IEEE BDA Tutorial Series: Big Data & Analytics for Power Systems

Learning Congestion Patterns in Optimal Power Flow Problems

Prof. Line A. Roald
University of Wisconsin-Madison

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Abstract: In power system operations, optimization problems such as the optimal power flow (OPF) are solved over and over and over again. In this tutorial, we discuss how to use statistical learning and bound tightening techniques to make this repeated solution process more efficient. A key observation is that traditionally, the solutions to the OPF problem have been characterized by a small number of binding constraints (and so-called active sets), giving rise to a limited number of operational patterns. The first part of the tutorial discusses how the small number of operational patterns makes it possible to learn the optimal power flow solution from previous solutions, both for statistical learning algorithms and for human operators. In the second part of the tutorial, we discuss how the introduction of renewable energy may change this picture of stable, recognizable operating conditions.

Bio: Line A. Roald is an Assistant Professor and Grainger Institute Fellow in the Department of Electrical and Computer Engineering at the University of Wisconsin-Madison. Prior to joining UW Madison, she received her Ph.D. in Electrical Engineering and her M.Sc. and B.Sc. in Mechanical Engineering at ETH Zurich in Switzerland and worked as a postdoctoral researcher at Los Alamos National Laboratory. Her research interests are in energy systems and optimization, with a focus on integration of renewable energy and the transition to a more sustainable and resilient electric grid.

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