PSERC Power Systems Engineering Research Center

PSERC WEBINAR

A Review of Recent Developments in Nonlinear Optimization of Electric Power Systems

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Many optimization problems relevant to the design and operation of electric power systems are inherently nonlinear due to the AC power flow equations that model the relationships among voltages and power flows in power grids. The nonlinearity of the power flow equations results in a variety of algorithmic and theoretical challenges, including non-convex feasible spaces for optimization problems containing these equations. This seminar describes four categories of recent developments regarding methods for addressing these challenges: 1) local optimization, 2) approximation, 3) convex relaxation, and 4) convex restriction. Local optimization methods search for an operating point that is superior to all nearby points. The applicability of local optimization methods has been demonstrated via results from the Department of Energy's Grid Optimization Competition, which compared algorithms for solving large-scale security-constrained AC optimal power flow problems. Approximations, convex relaxations, and convex restrictions simplify the power flow equations to obtain more tractable convex representations that are useful in a variety of applications. This seminar presents high-level overviews of these methods and describes several relevant applications.

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Daniel Molzahn is an Assistant Professor in the School of Electrical and Computer Engineering and a Fellow of the Strategic Energy Institute at the Georgia Institute of Technology. He also holds an appointment as a computational engineer in the Energy Systems Division at Argonne National Laboratory, where he was previously a member of the research staff. He was a Dow Postdoctoral Fellow in Sustainability at the University of Michigan and received the B.S., M.S., and Ph.D. degrees in electrical engineering and a Masters of Public Affairs degree from the University of Wisconsin–Madison, where he was a National Science Foundation Graduate Research Fellow. His research focuses on optimization and control of electric power systems.