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

无人系统集群智能与安全控制

组织

1. 刘晗笑，副教授，上海大学

2. 高生，助理研究员，华东理工大学

3. 郭珮瑶，博士后，清华大学

4. 瞿栋，实验师，上海大学

5. 宋锐，副教授，上海大学

个人简介

刘晗笑，上海大学未来技术学院副教授，硕士生导师。入选上海市海外高层次人才计划、上海市青年科技英才扬帆计划、中国指挥与控制学会青年人才托举工程。2017 年获得山东大学工学学士学位，2021 年获得新加坡南洋理工大学和瑞典皇家理工学院联合博士学位。主要研究方向为信息物理系统安全控制、海空跨域无人系统集群智能等。主持国家自然科学基金青年科学基金项目、上海市启明星项目（扬帆专项）等多项课题；作为骨干成员参与国自然重点项目、上海市重点项目等多项项目。近年来发表包括领域顶刊 Automatica、IEEE TAC 在内的高水平论文近 30 篇，授权国家发明专利 6 项。目前担任 CICC 青年工作委员会，以及 IEEE TAC、Automatica、IEEE TCNS 等多个国际顶级期刊审稿人。

高生，华东理工大学信息科学与工程学院助理研究员，入选中国指挥与控制学会青年人才托举工程，中国科协青年人才托举工程博士生专项计划，上海市超级博士后。2019 年 6 月毕业于东华大学自动化专业，获工学学士学位，2025 年 1 月毕业于同济大学控制科学与工程专业，获工学博士学位。主要研究方向为无人集群系统、网络安全和人工智能的基础理论和应用。主持国家自然科学基金青年项目、教育部产学研创新基金项目等国家省部级课题 6 项。近年

来已在 IEEE 汇刊和 AAAI 等控制领域权威期刊和会议发表论文 10 余篇，主编英文专著 1 部，授权和公开发明专利和软著 10 余项。研究成果曾获上海市人工智能学会青年优秀论文奖、上海市自动化学会优秀博士论文奖、Security and Safety 期刊最佳论文奖等。目前担任 JAICS、IR、RL 和《智能安全》期刊青年编委，担任 CAA 青年工作委员会委员、CICC 青年工作委员会和智能控制与系统专委会委员。

郭珮瑶，女，清华大学电子工程系博士后。2016 年 6 月毕业于南京大学通信工程专业，获工学学士学位；2019 年 6 月毕业于南京大学信号与信息处理专业,获工学硕士学位，2024 年 6 月毕业于南京大学信息与通信工程与专业，获工学博士学位。长期专注于图像/视频信号处理相关领域研究，重点解决复杂动态场景下的多源异构成像与融合感知问题。相关研究成果已在 IEEE JSTSP 等领域旗舰期刊及会议上发表学术论文 14 篇，授权专利 5 项，并依托相关项目在一线单位进行推广试用。入选 2025 年中国指挥与控制学会青年人才托举工程，主持国家自然科学基金青年项目 1 项，参与多项国家级科研项目。目前担任 CICC 青年工作委员会委员。

瞿栋，上海大学无人艇工程研究院副院长。2013 年 6 月毕业于上海大学机械工程及自动化专业，获工学学士学位，2016 年 6 月毕业于上海大学机械电子工程专业,获工学硕士学位。主要研究方向为水面无人艇导航、制导、控制与无人系统集群协同技术，主导研制了上海大学精海系列 24 个型号的水面无人艇平台，广泛应用于我国东海、黄海、南海等海域。主持国家、省部级课题及军工横向项目 4 项。近年来已在 IEEE 汇刊等控制领域权威期刊和会议发表论文 20 余篇，授权和公开发明专利和软著 17 项。研究成果曾获中国指挥与控制学会科技进步一等奖、中国造船工程学会科技进步一等奖、中国船舶集团有限公司科技进步一等奖。

宋锐，上海大学未来技术学院副院长，上海市海洋人工智能协同创新中心副主任，毕业于英国伦敦大学学院 UCL，研究方向为：海洋智能无人系统自主决策和博弈。获中国指挥与控制学会科技进步一等奖(排 1),上海市海外高层次人才(青年优秀)，先后主持承担了科技部新一代人工智能国家科技重大专项子课题、陆 Z 预研、海 Z 预言等项目。曾参与项目包括：美国 ONR“大西洋小型控制和设计中心”ACCeSS 项目、英国技术战略委员会 ALEAD 自主驾驶项目等。发表论文 37 篇（包括 Neurocomputing、Ocean Engineering 等 TOP 期刊)，1 篇高被引，论文他引超 900 次。带队指导学生参加科创竞赛，获第十八届“挑战杯”全国大学生课外学术科技作品竞赛“揭榜挂帅”专项赛特等奖，“最具人气作品”团队称号。

