Wind Energ. Sci. Discuss.,
https://doi.org/10.5194/wes-2020-93-RC1, 2020

WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "A fully integrated optimization framework for designing a complex geometry offshore wind turbine spar-type floating support structure" *by* Mareike Leimeister et al.

Anonymous Referee #1

Received and published: 15 July 2020

[11pt]article [a4paper,total=6in,9in]geometry

Reviewer's comments

July 15, 2020

General comment: This paper carried out a single-objective gradient-free optimization of three-section spar-buoy floater for floating wind turbine, where the mooring stiffness is kept constant. The study is well performed and the paper is well written. However, the results are not presented in the most effective way. Further, the way to handle the mooring system needs to be improved, or verified after the optimization.

To improve the quality of the paper, a number of questions, suggestions and comments are provided below.

1. page 1, line 45. The author does not provide an adequate literature review of the current state of the art in optimization of floating wind turbine support structures, except listing eight papers. The authors should, the studies related to single objective optimization, gradient-free optimization, and spar-buoy floater, which are most relevant to the study in this paper. Besides, there are also studies of multi-objective GA optimization of floating wind turbine support structures, which are also relevant to this study. Additionally, how the mooring system is treated in the relevant studies? After an adequate literature review, the authors need to justify the value and contribution of this work.

2. page 7, line 190. A general comment is related to the assumption that the mooring system is kept constant in this study. the mooring system is composed of

a few mooring lines. Did the authors use constant values for the horizontal and vertical stiffness of each mooring line? Or, did the authors use a constant mooring stiffness matrix for the entire mooring system? The former approach is more reasonable, because the floater pitch stiffness depends on the product of the horizontal stiffness of mooring line and the radius of the fairlead. Can the authors predict what is the impact of their assumption on the optimized designs? The optimizer may take advantage of the assumption. Can the authors improve the way to treat the mooring system? This minor improvement can provide a more realistic way to include the mooring system. Alternatively, the authors may consider provide a representative design of the mooring system that satisfies the mooring stiffness for the chosen optimized design. Such practice and guide would make the methodology in the study more convincing.

3. page 17, section 4.3.2. The authors classify the optimizers into single-objective optimizers and multi-objective optimizers. It is a little confusing. While single-objective and multi-objective optimization are widely used, this often points to the formulation of the optimization problem, rather than the optimizer. The performance of the optimizer highly depends on the algorithm itself. On the other hand, for example, GA can be used to solve both single-objective and multi-objective optimization problem as stated by the authors. In a strict way, GA can be called sing-objective and multi-objective optimizer. The authors may re-write this paragraph to avoid the confusion and directly highlight that they are using GA algorithm.

4. page 30, line 658. This study lacks a verification of the optimized design. Can the authors verify the hydrodynamic properties of the floater by using high-fidelity tools such as WAMIT?

5. page 32, line 725. This study assumes a rigid floater with a constant thickness. However, the chosen final design has a neck-like weak feature. The authors

noted in the conclusion that this can be manufactured by using truss structures. Can the authors further illustrate this? Further, how would this bias the cost and performance of the chosen design?

6. A general comment is related to the computation time for the optimization problem. How long does it takes? Can the authors provide such information?

7. Another general comment is related to the interpretation of the optimized design. The authors have noted its similarity with TetraSpar. Can the authors compare the system properties of the baseline design and the optimized design? For example, the buoyancy and mass centers of the entire wind turbine, the eigen-frequencies of the coupled floater-tower vibration mode?

A few minor comments are also listed as follows:

1. page 10, section 3. It is better to modify the formulation of the optimization problem into a single-objective optimization, which is the case in this study.

2. page 10, section 3.1. It may be easier to follow, if the design variables are replaced with d_i and h_i. Alternatively, one can also use d_u, d_m, d_l, h_u, h_m, h_l, h_b. But it does not affect the results. It is up to the authors.

3. page 11, line 305. “It is not practical to simulate ... the full set of DLCs". It is better to put “the full set of DLCs” right after “simulate”.

4. page 11, line 307. “... might be relevant and driving the design ...”. It may be changed to “... may be relevant or design driving ...”

5. page 17, line 407-412. The sentence is too long. It can be divided into three sentences.

6. page 23, Fig. 5. It is better to remove the baseline design. The text in the legend “original desing” may be “original design”. The text “optimum individual” means the final chosen optimized design, which may not be the global optimum. “optimum individual” may be replaced with “optimized design”.

7. page 26, Fig. 7. It is better to put the baseline design and the optimized design side by side. Then it is clearer to see the difference between the two designs.

8. page 31, line 673, “where trusses or tendons prevent any utilization of strongly tapered sections". Do the authors want to mean that the trusses or tendons support the use of strongly tapered sections?

9. page 32, line 725. The sentence is too long.