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Dear Reviewer,

We appreciate very much for your comments. We were asked to response to all comments, while a revised manuscript should not be prepared at this stage. In the following, we will therefore engage with all the comments and propose improvements for the final manuscript.

1) The paper lacks a critical literature review of wind turbine support structure optimization. There are several important papers in this field than need to be cited (and discussed) in the paper. Here are some examples:

- Muskulus, Michael, and Sebastian Schafhirt. "Design optimization of wind turbine support structures – a review." Journal of Ocean and Wind Energy 1, no. 1 (2014): 12-22.
- Zwick, Daniel, Michael Muskulus, and Geir Moe. "Iterative optimization approach for the design of full-height lattice towers for offshore wind turbines." Energy Procedia 24 (2012):297-304.
- Chew, Kok-Hon, Kang Tai, E. Y. K. Ng, and Michael Muskulus. "Optimization of offshore wind turbine support structures using an analytical gradient-based method". Energy Procedia 80 (2015): 100-107.
- Schafhirt, Sebastian, Niels Verkaik, Yilmaz Salman, and Michael Muskulus. "Ultrafast analysis of offshore wind turbine support structures using impulse based substructuring and massively parallel processors." In the Twenty-fifth International Ocean and Polar Engineering Conference. International Society of Offshore and Polar Engineers. 2015.
- Pasamontes, Lucia Barcena, Fernando Gomez Torres, Daniel Zwick, Sebastian Schafhit, and Michael Muskulus. "Support structure optimization for offshore wind turbines with genetic algorithm." In ASME 2014 33rd International Conference on Ocean, Offshore and Arctic Engineering, pp. V09BT09A033-V09BT09A033. American Society of Mechanical Engineers, 2014.
- Schafhirt, Sebastian, Ana Page, Gudmund Reidar Eiksund, and Michael Muskulus. "Influence of Soil Parameters on the Fatigue Lifetime of Offshore Wind Turbines with Monopile Support Structure". Energy Procedia 94 (2016): 347-356.
- Haghi, Rad, Turaj Ashuri, Paul LC van der Valk, and David P. Molenaar. "Integrated multidisciplinary constrained optimization of offshore support structures." In Journal of Physics: Conference Series, vol. 555, no. 1, p. 012046. IOP Publishing, 2014.
- Ashuri, Turaj, Michiel B. Zaaijer, Joaquim RRA Martins,, Gerard JW Van Bussel, and Gijs AM Van Kuik. "Multidisciplinary design optimization of offshore wind turbines for minimum levelized cost of

energy.” Renewable Energy 68 (2014): 893-905.

- Negm, Hani M., and Karam Y. Maalawi. “Structural design optimization of wind turbine towers.” Computers & Structures 74, no. 6 (2000): 649-666.
- Lavassas, I., G. Nikolaidis, P. Zervas, E. Efthimiou, I.N. Doudoumis, and C.C. Baniotopoulos. “Analysis and design of the prototype of a steel 1-MW wind turbine tower.” Engineering structures 25, no. 8 (2003): 1097-1106.
- Yoshida, Shigeo. “Wind turbine tower optimization method using a genetic algorithm.” Wind Engineering 30, no. 6 (2006): 453-469.
- Uys, P.E., J. Farkas, K. Jarmai, and F. Van Tonder. “Optimisation of steel tower for a wind turbine structure.” Engineering structures 29, no. 7 (2007): 1337-1342.

Our response:
A critical literature review of wind turbine tower and support structure optimization will be added, citing and discussing the important papers in this field.

2) In the introduction section, it is not clear what the knowledge-gap is that the authors want to address in this paper. Typically, a literature review should show what the state-of-the-art is and what is still needed to be addressed. Please clarify what the contribution of this paper is to the state-of-the-art, based on the identified knowledge gap.

Our response:
The knowledge-gap and the contribution of this paper will be added in the introduction section.

3) Line 179: Why did the authors change the tower height to 80 m? Mesh sensitivity has a different height. Please explain.

Our response:
The optimisation framework developed in this work is generic in nature and can be applied to the structural optimisation of wind turbine towers with an arbitrary height. In this paper, the NREL 5MW wind turbine 87.6m-height tower is used only for validation purpose. For the optimisation case study, a typical value of 80m is chosen as the height of the tower.

4) Line 204: Gravity is a body load, but the authors applied it to the tower top as a nodal load. Please explain why such a choice is made, and how accurate such an assumption will be. If gravity is used as a force, what is the corresponding mass? The authors could apply gravity as an acceleration in their model, and use an element type that would consider graviational acceleration.

Our response:
The gravity loads due to mass of the components on the tower top (such as the rotor and nacelle) are taken into account by applying a point mass with a value of 480,076 (LaNier, 2005) on the tower top. The gravity loads due to the mass of the tower itself are taken by ANSYS software automatically through defining gravity acceleration. This will be indicated clearly in the revised paper.

5) What values are used for equation 1 (and 2, 3 …)? Please add them in the paper.

Our response:
The aerodynamic loads on the rotor, as listed in Tables 5 and 6, are taken directly from Lanier (2005). Eq. (1) in Section 2.3.3.1 was added to present the formula which can be used to calculate the aerodynamic thrust force on the parked rotor. Eq. (1) will be removed in the revised paper, and statements will be added to clearly indicate the aerodynamic loads on the rotor are taken directly from Lanier (2005).

