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

自主无人水面航行器：技术创新与跨领域应用

组织者

1.王程博，博士后研究员，中国科学技术大学

2.高洪波，研究员，中国科学技术大学

3.吴征天，教授，苏州科技大学

4.陈立家，副教授，武汉理工大学

个人简介

王程博，博士，中国科学技术大学博士后，英国利物浦约翰摩尔斯大学 Visiting Lecturer，2023 年取得大连海事大学工学博士学位，英国海洋工程科学技术协会（IMarEST）会员，英国皇家造船工程师学会（RINA）会员，中国自动化学会会员，中国人工智能学会会员。主要从事强化学习决策理论、自主船舶决策规划技术及海上无人平台等研究。发表相关学术论文 29 篇，其中 1 项成果入选 ESI 高被引论文，2 项成果入选交通运输领域重大科技创新成果库。参与编撰专著《Offshore Robotics》，授权/申请国家发明专利 13 项，授权软件著作权 2 项。获得 2021 年博士研究生国家奖学金、2021 年度人民网奖学金、2023 年辽宁省优秀毕业生。担任 IEEE TNNLS、IEEE TITS、IEEE TASE、OE、JEET、CCS 等多个国际权威期刊和 TRB、CAC 等国际高影响力会议的审稿人。

高洪波，博士，中国科学技术大学信息科学与技术学院研究员、博士生导师。他于 2016 年 11 月在北航师从李德毅院士指导下获得博士学位，并曾在清华大学工作。主持了包括国家自然科学基金重点项目、科技部重点研发计划总体课题、子课题以及教育部人工智能专项在内的十余项项目，总资助超过 1200 万元人民币。作为第一作者/通讯作者，发表了 22 篇 JCR 一区/二区 SCI 论文（其中 16 篇发表在 JCR 一区顶级期刊），单篇 SCI 引用最高达 171 次，

1 篇 ESI 高被引论文，Google Scholar 引用次数 1721 次，H 因子为 22，SCI 因子超过 5.0 的论文超过 20 篇，获得 5 项国际期刊会议论文奖。获得了 22 项发明专利，1 项美国专利和 1 项 PCT 专利。曾获安徽省杰青、安徽省“特支计划”创新领军人才、中国指挥与控制学会科技进步奖一等奖（排名第一）、中国通信学会科技创新青年奖、中国指挥与控制学会优秀青年科学家奖、安徽省人工智能技术奖杰出奖（排名第三）等奖项。目前担任中国指挥与控制学会理事长、青年工作委员会副主任，安徽省机器人学会监事长、青年工作委员会主任，安徽省院士专家协会、安徽省科技人才企业家协会执行理事，中国指挥与控制学会青年工作委员会副主任。他还担任 IEEE TNNLS 和 TASE 两大人工智能领域顶级 SCI 期刊的副主编，《国际先进机器人系统》知名 SCI 期刊的副主编，两次 EI 期刊编委，九次领域主席和客座主编。曾多次受邀参加国际和国内会议发表演讲，次数超过 5 次。

吴征天，博士，教授，博士生导师，目前就职于苏州科技大学电子与信息工程学院，院长助理，IEEE Senior Member，江苏省青蓝工程学术带头人，江苏省一流课程负责人，江苏省科技副总。主持国家级科研项目 3 项，发表科研论文 60 余篇，担任多个 SCI/EI 检索期刊的副主编或编委。

陈立家，博士，副教授，博士生导师，目前就职于武汉理工大学航运学院。他于 2015 年从武汉理工大学获得博士学位；曾在利物浦约翰摩尔斯大学从事访问学者研究工作。长期从事智能船舶自主避碰、航海仿真与模拟技术的研究，在《交通运输工程学报》、《Ocean Engineering》等期刊发表 30 余篇学术论文，并主持或参与了多个国家级科研项目。

