Resilient Networks Minitrack

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This minitrack focuses on enhancing the resilience of future electric power infrastructure. Resilience includes but is not limited to reliability and security, it also includes aspects of graceful degradation and rapid restoration. Advanced technologies will require sophisticated methods for understanding how they can be incorporated into increasingly complex and dynamic infrastructure. This minitrack includes papers that examine issues of resiliency and secure interoperability of future grid systems, testbeds that will demonstrate the robustness of advanced technologies, and the associated computational and communication challenges associated with operating the power system.

This minitrack is comprised of two sessions.

Data Analytics and Decision Support

Power system operators now have an unprecedented wealth of data, coming from a variety of sources such as demand response participants, synchrophasors, and enhanced measurement systems, which if managed properly can provide opportunities to increase the efficiency, reliability and system performance of the power system. With the increased adoption of grid modernization, demand response programs, and distributed generation that is often renewable and intermittent system operators need to manage vast amounts of data, making big data analytics a requirement for future electrical energy systems.

This session includes technical papers presenting new approaches, methods, and applications related to big data analytics in planning, designing and operating electric energy systems. This session addresses some of the challenges and opportunities associated with big data in electrical energy systems, coming from a variety of sources such as behavior data in demand response, weather, and other measurement systems.

The session contains three papers:

- A Submodular Approach for Electricity Distribution Network Reconfiguration
- Exploring cascading outages and weather via processing historic data
- Systematic Framework for Integration of Weather Data into Prediction Models for the Electric Grid Outage and Asset Management Applications

Testbeds and Synthetic Networks

The combined cascading failure of electricity and other infrastructure networks greatly increases the discomfort, danger, and economic loss to a modern society. There are considerable challenges in modeling and coordinating the important interactions (including human, market, or economic factors) and quantifying the adverse interactions so that their risk can be estimated, mitigated and controlled. It is also important to verify and quantify these interactions in large-scale testbeds. An essential part of the testbed design is creation of synthetic networks of various infrastructures that allow the scale and complexity to be faithfully represented allowing evaluation of novel robust solutions.

The objective of this session is to describe new methods to analyze and quantify electric, natural gas, communications or water network outages and their interactions with each other so that they can be better mitigated. Novel test approaches that are enabling physical and virtual testing of the interactions, as well as large scale synthetic networks that are creating realistic test environments. The session includes new approaches to modeling and testing complex infrastructure failures in the context of complex systems, complex networks, and probabilistic analyses of cascades among interacting networks.

The session contains three papers:

- Assignment of Electrical Properties to Power Grid Topologies
- Interdependence of Transmission Branch Parameters on the Voltage Levels
- Building Synthetic Power Transmission Networks of Many Voltage Levels, Spanning Multiple Areas

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