

Wind Energ. Sci. Discuss., author comment AC2
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Reply on RC2

Rad Haghi and Curran Crawford

Author comment on "Surrogate models for the blade element momentum aerodynamic model using non-intrusive polynomial chaos expansions" by Rad Haghi and Curran Crawford, Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2021-110-AC2>, 2022

Thanks a lot for your constructive comments. Here is the response to your comment. In the new revision of the manuscript, we accommodated the majority of your comments.

Comment 1

The key findings of this work should be highlighted at the end of the abstract.

Reply

Thanks for the comment. This has been added to the work in the new revision.

Comment 2

1. Introduction

It would be appropriate to add one or two paragraphs to review relevant studies on this topic. For example, review relevant studies on developing surrogate models for the calculation of aerodynamic loads on wind turbine rotors. The research gap addressed by this paper should be highlighted. The novelty/contributions of the paper should be highlighted.

Reply

Thanks for the comment. The other researchers focused mainly on aero loads, but stochastic variables gross parameters like mean wind or TI. That is different from our purpose. More references of efforts in that other direction, suitable for wind farm dev have been added to the manuscript.

Comment 3

2. Methodology

It would be appropriate to add a flowchart to illustrate the methodology used in this paper.

The accuracy of aerodynamic load calculation is highly dependent on the aerodynamic model. The aerodynamic model used in this study should be elaborated.

It would be appropriate to highlight what the novelty of the methodology proposed by this paper is.

Reply

Thanks for your comment. A flowchart is provided in Fig 1. The strength of a surrogate model is the ability to treat the model as a black box. Therefore, the aerodynamic model accuracy is not in the scope of this paper.

Comment 4

3. Results

The aerodynamic model plays a crucial role in the calculation of the aerodynamic loads. Therefore, it would be appropriate to perform case studies to validate the simplified aerodynamic model used in this study. For example, perform a case study to compare the aerodynamic torque and thrust obtained from the simplified aerodynamic model against the results obtained from NREL FAST code.

For the surrogate model, it would be appropriate to list all the independent variables (i.e. input variables) and dependent variables (i.e. output variables).

More case studies should be performed to validate the surrogate model. For example, the results obtained from the surrogate model should be compared against the results obtained from the direct simulation using aerodynamic model. The R squared value should be presented.

Reply

Thanks for your comment and concern. We address this thoroughly in the revised manuscript. The simplified BEM model is verified against full NREL 5MW model in Bladed by Lupton in his PhD thesis.

This study aims to look at the statistics of the loads. The statistics of the surrogate model outputs are compared with the output of the aerodynamic model outputs in figure 5 by using the Hellinger distance. In this case, the reference is the 48K aerodynamic simulations and the plot shows how the output of 1 million MCS of the surrogate models differs from the actual simulations. Also, an L2 error for point-to-point comparison between the aerodynamic model and surrogate model is added to the revised manuscript.