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
海上无人集群：智能感知与协同控制

组织者
1.李一辰，助理研究员，上海交通大学
2.闫敬，教授，燕山大学
3.杨紫雯，长聘副教授，上海交通大学
4.于文彬，副研究员，上海交通大学
5.黄沛烁，助理研究员，上海交通大学

个人简介

李一辰，博士，上海交通大学助理研究员，入选中国科协青年人才托举工程与上海市"超级博士后"激励计划，获上海交通大学"十大科技进展"奖、中国指挥与控制学会优博论文、上海市自动化学会技术发明一等奖等。面向海洋智能无人系统的信息感知需求，开展涉海无人系统的协同定位跟踪、跨介质通信组网、多源数据融合等技术研究，在 IEEE JOE、IEEE/CAA JAS、IEEE TII 等国际期刊/会议发表论文 23 篇，申请专利 16 项。

闫敬，教授、博士生导师，主要从事水下网络系统定位、组网与协同控制等研究。入选国家优青，海洋强国青年科学家，河北省杰青、燕赵青年科学家，获河北省优秀博士学位论文、河北省自然科学二等奖。目前是 IEEE Senior Member、中国自动化学会高级会员，担任国际期刊 IEEE Trans. Intelligent Transportation Systems、Ocean Engineering、IEEE/CAA Journal of Automatica Sinica、 IEEE Systems Journal 以及 IET Control Theory & Applications 编委，《控制理论与应用》与《控制与决策》客座编委，《机器人》与《水下无人系统学报》青年编委。近年来，以第一作者出版英文专著 2 部，在 IEEE TAC、IEEE JOE 等期刊发表 SCI 论文 80 余篇，授权发明专利 17 项。指导学生获得 IEEE/OES 中国海洋声学 H2O 大赛全国一等奖、世界大学生水下机器人大赛亚军、中国控制与决策会议最具人气作品奖、IEEE CYBER 最佳学生论文奖、

CAIBDA 会议最佳论文奖等。

杨紫雯，长聘教轨副教授、博士生导师，主要研究方向为无人系统的感知控制联合设计。分别于 2014 年和 2020 年获上海交通大学学士与博士学位，并于 2021 年获香港城市大学联合培养博士学位。2020 至 2023 年在上海交通大学任职博士后期间，同时为瑞典皇家理工学院访问博士后一年，以及香港城市大学博士后 3 个月。获 2021 年中国博士后博新计划、2021 年中国自动化学会优秀博士论文提名奖。发表包括控制领域顶级期刊 IEEE TAC（长文）、Automatica 等 SCI、EI 论文共计 20 余篇。主要研究方向为无人系统的感知控制联合设计。主持国家自然科学青年基金等项目 3 项，参研国家自然科学基金重点项目等 5 项。

于文彬，博士，上海交通大学自动化系副研究员。主持国家自然科学基金面上、青年、上海市自然科学基金、国家重点研发计划子课题等，授权发明专利 8 项，发表 SCI 论文 20 余篇。获得上海市技术发明一等奖 1 项。面向智能无人系统感知需求，研究空天海潜目标与环境信息感知、传输与控制，针对各域高速小目标，通过复合系统进行跟踪与测量，设计目标探测"感-传-控"一体化架构，构建数据自适应采样、稳定传输以及传感设备最优化调度。

黄沛烁，博士，上海交通大学助理研究员。面向海上无人集群的协同规划需求，开展多智能体协同、分布式机器学习、多移动锚点辅助定位的路径规划研究，在电子与信息学报、IEEE IOT、IEEE ICUS 等国内外期刊/会议发表多篇论文。目前参与国家自然科学基金重点、高速小目标复合测量系统等项目。

特邀专题简介

随着人工智能、机器人技术和信息系统的飞速发展，海上无人集群已成为海洋科学研究、环境监测、资源探测等多个领域的重要组成部分。在复杂且动态的海洋环境中，感知与控制能力成为无人集群高效任务执行的基础。当前，

