

**IEEE ICUS 2022**  
**Invited Session Summary**

**Title of Session**

Secure Control of Multi-Robot Cyber-Physical Systems

**Name, Salutation and Affiliation of Organizers**

**1. Assoc. Prof. Zhiqiang Miao**

Hunan University, China

**2. Prof. Guoqiang Hu**

Nanyang Technological University, Singapore

**3. Prof. Yuzhe Li**

Northeastern University, China

**4. Assoc. Prof. Jiehao Li**

South China Agricultural University, China

**Biosketches of Organizers**



**Zhiqiang Miao** is an Associate Professor of Electrical and Information Engineering, Hunan University, and the National Engineering Research Center for Robot Visual Perception and Control Technology. He was the recipient of the Young Talents Supporting Program of the China Association for Science and Technology, the Huxiang Young Talents, and the Excellent Young Scientists Fund of Hunan Province. His research interests include multi-robot systems, unmanned systems, visual navigation, and nonlinear control. He was the recipient of the Science and Technology Innovation Team Award of Hunan Province (3/15), the Outstanding Doctoral Dissertation Award of Hunan Province, the Outstanding Doctoral Dissertation Nomination Award of Chinese Association of Automation, the Best Paper Honorable Mention Award of IEEE Robotics and Automation Letters, the Best Theoretic Paper Award of Youth Academic Annual Conference of Chinese Association of Automation, the Best Paper Finalist of the International Conference on Advanced Robotics, and the IEEE International Conference on Real-time Computing and Robotics. He served as the Associate Editor of the 2022 IEEE International Conference on Robotics and Automation (ICRA), and the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).



**Guoqiang Hu** is currently a Full Professor (Professor of Intelligent Systems and Robotics) in the School of Electrical and Electronic Engineering at Nanyang Technological University, Singapore. Before joining NTU Singapore in 2011, he was an Assistant Professor with Kansas State University, USA. He received B.Eng. in Automation from University of Science and Technology of China in 2002, M.Phil. in Automation and Computer-Aided Engineering from The Chinese University of Hong Kong in 2004, and Ph.D. in Mechanical Engineering from University of Florida in 2007. His research interest is on analysis, control, design and optimization of distributed intelligent systems. He works on distributed optimization and game theory, distributed decision making, distributed control, and data science, with applications to multi-robot systems and smart city systems. He was a recipient of the Best Paper in Automation Award in the 14th IEEE International Conference on Information and Automation, and a recipient of the Best Paper Award (Guan Zhao-Zhi Award) in the 36th Chinese Control Conference. He currently serves as Subject Editor for International Journal of Robust and Nonlinear Control, Associate Editor for IEEE Transactions on Control Systems Technology, and Associate Editor for IEEE Transactions on Automatic Control. He was an Associate Editor for IEEE Transactions on Automation Science and Engineering and a Technical Editor for IEEE/ASME Transactions on Mechatronics.



**Yuzhe Li** is currently a Professor in the State Key Laboratory of Synthetical Automation for Process Industries, Northeastern University, Shenyang, China. He received the B.S. degree in Mechanics from Peking University, China in 2011 and the Ph.D. degree in Electronic and Computer Engineering from the Hong Kong University of Science and Technology (HKUST) in 2015. Between June 2013 and August 2013, he was a visiting scholar in the University of Newcastle, Australia. From September 2015 to September 2017, he was a Postdoctoral Fellow at the Department of Electrical and Computer Engineering, University of Alberta, Canada. His research interests include networked control systems, cyber-physical systems security, and state estimation. He serves as an Editor for the International Journal of Robust and Nonlinear Control.



**Jiehao Li** received the M.Sc. degree in Control Engineering at South China University of Technology, Guangzhou, China, in 2017. He received the Ph.D. degree at the State Key Laboratory of Intelligent Control and Decision of Complex Systems, School of Automation, Beijing Institute of Technology, Beijing, China, in 2022. He is now an Associate Professor at Key Laboratory of Key Technology on Agricultural Machine and Equipment, Ministry of Education, College of Engineering, South China Agricultural University, Guangzhou, China. He is also a Visiting Fellow of the Medical and Robotic Surgery Group (NEARLab) in Politecnico di Milano, Milano, Italy. His interests mainly include mobile robotics, motion control, robot vision, and image processing. Dr. Li has been awarded the Best Conference Paper Finalist of IEEE International Conference on Advanced Robotics & Mechatronics in 2020, and the Outstanding Reviewer of China Automation Congress in 2021. He is the Session Chair of Youth Academic Annual Conference of Chinese Association of Automation in 2022. He has served the Academic Editor of Frontiers in Neurorobotics, and Journal of Control Science and Engineering.

#### **Details of Session**

Multi-robot systems, cyber-physical systems that interact with dynamic environments and humans, which can successfully accomplish the specified tasks rely on the safe and reliable interactions between the robots and the world. However, in real-world applications, multi-robot systems often face complex environments in dynamic scenes, and the deep integration of physical space and cyberspace makes them more complex, open, and vulnerable to external interference or even malicious attacks, resulting in increased system vulnerability. Therefore, the security of multi-robot systems has received increasing interest, especially with the widely applications of multi-robot systems in civil and military fields. For multi-robot systems that operate in safety-critical applications such as transportation, defense, and medical care, how to ensure the security of multi-robot systems from the perspective of control is of great theoretical and practical significance.

This invited session invites original papers of innovative ideas and concepts, new discoveries and improvements, and novel applications relevant to the following selected topics of “Secure Control of Multi-Robot Cyber-Physical Systems”.

- Attack detection and identification for networked unmanned systems

- Secure control of unmanned systems in adversarial environments
- Secure estimation for multi-robot systems
- Resilient control of multi-robot systems
- Security game of multi-robot systems
- Human-robot interaction security
- Formal verification and synthesis of unmanned systems
- Formal methods for planning and control of multi-robot systems