2025 第八届 IEEE 国际无人系统大会
特邀专题简介表

特邀专题名称

分布式协同学习控制与优化

组织者

1.温广辉，教授，东南大学

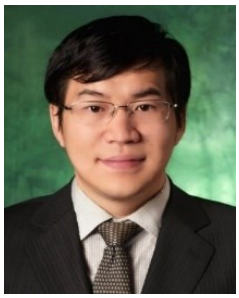
2.杨涛，教授，东北大学

3.周艳，助理研究员，东南大学

4.雷旭强，助理研究员，东南大学

个人简介

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。



杨涛，东北大学教授,博士生导师,国家青年高层次人才。2012 年获美国华盛顿州立大学博士学位,长期从事工业人工智能、智能优化与控制一体化、信息物理系统、分布式协同控制和优化等领域的研究工作。在 IEEE 汇刊和 Automatica 发表学术论文 40 余篇。获美国橡树岭大学联盟 Ralph E Powe 青年教授奖、高等教育(研究生)国家级教学成果二等奖（4/5)、辽宁省研究生教学成果特等奖(4/5)、中国自动化学会自然科学二等奖(1/5)；三次获国际会议最佳论文奖、最佳学生论文奖。主持国家自然基金重点项目、

重大项目课题、国家重点研发计划课题等科研项目。任《自动化学报》副主编、《控制工程》副主编、IEEE TCST、IEEE TCNS、IEEE TNNLS 等期刊编委。

周艳，东南大学博士后，助理研究员。2024 年获东南大学网络空间安全专业博士学位，主要从事多智能体系统、分布式控制、最优控制、学习控制、安全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，获国际学术会议最佳论文奖 2 次，入选中国指挥与控制学会博士学位论文激励计划。主持研究生培养创新基金等科研项目。任 IEEE TASE、IEEE TNNLS、IEEE TII、ICUS、ICONIP 等国际期刊和会议的审稿人。

雷旭强，东南大学博士后，助理研究员。2017 年获江苏大学信息与计算科学专业学士学位，2024 年获东南大学应用数学专业博士学位，主要从事信息-物理系统、分布式安全状态监测、攻击检测与隔离、弹性协同控制等领域的研究工作。在 IEEE 汇刊等国际期刊和会议发表学术论文 9 篇，获 CCISCC 最佳学生论文奖，获 SICE 学术年会学生旅行补助奖。任 Automatica、IEEE TII、ECC 等国际期刊和会议的审稿人。

特邀专题简介

智能无人集群系统是一种能观察、善思考、会决策、可协同，具有自学习、自进化能力的新一代无人集群系统。随着前沿科技和智能制造技术的飞速发展，智能无人集群系统的自主能力不断增强，使其广泛应用于地形勘测、安全巡逻、灾难搜救、海洋监管、分布式作战等实际场景中。分布式协同控制与优化是确保智能无人集群系统有效调控和高效合作的关键技术。然而，智能无人集群系统分布式协同控制与优化面临着单体物理动力学精准建模难、动态交互关系精细刻画难、决策信息不完全等挑战问题，导致基于模型的协同控制策略设计难且实用性差、优化算法求解效率低，使得开展**分布式协同学习控制与优化**技术研究迫在眉睫。同时，计算资源、存储容量和网络通信技术的飞速发展，显著提升了实时数据采集、处理与分析的能力，为开展**分布式协同学习控制与**

优化研究提供了先决条件。

本专题将聚焦适用于智能无人集群系统的**分布式协同学习控制与优化**技术，为该方向研究人员提供一个有效的交流平台，展示、总结及讨论近期相关进展，涉及主题包括但不限于：

- 参数估计与学习控制
- 基于分布式学习技术的安全监测与协同控制
- 基于分布式学习技术的故障诊断与容错控制
- 机器学习与分布式优化
- 分布式优化-控制一体化技术
- 分布式强化学习理论与方法
- 高效可信通信技术
- 具身智能、控制和决策

IEEE ICUS 2025
Invited Session Summary

Title of Session

Learning-Based Distributed Cooperative Control and Optimization

Organizers

1. Prof. Guanghui Wen

Southeast University, China

2. Prof. Tao Yang

Northeastern University, China

3. Dr. Yan Zhou

Southeast University, China

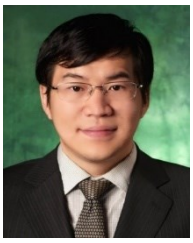
4. Dr. Xuqiang Lei

Southeast University, China

Biosketches of Organizers

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.



