

CPS: Medium: Collaborative Research: The Cyber-Physical Challenges of Transient Stability and Security in Power Grids

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Project Details

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Institution(s): University of California at Santa Barbara
Sponsor(s): National Science Foundation
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Abstract: The national transmission networks that deliver high voltage electric power underpin our society and are central to the ongoing transformation of the American energy infrastructure. Transmission networks are very large and complicated engineering systems, and "keeping the lights on" as the transformation of the American energy infrastructure proceeds is a fundamental engineering challenge involving both the physical aspects of the equipment and the cyber aspects of the controls, communications, and computers that run the system. The project develops new principles of cyber-physical engineering by focusing on instabilities of electric power networks that can cause blackouts. It proposes novel approaches to analyze these instabilities and to design cyber-physical control methods to monitor, detect, and mitigate them. The controls must perform robustly in the presence of variability and uncertainty in electric generation, loads, communications, and equipment status, and during abnormal states caused by natural faults or malicious attacks. The research produces cyber-physical engineering methodologies that specifically help to mitigate power system blackouts and more generally show the way forward in designing robust cyber-physical systems in environments characterized by rich dynamics and uncertainty. Education and outreach efforts involve students at high school, undergraduate, and graduate levels, as well as dissemination of results to the public and the engineering and applied science communities in industry, government and universities.

