Robust Cournot strategies in electricity markets using possibilistic optimization

F.A. Campos, J. Villar, J. Barquín

Abstract— Cournot equilibrium is one of the theoretical approaches more used to model market behavior in electricity industry. However, it is highly influenced by the residual demand curves of the market agents, which are usually difficult to estimate precisely, being necessary to consider uncertainty for a correct modeling. Traditionally, Probability Theory has been the standard mathematical tool for uncertainty modeling. However, several of its well known drawbacks, reminded in this paper, suggest the convenience of using other mathematical tools, such as Possibility Theory, that can model, not only uncertainty, but also imprecision and vagueness. In this paper, a possibilistic Cournot Equilibrium is formulated by means of a possibilistic optimization problem, when the residual demand uncertainty is modeled with possibility distributions.
Additionally two dual and complementary approaches are applied to compute a robust crisp solution using crisp optimization and some interesting results for a real-size electricity system show the robustness of the proposed methodologies when different risk attitudes for the agents are considered.

Index Terms— Electricity market, Cournot game theory, Possibility Theory, Fuzzy programming

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