Title: Toward a Self-Managing and Efficient Power Grid enabled by Corrective Power Flow Control and Distributed Grid Management

Duration: August 2013 - December 2017

Sponsor: National Science Foundation

Contributing Faculty: Gabriela Hug

Contributing Students: Dmitry Shchetinin, Rui Yang

Description: In this project, a new approach for managing the transmission grid is proposed enabling a future in which ubiquitous power flow control has become a reality. A distributed grid management scheme based on decomposition theory is devised which takes into account the capability for corrective, i.e. post-contingency, actions provided by power flow control devices. Advantage is taken of the decoupling between normal state and contingency cases and of the spatially limited influence of outages to derive computationally efficient algorithms. The objective is to minimize a risk-based security index in which probabilities of contingencies and the severity of their consequences are used to define the level of system security. To preserve the existing centralized market structure for generation dispatch, Locational Security Impact Factors (LSIF) are newly introduced. These factors provide the operator with a measure of influence of a generation redispatch on security. Hence, the proposed research provides the methods to transform the power grid into a flexible asset and realizes the vision of a self-managing grid. The available transmission assets are used in a non-conservative yet secure way to accommodate an economically optimal generation dispatch achieving the desired trade-off between security and cost.