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Convex Relaxations of the Power Flow Equations: Overview and Selected Applications

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Location: DLC 1B70

Abstract:

The power flow equations model the relationship between the voltage phasors and power injections in an electric power system. The nonlinearity of the power flow equations results in a variety of algorithmic and theoretical challenges, including non-convex feasible spaces for optimization problems constrained by these equations. Many convex relaxation techniques have recently been applied to simplify the power flow representations used in a variety of power system optimization and control problems. This presentation first overviews various convex relaxation techniques that have been applied to the power flow equations, with a focus on semidefinite programming and second-order cone programming formulations as well as techniques for tightening the relaxations. This presentation then describes recently proposed approaches that use convex relaxation techniques to assure robust feasibility of specified engineering constraints over a range of fluctuations in the power injections. These approaches are useful for addressing uncertainties resulting from, e.g., fluctuating renewable generation.

Bio:

Daniel Molzahn is a computational engineer at Argonne National Laboratory in the Center for Energy, Environmental, and Economic Systems Analysis (CEEESA). 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 the development of optimization and control techniques for electric power systems.

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