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Keynote Speech

Title: Applications of Output Regulation Principle in Consensus Control and Distributed Optimization

Abstract: In this network-connected world, many tasks require coordination and cooperation of subsystems/agents via network connection. Multi-agent systems are good examples of interplay between network communication and control applications. Output regulation is a classic control design method, which aims at tracking an output trajectory while rejecting undesirable disturbances, by exploring internal model design based on exosystem dynamics. The output regulation principle has been applied to network connected dynamic systems which leads to several important results in consensus control and distributed optimization. This talk will briefly review the fundamental design principle of output regulation for nonlinear dynamic systems, and then presents some results on output regulation of network connected dynamic systems, from consensus adaptive output regulation to time-varying distributed optimization. Further applications will also be presented for distributed time-varying optimization in resource allocation for power and energy systems with various constraints.

Biosketch: Zhengtao Ding received B.Eng. degree from Tsinghua University, Beijing, China, and M.Sc. degree in systems and control, and the Ph.D. degree in control systems from the University of Manchester Institute of Science and Technology, Manchester, U.K. After working in Singapore for ten years, he joined the University of Manchester in 2003, where he holds the title Professor of Control Systems. He is carrying out research on optimal operation of renewable energy systems and other methods of achieving Net Zero with CHDER. He has authored/co-authored three books, including the book Nonlinear and Adaptive Control Systems (IET, 2013) and has published over 300 research articles. His research interests include nonlinear and adaptive control theory and their applications, more recently network-based control, distributed optimization and distributed learning, with applications to power systems and robotics. Prof. Ding serves/has served as the Editor in Chief of Drones and Autonomous Vehicles, Subject Chef Editor of Nonlinear Control for Frontiers, and Associate Editor for Scientific Reports, IEEE Transactions on Automatic Control, IEEE Transactions on Circuit and Systems II, IEEE Control Systems Letters, Transactions of the Institute of Measurement and Control, Control Theory and Technology, Unmanned Systems and several other journals. He is a member of IEEE Technical Committee on Nonlinear Systems and Control, IEEE Technical Committee on Intelligent Control, and IFAC Technical Committee on Adaptive and Learning Systems. He was elected as a fellow of The Alan Turing Institute in 2021, the UK's national institute for data science and artificial intelligence.