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An optimization-based conjectured supply function equilibrium model for network constrained electricity markets

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Abstract-

This paper proposes a model to compute nodal prices in oligopolistic markets. The model generalizes a previous model aimed at solving the single-bus problem by applying an optimization procedure. Both models can be classified as conjectured supply function models. The conjectured supply functions are assumed to be linear with constant slopes. The conjectured price responses (price sensitivity as seen for each generating unit), however, are assumed to be dependent on the system line's status (congested or not congested). The consideration of such a dependence is one of the main contributions of this paper. Market equilibrium is defined in this framework. A procedure based on solving an optimization problem is proposed. It only requires convexity of cost functions. Existence of equilibrium, however, is not guaranteed in this multi-nodal situation and an iterative search is required to find it if it exists. A two-area multi-period case study is analysed. The model reaches equilibrium for some cases, mainly depending on the number of periods considered and on the value of conjectured supply function slopes. Some oscillation patterns are observed that can be interpreted as quasi-equilibria. This methodology can be applied to the study of the future Iberian electricity market.

Index Terms- OR in energy, electricity markets, network constraints

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