海上无人集群的任务执行模式逐渐向跨平台、协同合作及智能化方向发展，智能感知与协同控制技术为集群提供了关键的信息输入和实施手段，成为确保集群实现高效执行与精确决策的核心技术。

海上无人集群的智能感知与协同控制领域研究主要聚焦突破海上环境对传统感知与控制技术的挑战，提升无人集群在复杂海域中的自主作业能力。通过在多源数据融合、异构平台协同与智能算法等方面的创新，实现海上无人集群在不依赖外部指挥的条件下，自主感知并响应环境变化，协同执行复杂任务。

本特邀专题邀请以下与"海上无人集群：智能感知与协同控制"主题相关的原创论文，涉及创新思想、概念、新发现、改进及新应用，具体方向包括：

- 海上异构无人平台协同机理/机制
- 海上无人集群智能感知技术
- 海上跨介质协同控制技术
- 面向海上无人集群的"感知–传输–控制"联合设计
- 基于深度学习的海洋数据融合技术
- 多潜器协同决策与指挥控制技术
- 跨介质组网通信技术
- 异构平台弹性规划与协同部署技术
- 海上无人集群的应用场景验证
- 海上无人集群智能感知与协同控制的其它相关技术

IEEE ICUS 2025
Invited Session Summary

Title of Session   Maritime Unmanned Swarms: Intelligent Perception and Cooperative Control

Organizers
 	
1. Dr. Yichen Li
   Shanghai Jiao Tong University, China
 	
2. Prof. Jing Yan
   Yanshan University, China
 	
3. Prof. Ziwen Yang
   Shanghai Jiao Tong University, China
 	
4. Prof. Wenbin Yu
   Shanghai Jiao Tong University, China
 	
5. Dr. Peishuo Huang
   Shanghai Jiao Tong University, China

Biosketches of Organizers

Dr. Yichen Li, assistant researcher of Shanghai Jiao Tong University, was selected by Young Elite Scientists Sponsorship Program by CAST, by Shanghai "Super Postdoctoral" incentive program, and was awarded with the "Top Ten Technological Advancements" of Shanghai Jiao Tong University, the Excellent Doctoral Dissertation of Chinese Institute of Command and Control, and the First Prize for Technological Invention from SAA. Focusing on the information sensing of marine intelligent unmanned systems, he has carried out research on underwater localization and tracking, cross-media cooperative networking, and multi-source data fusion. Until now, he has published 23 international journal and conference papers, including IEEE JOE, IEEE/CAA JAS, IEEE TII, etc., and applied for 16 patents.

Dr. Jing Yan is a Professor and Doctoral Supervisor with Yanshan University. His research interests cover in the localization, networking and cooperation control for underwater network systems. He received the Excellent Youth Project for NSF of China, the Distinguished Youth Project for NSF of Hebei Province, the Excellent Doctoral Dissertation of Hebei Province,

and the Second Prize of Natural Science of Hebei Province. He was also honored as the young scientists of maritime power and Yanzhao. Currently, he is a Senior Member of IEEE and the Chinese Society of Automation. He serves as the Associate/Young Editors of some journals, e.g., IEEE Transactions on Intelligent Transportation Systems, Ocean Engineering, IEEE/CAA Journal of Automatica Sinica, IEEE Systems Journal, IET Control Theory & Applications, Control Theory and Applications, Control and Decision, Robot, and Underwater Unmanned Systems. In recent years, he has authored over 80 referred international journal and conference papers, such as IEEE TAC and IEEE JOE. Meanwhile, he is also the inventor of seventeen patents. In addition, he guided students to win the first prize in the IEEE/OES Chinese Ocean Acoustics H2O Competition, the runner up in the World University Underwater Robot Competition, the Most Popular Work Award at the Chinese Control and Decision Conference, the Best Student Paper Award and the IEEE CYBER Conference, and the Best Paper Award and the CAIBDA Conference.

