

Interactive comment on “Surrogate based aeroelastic design optimization of tip extensions on a modern 10MW wind turbine” by Thanasis Barlas et al.

Rad Haghi (Referee)

rhaghi@uvic.ca

Received and published: 17 January 2021

The authors try to use a surrogate model to optimize a DTU 10MW turbine's tip extension. The topic of tip extension is a fascinating topic to address. The followings are my comments and concerns for this piece of work.

Reading the title, I think it is a bit misleading. I expected the paper to have a more elaborate explanation about the used optimization method and the surrogate model part. The authors look at the surrogate model and optimization and black boxes from what I understood. There is not that much about the assumptions and methods used for the optimization part.

C1

It seems the optimization is done only for one wind speed (8m/s) for DLC 1.3. You expect the simulation to reach the maximum load in the simulation's length. What is your simulation length? How are you sure that a specific turbulence seed provides you with the max load?

In the top extension parametrization section, you mention, “Their range is a result of many prior parametric studies, and it is limited to ensure the validity of the aerodynamic modeling.” (L62) I think this needs a reference. In the same section, “The distribution of the planform variables is calculated with a cubic Hermite interpolating polynomial.” Why? I think it worth an explanation.

The part about the surrogate model is way too short. It is unclear about your assumptions and reasoning for the surrogate model part. Why did you use Latin Hypercube and not another sampling method? What type of surrogate model are you using (PCE, Kriging, etc.)? It seems you used polynomials; if that is the case, what is the reasoning behind that? Why do you use only 34 samples? That seems not enough to fit a surrogate model on your results. You refer to the previous studies (L116); what are they?

L 121: “Also a set of points that is uniformly selected from the whole variable domain is generated (using again a Latin Hypercube design) and the score is calculated over both sets of points.” This sentence is unclear. Please re-evaluate.

L 124: Your statement about 20 iterations and a total number of 174 HAWC evolutions is puzzling. I think it needs some clarification.

L 149: “We see that MIRAS over-predicts the 150 AEP for the baseline with around 1% deviation, and under-predicts the increased AEP due to the tip by around 1-2%.” This sentence is unclear. Please re-write the sentence.

In Figure 12, there is no increase in the rated power. What is the reason for that? I guess the reason is your optimization works only for one pitch degree, so your results

C2

only valuable for underrated wind speed.

The results part is extensive and well explained. The aeroelastic simulation is the authors' expertise. The results section proves the concept. However, the simulation setup's information is limited and replicating the experiment is not possible. What was the wind speed for your simulation? How many simulations did you run? I very much like to see a comparison between the blade root moment time series of the baseline and the optimized model.

L227: Claiming LCOE reduction potential based on an increase in AEP, and load neutrality on one wind speed without considering the tip extension's effect on the turbine lifetime, seems a bit too far fetch. If there are some studies on this, I am very interested in seeing them.

General comment: It seems some of the abbreviations are not missing. Please check them out.

Interactive comment on Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2020-108>, 2020.