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

网联环境下自动驾驶信息物理系统的决策、规划与先进控制

组织者

1. 采国顺，助理研究员，香港大学
2. 柏硕，助理研究员，东南大学
3. 孙陈，副教授，香港大学
4. 卢玉坤，副教授，加拿大新布朗斯维克大学
5. 张晶，副教授，澳门科技大学

个人简介

采国顺，现任香港大学数据与系统工程系助理研究员，分别于 2015 年和 2024 年在东南大学获得机械工程学士和博士学位。研究方向包括车辆动力学与控制、运动规划与控制，以及数据驱动建模与控制。已发表 30 余篇高质量期刊和会议论文，拥有 10 余项发明专利。曾获中国汽车工程学会 2025 年度优秀博士学位论文奖。担任 IEEE 消费技术学会汽车消费电子技术委员会委员，多次担任国际会议分会场主席或联合主席，组织和参与多次国际学术会议技术讨论。

柏硕，现任东南大学助理研究员，分别于 2017 年和 2025 年在东南大学获得机械工程学士和博士学位。当前研究方向主要包括分布式驱动电动车辆的状态估计与安全控制，网联交通环境下的车辆协同感知。已发表 20 余篇同行评审高水平期刊和会议论文，拥有 10 余项发明专利。现主持国家自然科学基金青年学生基础研究项目和江苏省研究生科研与实践创新计划项目。曾获世界智能驾驶挑战赛金奖和中国“互联网+”大学生创新创业大赛金奖。

孙陈，现任香港大学数据与系统工程副教授（独立 PI，博士生导师）。研究致力于面向智能自主系统（如自动驾驶车辆和野外机器人）发展理论与计算算法，以在不确定、动态和交互环境中实现安全性与高性能保障，当前重点方向包括野外机器人、自动驾驶安全规划以及人－信息物理系统（Human－CPS）自主性。担任多个期刊的副编辑，例如《IEEE Transactions on Vehicular Technology》和《IEEE Vehicular Technology Magazine》等，并于 2023 至 2025 年受邀担任 IEEE 智能交通系统国际会议（IEEE International Conference on Intelligent Transportation Systems）分会场主席或联合主席。已发表 70 余篇同行评审论文，拥有多项授权专利，并出版了 4 部国际学术专著。

卢玉坤，现任加拿大新布朗斯维克大学机械工程系副教授（独立 PI，博士生导师），同时担任智能移动与机器人实验室（Intelligent Mobility and Robotics Lab, IMRL）主任。于 2023 年在滑铁卢大学获得机械与机电一体化工程博士学位，并随后在该校机电车辆系统实验室（Mechatronic Vehicle Systems Lab, MVSL）从事博士后研究。于 2018 年获得车辆工程学士学位，并辅修工商管理。其研究背景及未来研究方向包括地面车辆角模块、智能机器人移动、数据驱动的学习控制策略以及车辆动力学与控制。已发表 40 余篇同行评审论文，拥有多项授权专利，并出版了 4 部国际学术专著。

张晶，现任澳门科技大学计算机科学与工程学院副教授（独立 PI，博士生导师）。于 2017 年和 2023 年分别在中国南京南京理工大学获得电气工程及其自动化专业学士学位和控制理论与控制工程专业博士学位。曾于 2022 年赴新加坡南洋理工大学进行学术访问。其研究方向包括自适应控制、事件触发控制、非线性系统以及切换系统。她已发表 20 余篇高质量研究论文。

