ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

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Recent Research in Power System Optimization: Approximation Error Quantification, Feasible Space Computation, and Convex Relaxations

Abstract: Electric power systems are critical infrastructure that underlie almost all aspects of modern society. With rapidly increasing quantities of renewable generation and the continuing expansion of electricity markets, electric power systems are undergoing significant changes. New algorithms for optimizing the design and operation of electric power systems are needed in order to enable these transformational changes.

This presentation focuses on recent developments relevant to the optimization and control of electric power systems. In particular, this presentation discusses the "power flow equations" which model the physical relationships that exist on electric transmission and distribution systems. Approximations such as the "DC power flow" are at the heart of many widely used power system algorithms. The errors associated with these approximations result in inefficient utilization of the electric grid. This presentation first describes a newly developed algorithm that characterizes the largest possible error in the power flows predicted by various approximations and presents a method for adaptively computing better approximations. Next, using another new algorithm, this presentation illustrates the challenges associated with solving power system optimization problems that use the non-approximated "AC power flow" equations. Finally, this presentation describes recent research using convex "moment" relaxations to find the global optima of many power system optimization problems.

Bio Sketch: Daniel Molzahn is a computational engineer at Argonne National Laboratory. Prior to his current position, Daniel was a Dow Sustainability Fellow at the University of Michigan. Daniel received the B.S., M.S. and Ph.D. degrees in Electrical Engineering and the Masters of Public Affairs degree from the University of Wisconsin–Madison, where he was a National Science Foundation Graduate Research Fellow. His research interests are in applications of optimization techniques and control theory to electric power systems.