Congestion Surplus Minimization Pricing Solutions When Lagrange Multipliers are not Unique

Donghan Feng[1], Quan Zhou, Liang Zhang
[1]Electrical Engineering, Shanghai Jiao Tong University

This paper proposes a comprehensive solution methodology for the pricing difficulty when Lagrange multipliers are not unique. A linear optimization model is proposed to solve the congestion-related pricing difficulty. The objective function of the model is set to be minimizing the congestion surplus. In addition, an incentive-based allocation approach is incorporated in the solution procedure for cases when no marginal participant exists. The unique pricing solution obtained through our methodology can achieve proper reallocation of the undetermined surplus. Further, we discuss the reference bus independence property of the proposed pricing methodology. Numerical results are provided to fully test the proposed methodology. Other possible solutions are also presented for comparison.

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