ESPO Platform

Uncertainty Modeling Toolbox

Forecasting Source Code For Renewables Using a Fuzzy ARIMA Model

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Introduction

Renewable energy has been growing as a solution to the climate change and decarbonization of energy sector. However, the renewable energy is variable due to its dependency with meteorological parameters that imposes technical and financial risks on planning and operation of energy sector. Powerful forecasting tools are recommended as a good solution to accommodate the stochastic renewable production in energy sector. A more accurate forecast is beneficial for energy system operators, as well as private owners of renewables. This way, the energy systems can be operated more efficient and the private owners achieve a higher benefit.

Aims

ESPO is intended to provide a powerful forecasting toolbox for the uncertainty modelling of stochastic renewable energy produced by wind or photovoltaic power plants with the features below:

- To receive historical renewable energy (wind or PV energy) and meteorological data (wind speed or irradiation), as well as the meteorological prediction in the forecasting time horizon.
- To apply Fuzzy ARIMA model [1].
- To provide forecasts under different uncertainty models: i) single-point forecasts, ii) scenarios, and iii) confidence bounds.

Applications

The toolbox is designed as a source code in the MATLAB environment, and can be used to forecast the stochastic renewable production spanning from short-term to long-term period. The user can adjust the parameters of Fuzzy model (e.g., standard deviation of Fuzzy membership functions) and change the structure of ARIMA model. The single-point forecasts can be incorporated into a deterministic model to make informed decisions. Additionally, the scenarios and confidence bounds can be used in stochastic programming and robust optimization models, respectively. The toolbox also allows the user to adjust the number of scenarios and the confidence level of forecasts bounds.

References

[1] M. Rahimiyan and L. Baringo, “Strategic bidding for a virtual power plant in the day-ahead and real-time markets: A price-taker robust optimization approach,” IEEE Trans. Power Syst., vol. 31 no. 4, 2676–2687, 2016.

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