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

无人机集群组网与任务协同

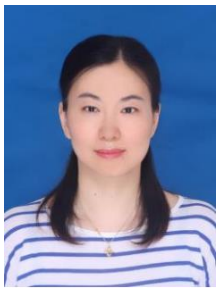
组织者

1. 张婷婷，教授，中国人民解放军陆军工程大学

2. 刘云平，教授，南京信息工程大学

3. 胡凯，副教授，南京信息工程大学

个人简介



张婷婷，博士，陆军工程大学教授，江苏省“333 高层次人才培养工程”中青年科技带头人，首届江苏青年女科学家。研究领域体系工程、复杂系统演化分析、无人系统协同与演化。主持国家自然科学基金、科技委基础加强计划等十余项科研项目。出版独立专著《网络信息体系能力演化分析方法研究》，获国家科技出版基金资助。获首届 CICC 优秀博士论文提名奖，中国指挥与控制学会科技进步一等奖 1 项（排名 1），军队科技进步二等奖 1 项，自主开发的智能陆战无人系统协同对抗演训平台 SwarmFlow 获全军软件创客大赛优秀奖。发表学术论文 80 余篇。授权国家/国防发明专利 12 项。

刘云平，教授/博导，入选江北新区高层次人才、烟台市双百计划人才团队，中国人工智能学会教育工作委员会委员/中国自动化学会混合智能专业委员会委员。主要研究方向为智能无人系统，承担国家重点研发计划、国家自然科学基金、装备部预研项目等省部级以上课题 20 余项，发表学术论文 50 余篇，授权专利 50 余项。

胡凯，男，江苏泰州兴化人，博士。南京信息工程大学自动化学院副教授，博士生导师，中国自动化学会人工智能与机器人教育专委会委员，江苏省自动化学会机器人竞赛工作委员会副主任，第一或通讯作者发表 SCI(E)论文 40 余篇，ESI 论文 4 篇，主持课题 20 余项，第 1 发明人授权发明专利 20 余项，研

究方向为基于多源时空数据融合的分析应用，如遥感分析、动作识别、联邦学习等。

特邀专题简介

无人机集群化是当下无人机系统发展的热点，其中稳健可靠的集群内部通信是实现无人机集群行为的前提和保障。无人机具有高速移动的特点，将导致多无人机系统的拓扑频繁变化，无人机之间的通信链路经常断裂，给建立低延时、高吞吐量、低能耗的通信链路带来了前所未有的挑战。目前以飞行自组网(Flying Ad Hoc Networks，FANETs)为代表的自组织网状网(ad hoc mesh network)不通过固定的基站等辅助设施，直接在无人机间自由快速建立网络，实现多无人机之间的有效通信，是目前学界普遍认可的解决方案。然而，通信资源短缺和高速移动带来的拓扑频繁变化、链路易于断裂，导致飞行自组网很难满足复杂任务的通信需求，其有效性、可靠性、安全性等方面还有待研究。另一方面，在信息不完全、环境不确定、高动态调整等对抗环境对集群任务规划提出更高的要求，系统的自主性、协同性、智能化水平还有待优化提升。针对上述问题，本专题以无人机集群组网通信问题和任务规划为研究对象，重点聚焦以自组织网状网为代表的无人机组网技术和面向集群系统的任务规划方法，交流探讨无人机集群协同通信中的问题并对下一步研究方向进行展望。

IEEE ICUS 2024
Invited Session Summary

Title of Session

UAV Swarm Network and Task Coordination

Organizers

1. Prof. Tingting Zhang

Army Engineering University of the PLA, China

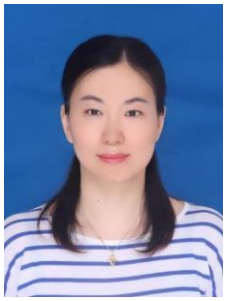
2. Prof. Yunping Liu

Nanjing University of Information Science and Technology, China

3. Assoc. Prof. Kai Hu

Nanjing University of Information Science and Technology, China

Biosketches of Organizers



Tingting Zhang, PhD, is a professor of Army Engineering University, a middle-aged and young science and technology leader of Jiangsu Province's "333 high-level talent training project", one of The First Jiangsu Young Female Scientists. Her research areas are system-of-systems engineering, evolutionary analysis of complex systems, unmanned system synergy and evolution. She is in charge of more than ten research projects including National Natural Science Foundation of China and Basic Strengthening Program of Science and Technology Commission. She published an independent monograph "Research on Analysis Method of Network Information-centric System of Systems Capability Evolution", which was funded by the National Science and Technology Publication Fund. She was nominated for the first CICC Outstanding Doctoral Dissertation Award, one First Prize of Science and Technology Progress of the Chinese Institute of Command and Control (ranked 1), one Second Prize of Army Science and Technology Progress, and SwarmFlow, the self-developed intelligent land warfare unmanned system collaborative countermeasure training platform, won the Excellence Award of the All-Army Software Creators Competition. Published more than 80 academic papers. Authorized 12 national/defense invention patents.

Yunping Liu, professor and doctoral supervisor, is listed in the high-level talents of Jiangbei New Area and Yantai Double Hundred Plan Talent Team. He is also a member of the Education Working Committee of the Chinese Association of Artificial Intelligence and the Hybrid Intelligence Professional Committee of the Chinese Association of Automation. His main research direction is intelligent unmanned systems. He has undertaken more than 20 provincial and ministerial-level projects such as the National Key Research and Development Program, the National Natural Science Foundation, and the Equipment Department's pre-research projects. He has published more than 50 academic papers and been granted more than 50 patents.

Kai Hu, male, born in Xinghua City, Jiangsu Province, China, Doctoral degree. Now he is working as associate professor and doctoral supervisor in Nanjing University of Information Science and Technology. He is also a member of the Artificial Intelligence and Robot Education Special Committee of the Chinese Society of Automation, and the Deputy Director of the Robot Competition Working Committee of the Jiangsu Society of Automation. He has published over 40 SCI (E) papers, includes 4 ESI papers, and has led more than 20 research projects. As the first inventor, he has been authorized more than 20 invention patents, His research focuses on analytical applications based on multi-source spatiotemporal data fusion, such as remote sensing, action recognition, federated learning, etc.

Details of Session

UAV swarm is a hot spot in the development of UAV system, in which robust and reliable cluster internal communication is the premise and guarantee to realize UAV swarm behavior. UAV has the characteristics of high-speed movement, which will lead to frequent changes in the topology of multi UAV system, and the communication links between UAVs are often broken, which brings unprecedented challenges to the establishment of communication links with low delay, high throughput and low energy consumption. At present, the ad hoc mesh network represented by flying ad hoc networks (fanets) directly establishes the network between UAVs freely and quickly without fixed base stations and other auxiliary facilities, so as to realize the effective communication between multiple UAVs, which is a generally recognized solution in the academic community. However, due

to the shortage of communication resources, frequent topology changes and easy link breakage caused by high-speed mobility, it is difficult for flight ad hoc network to meet the communication requirements of complex tasks, and its effectiveness, reliability and security need to be studied. On the other hand, in the confrontation environment such as incomplete information, uncertain environment and high dynamic adjustment, higher requirements are put forward for cluster task planning, and the autonomy, coordination and intelligence level of the system need to be optimized and improved. In view of the above problems, this topic takes the UAV cluster networking communication problem and task planning as the research object, focuses on the UAV network technology represented by self-organizing mesh network and the task planning method for cluster system, exchanges and discusses the problems in UAV cluster cooperative communication, and looks forward to the next research direction.