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

大规模无人集群系统优化、控制及应用

组织者

1.都海波，教授，合肥工业大学

2.温广辉，教授，东南大学

3.余兰林，副研究员，合肥工业大学

个人简介

都海波，合肥工业大学舢兵学者特聘教授，国家级青年人才入选者。主要研究机器人装备与智能控制，主持 GF 创新项目 2 项，国家自然科学基金 3 项，省能源互联网联合基金重点项目 1 项，其他省部级项目 4 项，主研企业委托类课题多项。在国际 Springer 出版社出版英文专著章节 1 篇，科学出版社合著中文专著 2 部，发表期刊和会议论文 100 余篇，Google Scholar 数据库引用 7000 余次（h 指数 41），10 篇论文入选 ESI 高引论文，连续入选 2020-2022 年爱思唯尔中国高被引学者。获教育部自然科学一等奖、二等奖、安徽省自然科学二等奖、日内瓦国际发明展金奖等。

温广辉，东南大学青年首席教授，IET Fellow，国家杰出青年、优秀青年基金获得者，教育部国家级青年人才入选者，某型号分系统副主任设计师。主要研究群体智能及应用，担任中国指挥与控制学会副秘书长、IEEE 工业电子学会工业信息学技术专委会（中国）主席，中国自动化学会大数据专委会副主任，中国指挥与控制学会青年工作委员会副主任；担任国家自然基金委、科技部国家重点研发计划、澳大利亚研究理事会、瑞士国家科学基金会项目通讯评议专家。主持国家自然科学基金联合重点项目、国家重点研发计划项目课题、国家某部委创新特区项目等 10 余项；申请国家发明专利 50 余项，授权 10 余项；申请国际 PCT 专利 2 项。获 ARC DECRA Fellow、亚太神经网络学会青年杰出研究奖、中国指挥与控制学会青年科学家奖、中国指挥与控制学

会科学技术一等奖等。

余兰林，合肥工业大学电气学院副研究员，博士毕业于中国科学技术大学控制科学与工程专业，主要研究优化理论及应用，主持国家自然科学基金青年项目 1 项(已完成)，主持省部级博士后项目 1 项(已完成)，参与国家自然科学基金国际(地区)合作与交流项目 1 项(已完成)，参与国家自然科学基金面上项目 1 项(已完成)，并发表国际高水平 SCI 及会议论文十余篇，5 项发明专利。主要研究方向为复杂网络系统模型分析及优化协同控制，着重研究多智能体协同优化控制研究，多无人机及无人车路径规划算法研究等。2023 年入选中国指挥与控制学会集群智能与协同控制专业委员会委员，所指导的本科生先后获 2023 年安徽省自动化学会和安徽省机器人学会优秀本科毕业论文。

特邀专题简介

得益于感知、通信和计算技术的快速发展，无人系统具有越来越强的自主能力，正在成为多个领域的战略性研究方向。通过个体间的信息共享和协作配合，多无人系统有望实现高层次的群体智能，进而满足复杂场景应用的需求。然而，目前的多无人系统协作模式通常要求全局统筹和预先设计，难以全面发挥个体智能，制约着大规模群体智能水平的进一步提升。随着多无人系统在各个领域的应用普及，系统自组织能力得到了越来越多的关注和重视。然而，大规模无人系统控制所需的高昂算力成本和通信成本导致了其应用方面的挑战。因此，以均衡控制器设计的算力成本和控制器实现的通信成本为目标，开展大规模无人集群系统优化、控制及应用，是实现多无人系统高效高精度控制的基础，不仅具有重要的理论意义，同时也具有巨大的应用价值。

本特邀专题征集与“大规模无人集群系统优化、控制及应用”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。

- 大规模无人集群系统分布式控制
- 大规模无人集群系统分布式优化
- 大规模无人集群系统分布式状态估计
- 大规模无人集群系统信息融合策略
- 大规模无人集群系统分层强化学习
- 大规模无人集群系统聚类
- 大规模无人集群系统博弈对抗

IEEE ICUS 2024
Invited Session Summary

Title of Session

Optimization and Control of Large-Scale Unmanned Systems:
Theory and Its Applications

