

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

智能车辆动力学建模、状态估计与决策控制

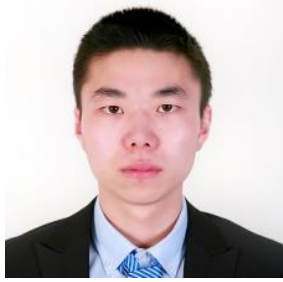
组织者

1. 王泽江, 副研究员, 美国橡树岭国家实验室
2. 莫远秋, 副教授, 东南大学
3. Mingyu Cai, 助理教授, 加州大学河滨分校
4. 武健, 教授, 聊城大学
5. 梁晋豪, 副研究员, 新加坡国立大学
6. 方振伍, 科研助理, 新加坡国立大学

个人简介



王泽江博士现任美国橡树岭国家实验室副研究员 (Associate R&D Staff). 他于 2022 年从德克萨斯大学奥斯汀分校 (UT-Austin) 获得机械工程博士学位, 于 2017 年从巴黎高科国立先进技术学院 (ENSTA ParisTech) 获得工程师学位, 以及巴黎萨克雷大学 (University of Paris-Saclay) 信息物理系统硕士双学位, 并于 2014 年从东南大学获得机械工程本科学位。王泽江博士曾在法国石油研究院 (IFPen) 以及三菱电机研究院 (MERL) 任实习研究员, 并曾赴法国国家科学研究中心 (CNRS) 访学。王泽江博士曾获 IEEE 智能交通系统 (ITSS) 协会最佳博士论文奖, UT-Austin 职业发展奖和 George J. Heuer, Jr. 奖学金, 美国机械工程师协会 (ASME) 车辆与交通系统 (ATS) 最佳会议论文奖。王泽江博士现任美国汽车工程师协会-网联智能车辆期刊 (SAE Int. J CAV) 副主编。他的研究兴趣包括车辆动力学与控制, 智能交通系统, 以及信息物理系统。



莫远秋博士是东南大学数学学院的副教授。他于 2019 年 12 月在爱荷华大学获得了电气与计算机工程博士学位。莫教授获得了 2018 年 IEEE CDC 杰出学生论文奖、2020 年 IFAC 青年作者奖入围奖和 2017 年 Hugh Vollrath Ross 暑期奖学金。他曾担任第 62 届 IEEE 决策与控制会议 (CDC) 的分会主席。他的研究兴趣主要集中在先进控制理论、分布式算法设计以及非线性系统稳定性分析方面。Mo 博士在期刊和会议论文集上发表了 20 多篇论文, 包括在先进控制方法顶级期刊《Automatica》、《IEEE 自动控制交易》和《IEEE 网络系统控制交易》上的贡献。



Mingyu Cai 博士目前是加州大学河滨分校机械工程学院的助理教授。在此之前, 他曾在利理海大学担任博士后研究员, 并且还在本田研究所担任 Research Scientist。他曾获得第 58 届中西部控制与博弈论研讨会最佳博士后奖、2019 年爱荷华大学创新奖、2019 年佛罗里达大学杰出毕业奖以及 2021 年博士学位最佳论文奖。他曾担任 2021 年 IEEE/RSJ 国际智能机器人与系统大会 (IROS) 的分会主席, 并分别担任 2022 年 IEEE 国际机器人与自动化大会 (ICRA)、2022 年美国控制会议 (ACC) 以及 2023 年 IEEE/RSJ 国际智能机器人与系统大会 (IROS) 的分会联席主席。他的研究兴趣包括机器人先进控制理论、强化学习、自动驾驶安全控制。Cai 博士在国际期刊和会议论文集上发表了 20 多篇论文, 并在自动驾驶技术领域拥有 10 多项专利。



武健于 2015 年获得南京航空航天大学车辆工程博士学位, 2016 年至 2018 年在清华大学做了两年博士后研究, 他目前是聊城大学的教授。在国际期刊和会议论文集上发表了 50 多篇论文, 拥有 10 多项有关车辆系统动力学及控制的专利。他的研究兴趣包括人车系统动力学, 人车自动化协作和共享控制。



梁晋豪目前是新加坡国立大学土木与环境工程系的研究员。他的研究兴趣主要集中在车辆动力学与控制、智能联网和自动驾驶车辆、电动车辆、车辆-道路协同控制等方面。在国际期刊和会议论文集上发表了 30 多篇论文,拥有 10 多项有关车辆系统动力学和控制的专利。他曾在第一届世界智能驾驶挑战赛上荣获自动紧急制动辅助系统 (AEB) 的领先奖。他还担任国际自动化与智能技术会议的国际程序委员会委员,并受邀担任 2023 年第六届国际机械工程与应用复合材料会议的演讲嘉宾。