Tao Yang is a Professor and Doctoral Supervisor at Northeastern University, and a recipient of the Candidates of national youth talent program. He received the Ph.D. degree from Washington State University in 2012. His research focuses on industrial artificial intelligence, integrated intelligent optimization and control, cyber-physical systems, and distributed control and optimization. He has published more than 40 academic papers in Top-tier journals such as IEEE Trans. and Automatica. In 2018, he received the Ralph E. Powe Junior Faculty Enhancement Award from the Oak Ridge Associated Universities (ORAU). In 2022, he was awarded the Second Prize in the National Teaching Achievement Award (Postgraduate Education) (Ranked 4/5) and the Special Prize in Liaoning Province Graduate Teaching Achievement Awards (Ranked 4/5). In 2023, he received the Second Prize of the Natural Science Award from the Chinese Association of Automation (CAA) (Ranked 1/5). Additionally, he has won three Best Paper Awards and Best Student Paper Awards at international conferences. Prof. Yang has led several major research projects, including key projects funded by the State Key Program of National Natural Science of China, the Major Program of National Natural Science of China, National Key Research and Development Program of China. Currently, he serves as an Associate Editor for IEEE/CAA Journal of Automatica Sinica and Control Engineering of China, and a member of the editorial boards for journals including IEEE TCST, IEEE TCNS, and IEEE TNNLS.

Yan Zhou is a Post-doctoral Fellow and Assistant Researcher of Southeast University. She received the Ph.D. degree in the school of cyber science and engineering from Southeast University, Nanjing, China, in 2024. She current research interests include multi-agent systems, distributed control, optimal control, learning-based control, and security control. She has published over 20 academic papers in international journals and conferences such as IEEE Transactions and Automation. She was the recipient of best paper awards twice from international academic conferences and CICC excellent doctoral dissertation. She has led research projects such as innovation fund of graduate program. She serves as a reviewer for international journals and conferences such as IEEE TASE、IEEE TNNLS、IEEE

TII、ICUS、ICONIP.

Xuqiang Lei is a Post-doctoral Fellow and Assistant Researcher of Southeast University. He received the B.S. degree in information and computing sciences from Jiangsu University, Zhenjiang, China, in 2017, and the Ph.D. degree in mathematics from Southeast University, Nanjing, China, in 2024, respectively. His research interests include cyber-physical systems, distributed secure state monitoring, attack detection and isolation, and resilient consensus control. Dr. Lei has published 9 academic papers in international journals and conferences. He was the recipient of 2023 7th CCISCC Best Student Paper Award and the SICE Annual Conference 2023 Student Travel Grant Award. He served as a reviewer for international journals and conferences such as Automatica, IEEE TII and ECC.

Details of Session

The intelligent unmanned swarm system is a new-generation unmanned swarm system that possesses the capabilities to observe, think effectively, make decisions, and collaborate, as well as the abilities to self-learn and self-evolve. With the rapid development of frontier science and technology and intelligent manufacturing, the autonomous capability of intelligent unmanned swarm systems continues to enhance, making them widely used in several practical scenarios such as topographic survey, security patrol, disaster search and rescue, ocean supervision, and distributed warfare. Distributed cooperative control and optimization are key technologies to ensure effective regulation and efficient collaboration of intelligent unmanned cluster systems. However, the distributed cooperative control and optimization of intelligent unmanned swarm systems face several challenges, such as the difficulty in accurately modeling individual physical dynamics, the difficulty in precisely characterizing dynamic interaction relationships, and incomplete decision-making information, which leads to difficulty in designing and poor practicality of model-based collaborative control strategies, as well as low solving efficiency of optimization algorithms, making it imperative to study on learning-based distributed cooperative control and optimization. Meanwhile, the rapid development of the computing resource, storage capacity, and network communication technology has significantly improved the ability to collect, process, and analyze real-time data, providing a prerequisite for studying learning-based distributed cooperative control and optimization.

This topic will focus on learning-based distributed cooperative control and optimization techniques which are applicable to intelligent unmanned swarm systems and provide an effective communication platform for researchers in this field to display, summarize and discuss recent developments. Topics include but are not limited to:

- Parameter estimation and learning-based control
- Distributed learning-based security monitoring and cooperative control
- Distributed learning-based fault diagnosis and fault-tolerant control
- Machine learning and distributed optimization
- Distributed optimization-control integration technology
- Theory and methods of distributed reinforcement learning
- Efficient and trustworthy communication technology
- Embodied intelligence, control, and decision-making