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

无人系统集群的对抗理论与方法

组织者

1. 潘鹿鹿，助理教授，上海交通大学
2. 李德伟，教授，上海交通大学
3. 邵海滨，副教授，上海交通大学
4. 苏奇，副教授,上海交通大学

个人简介

潘鹿鹿，博士，上海交通大学电子信息与电气工程学院自动化系助理教授。中国自动化学会预测控制与智能决策专业委员会委员、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、中国自动化学会青年工作委员会委员，IEEE 会员。主要从事群体智能、隐私保护多方计算和数据驱动预测控制方面的理论与应用研究。2018 年毕业于上海交通大学电子信息与电气工程学院自动化系，获工学博士学位。2013 年 9 月至 2015 年 9 月于华盛顿大学（美国）航空航天系从事博士生联合培养。2018 年 5 月至 2021 年 5 月，于上海交通大学电子信息与电气工程学院仪器科学与工程系从事博士后研究。在系统控制领域国内外期刊及学术会议发表论文 30 余篇，包括 IEEE Transactions on Automatic Control 和 Automatica 论文 7 篇。获 2019 年度上海市“超级博士后”资助，主持国家自然科学基金青年项目，JKW 国防科技创新特区项目，参与国家自然科学基金重点项目、面上项目、国际合作交流项目等。

李德伟，上海交通大学自动化系教授，博士生导师。李德伟教授分别于 1993 年毕业于上海交通大学自动控制系获工学学士学位，2009 年毕业于上海交通大学自动化系获工学博士学位，并在同年进入上海交通大学仪器工程系进行博士后研究工作，于 2011 年出站后留校任教，并于 2011 年、2014 年和 2017 年赴香港科技大学进行合作研究工作。李德伟教授当

前的主要研究方向包括复杂系统建模与优化控制、预测控制理论与应用、智能交通、群体智能、工业机器人等。李德伟教授在 Automatica 和 IEEE Transactions on Automatic Control 等国内外学术刊物及会议上发表论文 200 余篇，出版英文专著《Predictive Control: Fundamentals and Developments》，授权发明专利 6 项，软件著作权 5 项，主编国际期刊专辑 2 本。李德伟教授现为中国自动化学会预测控制与智能决策专业委员会主任委员，控制理论与应用教育工作组委员，国际著名刊物 Control Engineering Practice 编委，主持国家 863 项目、自然科学基金、国家教委、上海市教委等项目 10 余项，承担企业委托项目 30 余项。李德伟教授曾获得 2017 年国家自然科学二等奖，2016 年中国自动化学会自然科学一等奖，上海交通大学科技成果一等奖，2021 年中国自动化学会技术发明二等奖。

邵海滨，上海交通大学电子信息与电气工程学院自动化系，副教授。中国自动化学会、中国指挥与控制学会和 IEEE 会员，中国自动化学会青年工作委员会委员，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。研究方向为群体智能理论和方法、数据驱动的群体学习方法，分布式预测控制理论与应用。在国内外重要期刊和会议上发表包括 IEEE Transactions on Automatic Control 和 Automatica 在内的学术论文 60 余篇。承担项目包括科技部国家重点研发计划项目子课题负责人、主持国家自然科学基金面上项目、上海市自然科学基金项目、中国博士后科学基金项目等，参与国家自然科学基金重点项目和地区科学基金项目等。

苏奇，上海交通大学电子信息与电气工程学院副教授。2014 年、2020 年分别于华中科技大学、北京大学取得学士、博士学位。曾在美国波士顿大学开展博士学位联合培养，哈佛大学进行学术访问。曾获得美国西蒙斯基金会为期三年的独立经费资助，在宾夕法尼亚大学数学系和生物系从事学术研究。主要研究兴趣为网络科学、群体决策和博弈理论等。在 PNAS、Nature Human Behaviour、Nature Computational Science、Science Advances 等期刊上发表研究论文 20 余篇。多项成果被国家基金委员会、中国教育网、宾夕法尼亚

大学、北京大学、上海交通大学官网报道。获得西蒙斯博士后学者奖，中国控制与决策会议张嗣瀛奖，全国大数据与社会计算会议新星奖等。担任匈牙利基金会评审人以及四个学术期刊副编辑/客座编辑。

特邀专题简介

以集群无人机为代表的集群无人系统在军事和民用领域发挥着越来越重要的作用。鉴于集群无人系统具有极为突出的渗透和突防能力，近年来集群无人系统的对抗问题受到关注。虽然集群无人系统可以被视作一类非常典型的信息物理系统，但是它又具备诸多非常鲜明的自身特点。在网络化通信的环境下，集群无人系统的性能更容易受到来自诸如物理层和信息层等不同层面、不同形式的对抗因素的影响。为此，聚焦集群无人系统对抗的理论和方法研究有利于系统性的建立集群无人系统对抗方法的分析与设计框架，为相关理论和方法在实践中的应用奠定坚实的基础。

