

Wind Energ. Sci. Discuss., referee comment RC3
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Comment on wes-2022-109

Anonymous Referee #3

Referee comment on "Damping analysis of floating offshore wind turbines (FOWTs): a new control strategy reducing the platform vibrations" by Matteo Capaldo and Paul Mella, Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2022-109-RC3>, 2023

Overall:

- This is a detailed analytical account of floating wind turbine dynamics and a controller designed to provide a fixed amount of damping to the platform motion. Some analytical derivations are novel, but most are already presented in the literature. The controller is compared against a scheme known to not work well for floating systems, rather than a standard floating feedback controller, so its benefits are unclear. The article could be used to find, or eliminate, FOWT designs with controllability issues. This article could be improved by tailoring the presentation to a wind energy audience.

Major Comments:

- The introduction is clear and focused. However, in L46, the authors give the impression that they will be varying the rated generator speed of the controller based on the platform pitch velocity. The controller described in Section 3 only changes the blade pitch angle, similar to other floating feedback controllers. Maybe the authors are talking about "this paper," and not the paper that I am currently reviewing. Either way, the article could be revised throughout for clarity, e.g., be clear about what "this" is. The introduction does not mention ROSCO or other platform/generator speed decoupling methods, though they appear later in the manuscript.
- The choice and use of $k_{\tau g}$ are not clear and based on reading this paper, it seems like that is one of the main contributions of the controller, along with switching the sign of k_{β}
- The analysis and reasoning in Section 2.3.1 are not clear. Please elaborate on "Is rather influenced by" as this is not typical verbiage for a wind energy audience.
- Overall, the references to sections, figures, and tables in this paper are broken. As there are a lot of equations and references to them, it hinders the readability of the paper.
- In the NMPZ analysis, the tables and figures should probably be combined, since each table corresponds to a plot. Additionally, it's not clear where these partial derivatives come from. Are they the IEA-15MW VoltturnUS turbine at a specific wind speed? It would be very helpful to put the sensitivities of that turbine (at a specific wind speed, probably 12 m/s where the NMPZ issues are greatest) for reference. Then, the readers would have a better understanding of the conditions that cause the NMPZs you

describe.

- A fixed k_β is a better reference than $k_\beta = 0$. Please include this case in the simulation study, as tuned by the ROSCO toolbox for reference. Most readers will want to compare this controller with one that has a simple floating feedback controller.
- Please revise and edit this manuscript throughout for grammar and for in-text references. E.g.,
 - L254: It is complicated to explicit[ly determine] the damping
 - L374: [Section] 2.5. Copernicus journals typically use Fig. [X] and eq. (Y) for references.
- Is it true that the signs are flipped from the standard ROSCO floating feedback controller? Please make this very clear in the article.
- In the results section, please use specific language when comparing the performance of controllers. E.g., The X measure is 15% greater in A than in B. The term "gain" can have multiple meanings and is not explicitly clear.
- It would be great to see a time series (600 seconds) of the control signals, generator speed, and platform pitch for the proposed controller and both references in a figure.

Minor Comments:

- What is the characteristic time? The wave period? Please use wind energy verbiage for this journal. Why is the focus of this analysis outside of the likely wave periods? Please base the analysis on realistic wave conditions (6-10 seconds).
- Figure 10 shows very large rotor speed excursions. Why is that?
- L370: what is diagram 5?
- Figures 10 and 11 could be combined. Please include case information in the caption. Other figures, like 6 and 7, could be combined, as well. In general, it's helpful to have the figures near where they are referenced in the manuscript.
- Is Figure 8 necessary? The reader can see these results in Figs. 6 and 7, and the load "densities" are not typical wind energy measures. You could easily include the amplitude or standard deviations in Figs. 6 and 7.
- What is the quality factor Q? Is it necessary for this audience? There are already a lot of equations and terms. Please consider what other terms can be eliminated to improve readability.