特邀专题简介

随着车联网、智能交通基础设施及车路云协同体系的快速发展，自动驾驶系统正由传统依赖车载感知与本车决策的孤立智能模式，逐步演进为深度融合感知、通信、计算与控制的信息物理系统（Cyber-Physical System, CPS）。在这一框架下，车辆不仅依赖车载传感器获取局部环境信息，还通过车车通信（V2V）、车路通信（V2I）及更广义的 V2X 交互，融合来自周边交通参与者、道路基础设施和云端平台的多源异构信息，从而实现更具前瞻性的驾驶决策、轨迹规划与运动控制。然而，网联环境并非仅仅为自动驾驶提供了更多信息，而是从根本上改变了规划与控制问题的结构。一方面，通信链路中的时延、丢包、异步更新及信息不确定性，使决策与规划所依赖的外部信息具有动态性与非理想性；另一方面，高层决策与轨迹规划越来越依赖对交通演化、协同行为及基础设施约束的预测，而低层控制必须在车辆动力学边界、执行器饱和及安全约束下将规划结果可靠落地。由此，信息层面的全局前视性与物理层面的局部可执行性之间容易产生显著失配，进而影响闭环系统的可行性、鲁棒性与安全性。因此，亟需面向网联自动驾驶这一典型 CPS 场景，系统研究决策、规划与控制的跨层协同机理，构建兼顾通信不确定性、物理约束与实时性要求的一体化理论与方法框架。

本特邀专题欢迎围绕“网联环境下自动驾驶决策、规划与先进车辆控制”主题的原创研究论文，重点关注该领域中的创新思想、理论突破、方法改进、关键技术进展以及新兴应用成果。

- 网联自动驾驶系统的决策与行为规划
- 面向车路协同环境的轨迹规划与运动规划方法
- 网联环境下的先进车辆动力学控制与运动控制
- 自动驾驶信息物理系统的协同感知、状态估计与信息融合
- 考虑通信时延、丢包与不确定性的规划与控制方法
- 面向安全关键场景的自动驾驶预测控制与鲁棒控制
- 车路云协同架构下的规划、控制与执行一体化设计
- 复杂交通环境下自动驾驶系统的实时优化与闭环决策控制
- 面向自动驾驶 CPS 的故障诊断、容错控制与安全保障方法

- 网联自动驾驶系统的高保真仿真、测试验证及实验评估

IEEE ICUS 2026
Invited Session Summary

Title of Session

Connected Autonomous Driving: Decision-Making, Motion Planning, and Advanced Vehicle Control

Organizers

1. Dr. Guoshun Cai
The University of Hong Kong, China

2. Dr. Shuo Bai
Southeast University, China

3. Asst. Prof. Chen Sun
The University of Hong Kong, China

4. Asst. Prof. Yukun Lu
The University of New Brunswick, Canada

5. Asst. Prof. Jing Zhang
Macao University of Science and Technology, China

Biosketches of Organizers

Guoshun Cai is currently a Research Fellow at The University of Hong Kong, Hong Kong. He received the B.S. and Ph.D. degrees in Mechanical Engineering from Southeast University, Nanjing, China, in 2015 and 2024, respectively. His research interests include vehicle dynamics and control, motion planning and control, and data-driven modeling and control. He has published more than 30 high-quality journal and conference papers and holds over 10 patents. He was the recipient of the 2025 Best Doctoral Dissertation Award from the China Society of Automotive Engineers. He also serves as a Technical Committee Member on Automotive Consumer Electronics of the IEEE Consumer Technology Society, and has served multiple times as a session chair or co-chair at international conferences.

Shuo Bai is currently working as a Research Fellow with Southeast University. He received the B.S. and Ph.D. degrees in Mechanical Engineering from Southeast University, Nanjing, China, in 2017 and 2025, respectively. His current research interests include state estimation and safety control for distributed driven electric vehicles. He has authored/co-authored over 20 peer-reviewed journal and conference papers, and holds 10+

Chinese patents. He is leading a National Natural Science Foundation of China (NSFC) Youth Student Basic Research Project. He was awarded the Gold Award at the World Intelligent Driving Challenge and the Gold Award at the China "Internet Plus" Innovation and Entrepreneurship Competition.

Chen Sun is an Assistant Professor in Data and Systems Engineering at The University of Hong Kong. His research develops theory and computational algorithms for intelligent autonomy (e.g., autonomous vehicles and field robots) to ensure safety and strong performance guarantees in uncertain, dynamic, and interactive environments, with current thrusts in field robotics, safe planning for autonomous driving, and human–CPS autonomy. He serves as an Associate Editor for several journals, such as IEEE Transactions on Vehicular Technology, IEEE Vehicular Technology Magazine, etc. and as a chair/co-chair of the IEEE International Conference on Intelligent Transportation Systems (2023–2025). He has published 70+ peer-reviewed papers, holds multiple granted patents, and has authored four international monographs.

