

Interactive comment on “Optimizing Wind Farm Control through Wake Steering using Surrogate Models based on High Fidelity Simulations” by Paul Hulsman et al.

Anonymous Referee #1

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The paper looks at the use of approximating physical model results using a surrogate model and then conducting an optimisation. The authors use Ellipsys3D LES AL model coupled to Flex5 and the results are used to build training data for the surrogate model (PCE). The yaw angles are then optimised for power and DEL. The paper is both interesting and novel, the authors provide useful insights into how this approach can be used for turbine yaw control. The paper is very long and although the paper maintains its focus, due to the range of topics, some aspects are covered in only minimal detail. I recommend that the paper should be published with only minor revisions.

The use of PCE is really the key focus of the paper but the model isn't discussed

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in much detail. Although references are given, presenting some mathematics for the model in this paper would aid the reader's understanding of what is being done. Make it clear in one place what the parameters of the PCE model are and what inputs are being used.

How does the accuracy of the Ellipsys3D model compare to real measurement data? It seems validation is only conducted for the surrogate against Flex5 and, unless I missed it, no consideration seems to be given for the error of the Ellipsys3D model against reality. Although this is not the focus of the paper, it would give useful context for the results. Consequentially, the use of the phrase 'true power gain', although expanded on in page 22 line 6, should be reconsidered.

The addition of results from FLORIS doesn't add much as it's not part of the Ellipsys3D-Flex5-PCE approach. I can see that it's present as a comparison, but I believe that sections discussing this could be reduced or eliminated without detracting from the paper.

The CFD grid is not described in enough detail and more needs to be presented. What does the grid look like? Why are these grid values used? Was a grid convergence study conducted?

Line 21 page 15 – Relative error is introduced in the following chapter, can an estimate be produced for how large the errors are from overfitting in the case shown in figure 7?

It's mentioned page 22 line 21 that induction is not accounted for. Actually from my understanding of what was done, it would be for the lead turbine as an actuator line is modelled in the fluid domain of Ellipsys3D, but not for the following turbine.

The context for these findings should be presented. How do these results compare to other researchers' findings on yaw control?

Minor and typographical errors:

Equation 2 – Check subscripts in eddy-viscosity terms.

Line 5 page 15, rephrase slightly to be less general.

The sentence at page 20 line 16-19 has some grammatical errors and is hard to follow.

Page 21 line 18 'Note' is capitalised mid-sentence.

Page 25 line 16 'presumably an acceptable difference' is vague and should be reconsidered.

Please check for other spelling and grammatical errors.

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