

# 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

海空跨域无人集群协同规划与控制

## 组织者

1. 缪志强，教授，湖南大学
2. 王旭东，副教授，湖南大学
3. 谢 威，副教授，上海交通大学

## 个人简介



**缪志强**，湖南大学人工智能与机器人学院教授，博士生导师，自动化系主任，国家优秀青年基金获得者。担任湖南省自动化学会副秘书长，中国指挥与控制学会(湖南)青年科学家俱乐部主席，中国仿真学会智能无人系统建模与仿真专业委员会副秘书长，《信息与控制》青年编委会主任，湖南大学-云洲智能联合研发中心副主任。主要从事多机器人系统、跨域无人系统、多模态机器人、机器人自主导航与控制等领域的研究，获省部级奖励 4 项、最佳论文(提名)奖 7 次。近年来，主持国家级项目 10 余项，以第一/通讯作者在 *IEEE Transactions* 等期刊上发表高水平论文 50 余篇，申请授权国家发明专利 20 余项。受邀担任期刊 *IEEE TASE* 编委，《机器人》《无人系统技术》青年编委，*IEEE Control Systems Society* 会议编委会委员，国际会议 ICRA、IROS、ACC Associate Editor。



**王旭东**，副教授，机器人视觉感知与控制技术国家工程研究中心副研究员，中国自动化学会/人工智能学会/指挥与控制学会会员，湖南省青年骨干教师/湖湘青年英才/青年科学基金 B 类获得者。主要从事无人集群协同规划控制、海空跨域无人系统、无人系统故障诊断与容错控制等研究。近年来先后主持国家自然科学基金青年&面上项目、湖南省自然科学基金优秀青年项目、广东省自然科学基金面上项目、国家自然科学基金委基础科学中心开放基金等多项国家级省部级科研项目，相关研究成果以第一作者/通讯作者在 *IEEE*

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**谢威**，上海交通大学自动化与感知学院副教授，中国科协第八届青年托举人才工程入选者，上海市海外高层次人才入选者，上海市启明星-扬帆计划入选者；主要从事无人系统控制方面的研究；正在主持多项国家级课题；已发表和接收的期刊会议论文六十余篇，其中以第一和通讯作者在无人系统领域期刊 IEEE TCST, IEEE TIE 等发表论文三十余篇；先后获得了 2022 年度第五届中国先进技术转化应用大赛优胜奖（排名 2）、2022 年度海南省科学技术奖技术发明奖-特等奖（排名 2）等奖项；指导学生获得 2023 年 7th Chinese Conference on Swarm Intelligence and Cooperative Control 最佳学生论文提名奖以及 2024 年第八届 International Symposium on Computer Science and Intelligent Control 最佳论文奖。

### 特邀专题简介

随着无人系统与智能控制技术的快速发展，海空协同作战与协同作业已成为未来智能装备的重要发展方向。海空跨域异构无人集群（包括无人机、无人艇、无人潜航器等）通过空中与水面/下平台的优势互补，可在侦察监视、目标搜索与跟踪、应急救援、海洋观测等任务中展现出远超单一平台的综合效能。然而，受限于复杂多变的海空环境、通信约束、不确定扰动以及平台间异构特性，实现大规模集群的高效协同规划与安全可靠控制仍面临诸多挑战，例如跨域感知融合、分布式协同决策、任务分解与分配、鲁棒控制与容错协同等问题亟需深入研究。

当前，围绕海空跨域无人集群的自主智能与协同控制，国内外学术界和工程界已在多智能体强化学习、分布式优化、博弈与一致性控制、任务规划与航路重构、数字孪生与仿真验证等方面取得了一系列进展。本特邀专题聚焦“海空跨域无人集群协同规划与控制”，征集在理论方法、关键技术与典型应用方面具有创新思想、前沿概念、新发现、改进方法以及新应用实践的高水平原创论文。本特邀专题拟邀请但不限于以下方向的研究工作：

- 海空跨域异构无人集群建模与系统架构设计
- 面向海空协同的任务分解、任务分配与多层级规划
- 海空跨域无人集群协同路径规划与轨迹优化
- 面向集群的分布式与一致性控制、编队控制与重构控制
- 多智能体强化学习在跨域集群协同决策与控制中的应用
- 考虑通信受限与网络攻击的弹性协同规划与安全控制
- 海空跨域感知融合、态势感知与环境建模方法
- 典型任务场景下的仿真平台构建、数字孪生与系统集成验证
- 海空跨域无人集群在海洋观测、应急救援与国防安全等领域的应用案例与工程实践

**IEEE ICUS 2026**  
**Invited Session Summary**

**Title of Session**

Cooperative Planning and Control of Cross-Domain Air-Sea Unmanned Swarms

**Organizers**

**1. Prof. Zhiqiang Miao**

Hunan University, China

**2. Assoc. Prof. Xudong Wang**

Hunan University, China

**3. Assoc. Prof. Wei Xie**

Shanghai Jiao Tong University, China

**Biosketches of Organizers**



**Zhiqiang Miao** received the B.S. and Ph.D. degrees in electrical and information engineering from Hunan University, Changsha, China, in 2010 and 2016, respectively. From 2014 to 2015, he was a Visiting Scholar with the University of New Mexico, Albuquerque, NM, USA. From 2016 to 2018, he was a Postdoc Fellow with the Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong, Hong Kong, China. He is currently a Professor with the School of Artificial Intelligence and Robotics, Hunan University. His research interests include robotics, multirobot systems, visual navigation, and nonlinear control. Prof. Miao was the recipient of the IEEE Robotics and Automation Letters Best Paper Honorable Mention Award in 2020, the Outstanding Doctoral Dissertation Nomination Award of Chinese Association of Automation in 2018, and the Outstanding Reviewer of IEEE Journal of Oceanic Engineering in 2022. He is serving as an Associate Editor of IEEE Transactions on Automation Science and Engineering, and a member of IEEE CSS Conference Editorial Board. He is (was) an Associate Editor for the ICRA, IROS, and ACC.



