Proceedings of the 54th Hawaii International Conference on System Sciences | 2021

Resilient Networks Minitrack Introduction

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This minitrack focuses on enhancing the reliability, security, and 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. Papers here examine issues of reliability, security, and resilience of interconnected power systems, including testbeds that will demonstrate the robustness of advanced technologies, and the associated computational and communication challenges associated with operating the power system.

The minitrack papers are divided into two groups, with the first group focusing on electric grid enforcement, testbeds and synthetic networks. The motivation is the combined cascading failure of electricity and other infrastructure networks greatly increases the discomfort, safety, and economic loss to society. There are considerable challenges in modeling and coordinating the important interactions (possibly 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. Methods for reinforcing networks through hardening the physical components or offering distributed energy resources (DER) as network support are of interest as well. The objective of the papers here is to describe new methods to analyze and quantify electric, 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 environment are needed.

The second paper group is focused on data analytics, machine learning and artificial intelligence. The motivation here is electric power systems are safety-critical infrastructure systems, and operators now have an unprecedented wealth of data from a variety of sources such as demand response participants, synchrophasors, and enhanced SCADA systems. If managed properly, this data can provide opportunities to increase the efficiency, reliability, and overall performance of the power system. With the increased adoption of grid modernization, demand response programs, and distributed generation that is often renewable, intermittent, and stochastic, system operators need to manage vast amounts of data in the presence of data inaccuracy and system uncertainties. This introduces new opportunities for various artificial intelligence (AI) and machine learning (ML) technologies including probabilistic AI/ML. Papers here are presenting new approaches, methods, and applications related to data analytics including AI/ML that advances the state of the art for safety-critical applications in planning, designing, operating and protecting electric power systems.

URI: https://hdl.handle.net/10125/71019
978-0-9981331-4-0