特邀专题简介

随着海洋经济开发、环境监测与水路运输等需求的快速增长，无人船（Unmanned Surface Vessels，USVs）作为智能海洋装备的核心载体，正经历革命性技术突破。通过融合自主导航、人工智能、多模态感知与协同控制技术，无人船系统已广泛应用于水文测绘、灾害救援、海上物流、生态保护及军事侦

察等领域，成为智慧海洋与水域智能化的重要支撑。

然而，无人船技术的深化发展仍面临多重挑战：复杂海洋环境下的高鲁棒性感知、长续航能源管理、异构系统协同作业、人机交互安全及国际海事法规适配等问题亟待突破。同时，跨学科交叉（如海洋工程、控制科学、通信技术、政策研究）的协同创新需求日益凸显。本专题会议旨在汇聚全球学术界与产业界专家，共同探讨无人船领域的前沿技术、标准化进程及社会影响，推动产学研深度融合。

本特邀专题邀请以下与“自主无人水面航行器：技术创新与跨领域应用”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。

- 智能感知与多传感器融合
- 航行环境建模技术
- 动态避障与自主决策技术
- 自主规划与智能控制技术
- 故障自诊断与容错控制技术
- 无人船-无人机-水下机器人异构协同技术
- 无人船智能通信技术
- 远程遥控技术
- 数字孪生驱动的虚拟测试平台
- 氢能/波浪能等绿色船舶技术
- E-航海与气象导航技术
- 跨领域应用案例

IEEE ICUS 2025
Invited Session Summary

Title of Session

Autonomous Unmanned Surface Vehicle: Technological Innovation and Cross-Domain Applications

Organizers

1. Dr. Chengbo Wang

University of Science and Technology of China

2. Prof. Hongbo Gao

University of Science and Technology of China

3. Prof. Zhengtian Wu

Suzhou University of Science and Technology, China

4. Assoc. Prof. Lijia Chen

Wuhan University of Technology, China

Biosketches of Organizers

Dr. Chengbo Wang, is a postdoctoral researcher at University of Science and Technology of China, a visiting lecturer from Liverpool John Moores University of UK. In 2023, he obtained his Ph.D. degree in Traffic Information Engineering and Control from Dalian Maritime University, China. He is a member of the Institute of Marine Engineering, Science, and Technology (IMarEST) and the Royal Institution of Naval Architects (RINA) in the United Kingdom, as well as a member of the Chinese Association of Automation and the Chinese Association for Artificial Intelligence. His research primarily focuses on reinforcement learning decision theory, autonomous ship decision planning technology, and unmanned platforms at sea. Wang has published 29 related academic papers, with one inclusion in the ESI highly cited papers, and two included in the Major Technological Innovation Achievements Library of Transportation. He contributed to the compilation of the book "Offshore Robotics" and holds 13 granted/applied national invention patents and 2 software copyright grants. Dr. Chengbo Wang has received numerous accolades, including national scholarships, the 2021 People's Net Scholarship, and being recognized as an outstanding graduate by Liaoning Province. He serves as a reviewer for several prestigious international

journals and conferences such as IEEE TNNLS, IEEE TITS, IEEE TASE, OE, JEET, CCS, TRB and CAC.

