Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Distributed Energy Management in Smart Grids: From Theory to Practice

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Abstract—It is expected that the power grid of the future differs from the current system by the increased integration of distributed generation, distributed storage, demand response, power electronics, and communications and sensing technologies. The consequence is that the physical structure of the system becomes significantly more distributed. The existing centralized control structure is not suitable any more to operate such a highly distributed system. In this talk I will introduce a promising solution to a class of energy management problems in power systems with a high penetration of distributed resources. This class includes optimal dispatch problems such as optimal power flow, security constrained optimal dispatch, optimal power flow control. The proposed distributed framework is based on iteratively solving in a distributed fashion the first order optimality conditions associated with the optimization formulations. A multi-agent viewpoint of the power system is adopted, in which at each iteration, every network agent updates a few local variables through simple computations, and exchanges information with neighboring agents. The proposed distributed solution is based on the consensus+innovations framework, in which the consensus term enforces agreement among agents while the innovations updates ensure that local constraints are satisfied. Finally, I will present practical examples to showcase that the proposed fully distributed algorithm not only handles the computational complexity of the problem, but also provides a more practical solution for these problems in the emerging smart grid environment.

Bio—Javad Mohammadi a special faculty in Electrical and Computer Engineering at Carnegie Mellon University. Prior to this, he was with the Electrical and Computer Engineering Department at CMU as a research scientist. He received my Ph.D. in Electrical and Computer Engineering from CMU in 2016. My research interests include energy system optimization and control, distributed computations, smart grid, and electrified transportation systems.

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