Yukun Lu is currently an Assistant Professor with the Department of Mechanical Engineering at the University of New Brunswick in Canada. She is also the Director of the Intelligent Mobility and Robotics Lab (IMRL). She earned her Ph.D. in Mechanical and Mechatronics Engineering from the University of Waterloo in 2023, where she continued as a Postdoctoral Researcher at the Mechatronic Vehicle Systems Lab (MVSL). She holds a B.Eng. in Vehicle Engineering with a minor in Business Administration, completed in 2018. Her background and future research interests include ground vehicle corner modules, intelligent robotic mobility, data-driven learning-based control strategies, vehicle dynamics and control. He has published 40+ peer-reviewed papers, holds multiple granted patents, and has authored four international monographs.

Jing Zhang is currently an Assistant Professor with the School of Computer Science and Engineering, Macau University of Science and Technology, Macau. She received the B.E. degree in electrical engineering and automation and the Ph.D. degree in control theory and control engineering from the Nanjing University of Science and Technology, Nanjing, China, in 2017 and 2023, respectively. She was a Visiting Student with Nanyang Technological University, Singapore, in 2022. Her research interests include adaptive control, event-triggered control, nonlinear systems, and switched systems. She has published more than 20

high-quality research papers.

Details of Session

With the rapid development of connected vehicle technologies, intelligent transportation infrastructure, and vehicle–road–cloud collaborative systems, autonomous driving is evolving from the conventional isolated-intelligence paradigm, which mainly relies on onboard perception and ego-vehicle decision-making, toward a cyber-physical system (CPS) that deeply integrates perception, communication, computation, and control. Within this framework, vehicles not only depend on onboard sensors to obtain local environmental information, but also leverage vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and broader V2X interactions to fuse multi-source heterogeneous information from surrounding traffic participants, roadside infrastructure, and cloud platforms, thereby enabling more anticipative driving decision-making, trajectory planning, and motion control. However, connected environments do not merely provide autonomous driving systems with more information; they fundamentally reshape the structure of planning and control problems. On the one hand, communication delays, packet loss, asynchronous updates, and information uncertainty render externally acquired information dynamic and non-ideal. On the other hand, high-level decision-making and trajectory planning increasingly rely on the prediction of traffic evolution, cooperative behaviors, and infrastructure constraints, whereas low-level control must reliably execute these plans under vehicle dynamic limits, actuator saturation, and safety constraints. As a result, a significant mismatch may arise between the global preview capability at the information layer and the local executability at the physical layer, which can degrade the feasibility, robustness, and safety of the closed-loop system. Therefore, for connected autonomous driving as a representative CPS application, it is essential to systematically investigate the cross-layer coordination mechanisms among decision-making, planning, and control, and to develop integrated theoretical and methodological frameworks that explicitly address communication uncertainty, physical constraints, and real-time requirements.

The invited session welcomes original research papers on decision-making, planning, and advanced vehicle control for autonomous driving in connected environments, with a particular focus on innovative ideas, theoretical advances, methodological improvements, key technological developments, and emerging applications in this field.

- Decision-making and behavior planning for connected autonomous driving systems
- Trajectory planning and motion planning methods for vehicle–road collaborative environments

- Advanced vehicle dynamics control and motion control in connected environments
- Cooperative perception, state estimation, and information fusion for autonomous driving cyber-physical systems
- Planning and control methods considering communication delays, packet loss, and uncertainties
- Model predictive control and robust control for autonomous driving in safety-critical scenarios
- Integrated design of planning, control, and execution under vehicle–road–cloud collaborative architectures
- Real-time optimization and closed-loop decision-making control for autonomous driving systems in complex traffic environments
- Fault diagnosis, fault-tolerant control, and safety assurance methods for autonomous driving CPS
- High-fidelity simulation, hardware-in-the-loop testing, and experimental platforms for connected autonomous driving systems