Answers to the reviewer:

The authors would like to thank the reviewer for the constructive recommendations and comments which will help improve the current and future work. In the following, the authors would like to respond to the reviewer's comments. The addressed comments are included in italic font.

1. *There is a mismatch between the many simplifying assumptions and the claims of a "fully integrated framework for designing complex geometry". The fact that the turbine, mooring system, and structural analysis are all excluded and that some of the hydrodynamic constants are not updated with design changes means that the work oversells itself. Hence the unfamiliar designs in the results seem even more surprising given the claims earlier in the paper.*

    - The focus of the paper is further clarified by emphasizing that the applied approach targets a conceptual but more innovative design by incorporating advanced features, while the fully modular and multi-fidelity character of the numerical modelling and optimization environment allow for further extension to address as well holistic design optimization task of higher fidelity. Thus, the following paragraph in the introduction is modified and extended:

        Thus, this paper aims to demonstrate that through a freer optimization formulation more potential solutions for an advanced spar-type floater design with a higher degree of innovation can be captured. The conceptual design study and optimization approach, applied in this work, focus on hydrodynamic and system-level analyses. Due to the conceptual character of this study, which precisely targets to explore novel design spaces, not that stringent limitations on the structure and dimensions are yet required. The optimization approach followed in this paper bases on an initial design optimization example by Leimeister et al. (2020b), which, however, is quite simple and does not include any aspects and goals for going beyond and advancing the common spar-buoy floater design but only focuses on optimizing the global system performance. While global system performance criteria still have to be fulfilled but are only incorporated as constraints, the main objective of this study is cost reduction – expressed in terms of the material used – and the optimization problem is specified in such a way that advancements, which go beyond just obtaining a reduced draft, can be achieved. Hence, by allowing design variables out of a wider range of values, contemplating different ballast materials, and considering novel structural realization approaches for the resulting optimized geometries, new alternatives of potential and innovative floater design solutions are opened up. All these requirements regarding design variables and optimization criteria are – together with specific environmental conditions and the fully coupled aero-hydro-servo-elastic dynamic characteristics of a FOWT system – incorporated into a fully modular optimization framework. Its current capability is sufficient for this conceptual design study; however, due to its close interlinking with the – as well – fully modular and multi-fidelity numerical modeling environment, the framework can easily be extended for serving more holistic FOWT system design optimization problems of higher fidelity, including a subsequent detailed design development.

- With respect to the reviewer's comment on the hydrodynamic constants, which are not all updated, the authors want to refer to the details provided in the discussion and want to emphasize that "the horizontal added mass coefficient, as well as the total inertia force, are already determined in dependency of the actual structural diameter and wave number" for each column element separately. Only "the horizontal drag coefficient is currently not altered from the original value of 0.6. This is a valid assumption for large diameters already at low flow velocities" and, hence, a valid assumption as well for the optimized design solution obtained within this work.
- Indeed, the designs in the result are quite unfamiliar, however, the can indicate potential design solutions, which might be more cost-efficient, however, require innovative structural realization approaches and alternative features. More details on ways to realize these "unfamiliar" designs, including the presentation of real examples of such innovative design solutions, which might deal as idea and impulse provider for alternative structural realization approaches, have been added and included in the introduction and Section 4.2 (which was previously Section 5.2) in the revised paper version from 5th June 2021.

2. *With that idea in mind, the Introduction does a poor job of setting up the paper. Too much text is devoted to a market survey and not enough to explaining the premise of the paper. For instance, the Introduction makes statements that assume spars are difficult to handle (line 47) and that "advanced" spars can address those shortcomings. However, these concepts are not explained until he beginning of Section 2. Also, given the prior publication by the authors (https://www.sciencedirect.com/science/article/pii/S0029801820302286) I would also recommend including the explanation of how this article goes beyond it. I would state explicitly what the contribution is to the literature in this paper.*

Some comments by the reviewer do not refer to the latest version of the paper (submitted on 5th June 2021) but still address the previous version from 22nd March 2021. In the revised paper from 5th June 2021, the following changes compared to the previous version had already been made, which address the reviewer's comments in the first four sentences:

- The market survey, mentioning relevant milestones of the floating wind technology development, has been completely removed.
- The comment regarding line 47 and "the statements that assume spars are difficult to handle and that 'advanced' spars can address those shortcomings" refers to the previous version of the paper, submitted on 22nd March 2021.
- In the paper version from 22nd March 2021, there has been indeed the definition of such "advanced" spars just in Section 2; however, in the revised paper from 5th June 2021, this part from Section 2 has been incorporated into the Introduction to clarify already at that point what "advanced" solutions might comprise.

