PSERC Power Systems Engineering Research Center

PSERC WEBINAR

Nonconvexity in Power System Optimization: Are Local Minima Really So Bad?

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Optimization problems that arise in power systems entail making safety-critical decisions over a short span of time. These are challenging mathematical problems because they are large-scale in the number of decision variables, and highly nonconvex. An algorithm that is capable of large-scale optimization is necessarily "greedy"; in principle, it can become stuck at a local minimum which may not even be physically realizable. Nevertheless, greedy algorithms routinely find great solutions in practice, even though neither solution quality nor solution speed can be guaranteed.

In this talk, we argue that the quadratic relationship between power and voltage gives power systems a convex-like behavior despite being nonconvex. In the first part, assuming the existence of bad local minima in optimal power flow, we discuss various strategies for solving convex relaxations using fast algorithms with efficiency guarantees. In the second part, we review recent progress on guaranteeing the inexistence of bad local minima for state estimation and related problems. We discuss possible implications for solving optimal power flow via local optimization.

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LINK TO WEBINAR

(11:00-12:00 P.M. PST)

Richard Y. Zhang is an Assistant Professor in the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. He received the B.E. (hons) degree with first class honors in Electrical Engineering from the University of Canterbury, Christchurch, New Zealand, in 2009 and the S.M. and Ph.D. degrees in Electrical Engineering and Computer Science from MIT in 2012 and 2017 respectively. From 2017 to 2019, he was a Postdoctoral Scholar at the University of California, Berkeley. His research interests are in mathematical optimization and machine learning for power and energy applications. He is a 2021 recipient of the NSF CAREER Award.