Dr. Ziwen Yang is currently a tenure-track associate professor and doctoral supervisor, specializing in the integrated design of perception and control for unmanned systems. She earned her Bachelor's degree in 2014 and her Ph.D. in 2020 from Shanghai Jiao Tong University, and she was awarded a joint Ph.D. degree from City University of Hong Kong in 2021. From 2020 to 2023, she served as a postdoctoral researcher at Shanghai Jiao Tong University, during which she conducted a one-year visiting postdoctoral fellowship at the Royal Institute of Technology in Sweden and a three-month postdoctoral research at City University of Hong Kong. Her academic accolades include receiving the China Postdoctoral Innovative Talent Support Program in 2021 and being nominated for the Excellent Doctoral Dissertation Award by the Chinese Association of Automation in the same year. She has published over 20 SCI and EI-indexed papers, including long articles in top-tier control journals such as IEEE TAC and Automatica. Her research primarily focuses on the co-design of perception and control for unmanned systems. She has led three projects, including the National Natural Science Foundation for Young Scholars, and participated in five key projects, such as the National Natural Science Foundation of China.

Dr. Wenbin Yu is an associate professor in the Department of Automation at Shanghai Jiao Tong University. He has been involved in various research projects, including the National Natural Science Foundation's General and Youth Programs, Shanghai Natural Science Foundation, and sub-projects of the National Key Research and Development Program. He has been granted 8 invention patents and has published over 20 SCI papers. He has also received the first prize in the Shanghai Technical Invention Award. Dr. Yu's research focuses on the perception, transmission, and control of targets and environmental information in intelligent unmanned systems. He specifically studies the tracking and measurement of high-speed small targets in different domains using composite systems. He designs an integrated architecture for target detection, transmission, and control, and develops data-adaptive sampling, stable transmission, and optimal scheduling of sensing devices.

Dr. Peishuo Huang, Assistant Researcher at Shanghai Jiao Tong University，specializing in collaborative planning for marine unmanned swarm systems. His research focuses on multi-agent collaboration, distributed machine learning, and path planning with mobile anchor-assisted localization. He has published multiple papers in domestic and international journals and conferences, including the Journal of Electronics & Information Technology, IEEE Internet of Things Journal, and IEEE International Conference on Unmanned Systems (ICUS). Currently, he is involved in key projects including the National Natural Science Foundation of China and high-speed small target composite measurement systems.

Details of Session

With the rapid development of artificial intelligence, robotics, and information systems, maritime unmanned swarms have become an essential component in various fields, including marine scientific research, environmental monitoring, and resource exploration. In the complex and dynamic marine environment, perception and control capabilities serve as the foundation for the efficient execution of tasks by unmanned swarms. Currently, the operation of maritime unmanned swarms gradually evolves towards cross-platform integration, cooperation, and intelligent automation. Intelligent perception and cooperative control technologies respectively

provide key information inputs and implementation methods for the swarms, becoming the core technologies that ensure efficient execution and precise decision-making.

Research in the field of intelligent perception and cooperative control for maritime unmanned swarms primarily focuses on overcoming the challenges posed by the harsh marine environment to traditional technologies, aiming to enhance the autonomous operational capabilities. Through innovations in multi-source data fusion, heterogeneous platform coordination, and intelligent algorithms, maritime unmanned swarms are enabled to autonomously perceive and respond to environmental changes, and cooperatively execute complex tasks without relying on external commands.

The invited session invites original papers of innovative ideas and concepts, new discoveries and improvements, and novel applications relevant to the following selected topics of "Maritime Unmanned Swarms: Intelligent Perception and Cooperative Control".

- Cooperation mechanisms for heterogeneous maritime unmanned platforms
- Intelligent perception technology for maritime unmanned swarms
- Cross-media cooperative control for maritime operations
- Integrated Design of "Perception-Transmission-Control" for Maritime Unmanned Swarms
- Massive Oceanic Data Fusion Technology Using Deep Learning
- Cooperative decision-making and command control technology for Multi-AUV systems
- Cross-media networking and communication technology
- Elastic Planning and Cooperative Deployment Technology for Heterogeneous Platforms
- Application validation for maritime unmanned swarms
- Other relevant technologies for intelligent perception and cooperative control of maritime unmanned swarms