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

群智学习：智能无人系统的分布式控制与优化

组织者

1.房肖，助理研究员，东南大学

2.栾萌，助理研究员，东南大学

3.刘智伟，教授，华中科技大学

4.温广辉，教授，东南大学

个人简介

房肖，东南大学助理研究员。2025 年获得东南大学数学专业博士学位，主要从事多智能体系统分布式优化、博弈与协同控制等领域的研究工作。在 IEEE 汇刊和 Automatica 等国际期刊和会议发表学术论文 20 余篇，获重要学术会议最佳论文奖 2 次，任 IEEE TAC、IEEE TCNS、IEEE TSMC、ICUS、ICONIP 等国际期刊和会议审稿人。

栾萌，东南大学助理研究员。2025 年获得东南大学数学专业博士学位，主要从事多智能体系统、分布式优化决策、资源分配、网络化博弈等领域的研究工作。在 IEEE 汇刊和 Automatica 等国际期刊和会议发表学术论文 10 余篇，入选 2024 年中国科协青年人才托举工程博士生专项计划，获国内外学术会议最佳论文奖 2 次。任 IEEE TAC, Automatica, IEEE TII, IEEE TCNS, IEEE TSMC, ICUS 等国际期刊和会议审稿人。

刘智伟，华中科技大学教授/博士生导师，教育部青年长江学者，湖北省杰出青年基金获得者。主持国家自然科学基金项目 5 项（含联合基金、面上项目、青年项目），承担国网总部科技项目、国网电科院科研项目等多项国家及企业级项目 20 余项。在 IEEE Transactions 发表论文 83 余篇、Automatica 9 篇，

16 篇论文入选 ESI 高被引论文，谷歌学术引用超 6300 次，获授权发明专利 21 项。曾获日内瓦国际发明展金奖、银奖各 1 项，中国自动化学会自然科学二等奖（排名第一）、中国发明协会发明创业奖二等奖（排名第一）、指挥与控制学会技术发明二等奖（排名第二）、机械工业科学技术奖科技进步奖二等奖（排名第二），国际会议论文奖 4 次。担任 IEEE Wuhan Section 副主席、（曾）任 IEEE Transactions on Industrial Informatics、控制工程、Energy Conversion and Economics 等国内外期刊的副编辑或编委。

温广辉，东南大学首席教授，博士生导师，国家杰出青年科学基金获得者，IET Fellow。2012 年获北京大学力学系统与控制专业博士学位，长期从事网络群体智能理论与技术、分布式控制与优化、弹性协同控制和分布式强化学习等领域的研究工作。在 Nature Reviews Electrical Engineering、Research、The Innovation 和 IEEE 汇刊发表学术论文 200 余篇，出版学术专著 4 部，获国际学术期刊最佳论文奖 1 次、国内外学术会议最佳论文奖 4 次。任中国指挥与控制学会副秘书长、中国指挥与控制学会青年工作委员会副主任；主持国家杰青项目、优青项目，国家自然基金联合重点项目、科技部重点研发计划项目课题等 30 余项科研项目。获中国青年科技奖，ARC Decra Fellow、中国指挥与控制学会青年科学家奖等荣誉称号。

特邀专题简介

在人工智能与自主系统深度融合的背景下，智能无人集群正从简单的协同运动向高阶的群智决策跨越。作为新一代自主协同体，无人集群在地形测绘、灾难搜救、海洋监测及分布式作战等关键领域展现出巨大的应用潜力。然而，随着应用场景向非平稳、高动态环境演进，传统的机理建模与控制方法面临着严峻挑战：个体动力学精确建模困难、智能体间交互耦合复杂、决策信息高度不完备，以及大规模集群带来的维数灾难与鲁棒性瓶颈。分布式协同控制与优化是确保集群行为规范、高效运行的核心。面对传统算法在求解效率与环境适应性上的局限，群智学习正成为破局的关键路径。依托计算力、存储及通信技术的跨越式发展，将数据驱动的机器学习与坚实的控制理论深度融合，能够驱动无人集群实现从“个体智能”到“群智涌现”的进化。该技术路径不仅增强