Organizers

1. Prof. Haibo Du

Hefei University of Technology, China

2. Prof. Guanghui Wen

Southeast University, China

3. Prof. Lanlin Yu

Hefei University of Technology, China

Biosketches of Organizers

Haibo Du received the Ph.D. degree in automatic control from Southeast University, Nanjing, China, in 2012. He is currently a Professor with the School of Electrical Engineering and Automation, Hefei University of Technology, Hefei, China. He held several visiting positions in USA, Australia, and Hong Kong. His research interests include nonlinear control theory with applications to multiagent systems, spacecraft, and power electronics. Prof. Du was a recipient of the Natural Science Award (First and Second Class) of the Ministry of Education of China in 2014 and the Natural Science Award (Second Class) of Anhui Province in 2020. He is one of the Elsevier Scopus Most Cited Chinese Researchers (Control and Systems Engineering) all over the world in 2020. He currently serves as a Guest Editor for the Asian Journal of Control and International Journal of Advanced Robotic Systems and other editorial board member.

Guanghui Wen received the Ph.D. degree in mechanical systems and control from Peking University, China, in 2012. Currently, he is a Full Professor with the Department of Systems Science, Southeast University, Nanjing, China. His current research interests include cooperative control of multi-agent systems, analysis and synthesis of complex networks, cyber-physical systems, and resilient control. Dr. Wen was the recipient of the Best Student

Paper Award in the 6th Chinese Conference on Complex Networks in 2010. He was named a Highly Cited Researcher by Clarivate Analytics since 2018. Dr. Wen was awarded a National Natural Science Fund for Excellent Scholars. Moreover, he was a recipient of the Australian Research Council Discovery Early Career Researcher Award in 2018. He currently serves as an Associate Editor of IEEE Journal of Emerging and Selected Topics in Industrial Electronics, IEEE Trans. Systems, Man and Cybernetics: System, and Asian J. Control. He is an IET Fellow.

LanlinYu is currently an Associate Professor in the School of Electrical Engineering and Automation, Hefei University of Technology. She received her B.Sc. Degree from the Southwest University, Chongqing, China in 2013, respectively, and the Ph.D. degree from the University of Science and Technology of China, Hefei, China in 2019. From 2018 to 2019, she has been a visiting researcher with the Faculty of Science and Engineering, University of Groningen, The Netherlands. Then, she was appointed as a postdoctoral researcher with the School of Engineering, Westlake University, Hangzhou, China, from 2019 to 2021. During this period, she visited the Technical University of Munich, Germany, as a visiting researcher. Her research interests include model reduction, cooperative optimization control for the complex networks, and path planning for mobile robots.

Details of Session

Benefiting from the rapid advancements in perception, communication, and computing technologies, unmanned systems are gaining increasingly strong autonomous capabilities and are becoming a strategic research focus in multiple fields. Through information sharing and collaborative coordination among individuals, multi-unmanned systems are expected to achieve high-level collective intelligence, meeting the demands of complex scenario applications. However, current collaboration modes of multi-unmanned systems typically require global coordination and pre-design, making it difficult to fully utilize individual intelligence and limiting the further enhancement of collective intelligence levels. As multi-unmanned systems become more widely applied in various fields, the capability of system self-organization has received increasing attention. However, the high computational and communication costs required for multi-unmanned systems control pose challenges for their practical applications. Therefore, conducting

research on optimization and control of large-scale unmanned systems with the goal of balancing the computational cost of controller design and the communication cost of controller implementation is fundamental for achieving efficient and precise control of multi-unmanned systems. This research not only holds significant theoretical value but also carries substantial practical application value.

This session will focus on Optimization and Control of Large-Scale Unmanned Systems. We aim to provide an effective communication platform for researchers in this field to display, summarize and discuss recent developments. Topics include but are not limited to:

- Distributed control of large-scale unmanned systems
- Distributed optimization of large-scale unmanned systems
- Distributed state estimation of large-scale unmanned systems
- Information fusion strategies for large-scale unmanned systems
- Hierarchical reinforcement learning of large-scale unmanned systems
- Clustering of large-scale unmanned systems
- Game theory and adversarial behavior in large-scale unmanned systems