特邀专题简介

随着人工智能、通信网络与自主控制技术的快速发展，无人系统（含无人机、无人车、无人艇等）已广泛应用到交通运输、海洋探测、灾害应急、智慧农业、工业巡检、军事侦察等众多领域。相较于单体作业，多无人系统通过信息交互、任务分配与协同决策所形成的“集群”，能够突破单平台在感知范围、载荷能力与任务复杂度上的固有局限，在大范围搜救、编队侦察、协同打击、管线巡检和森林火情监测等典型场景中展现出更高的任务效率、更强的环境适应性与更优的系统鲁棒性，已成为无人系统发展的重要趋势。然而，集群规模的扩大、任务场景的多样化以及开放式通信环境的引入，也使无人集群面临前所未有的挑战：一方面，复杂动态环境下的不确定性、强耦合性与有限通信带宽，对集群的协同感知、分布式决策与一致性控制提出了更高要求；另一方面，集群系统暴露在网络攻击、数据窃听、节点失效与恶意干扰等多重威胁之下，其隐私保护、韧性防御与容错能力直接关系到任务的成败与系统的安全。因此，如何在智能化的同时实现安全可靠的集群控制，已成为当前控制科学与人工智能交叉领域的研究热点和前沿难题。

本特邀专题邀请以下与“无人系统集群智能与安全控制”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，主题包括但不限于：

- 无人系统集群协同感知与信息融合

- 无人系统集群任务规划
- 无人系统集群博弈对抗
- 无人集群自主决策与协同控制
- 无人系统集群的隐私保护与数据安全
- 面向网络攻击与安全威胁的协同防御与弹性控制机制
- 面向无人系统的分布式控制、一致性控制、编队控制与队形重构
- 无人集群的故障诊断、容错控制与任务在线重构

IEEE ICUS 2026
Invited Session Summary

Title of Session

Swarm Intelligence and Secure Control of Unmanned Systems

Organizers

1. Assoc. Prof. Hanxiao Liu
Shanghai University, China
2. Dr. Sheng Gao
East China University of Science and Technology, China
3. Dr. Peiyao Guo
Tsinghua University, China
4. Dr. Dong Qu
Shanghai University, China
5. Assoc. Prof. Rui Song
Shanghai University, China

Biosketches of Organizers

Hanxiao Liu is an Associate Professor and Master's Supervisor at the School of Future Technology, Shanghai University. She has been selected for the Shanghai Overseas High-Level Talent Program, the Shanghai Sailing Program for Young Scientific and Technological Talents, and the Young Elite Scientist Sponsorship Program of the Chinese Institute of Command and Control. She received her B.Eng. degree from Shandong University in 2017, and her joint Ph.D. degree from Nanyang Technological University and KTH Royal Institute of Technology in 2021. Her research interests include security control of cyber-physical systems and swarm intelligence of air-sea cross-domain unmanned systems. She has led several research projects, including the Young Scientists Fund of the National Natural Science Foundation of China and the Shanghai Sailing Program, and has participated as a key member in multiple projects such as the NSFC Key Program and Shanghai Key Projects. In recent years, she has published nearly 30 high-quality papers in top-tier journals in the field, including Automatica and IEEE Transactions on Automatic Control (IEEE TAC), and holds 6 authorized national invention patents. She currently serves as a member of the Youth Working Committee of CICC, as well as a reviewer for several leading international journals, including IEEE TAC, Automatica, and IEEE TCNS.

Sheng Gao, an Assistant Researcher, at the School of Information Science and Engineering, East China University of Science and Technology. He was selected for the Young Elite Scientists Sponsorship Program by the Chinese Institute of Command and Control (CICC), the Young Elite Scientists Sponsorship Program (Ph.D. Student Special Project) by the China Association for Science and Technology, and the Shanghai Super Postdoctoral Program. He received his B.E. degree in Automation from Donghua University in June 2019, and his Ph.D. degree in Control Science and Engineering from Tongji University in January 2025. His main research directions are the fundamental theory and application of unmanned swarm systems, cybersecurity, and artificial intelligence. He has presided over 6 national and provincial-level projects, including the National Natural Science Foundation of China (Youth Project) and the Industry-University-Research Innovation Fund of the Ministry of Education. In recent years, he has published more than 10 papers in authoritative journals and conferences in the control field, such as IEEE Transactions and AAAI, edited 1 English monograph, and holds more than 10 authorized and published invention patents and software copyrights. His research achievements have won the Youth Excellent Paper Award from the Shanghai Association for Artificial Intelligence, the Outstanding Ph.D. Thesis Award from the Shanghai Association of Automation, and the Best Paper Award from the journal Security and Safety. He currently serves as a young editorial board member for journals including JAICS, IR, RL, and Intelligent Safety, and is a member of the Youth Work Committee of CAA, as well as the Youth Work Committee and the Intelligent Control and Systems Technical Committee of CICC.

