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The arithmetic of stepwise offer curves

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Abstract-

In liberalized electricity markets, aggregated stepwise supply and demand curves are at the core of many relevant processes. Efficient and meaningful representations of the offer curves is an essential procedure for agents participating in those markets. However, there is not a formal framework that allows operating with those offer curves using basic arithmetic operations. In this paper we first formalize the concept of stepwise offer curve by explicitly defining the standard True Offer Curve (TOC). To overcome the inherit difficulties of this non-continuous TOC, we propose the Encoded Offer Curve (EOC), a continuous piecewise version that approximates the steps of the TOC with high accuracy. We present fast and simple specialized algorithms to obtain both TOC and EOC models, as well as a formal framework to deal with elementary mathematical operations involving TOCs and EOCs. The proposed framework has been tested in the Italian electricity market, computing the residual demand curves of the producers in a particular Market Zone; and in the Iberian electricity market, quantifying the differences in the bidding behavior of market agents in different stages of the COVID-19 pandemic.

Index Terms- Electricity markets; Piecewise linear function; Supply function; Demand function; Residual demand curve

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