了集群在动态对抗及复杂不确定环境下的在线学习、协同演化与鲁棒决策能力，更为构建可信、可解释且可验证的自主协同系统提供了坚实的方法论支撑与技术框架。

本特邀专题聚焦于智能无人集群系统的学习型分布式协同控制与优化技术，旨在汇聚控制科学、人工智能与机器人领域的顶尖研究者，探讨如何通过学习算法突破传统理论边界，分享最新的突破性研究成果。

征稿方向（包括但不限于）：

- 参数估计与学习控制
- 分布式学习驱动的安全监测与协同控制
- 分布式学习驱动的故障诊断与容错控制
- 机器学习与分布式优化技术
- 分布式优化-控制一体化协同设计
- 具身智能及其与控制决策的深度融合
- 分布式对抗决策与集群博弈学习
- 竞争环境下的多智能体对手建模与策略自适应
- 复杂环境下的协同感知与不确定性信息处理

IEEE ICUS 2026
Invited Session Summary

Title of Session

Learning in Swarms: Distributed Control and Optimization for Intelligent Unmanned Systems

Organizers

1. Dr. Xiao Fang
Southeast University, China

2. Dr. Meng Luan
Southeast University, China

3. Prof. Zhi-Wei Liu
Huazhong University of Science and Technology, China

4. Prof. Guanghui Wen
Southeast University, China

Biosketches of Organizers

Fang Xiao is an Assistant Researcher at Southeast University. She received her Ph.D. in Mathematics from Southeast University in 2025. Her research focuses on distributed optimization, game-theoretic learning, and cooperative control of multi-agent systems. She has published over 20 academic papers in international journals and conferences such as IEEE Transactions and Automatica. She has been honored with the Best Paper Award twice at important academic conferences. She serves as a reviewer for several journals and conferences, including IEEE Transactions on Automatic Control (TAC), IEEE Transactions on Control of Network Systems (TCNS), IEEE Transactions on Systems, Man, and Cybernetics (TSMC), International Conference on Unmanned Systems (ICUS), and International Conference on Neural Information Processing (ICONIP).

Meng Luan is an Assistant Researcher at Southeast University. She received her Ph.D. in Mathematics from Southeast University in 2025. Her research focuses on multi-agent systems, distributed optimization and decision-making, distributed resource allocation, and networked games. She has published more than 10 academic papers in international journals and conferences, including IEEE Transactions and Automatica. She was selected for the 2024 China Association for Science and Technology Youth Talent Promotion Program (Doctoral Candidate Special Plan). She has been awarded two Best Paper Awards from domestic and

international conferences. Additionally, she serves as a reviewer for several international journals and conferences, including IEEE Transactions on Automatic Control (TAC), IEEE Transactions on Industrial Informatics (TII), IEEE Transactions on Control of Network Systems (TCNS), IEEE Transactions on Systems, Man, and Cybernetics (TSMC), International Conference on Unmanned Systems (ICUS).

Zhi-Wei Liu is a Professor and Doctoral Supervisor at Huazhong University of Science and Technology. He is a recipient of the Young Changjiang Scholar award from the Ministry of Education and the National Science Fund for Excellent Young Scholars of Hubei Province. He has presided over 5 projects funded by the National Natural Science Foundation of China (including joint funds, general programs, and youth programs), and has undertaken more than 20 national and enterprise-level projects such as those from the State Grid Corporation of China Headquarters and the State Grid Electric Power Research Institute. He has published over 83 papers in IEEE Transactions and 9 papers in Automatica. Currently, 16 of his works have been recognized as ESI highly cited papers. His research has garnered over 6,300 citations on Google Scholar, and he holds 21 authorized invention patents. He has won one gold and one silver award at the International Exhibition of Inventions Geneva, the Second Prize of Natural Science Award of the Chinese Association of Automation (ranked 1st), the Second Prize of Invention and Entrepreneurship Award of the China Association of Inventions (ranked 1st), the Second Prize of Technical Invention Award of the Chinese Institute of Command and Control (ranked 2nd), the Second Prize of the Science and Technology Progress Award from the China Machinery Industry (ranked 2nd), and Best Paper Awards at international conferences (4 times). He has served as the Vice Chair of IEEE Wuhan Section and has been an associate editor or editorial board member of several domestic and international journals such as IEEE Transactions on Industrial Informatics, Control Engineering (China), and Energy Conversion and Economics.

