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Local Grey Predictor Based on Cubic Polynomial Realization for Market Clearing Price Prediction

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Abstract: With the development of restructured power markets, the profit-making competitive business environment has emerged. With the help of different advanced technologies, generating companies are taking decisions regarding trading electricity with imperfect information about marketing operating conditions. The forecasting of the market clearing price (MCP) is a potential issue in these markets. Early information on the MCP can be a proven beneficial tool for accumulating profit. In this work, a local grey prediction model based on a cubic polynomial function is presented to estimate the MCP with the help of historical data. The mathematical framework of this grey model was established and evaluated for different market conditions and databases. The comparison between traditional grey models and some advanced grey models reveals that the proposed model yields accurate results.

Keywords: market clearing price (MCP); forecasting methods; grey prediction theory; mean absolute percentage error (MAPE)

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1. Introduction

A competitive business environment enables consumer-centric policies in energy markets, while framing these policies at the generating company end, profit-making propositions and decision-making algorithms play a vital role. In a partially known system, the fundamentals of grey mathematics are easily applicable. Equilibrium price information is a crucial parameter to determine as it depends upon several conditions, such as no. of market players, operating conditions, no. of bidding blocks and behavior of rivals. A mechanism that provides early anticipation of the market clearing price can be a potential tool for accumulating profit in energy markets. This also helps in submitting effective bids with low risks in losing revenue.

Scant information on rival behavior is a big problem in achieving a high profit accumulation and is a major hurdle when anticipating the response of the market. Hence, the energy market behaves like a grey system. A system with a partial known and partial unknown system can be treated as a grey system [1]. In an electricity market, suppliers of energy, which are also known as generating companies, offer their energy-selling propositions in terms of the energy packet and the cost of that packet. After accumulating all of the seller propositions, the system demand is calculated and the purchaser offers are also accumulated. The intersection of the demand and supply becomes the market clearing equilibrium. The clearing price related to this equilibrium point becomes the market clearing price (MCP).