ACMS Applied Math Seminar

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127 Hayes-Healy

3:30 PM

Moment-Based Relaxations of Optimal Power Flow Problems

Recent advances in optimization techniques provide opportunities to better analyze and operate electric power systems. With the ability globally solve many power system problems (most notably the optimal power flow (OPF) problem used to determine an optimal operating point), significant research interest has focused on convex relaxation techniques. Existing relaxations globally solve many OPF problems. However, there are practical problems for which existing relaxations fail to yield physically meaningful solutions.

This presentation describes a hierarchy of “moment-based” convex relaxations that globally solve many problems for which existing relaxations fail. The moment-based relaxations, which take the form of semidefinite programs, are developed from the Lasserre hierarchy for generalized moment problems. Increasing the order in this hierarchy results in “tighter” relaxations at the computational cost of larger semidefinite programs. The semidefinite relaxation studied in existing literature is closely related to the first-order relaxation in the Lasserre hierarchy. The second-order relaxation in the Lasserre hierarchy globally solves many small OPF problems for which the first-order relaxation fails. Comparing the feasible spaces of the first- and second-order relaxations of small problems illustrates the capabilities of the higher-order relaxations. Exploiting power system sparsity and targeting the application of the computationally intensive moment relaxations enables global solution of larger OPF problems.

Daniel Molzahn is a Dow Sustainability Fellow at the University of Michigan. He 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 application of optimization techniques and policy analysis to electric power systems.

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