Prof. Hongbo Gao, Researcher, Doctoral Supervisor, School of Information Science and Technology, University of Science and Technology of China. He graduated with a PhD from Beihang University in November 2016 under the supervision of Academician Deyi Li, and worked at Tsinghua University. Chaired more than 10 projects including key projects of the National Natural Science Foundation of China, integrated project topics, sub-topics of the Key R&D Program of the Ministry of Science and Technology of China, and special projects on artificial intelligence of the Ministry of Education, with total funding of more than 12 million RMB. He has published 22 JCR Zone 1 / Zone 2 SCI papers as first/corresponding author (16 papers in top JCR Zone 1 journals), with the highest single SCI citations of more than 171, one ESI highly cited paper, 1721 Google Scholar citations, H-factor of 22, more than 20 papers with SCI factor > 5.0, and 5 international journal conference paper awards. He has been granted 22 invention patents, 1 US patent and 1 PCT patent. He has been awarded the Anhui Province Outstanding Youth, the "Special Support Plan" Innovation Leader of Anhui Province, the First Prize of Science and Technology Progress Award of China Command and Control Society (rank 1), the Science and Technology Innovation Youth Award of China Communications Association, the Young Scientist Award of China Command and Control Society, and the Outstanding Award of Anhui Province Artificial Intelligence Technology Award (rank 3). He is currently the director of the China Command and Control Society and the deputy director of the Youth Working Committee, the chairman of the supervisory board and the chairman of the youth working committee of the Anhui Robotics Society, the executive director of the Anhui Association of Academicians and Experts and the Anhui Association of Scientists and Entrepreneurs, and the deputy chairman of the youth working committee of the China Command and Control Society. He serves as Associate Editor of IEEE Trans. on Neural Network and Learning System, a leading SCI journal in artificial intelligence, and IEEE Trans. on Automation Science and Engineering, a leading SCI journal in robotics, Associate Editor of the well-known SCI journal Int. J. Adv. Robot. Syst, Editorial Board member of EI journals for two times, Section Chair and Guest Editor-in-Chief for nine times. He has been invited to present at

international and national conferences more than 5 times.

Prof. Zhengtian Wu, PhD, doctoral supervisor, currently works at the School of Electronic and Information Engineering, Suzhou University of Science and Technology, as the Dean's Assistant, IEEE Senior Member, the academic leader of Jiangsu Province Qinglan Project, the person in charge of Jiangsu Province's first-class courses, and the Vice President of Science and Technology of Jiangsu Province. He has presided over 3 national scientific research projects, published more than 60 scientific research papers, and served as the deputy editor-in-chief or editorial board member of several SCI/EI indexed journals.

Dr. Lijia Chen, associate professor, doctoral supervisor, currently works at the School of Navigation, Wuhan University of Technology. He received his PhD from Wuhan University of Technology in 2015 and worked as a visiting scholar at Liverpool John Moores University. He has been engaged in the research of autonomous collision avoidance of intelligent ships, navigation simulation and simulation technology for a long time, published more than 30 academic papers in journals such as Journal of Transportation Engineering and Ocean Engineering, and presided over or participated in many national scientific research projects.

Details of Session

With the rapid growth of demands in marine economic development, environmental monitoring, and waterway transportation, Autonomous Unmanned Surface Vehicles (USVs), as the core carrier of intelligent marine equipment, are undergoing revolutionary technological breakthroughs. By integrating autonomous navigation, artificial intelligence, multimodal perception, and collaborative control technologies, USV systems have been widely applied in fields such as hydrographic surveying, disaster rescue, maritime logistics, ecological protection, and military reconnaissance, becoming an essential support for smart oceans and waterway intelligence.

However, the further development of USV technology still faces multiple challenges: high robustness perception in complex marine environments, long-endurance energy management, heterogeneous system collaborative operations,

human-machine interaction safety, and adaptation to international maritime regulations all require breakthroughs. At the same time, the demand for interdisciplinary collaborative innovation, such as in marine engineering, control science, communication technology, and policy research, is becoming increasingly prominent. This special session aims to bring together global experts from academia and industry to discuss cutting-edge technologies, standardization processes, and societal impacts in the field of USVs, promoting deeper integration of industry, academia, and research.

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 "Autonomous Unmanned Surface Vehicles: Technological Innovation and Cross-Domain Applications".

- Intelligent perception and multi-sensor fusion
- Navigation environment modeling technologies
- Dynamic obstacle avoidance and autonomous decision-making technologies
- Autonomous planning and intelligent control technologies
- Fault diagnosis and fault-tolerant control technologies
- USV-UAV-Underwater robot heterogeneous collaborative technologies
- USV intelligent communication technologies
- Remote control technologies
- Digital twin-driven virtual testing platforms
- Green vessel technologies such as hydrogen energy/wave energy
- E-navigation and meteorological navigation technologies
- Cross-domain application cases