Peiyao Guo is a postdoctoral researcher in the Department of Electronic Engineering at Tsinghua University. She received her B.Eng. degree in Communication Engineering from Nanjing University in June 2016, her M.Eng. degree in Signal and Information Processing from Nanjing University in June 2019, and her Ph.D. degree in Information and Communication Engineering from Nanjing University in June 2024. Her research has long focused on image/video signal processing, with an emphasis on addressing multi-source heterogeneous imaging and fusion perception in complex dynamic scenarios. She has published 14 academic papers in flagship journals and conferences in the field, including IEEE JSTSP, and has been granted 5 patents. Based on related projects, her research outcomes have been promoted and trialed in frontline application units. She was selected for the 2025 Young Talent Support Program of the Chinese Institute of Command and Control, has served as the principal investigator of one Young

Scientists Fund project supported by the National Natural Science Foundation of China, and has participated in several national-level research projects. She currently serves as a member of the Youth Working Committee of CICC.

Dong Qu is the Vice Director of the Unmanned Surface Vessel Engineering Research Institute. He received his B.E. degree in Mechanical Engineering and Automation from Shanghai University in June 2013, and his Master's degree in Mechatronics Engineering from Shanghai University in June 2016. His main research interests are navigation, guidance, and control of unmanned surface vehicles (USVs), as well as cooperative technologies for unmanned swarm systems. He has led the development of 24 models of the "JingHai" series USV platforms at Shanghai University, which have been widely applied in China's East China Sea, Yellow Sea, and South China Sea. He has presided over 4 national and provincial-level projects, as well as military-industry horizontal projects. In recent years, he has published more than 20 papers in authoritative journals and conferences in the control field, such as IEEE Transactions, and holds 17 authorized and published invention patents and software copyrights. His research achievements have won the First Prize of the Science and Technology Progress Award from the Chinese Institute of Command and Control, the First Prize of the Science and Technology Progress Award from the Chinese Society of Naval Architecture and Marine Engineering, and the First Prize of the Science and Technology Progress Award from China State Shipbuilding Corporation Limited.

Rui Song, is the Vice Dean of the School of Future Technology, Shanghai University, and Deputy Director of the Shanghai Collaborative Innovation Center for Marine Artificial Intelligence. She received her degree from University College London (UCL), United Kingdom. Her research focuses on autonomous decision-making and game theory for intelligent marine unmanned systems. She received the First Prize of the Science and Technology Progress Award from the Chinese Institute of Command and Control, ranking first among the contributors, and was selected for the Shanghai Overseas High-Level Talents Program for Outstanding Young Scholars. She has led several research projects, including a sub-project under the National Science and Technology Major Project on New Generation Artificial Intelligence of the Ministry of Science and Technology of China, as well as pre-research projects in land and maritime domains. She has also participated in international projects, including the U.S. ONR ACCeSS project and the UK Technology Strategy Board ALEAD autonomous

driving project. She has published 37 papers in leading journals, including Neurocomputing and Ocean Engineering, with one highly cited paper and more than 900 citations by other researchers. She has led and supervised students in science and innovation competitions, winning the Special Prize in the "Challenge Cup" National College Students' Extracurricular Academic Science and Technology Works Competition "Open Challenge" track, as well as the title of "Most Popular Project" team.

Details of Session

With the rapid development of artificial intelligence, communication networks, and autonomous control technologies, unmanned systems, including UAVs, UGVs, and USVs, have been widely deployed in numerous fields such as transportation, ocean exploration, disaster emergency response, smart agriculture, industrial inspection, and military reconnaissance. Compared with single-platform operations, the "swarm" formed by multiple unmanned systems through information interaction, task allocation, and cooperative decision-making can overcome the inherent limitations of a single platform in terms of sensing range, payload capacity, and task complexity. In typical scenarios such as large-scale search and rescue, formation reconnaissance, cooperative engagement, pipeline inspection, and forest fire monitoring, unmanned swarms have demonstrated higher mission efficiency, stronger environmental adaptability, and superior system robustness, and have therefore become an important trend in the development of unmanned systems.

However, the expansion of swarm scales, the diversification of mission scenarios, and the introduction of open communication environments have also brought unprecedented challenges to unmanned swarms. On the one hand, the uncertainty, strong coupling, and limited communication bandwidth in complex dynamic environments impose higher requirements on cooperative perception, distributed decision-making, and consensus control of the swarm. On the other hand, swarm systems are exposed to multiple threats such as cyber attacks, eavesdropping, node failures, and malicious interference, where their capabilities of privacy preservation, attack resilience, and fault tolerance directly determine mission success and system security. Therefore, how to achieve safe and reliable swarm control while enhancing intelligence has become a research hotspot and a frontier challenge at the intersection of control science and artificial intelligence.

This invited special session welcomes original papers containing innovative ideas, concepts, new findings, improvements, and novel applications related to the theme of "Swarm Intelligence and Secure Control of Unmanned Systems". Topics of interest include, but are not limited to:

- Cooperative perception and information fusion of unmanned swarms

- Mission planning of unmanned swarms
- Adversarial games and confrontation of unmanned swarms
- Autonomous decision-making and cooperative control of unmanned swarms
- Privacy preservation and data security of unmanned swarms
- Cooperative defense and resilient control mechanisms against cyber attacks and security threats
- Distributed control, consensus control, formation control, and formation reconfiguration of unmanned systems
- Fault diagnosis, fault-tolerant control, and online mission reconfiguration of unmanned swarms