Power Systems Computation Conference 2026

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Title: Inverse Optimization for Inferring Generation Cost Functions

Author 1:
First Name: William
Last Name: Nzitat Yomi
Organization: University of Mons - Polytechnic Faculty
Country: Belgium
Email: william.nzitatyomi@student.umons.ac.be

Author 2:
First Name: Victor
Last Name: Darleguy
Organization: Polytechnique Montréal, GERAD & Mila
Country: Canada
Email: victor.darleguy@polymtl.ca

Author 3:
First Name: Hooman
Last Name: Khaloie
Organization: University of Mons - Polytechnic Faculty
Country: Belgium
Email: hooman.khaloie@umons.ac.be

Author 4:
First Name: Antoine
Last Name: Lesage-Landry
Organization: Polytechnique Montréal, GERAD & Mila
Country: Canada
Email: antoine.lesage-landry@polymtl.ca

Contact Author: Author 1

Alternate Contact:

Topic(s):
- Power system economics, energy markets and regulation
- Data-driven modelling techniques for power systems

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Abstract: In wholesale electricity markets, generation cost functions are private and typically unknown to regulators, system operators, or market analysts. However, this information is critical for several purposes, such as designing more efficient market-clearing mechanisms, evaluating the rationality of market outcomes, or improving the bidding strategies of market participants. The lack of transparency in generator cost structures limits the ability to assess market efficiency, enforce competition policies, or provide fair incentives. This paper presents a data-driven inverse optimization framework for estimating generation cost functions using publicly available market data, including locational marginal prices (LMPs) and generator dispatches. The problem is structured as a bi-level optimization model then re-expressed as a single-level problem using the Karush-Kuhn-Tucker (KKT) conditions of the DC optimal power flow (DC-OPF), thereby ensuring that the inferred cost parameters are consistent with the optimality conditions of the economic dispatch. The proposed framework is validated using synthetic data generated from known cost functions applied to IEEE standard test systems (9-bus, 14-bus, and 118-bus), in addition to a larger test instance, namely, the 1354-bus.

Comments:
