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Endogenous computation of conjectured supply functions with network constraints

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Abstract-

This paper presents a new iterative algorithm to compute a conjectured supply function electricity market equilibrium with DC transmission network constraints. This approach extends, to a network constrained system, a model previously developed by the authors for the single-bus case. At each iteration nodal prices are used to split the market into single prices areas. Since each area can be treated as a single-bus market from the transmission constraints’ point of view, the single-bus algorithm is applied to compute the generators supply functions for each area. These new generators strategies are then cleared to determine new nodal prices and areas for the next iteration, and convergence is achieved when the network lines status and strategies of the generators do not change significantly in two consecutive iterations. The current approach has also been extended to deal with nodal elastic demands. Unlike previous approaches, the main contribution of this work is that the parameters of the first order approximation of the conjectured supply functions (intercepts and slopes) are endogenously determined, coherently with the network lines status. The algorithm has been applied to some illustrative case examples, and to a simplified version of the MIBEL market (Spain - Portugal). Results have shown to be very close to real data, and very relevant to analyze the economic impact of the capacity network constraints.

Index Terms- Conjectured supply function equilibrium, equilibrium with network constraints, market splitting, Nash equilibrium.

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