方振伍博士现为新加坡国立大学土木与环境工程系联合博士生。他分别于 2017 年和 2020 年获得了东南大学学士学位和硕士学位。研究方向为车辆动力学与控制、线控转向控制、人机共享控制等。在国际学术期刊和论文集上发表论文 10 余篇。拥有 10 多项线控转向和 ADAS 专利。荣获 2023 年国际大学生创新创业大赛国家银奖。担任 IEEE Trans TE、IV、ITS 等期刊审稿人。负责厦门金龙联合汽车工业有限公司商用车电液耦合线控转向系统项目开发,中国商飞信息技术有限公司数字孪生自动驾驶 HIL 平台开发。

特邀专题简介

在未来的交通出行中,车辆的自动化和智能化水平不断提高,已经成为增强交通安全、提高交通效率以及改善驾驶体验的关键因素。特别是智能汽车在感知环境、做出决策以及执行控制方面所需要呈现的类人特性是提升车辆性能的至关因素。这不仅体现在它们处理复杂交通场景的能力上,还体现在与驾驶人的交互和协作上。高精度的动力学建模和状态估计为智能汽车提供了准确的自我感知能力,这是实现高级自动化驾驶功能的基础。通过对车辆动态特性的深入理解和精确建模,智能汽车能够更好地预测未来状态并作出更为合理的驾驶决策,从而提高行驶的安全性和效率。决策控制系统的拟人化和实时性是实现智能汽车高级功能的另一个核心技术。这要求系统不仅能够在瞬息万变的交通环境中迅速做出响应,还要能够在多变的交通情境中做出类似人类驾驶者的决策,包括应对紧急情况、与其他交通参与者的交互以及遵守交通规则等

本特邀专题邀请以下与“智能车辆动力学建模、状态估计与决策控制”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。

- 个性化决策与自动驾驶控制
- 端到端自动驾驶
- 动力学建模、仿真分析及控制系统设计
- 高级驾驶辅助系统
- 驾驶员-车辆系统中的 AI 应用
- 智能车辆的人因问题
- 智能车辆的线控底盘协调控制
- 网联车辆协作自动驾驶

IEEE ICUS 2024

Invited Session Summary

Title of Session

Intelligent Vehicle Dynamics Modeling, State Estimation and Decision Control

Organizers

1. Dr. Zejiang Wang

Oak Ridge National Laboratory, USA

2. Assoc. Prof. Yuanqiu Mo

Southeast University, China

3. Asst. Prof. Mingyu Cai

University of California Riverside, USA

4. Prof. Jian Wu

Liaocheng University, China

5. Dr. Jinhao Liang

National University of Singapore, Singapore

6. Dr. Zhenwu Fang

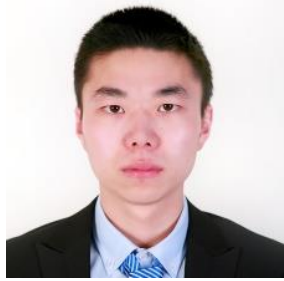
National University of Singapore, Singapore

Biosketches of Organizers



Dr. Zejiang Wang is an R&D Associate Staff at Oak Ridge National Laboratory. He received his Ph.D. degree in Mechanical Engineering from The University of Texas at Austin in May 2022, the Dipl. Ing. degree from ENSTA ParisTech, France, the double M.S. degree in Design, Modeling, and Architecture of Complex Industrial Systems from Ecole Polytechnique, University of Paris-Saclay, France, both in 2017, and the B.E. degree (Hons.) in Mechanical Engineering and Automation from Southeast University, Nanjing, China, in 2014. He was a research intern at the French Institute of Petroleum (IFPen) in Rueil-Malmaison, France, the Mitsubishi Electric Research Laboratories in Cambridge, MA, USA, and a visiting scholar at the French National Centre for Scientific Research (CNRS). He received the IEEE ITSS Best Dissertation-First Prize from IEEE, Professional Development Awards and George J. Heuer, Jr. Ph.D. Endowed Graduate Fellowship from the University of Texas at Austin, the ATS Technical Committee Best Paper Award from the American Society

of Mechanical Engineers (ASME). He is an Associate Editor of SAE Int. J. CAV. His research interests include vehicle dynamics and control, intelligent transportation systems, and cyber-physical systems.



Dr. Yuanqiu Mo is an associate professor in the School of Mathematics at Southeast University. He received his Ph.D. degree in Electrical and Computer Engineering from the University of Iowa in Dec. 2019. Dr. Mo received the 2018 IEEE CDC Outstanding Student Paper Award, 2020 IFAC Young Author Prize Finalist, and 2017 Hugh Vollrath Ross Summer Scholarship. He served as the Session Chair at the 62nd IEEE Conference on Decision and Control (CDC). His research interests have focused on the Advanced control theory, Distributed algorithms design, and Stability analysis of non-linear systems. Dr. Mo has published more than 20 papers in journals and conference proceedings, including contributions to top journals in advanced control methods, such as *Automatica*, *IEEE Transactions on Automatic Control*, and *IEEE Transactions on Control of Network Systems*.



