

# 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

无人水下航行器技术

## 组织者

1. 秦洪德，教授，哈尔滨工程大学
2. 姜宇，副教授，吉林大学
3. 薛祎凡，助理教授，哈尔滨工程大学
4. 余相，助理教授，中国石油大学（华东）

## 个人简介



**秦洪德**，教授、博导，国家杰出青年科学基金获得者，国家重点研发计划首席科学家，哈尔滨工程大学水下智能机器人技术团队负责人。现担任十四五国家重点研发计划“智能机器人”重点专项专家委员会委员、中国计算机学会智能机器人专委会秘书长、中国海洋学会深海技术分会理事、中国海洋学会海洋物理分会理事、中国光学工程学会海洋信息网络专委会海洋装备与工程组组长；IEEE Senior member，担任 JMSA 副主编、SIVP 副主编。主要从事自主水下航行器、水面无人艇技术研究，研发了“星海”系列海洋机器人。在海洋机器人总体设计、近底观测作业、自主导航与精细控制等方面取得突破，获得省部级奖励 6 项，发表 SCI 论文 100 余篇，授权发明专利九十余件。



**姜宇**，吉林大学副教授、博士生导师。中国计算机学会智能机器人专委会委员、人工智能与模式识别专委会委员、区块链专委会委员，中国仿真学会机器人系统仿真专委会委员，中国指挥与控制学会高级会员。担任 CES 副主编，浙大学学报（英文版）、Science Progress 等期刊客座编辑。长期围绕水下自主航行器智能感知技术从事人工智能、数据科学、智能控制、海洋工程等多学科领域的交叉融合研究。主持和参加国家、省部级项目 13 项，获得省部级奖励 2 项，发表 SCI 论文三十余篇，授权发明专利三十

余项。



**薛祎凡**，哈尔滨工程大学预聘副教授，硕导。致力于海洋机器人智能控制、海洋装备优化设计等领域的研究；主要涉及系统辨识、模型预测控制、海洋机器人研发与应用等研究方向。承担国家自然科学基金青年基金、山东省自然科学基金青年基金、基础加强项目专题等纵向项目，作为骨干成员参加国家重点研发计划 3 项，承担多项无人船、水下航行器的横向委托项目。担任机械工程学报青年编委，Science Progress 客座编辑，CIRAC 2023 论文副主席。在海洋机器人、船舶工程等权威期刊发表 SCI 论文十余篇。



**余相**，中国石油大学（华东）机电工程学院助理教授。长期致力于海洋机器人单信标导航、水下组合导航、水下传感器网络定位以及最优状态估计等领域的研究。参与了多款海洋机器人的研发与应用。作为骨干成员参加国家自然科学基金、国家重点研发计划、工信部高技术船舶项目等科研项目 5 项。发表海洋机器人相关学术论文十余篇，授权发明专利八项。

### 特邀专题简介

近年来，水下自主航行器已在海洋测绘、环境数据采集、水域应急救援、水下监测与侦查等领域得到了广泛应用，其具备探测效率高、环境影响小、运营成本低、安全可靠性强等优势，改变了人类从海面到水下认识海洋和利用海洋的方式。无人水下航行器的应用场景从开阔水域逐步扩展到了环境动态变化、空间受限、通信拒止等复杂场景，因此需要结合人工智能、机器学习等方法，采用新的软硬件技术来实现其在复杂水下环境中的感知、通信、导航定位、路径规划与控制，提高航行器的自主性、鲁棒性和智能性。此外，需要研究面向多智能体协同的相关方法，以更高效地执行水下任务。