本特邀专题邀请与“无人系统的对抗理论与方法”主题相关的包含创新性思想、概念、发现、应用以及技术的原创论文。本特邀专题主要接收（并不限于）以下方向的研究论文：

- 集群无人系统的对抗博弈
- 对抗环境下集群无人系统的性能评估
- 集群无人系统的安全与隐私
- 合作-对抗集群无人系统分析与控制
- 基于学习的集群无人系统对抗方法
- 集群无人系统的自愈控制方法

IEEE ICUS 2024
Invited Session Summary

Title of Session

Theory and Approach for Unmanned System Confrontation

Organizers

1. Asst. Prof. Lulu Pan

Shanghai Jiao Tong University, China

2. Prof. Dewei Li

Shanghai Jiao Tong University, China

3. Assoc. Prof. Haibin Shao

Shanghai Jiao Tong University, China

4. Assoc. Prof. Qi Su

Shanghai Jiao Tong University, China

Biosketches

Lulu Pan is currently an Assistant Professor at the Department of Automation at Shanghai Jiao Tong University. She received her Ph.D. degree in control science and engineering from Shanghai Jiao Tong University, Shanghai, China, in 2019. She is currently an Assistant Professor at the Department of Automation at Shanghai Jiao Tong University. She was a visiting scholar in the RAIN lab, William E. Boeing Department of Aeronautics and Astronautics, University of Washington from October 2013 to October 2015. She is a member of IEEE. Her research interest includes swarm intelligence, secure multi-party computation, and data-driven predictive control. She has published over 30 scientific papers, including 7 journal papers published in *IEEE Transactions on Automatic Control and Automatica*.

Dewei Li is a Professor in the Department of Automation at Shanghai Jiao Tong University. Professor Li received the bachelor's degree and the Ph.D. degree from Shanghai Jiao Tong University in 1993 and 2009, respectively. In 2011, 2014, and 2017, he did collaborative research at the Hong Kong University of Science and Technology. His research interests mainly include modeling and optimal control of complex systems, model

predictive control theory and applications, multi-agent systems, and industrial robots. He has published more than 200 papers (including Automatica, IEEE Transactions on Automatic Control, etc.) and a book entitled “Predictive Control: Fundamentals and Developments”. He has won the second Prize in the National Natural Science Award and the First Prize in the Natural Science Award from the Chinese Association of Automation.

Haibin Shao is currently an Associate Professor in the Department of Automation at Shanghai Jiao Tong University. He received the Ph.D. degree from the Shanghai Jiao Tong University, Shanghai, in 2017. He was a postdoctoral researcher at the Department of Computer Science and Engineering at the Shanghai Jiao Tong University from 2017 to 2019. He was a visiting scholar in the RAIN lab, William E. Boeing Department of Aeronautics and Astronautics, University of Washington from 2012 to 2014. He is a member of IEEE. He has published over 60 scientific papers, including *IEEE Transactions on Automatic Control, Automatica, and IEEE Transactions on Neural Networks and Learning Systems*. His research interests include swarm intelligence, data-driven collective learning, distributed predictive control, and distributed optimization.

Qi Su is currently an Associate Professor in the Department of Automation at Shanghai Jiao Tong University. He received the Bachelor degree and Ph.D. degree from Huazhong University of Science and Technology and Peking University in 2014 and 2020, respectively. Supported by the Simons Foundation, he had been working as a Simons Postdoctoral Fellow in the Department of Mathematics at the University of Pennsylvania from 2020 to 2022. He was a visiting scholar at Boston University and Harvard University. His research interests include network science, collective decision-making, and game theory. He has published over 20 scientific papers, including PNAS, Nature Human Behaviour, Nature Computational Science, Science Advances.

Details of Session

Unmanned system swarms (e.g., drone swarms) have become increasingly important in military and civilian domains. Notably, unmanned system swarms find their extraordinary capacity of permeation, and concerns about defending unmanned

system swarms have arisen recently. The performance of an unmanned system swarm is determined by efficient networking, communication, computation, and control from both cyber layers and physical layers. Although an unmanned system swarm can be regarded as a cyber-physical system, it also exhibits notable distinctions from typical cyber-physical systems. Therefore, establishing the fundamental theory and developing applicable technologies for unmanned system swarm confrontation is imminent.

This invited session invites original papers of innovative ideas, concepts, discoveries, applications, and technologies related to the topic "Theory and Approach for Unmanned System Confrontation" and mainly accepts (but is not limited to) submissions related to the following topics.

- Performance evaluation of unmanned system swarms in confrontation
- Secure and privacy of unmanned system swarms
- Antagonistic game of unmanned system swarms
- Unmanned system swarms with cooperation and antagonism
- Learning-based approach for unmanned system swarm confrontation
- Self-healing control in unmanned system swarms