

# Networked Control Systems and Distributed Power Dispatch of Scalable Microgrids

Le Yi Wang (Wayne State University, Detroit, Michigan)

In this presentation, we will highlight some methodology and technology challenges in networked control systems, summarize some recent advancements on state estimation, system identification, and feedback control under communication uncertainties, describe some cyber-physical coordination strategies, and elaborate their potential applications to active distribution networks.

Microgrids with distributed energy generators, controllable appliances, electric vehicle charging infrastructures, and energy storage systems introduce new technical challenges in the management of distribution networks. A new framework for power flow control based on the emerging weighted-and-constrained consensus control for networked systems. Due to unique features of power systems, the consensus control problem becomes weighted and constrained, beyond the typical consensus formulation. Using only neighborhood communication for each bus on the microgrid, the consensus control achieves global weighted load balancing. Algorithms are introduced and their convergence properties are established. It is shown that the algorithms have the fastest convergence rates in terms of consensus error variances, by achieving asymptotically the Cramér-Rao lower bound, and hence is optimal among all algorithms. Examples and case studies demonstrate convergence, robustness, and scalability of the methodology and feasibility in distribution networks.

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Le Yi Wang received the Ph.D. degree in electrical engineering from McGill University, Montreal, Canada, in 1990. Since 1990, he has been with Wayne State University, Detroit, Michigan, where he is currently a professor in the Department of Electrical and Computer Engineering. His research interests are in the areas of complexity and information, system identification, robust control, H-infinity optimization, time-varying systems, adaptive systems, hybrid and nonlinear systems, information processing and learning, as well as medical, automotive, communications, power systems, and computer applications of control methodologies. He was a keynote speaker in several international conferences. He serves on the IFAC Technical Committee on Modeling, Identification and Signal Processing. He was an Associate Editor of the IEEE Transactions on Automatic Control and several other journals, and currently is an Associate Editor of Journal of Control Theory and Applications. He was a Visiting Faculty at University of Michigan in 1996 and Visiting Faculty Fellow at University of Western Sydney in 2009 and 2013. He is a member of a Foreign Expert Team in Beijing Jiao Tong University and a member of the Core International Expert Group at Academy of Mathematics and Systems Science, Chinese Academy of Sciences. He is a Fellow of IEEE.