

PhD DEFENSE STUDENT: Hung Khanh Nguyen

DATE: Friday, April 21, 2017

TIME: 11:30 AM

PLACE: ECE Small Conference Room

DISSERTATION CHAIR: Dr. Zhu Han

TITLE:

Big Data Optimization for Distributed Resource Management in Smart Grid

Electric power grids are experiencing the increasing adoption of distributed energy resources, which can bring huge economical and environmental benefit. However, the large-scale penetration of distributed energy resources will make both operations and long-term planning to be more and more complex due to the higher degree of output variability than traditional centralized sources. This variability creates irresistible challenges for grid operators to ensure system security and reliability. In addition, traditional optimization algorithms are no longer applicable for such integrated and complex systems in which economic efficiency, grid reliability and privacy need to be simultaneously satisfied. Therefore, an innovative optimization framework is critical to tackle the emerging challenges due to the large-scale and independent decision-making nature of distributed resource management problem in the future power system.

In this dissertation, we focus on the application of big data optimization methods for distributed resource management problem in smart grid to improve the reliability and security of the distribution system. First, we propose an incentive mechanism design to motivate microgrids to participate in the peak ramp minimization problem for the system to mitigate the ramping effect due to the high penetration of distributed renewable generations. Distributed algorithms to achieve the optimal operation point are proposed, which allow microgrids to execute their computation in either synchronous fashion or asynchronous fashion. Second, a large-scale optimization problem for microgrids optimal scheduling and load curtailment problem is formulated. We propose a decomposition algorithm and implement parallel computation for the proposed algorithm to run on a computer cluster using the Hadoop MapReduce software framework. Third, a decentralized reactive power compensation model is studied to reduce the power losses and improve the voltage profile for distribution networks. Finally, we consider big data optimization methods for resource allocation problem in wireless network virtualization to prevent traffic disruption against physical network failures.