本特邀专题邀请以下与“无人水下航行器技术”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。

- 水下自主航行器设计与应用
- 海洋机器人控制
- 水下目标识别
- 水下同步定位与建图
- 水下导航与定位
- 水下多智能体

# IEEE ICUS 2024

## Invited Session Summary

### Title of Session

Unmanned Underwater Vehicle Technology

### Organizers

#### 1. Prof. Hongde Qin

Harbin Engineering University, China

#### 2. Assoc. Prof. Yu Jiang

Jilin University, China

#### 3. Asst. Prof. Yifan Xue

Harbin Engineering University, China

#### 4. Asst. Prof. Xiang Yu

China University of Petroleum (East China), China

### Biosketches of Organizers



**Hongde Qin** is a professor and doctoral supervisor, recipient of the National Distinguished Youth Science Foundation, and chief scientist of the National Key Research and Development Program. He leads the Underwater Intelligent Robotics Technology Team at Harbin Engineering University. Currently, he serves as a member of the Expert Committee of the "Intelligent Robots" Key Special Project of the 14th Five-Year Plan, Secretary-General of the Intelligent Robotics Special Committee of the China Computer Society, director of the Deep Sea Technology Branch of the China Oceanographic Society, director of the Ocean Physics Branch of the China Oceanographic Society, and leader of the Ocean Equipment and Engineering Group of the Marine Information Network Special Committee of the Chinese Optical Engineering Society. He is an IEEE Senior member and serves as Associate Editor of JMSA and Associate Editor of SIVP. His main research interests include autonomous underwater vehicles and unmanned surface vessels, and he has developed the "Xinghai" series of marine robots. He has made breakthroughs in overall design of marine robots, near-bottom observation operations, autonomous navigation, and fine control, receiving six provincial and ministerial awards, publishing over a hundred SCI papers, and holding more than ninety authorized patents.



**Yu Jiang** is an associate professor and doctoral supervisor at Jilin University. He also serves as a member of the Intelligent Robotics Special Committee, the Artificial Intelligence and Pattern Recognition Special Committee, and the Blockchain Special Committee of the China Computer Society. Additionally, he is a member of the Robot System Simulation Special Committee of the China Simulation Society and a senior member of the China Command and Control Society. He holds the position of Associate Editor for CES and serves as a guest editor for the Journal of Zhejiang University and Science Progress. His research focuses on intelligent perception technologies for autonomous underwater vehicles. Furthermore, he engages in interdisciplinary research spanning artificial intelligence, data science, intelligent control, and ocean engineering. He has led or participated in 13 national and provincial-level projects, receiving awards for two of them at the provincial and ministerial levels. He has published over thirty SCI papers and holds more than thirty authorized patents.



**Yifan Xue** is an Assistant Professor and Master's Supervisor at Harbin Engineering University. He is dedicated to research in the fields of intelligent control of marine robots and optimization design of marine equipment. His research mainly involves system identification, model predictive control, development, and application of marine robots. He has undertaken longitudinal projects such as the National Natural Science Foundation of China (NSFC) Youth Fund, the Shandong Provincial Natural Science Foundation Youth Fund, and specialized projects of basic strengthening projects. He has also been involved as a core member in three national key research and development programs and has undertaken multiple commissioned projects related to unmanned surface vessels and underwater vehicles. Xue serves as a youth editorial board member for the Journal of Mechanical Engineering, guest editor for Science Progress, and Vice Chair of Papers for CIRAC 2023. He has published over ten SCI papers in authoritative journals related to marine robotics and ship engineering.



**Xiang Yu** is an Assistant Professor at College of Mechanical and Electronic Engineering, China University of Petroleum (East China). He has been devoted to the research in the fields of marine robotic single beacon navigation, underwater integrated navigation, underwater sensor network localization and optimal state estimation for a long time. He has been involved in the development and application of several marine robots. As a key member, he has participated in five projects such as the National Natural Science Foundation of China (NSFC), the National Key Research and Development Program of China, and the High-tech ship research project of Ministry of Industry and Information Technology. He has published over ten academic papers related to marine robotics, and has been authorized eight invention patents.

#### **Details of Session**

In recent years, autonomous underwater vehicles (AUVs) have been widely applied in various fields such as ocean mapping, environmental data collection, underwater emergency rescue, and underwater monitoring and reconnaissance. They possess advantages such as high detection efficiency, minimal environmental impact, low operating costs, and strong safety and reliability, thus changing the way humans understand and utilize the oceans from the surface to underwater. The application scenarios of unmanned underwater vehicles have gradually expanded from open waters to complex environments characterized by dynamic environmental changes, spatial constraints, and communication obstacles. Therefore, it is necessary to integrate novel methods such as artificial intelligence and machine learning and adopt new software and hardware technologies to realize perception, communication, navigation, positioning, path planning, and control in complex underwater environments, thereby enhancing the autonomy, robustness, and intelligence of the vehicles. In addition, research on methods for multi-agent coordination is needed to execute underwater tasks more efficiently.

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 “Unmanned Underwater Vehicle Technology”.

- Design and application of autonomous underwater vehicles
- Control of marine robots
- Underwater target recognition

- Underwater navigation and positioning
- Underwater simultaneous localization and mapping
- Underwater multi-agent systems