Guanghui Wen is a Chief Professor and Doctoral Supervisor of Southeast University, a recipient of the National Science Fund for Distinguished Young Scholars, an IET Fellow. He received the Ph.D. degree in mechanical systems and control from Peking University, Beijing, China, in 2012. He has been engaged in long-term research in the fields of analysis and synthesis of complex networks, distributed control and optimization, resilient control, and distributed reinforcement learning. He has published over 200 academic papers in prestigious journals, including Nature Reviews Electrical Engineering, Research, The

Innovation, and various IEEE Transactions. He has authored four academic monographs and received one Best Paper Award from an international academic journal and four Best Paper Awards from domestic and international conferences. Prof. Wen currently serves as the Deputy Secretary-General of the Chinese Institute of Command and Control and the Deputy Director of its Youth Working Committee. He has led over 30 major research projects, including projects funded by the National Science Fund for Distinguished Young Scholars of China, the Excellent Young Scientists Fund of China, the Key Joint Funds of the National Natural Science Foundation of China, and key projects of the Ministry of Science and Technology, China. His honors include the China Youth Science and Technology Award, ARC Decra Fellow, and the Young Scientist Award from the Chinese Institute of Command and Control.

Details of Session

In the context of the deep integration of artificial intelligence and autonomous systems, intelligent unmanned clusters are making a leap from simple coordinated movement to high-level swarm intelligence decision-making. As a new generation of autonomous cooperative entities, unmanned clusters have demonstrated significant application potential in key areas such as terrain mapping, disaster search and rescue, marine monitoring, and distributed combat. However, as application scenarios evolve towards non-stationary and highly dynamic environments, traditional mechanism modeling and control methods are facing severe challenges: difficulties in precisely modeling individual dynamics, complex interaction coupling among agents, highly incomplete decision-making information, as well as the curse of dimensionality and robustness bottlenecks brought about by large-scale clusters. Distributed cooperative control and optimization are the core to ensuring the normative and efficient operation of the cluster. In the face of the limitations of traditional algorithms in terms of solution efficiency and environmental adaptability, swarm intelligence learning is emerging as a key path to break through these challenges. Relying on the leapfrog development of computing power, storage, and communication technologies, the deep integration of data-driven machine learning and solid control theory can drive unmanned clusters to evolve from “individual intelligence” to “swarm intelligence emergence”. This technological path not only enhances the online learning, collaborative evolution, and robust decision-making capabilities of the cluster in dynamic adversarial and complex uncertain environments but also provides a solid methodological support and technical framework for building trustworthy, interpretable, and verifiable autonomous cooperative systems.

This Invited Session focuses on the learning-based distributed cooperative control and optimization technologies for intelligent unmanned cluster systems,

aiming to bring together top researchers in control science, artificial intelligence, and robotics to explore how learning algorithms can break through the boundaries of traditional theories and share the latest breakthrough research results.

Call for Papers (including but not limited to):

- Parameter estimation and learning control
- Distributed learning-driven safety monitoring and cooperative control
- Distributed learning-driven fault diagnosis and fault-tolerant control
- Machine learning and distributed optimization techniques
- Integrated design of distributed optimization and control
- Embodied intelligence and its deep integration with control decision-making
- Distributed adversarial decision-making and swarm game learning
- Multi-agent opponent modeling and strategy adaptation in competitive environments
- Cooperative perception and uncertainty information processing in complex environments