as a responsible person; he has been a key researcher. Responsible for and participated in more than 10 Ministry of Industry and Information Technology unveiled marshal task, the Chinese Academy of Sciences strategic pioneering science and technology A class special and nuclear high base and other major national special projects; in the domestic and international top conferences and journals published more than 30 papers (including TACO, PPOPP, Eurosys, ICS, PACT, etc.), more than 10 invention patents and software copyrights; served as TPDS, JPDC, JSC, Journal of Software and other core journals at home and abroad as a reviewer; as the person in charge of three enterprise cooperation projects, participate in openEuler, OpenHarmony open source operating

system sub-module development work.



**Shuo Li** is a researcher/doctoral director. He received his B.S. and M.S. degrees from Northwestern Polytechnical University, and Ph.D. degree from Delft University of Technology, the Netherlands, and was a postdoctoral researcher at the University of Edinburgh, U.K., from January 2020 to August 2021, and he joined the "Network Sensing and Control" research group of Academician Sun Youxian and

Professor Chen Jiaming at the School of Control Science and Engineering, Industrial Control Research Institute, Zhejiang University, China, as a researcher under the "Hundred Talent Program" and a doctoral supervisor. In February 2022, he joined the "Network Sensing and Control" group of Prof. Jieming Chen and Academician Youxian Sun in the School of Control Science and Engineering, Institute of Industrial Control, Zhejiang University, and was appointed as a researcher and doctoral supervisor under the "Hundred Talents Program". His current research interests include high-speed flight of tiny UAVs (swarms) in uncertain environments, and cooperative exploration of quadruped robots and UAV swarms in uncertain environments. He has been working on autonomous racing of tiny UAVs (MAVs) with limited computational resources for many years, and developed a 72g autonomous racing UAV in 2019 and was reported by several media including IEEE Spectrum. He was awarded the second place in IROS Autonomous Racing UAV Competition in 2016. Published several papers in JFR, RAS, ICRA, etc. as the first author. Long term reviewer for journals/conferences such as JFR, RAL, ICRA, IROS, etc.



**Dong Wang** is a professor of School of Control Science and Engineering, Dalian University of Technology, a doctoral supervisor, a "Young Changjiang Scholar" of the Ministry of Education, and the director of the Institute of Intelligent Control. He is mainly engaged in the research of multi-intelligence reinforcement learning and game confrontation, robot fruit and vegetable picking, and multi-robot collaboration.

He has published one English monograph in Springer, a world-renowned academic publisher, more than 80 papers in *Automatica* and other domestic and international core journals and conferences, of which more than 60 are SCI searches and journals,

more than 10 patents for invention and authorization, and 4 authorized software copyrights. He has presided over one project of National Key Research and Development Program, one project of JKW Basic Enhancement Program, two projects of National Natural Science Foundation of China (NSFC) at face level, one project of Youth Foundation, and participated in many national projects.

### **Details of Session**

Intelligent multi-unmanned system can refer to an intelligent joint system that consists of a certain number of similar or heterogeneous unmanned systems, control systems and human-computer interaction interfaces, and uses information interaction and feedback, incentives and responses to realize mutual behavioral synergies, adapt to dynamic environments, and work together to accomplish specific tasks. With the rapid development of unmanned systems-related technologies, unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), unmanned surface vessels (USVs), unmanned underwater vehicles (UUVs), space robots, marine robots, polar robots, and other unmanned systems have been widely applied. Environmental perception is a crucial link for unmanned systems to interact with external environmental information. By dynamically perceiving the operational environment of unmanned systems through sensors, unmanned systems make appropriate decisions, controls, and actions based on the perceived environmental information and operational tasks. The key focus of current academic and industrial attention lies in how to empower unmanned systems with intelligent methods for environmental perception and recognition, simultaneous localization and mapping (SLAM), autonomous navigation and obstacle avoidance, decision-making and control, path planning, and trajectory tracking.

This invited session invites original papers that are related to the theme of "Key Technologies for Intelligent Perception, Planning and Decision Making in Multi-Unmanned Systems." These papers should include innovative ideas, concepts, new discoveries, improvements, and new applications. Additionally, comprehensive review papers are invited that systematically analyze, summarize, and infer viewpoints, papers, and research achievements representing the cutting-edge level in this research field. These review papers should also propose future development trends.

- Environmental perception and recognition for unmanned systems
- Simultaneous localization and mapping (SLAM) for unmanned systems

- Autonomous navigation and obstacle avoidance for unmanned systems
- Decision-making and control for unmanned systems
- Path planning and trajectory tracking for unmanned systems