Eqs. (2) and (3) in Section 2.3.3.1 were used in this paper to calculate the wind loads on the tower itself. Values used in Eqs. (2) and (3) will be added in the revised paper.

6) What approach is used to do the fatigue analysis? What properties are used to find the damage on the structure? Please elaborate how the fatigue damage is obtained from iteration to iteration? Is there any time domain analysis performed? Is the Miner rule or Paris formulas used? Section 2.3.3.2 needs more details to allow other authors replicate the same analysis if needed.

Our response:
The S-N curve method is used in the fatigue analysis, as presented in Fatigue Constraint in Section 4.3. More details about the fatigue analysis will be added in the revised paper.

7) Line 262, "For ultimate load case, both gravity loads due to the weight of the tower itself and the wind loads due to wind passing the tower are taken into account as distributed loads on the tower ..", is there any time-domain simulation used here or is this just a static analysis? How the tower shadow considered in this work? Please clarify.

Our response:
It is a static analysis. The tower shadow is not considered in this work, as the tower shadow effects are deemed negligible in the case studies performed in this work. This will be clearly indicated in the revised paper.

8) Section 3: GA is a standard and routine approach and no need to spend 2 pages on that. Few citations to relevant paper would do the job. Please consider removing it and adding few citations instead.

Our response:
Section 3 will be revised to make it more concise.

9) Section 4.2: Why does the tower geometry vary linearly? Is this done to save computational time? Such an assumption has increase the initial weight of the tower. Please explain by how much?

Our response:
It is the common practice to design the tower with a linear variation of outer diameters across the

length of the tower. Examples can be seen in NREL 5MW wind turbine tower and DTU 10MW wind turbine tower [1]. These will be added in the revised paper to support the assumption of linearly varied tower outer diameters.

[1] Christian Bak, et al. "Description of the DTU 10 MW Reference Wind Turbine", DTU Wind Energy Report-I-0092, 2013

10) Line 374: Such an assumption is not acceptable. To do an optimization of the 5 MW NREL tower, the authors should use the same deformation of the tower top as the original design. You can relax a constraint to always have a better design in an optimization study. This is a very crude approach used in the paper.

Our response:
In this paper, the NREL 5MW wind turbine 87.6m-height tower is used only for validation purpose. For the optimisation case study, a 80m-height tower is considered. This will be clearly indicated in the revised paper.

11) Line 395: This is not an acceptable assumption. How do you know that the tower oscillates at the same RPM as the rotor to find the number cycles? Please clarify.

Our response:
Due to the rotor rotation and wind shear, the rotor aerodynamic thrust force Fx and bending moment My transferable to the tower top are cyclic loads, of which frequency is associated with the frequency of rotor rotation. This assumption is then used to estimate the number of cycles. Clarification on this assumption will be added in the revised paper.

12) Page 14: Fatigue constraint: How did you compute the fatigue damage? How did the authors find the cumulative stresses to be used in the S-N curve?

Our response:
It should be noted that the fatigue loads (see Table 6) taken from LaNier (2005) are load range. With load range, the stress range, which is used in the S-N curve, is determined using the parametric FEA model.

13) Line 415: Please elaborate how the buckling is performed, and how is the design guard against buckling?

Our response:
The details of buckling analysis will be added in the revised paper.

14) Line 440: The rotor rotational speed is 12.1 RPM and not 11.2 RPM. I hope this to be a typo, otherwise the optimization has to be redone.

Our response:
It is a typo and will be corrected in the revised paper.

15) I do not see an evaluation of the fatigue damage in the results section. Please add this, since it is important.

Our response:
The evaluation of the fatigue damage will be added in the results section in the revised paper.

16) I expect this to be in the methodology section, particularly figure 7. Please consider making a new section named methodology to explain how you setup your research, and how the design constraints, objective function and optimization algorithm are defined.

Our response:
Fig. 7 is in the Section 4.4. Section 4 is the methodology section, covering objective function (Section 4.1), design variables (Section 4.2), constraints, parameter settings of genetic algorithm (Section 4.3), and flowchart of the optimisation model (Section 4.4).

17) There is no soil-structure interaction considered. Please explain why and how you would this impact your results.

Our response:
The soil-structure interaction is important for the design of offshore wind turbine support structures. However, as indicated in the end of the introductory part of the paper, this paper deals with onshore wind turbine towers, of which design usually does not consider soil-structure interactions.

18) How is the mesh perturbation done in this work? Please explain.

Our response:
The element size, which is determined from mesh convergence exercises, is fixed during the optimisation process.

19) Minor comments:
- In table 1, please also add the Poisson's ratio.
- Line 175, "80m", add half-space.
- All the equations seem to be copied from somewhere instead of being typeset. Please consider typesetting them.
- Math symbol sub-indexes in Table 5,6 … are difficult to read. Please increase the font size.
- Table 8 to be left adjusted.
- Correct "force-aft" in line 151 and 160 to "fore-aft".

Our response:
Typos will be corrected and the format will be adjusted in the revised paper.

Best regards,
Lin