Dr. Mingyu Cai is currently an assistant professor in the School of Mechanical Engineering at the University of California, Riverside. Before this, he was a Postdoctoral Associate at Lehigh University and also a Research Scientist at Honda Research Institute. He received the Best Post Award at the 58th Midwest Workshop on Control and Game Theory, the 2019 University of Iowa Innovation Award, the 2019 Outstanding Graduation Award at the University of Florida, and the 2021 Best Dissertation Award for the Doctor of Philosophy. He served as the Session Chair at the 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) and as session co-chair for the 2022 IEEE International Conference on Robotics and Automation (ICRA), the 2022 American Control Conference (ACC), and the 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). His research interests include Robotics, Machine learning, Formal method, control, Reinforcement learning, Autonomous driving, and Safety-critical systems. Dr. Cai has published more than 20 papers in journals and proceedings of international conferences, and holds more than 10 patents in the field of autonomous driving

technology.



Jian Wu received the Ph.D. degree in Vehicle Engineering from Nanjing University of Aeronautics and Astronautics in 2015, and did two years research at Tsinghua University as a postdocor from 2016 to 2018. He is a Professor at Liaocheng University. Prof. Jian Wu has published more than 50 papers in Journals and proceedings of international conferences. 10+ patents on Vehicle System dynamics and control. His research interests include driver-vehicle system dynamics, driver-vehicle automation collaboration and shared control.



Dr. Jinhao Liang is currently a Research Fellow with Department of Civil and Environmental Engineering, National University of Singapore, Singapore. His research interests have focused on the vehicle dynamics and control, connected and autonomous vehicles, electric vehicles, vehicle-road cooperative control, etc. Moreover, Dr. Jinhao liang has published more than 50 papers in Journals and proceedings of international conferences. 10+ patents on Vehicle System dynamics and control. He won the Leading Prize for Autonomous Emergency Braking (AEB) assistance system at the 1st World Intelligent Driving Challenge. He serves as a member of the international program committee for the 2024 International Conference on Automation and Intelligent Technology. Moreover, he is an invited speaker at the 2023 6th International Conference on Mechanical Engineering and Applied Composite Materials.



Dr. Zhenwu Fang is currently a joint PhD student with Department of Civil and Environmental Engineering, National University of Singapore, Singapore. He received the B.S. degree and the M.S. degree from Southeast University in 2017 and 2020, respectively. His research interests have focused on the vehicle dynamics and control, steering-by-wire control, human-machine shared control, etc. Moreover, Zhenwu Fang has published more than 10 papers in Journals and proceedings of international conferences and 20+ patents on steering-by-wire control and ADAS. He won the National Silver Award in the International College Student Innovation and Entrepreneurship Competition (2023). He served as a reviewer for IEEE Trans TE, IV, ITS and other journals. Additionally, He was

responsible for the development of the commercial vehicle electro-hydraulic coupling steering system project, funded by Xiamen Jinlong United Automotive Industry Co., Ltd. He developed the digital twin autonomous driving HIL platform for Shenzhen Research Institute and COMAC Information Technology Co., Ltd.

Details of Session

In the future of transportation, the level of automation and intelligence of vehicles is continuously improving, becoming a key factor in enhancing traffic safety, improving traffic efficiency, and improving driving experience. In particular, the human-like characteristics that intelligent vehicles need to exhibit in perceiving the environment, making decisions, and executing control are crucial factors in enhancing vehicle performance. This is not only reflected in their ability to handle complex traffic scenarios but also in their interaction and collaboration with drivers. High-precision dynamics modelling and state estimation provide intelligent vehicles with accurate self-perception capabilities, which are the foundation for implementing advanced automated driving functions. By deeply understanding and accurately modeling the dynamic characteristics of vehicles, intelligent vehicles can better predict future states and make more reasonable driving decisions, thereby enhancing driving safety and efficiency. The human-like and real-time nature of the decision-control system is another core technology for achieving advanced functions in intelligent vehicles. This requires the system not only to respond quickly in a rapidly changing traffic environment but also to make decisions similar to human drivers in various traffic situations, including responding to emergencies, interacting with other traffic participants, and adhering to traffic rules.

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 “Intelligent vehicle dynamics modeling, state estimation and decision control”.

- Personalized Decision and Control for Autonomous Driving
- End-To-End (E2E) Autonomous Driving
- Dynamics Modeling, Simulation Analysis, and Control System Design
- Advanced Driver Assistance Systems
- Application of AI and Machine Learning for Driver-Vehicle System
- Human Factors for Intelligent Vehicles
- X-by-wire Control and Optimization Design of Intelligent Vehicles

