

IEEE ICUS 2022
Invited Session Summary

Title of Session

Distributed Control and Optimization for Constrained Multi-Unmanned Systems

Name, Salutation and Affiliation of Organizers

1. Assoc. Prof. Junjie Fu

Southeast University, China

2. Prof. Guanghui Wen

Southeast University, China

3. Prof. Dezhi Zheng

Beijing Institute of Technology, China

Biosketches of Organizers



Junjie Fu received the B.S. degree in 2011 and the Ph.D. degree in 2017, both from Peking University, Beijing, China. From 2016 to 2017, he was a Visiting Research Student with the Department of Electrical and Electronic Engineering at The University of Melbourne for six months. Since 2017, he has been with the Southeast University, Nanjing, China, where he is currently an Associate Professor. His research interests include consensus and coordination in multi-agent systems, input saturation control and distributed optimization. He has published more than 30 SCI journal papers and is an active reviewer for many research journals and conferences.



Dr. Wen received the Ph.D. degree in mechanical systems and control from Peking University, China, in 2012. Currently, he is a Full Professor with the Department of Systems Science, Southeast University, Nanjing, China. His current research interests include cooperative control of multi-agent systems, analysis and synthesis of complex networks, cyber-physical systems, and resilient control. Dr. Wen was the recipient of the Best Student Paper Award in the 6th Chinese Conference on Complex Networks in 2010. He was named a Highly Cited Researcher by Clarivate Analytics since 2018. Dr. Wen was awarded a National Natural Science Fund for Excellent Young Scholars

in 2017. Moreover, he was a recipient of the Australian Research Council Discovery Early Career Researcher Award in 2018. He currently serves as an Associate Editor of IEEE Journal of Emerging and Selected Topics in Industrial Electronics, IEEE Trans. Systems, Man and Cybernetics: System, and Asian J. Control. He is an IET Fellow.



Dezhi Zheng is currently a professor and doctoral supervisor of the Institute of Frontier Interdisciplinary Sciences of Beijing Institute of Technology. He has been engaged in the research of sensor sensitive mechanism and intelligent detection technology for a long time. Guided by the major needs of serving aviation airborne and ground test parameter measurement, he has carried out key technology research on

resonant pressure and flow sensors; in order to meet the urgent national defense needs of explosion vibration measurement, the Research on low-frequency vibration sensor and its calibration technology; at the same time, aiming at the frontier direction of interdisciplinary, research on biological information perception technology is carried out. Some achievements have been successfully applied in resonant pressure and mass flow sensors and national defense low-frequency vibration calibration technology. He has presided over more than 20 major national key projects, and won a second prize of the 2008 National Science and Technology Progress Award (Ranked 5) and a second prize of the annual National Technological Invention Award of 2013 (Ranked 2), more than 60 academic papers, and more than 20 authorized invention patents.

Details of Session

The rapid development of network communication technology, sensing technology, and distributed computing technology makes multi-unmanned systems (MUS) appear widely in various fields. Typical MUS include multiple drones, multiple unmanned vehicles, complex power grids, and multiple satellite systems. The effective control and efficient cooperation of MUS depend on the design of cooperative control laws and distributed optimization algorithms. The cooperative control law enables the MUS to realize swarm movement and complete complex cooperative tasks. The distributed optimization algorithm can realize the global optimal state or optimal path of MUS through local interaction. The cooperative control and optimization of MUS needs to deal with many practical constraints at the

same time. In terms of dynamics, unmanned systems may have complex, nonlinear and uncertain dynamics; in terms of communication, information exchange between MUS faces packet loss, delay, switching communication topology, etc.; MUS need to consider constraints such as collision avoidance, task allocation, and formation constraints. Therefore, it is of great significance to study the distributed cooperative control and optimization theory of restricted MUS for the wide practical application. This special session invites original papers including innovative ideas, concepts, new discoveries, improvements, and new applications related to distributed cooperative control and optimization of constrained MUS. Relevant topics include but are not limited to:

1. Distributed optimization and control of MUS with complex dynamics constraints
2. Distributed path planning for MUS in complex environments
3. Distributed obstacle avoidance motion control for restricted MUS
4. Robust adaptive cooperative control of constrained MUS
5. Restricted multi-unmanned system cooperative coverage control
6. Online learning robust cooperative control of MUS