**Xudong Wang** is an Associate Professor at Hunan University and Associate Researcher at the National Engineering Research Center for Robot Visual Perception and Control Technology. He is a member of the Chinese Association of Automation, the Chinese Association for Artificial Intelligence, and the Chinese Institute of Command and Control. He has been recognized as a Young Backbone Teacher of Hunan Province and a Huxiang Young Talent, and is a recipient of a Category B Young Scientists Fund. His research interests include

cooperative planning and control of unmanned swarms, cross-domain air–sea unmanned systems, and fault diagnosis and fault-tolerant control of unmanned systems. In recent years, he has led multiple national and provincial research projects, including National Natural Science Foundation of China (NSFC) Young Scientists and General Program projects, an Excellent Young Scholars project of the Hunan Provincial Natural Science Foundation, a General Program of the Natural Science Foundation of Guangdong Province, and an Open Fund project of an NSFC Science Center. He has published over 20 SCI-indexed papers as first or corresponding author in prestigious international journals such as IEEE Transactions on Industrial Informatics, IEEE Transactions on Cybernetics, IEEE Transactions on Fuzzy Systems, and IEEE Transactions on Systems, Man, and Cybernetics: Systems, and holds 5 granted invention patents.



**Wei Xie** is an associate professor at the School of Automation and Intelligent Sensing, Shanghai Jiao Tong University. He has been selected for the China Association for Science and Technology Youth Talent Support Program (8th batch), the Shanghai High-Level Overseas Talent Program, and the Shanghai Rising-Star Program (Sailing Track). His primary research focuses on unmanned systems control. Currently, he is leading several national-level research projects. He has published or accepted over 60 journal and conference papers, including more than 30 first-author or corresponding-author papers in leading unmanned systems journals such as IEEE TCST and IEEE TIE. Among his awards are the Fifth China Advanced Technology Transformation Application Competition Excellence Award (2022, ranked 2nd) and the Hainan Provincial Science and Technology Award—Special Prize for Technological Invention (2022, ranked 2nd). He has supervised students to win the Best Student Paper Nomination Award at the 2023 7th Chinese Conference on Swarm Intelligence and Cooperative Control and the Best Paper Award at the 2024 8th International Symposium on Computer Science and Intelligent Control.

### **Details of Session**

With the rapid development of unmanned systems and intelligent control technologies, air–sea cooperative operations and missions have become an important direction for future intelligent equipment. Heterogeneous air–sea unmanned swarms (including unmanned aerial vehicles, unmanned surface vehicles, and unmanned underwater vehicles) can fully exploit the complementary advantages of aerial and surface/underwater platforms, demonstrating far superior comprehensive capabilities to single platforms in tasks such as reconnaissance and surveillance, target search

and tracking, emergency rescue, and ocean observation. However, due to the complexity and variability of the air–sea environment, communication constraints, uncertain disturbances, and platform heterogeneity, achieving efficient cooperative planning and safe, reliable control for large-scale swarms still faces many challenges. Issues such as cross-domain perception fusion, distributed cooperative decision-making, task decomposition and allocation, robust control, and fault-tolerant cooperation call for in-depth investigation.

In recent years, substantial progress has been made by academia and industry worldwide on autonomous intelligence and cooperative control of cross-domain air–sea unmanned swarms, including multi-agent reinforcement learning, distributed optimization, game-theoretic and consensus control, task planning and trajectory replanning, as well as digital twin and simulation-based validation. This special session focuses on “Cooperative Planning and Control of Cross-Domain Air–Sea Unmanned Swarms” and seeks high-quality original papers that present innovative ideas, cutting-edge concepts, new findings, improved methods, and novel application practices in theoretical approaches, key technologies, and typical applications. Topics of interest include, but are not limited to:

- Modeling and system architecture design for heterogeneous cross-domain air–sea unmanned swarms
- Task decomposition, task allocation, and hierarchical planning for air–sea cooperative missions
- Cooperative path planning and trajectory optimization for cross-domain air–sea unmanned swarms
- Distributed and consensus control, formation control, and reconfigurable control for unmanned swarms
- Applications of multi-agent reinforcement learning in cross-domain swarm cooperation and control
- Resilient cooperative planning and secure control under communication constraints and cyber attacks
- Cross-domain perception fusion, situation awareness, and environment modeling methods
- Construction of simulation platforms, digital twins, and system-level integration and verification for typical mission scenarios
- Application cases and engineering practices of cross-domain air–sea unmanned swarms in ocean observation, emergency rescue, and national defense security