Resilient Networks Minitrack

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This minitrack focuses on enhancing the resilience of future electric power infrastructure. 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, and the associated computational and communication challenges associated with the power system.

Many infrastructure networks, such as power, water, and natural gas systems, have similar properties governing flows. However, these systems have distinctly different sizes and topological structures. The best paper nominated from this minitrack seeks to understand how these different features can emerge from relatively simple design principles. Specifically, the paper explores understanding the conditions under which it is optimal to build small decentralized infrastructures, such as a microgrid, rather than centralized ones, such as a large high-voltage power system.

Another paper presents a robust reconfiguration approaches to reduce power loss, restore out-of-service zones, and decrease network overloading. The paper addresses optimization based on mixed integer programming using a depth-first search algorithm to enumerate possible loops that provide radiality constraints. This provides a general solution for system reconfiguration problems. Ambiguity due to lack of sufficient measurements are addressed by two methods introduced in this paper: a stochastic mixed integer programming formulation, and a fuzzy mixed integer programming formulation.

The next paper addresses the role of advanced measurements to provide automated anomaly detection in distribution systems. The impact of phasor measurements for providing situational awareness to transmission system operators has been widely documented. Using this emerging sensing technology that can provide similar benefits to distribution system operators is addressed in this paper. To support the deployment of these high-resolution sensors, the automation of data analysis and prioritizing communication to the system operator becomes crucial. This paper explores the use of micro phasor measurement units to detect anomalies on the distribution system.

Another paper presents an online data-driven algorithm to detect a class of cyber attacks towards synchrophasor measurements. The proposed algorithm applies density-based local outlier factor analysis to detect the anomalies among the data, which can be described as spatio-temporal outliers among all the synchrophasor measurements. By leveraging the spatio-temporal correlations among multiple time instants of synchrophasor measurements, this approach could detect false data injection attacks which are otherwise not detectable using measurements obtained from a single snapshot.

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