Classifying and Quantifying Uncertainty in Wind Energy Production

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INTRO

The accuracy of predicting power production for offshore wind generation under different conditions is crucial as offshore wind energy is becoming a significant renewable energy source for the next decades. However, our knowledge of uncertainty in using numerical models to predict power generation is limited. As the first step to understand the uncertainty, this study focuses on classifying and quantifying three types of uncertainties including sensing, modeling, and response uncertainty.

METHODS

In the 15-MW offshore reference turbine, modeled data in Openfast is used as a basis for how the model behaves. Utilizing MATLAB, trial cases can be created to test these uncertainties and give evidence to their existence in the model. These cases display several uncertainties contained in these models.

RESULTS
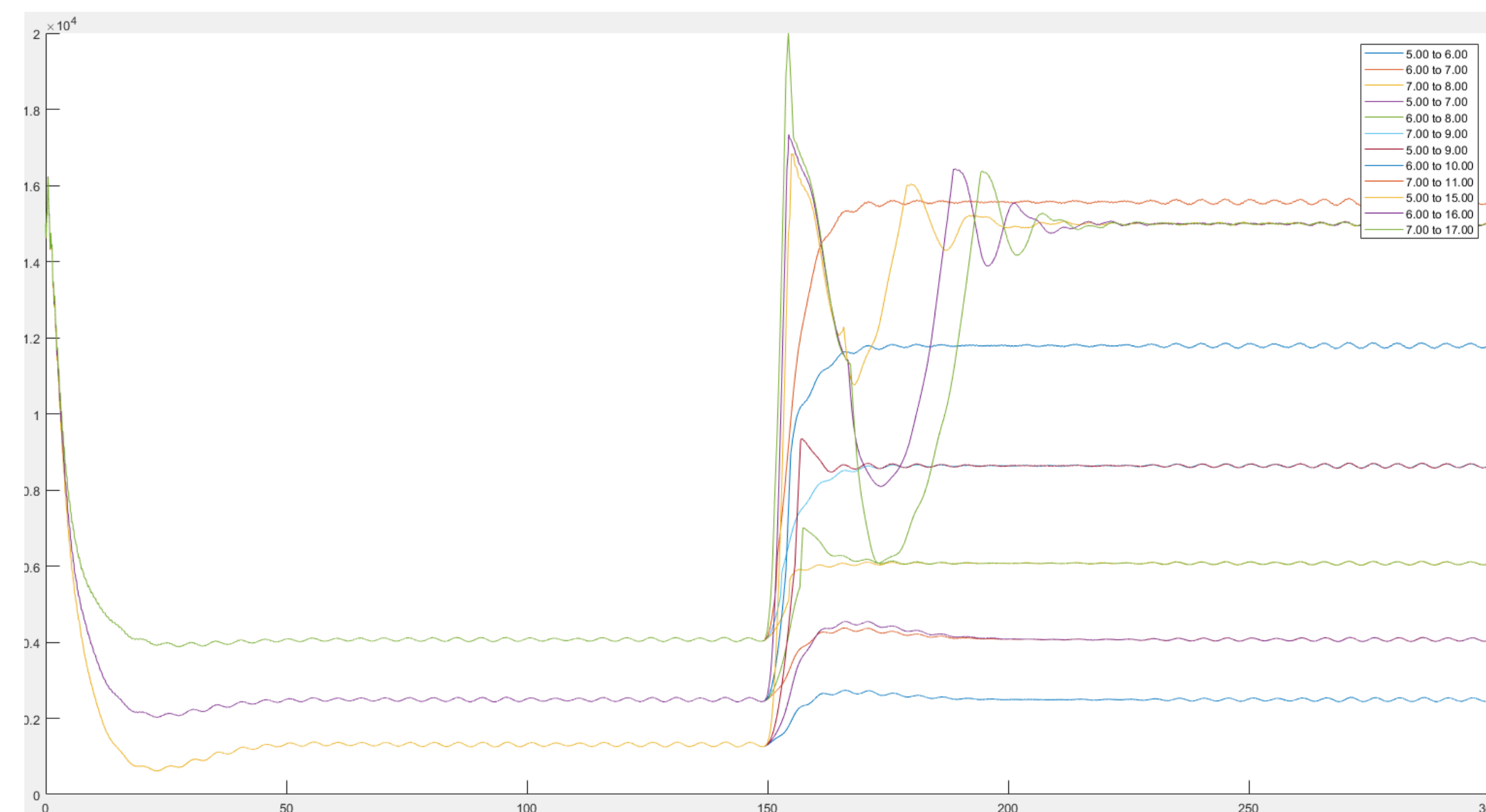
DISCUSSION

In all models, there it is almost impossible for no uncertainty to be contained in a model. In this model of the performance a 15-MW offshore turbine, there are measurable amounts of uncertainty in the model. In the future more tests in comparison to raw data would allow for more in-depth analysis.

Results:

1. For the first time, the wind power prediction uncertainty is classified.

2. Three different uncertainties of modeling uncertainties in the model are quantified.

3. Monte Carlo Simulations shows the distribution of the uncertainty distribution.

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