To further address the reviewer's first comment, as well as the remaining to regarding the other publication by the authors and the contribution, the following additional changes are done: The focus and contribution of the paper are further clarified and the prior publication by the authors is addressed already in the introduction, specifying how this paper goes beyond the previous work and what the contribution of this paper to research and literature is. Thus, the following paragraph in the introduction is modified and extended:

Thus, this paper aims to demonstrate that through a freer optimization formulation more potential solutions for an advanced spar-type floater design with a higher degree of innovation can be captured. The conceptual design study and optimization approach, applied in this work, focus on hydrodynamic and system-level analyses. Due to the conceptual character of this study, which precisely targets to explore novel design spaces, not that stringent limitations on the structure and dimensions are yet required. The optimization approach followed in this paper bases on an initial design optimization example by Leimeister et al. (2020b), which, however, is quite simple and does not include any aspects and goals for going beyond and advancing the common spar-buoy floater design but only focuses on optimizing the global system performance. While global system performance criteria still have to be fulfilled but are only incorporated as constraints, the main objective of this study is cost reduction – expressed in terms of the material used – and the optimization problem is specified in such a way that advancements, which go beyond just obtaining a reduced draft, can be achieved. Hence, by allowing design variables out of a wider range of values, contemplating different ballast materials, and considering novel structural realization approaches for the resulting optimized geometries, new alternatives of potential and innovative floater design solutions are opened up. All these requirements regarding design variables and optimization criteria are – together with specific environmental conditions and the fully coupled aero-hydro-servo-elastic dynamic characteristics of a FOWT system – incorporated into a fully modular optimization framework. Its current capability is sufficient for this conceptual design study; however, due to its close interlinking with the – as well – fully modular and multi-fidelity numerical modeling environment, the framework can easily be extended for serving more holistic FOWT system design optimization problems of higher fidelity, including a subsequent detailed design development.

3. *The article is still unnecessarily long and many statements are repeated section by section. For instance, both sections 2.3, 2.4, 3.*, explain the design variables and constraints. These should be condensed and combined. For Sections 2 & 4, if the approach or methods are the same as in prior publications, it might be easiest to provide a very terse description and cite the prior work. Finally, the paper could be much more succinct by reading the paper through and determining if each sentence/paragraph contributes to core narrative or not. For instance, some of the comments about the computational execution history (first paragraph in Section 5) are extraneous and the plots of the GA results (Fig 3,4,6) say very little to the reader. I could list many more examples. If professional editing is available, that could help quite a bit as well.*

Some comments by the reviewer do not refer to the latest version of the paper (submitted on 5th June 2021) but still address the previous version from 22nd March 2021. In the revised paper from 5th June 2021, for example, Section 2 only comprises subsections up to 2.3. Thus, there is no longer a Section 2.4., which, however, the reviewer refers to. As the first subsection of Section 2 was removed and shifted to the introduction in the revision from 5th June 2021, the authors transfer the reviewer's comments regarding Sections 2.3 and 2.4 to the Sections 2.2 and 2.3. Furthermore, the reviewer refers to Figs. 3, 4, and 6 as plots of the GA results. Due to the additional figures included in the revised paper from 5th June 2021, the authors derive from the comments on the "plots of the GA results" that the reviewer refers to Figs. 4, 5, and 8. Based on this, the following changes are done:

- The specification of the optimization problem, which was originally covered separately in Section 3, is now directly incorporated in Section 2 and the design variables, objective function, and optimization constraints are directly derived from the specifications in Sections 2.2. and 2.3.
- Apart from the same basis floating wind turbine system, which is since the last revision from 5th June 2021 already only very shortly specified in Section 2.1 (with some more details on the parameters moved to the appendix), and the same three values for the constraints on the global system performance – as well only covered very briefly in the final paragraph of Section 2.3, all methods and approaches presented in Section 2 are new and have not yet been covered in any prior work.
- Section 4 (which is now Section 3) is shortened and details from prior work, which are not necessarily to be repeated and presented in this paper again, are removed to condense the text.
- The extraneous information and comments on the computational execution history at the beginning of Section 4 (which was previously Section 5) are removed. The plots of the GA results (Figs. 4, 5, and 8), however, are kept in the paper, as the support the reader in understanding the development process described textually in Section 4.1.
- Throughout the paper, modifications are made and not elementary parts are removed to condense the entire paper.