

Distributed Consensus and Optimization of Multi-Agent Systems with Switching Communication Topologies

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Abstract

In recent years, the development of perception, communication, and embedded technologies has had a transformative impact on system analysis and control methods. Modern engineering control systems are increasingly characterized by networked structures and intelligent units. Within this context, the concept of multi-agent systems (MASs) has emerged, and the distributed cooperative control and optimization of such systems have gradually become a research frontier in the fields of systems and control. In practice, due to factors such as the limited communication range of agents and interference in communication links, the communication topology of MASs often exhibits dynamic switching characteristics. This talk begins by discussing the key issues of consensus control in MASs under switching communication topologies, outlining the critical techniques for addressing these problems: the common Lyapunov function method and the multiple Lyapunov function method. For MASs with directed switching communication topologies, it presents the construction methods and consensus criteria of multiple Lyapunov functions based on nonsingular M-matrix theory, and further explores low-conservatism multiple Lyapunov function construction methods based on Lyapunov inequalities and optimization techniques. On this basis, the robust optimization problems of MASs with physical dynamics under switching communication topologies are discussed. Finally, the application of the related theoretical results in the formation control of unmanned surface vessels is shared, along with personal insights on related emerging research topics.



Guanghui Wen received his Ph.D. degree in Mechanical Systems and Control from Peking University, Beijing, China, in 2012. He is currently an Endowed Chair Professor and the Vice Dean of the School of Automation at Southeast University, Nanjing, China. His current research interests include coordination control of autonomous intelligent systems, analysis and synthesis of complex networks, cyber-physical systems, resilient control, and distributed reinforcement learning. He has published more than 200 papers, including more than 200 publications in top-tier journals in the

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