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Wind Energy Science Discussion

Date: August 16, 2021
Subject: WES-2021-12 – manuscript needs minor revisions

Dear Athanasios,

Thank you for having reviewed the last version of our paper. We think your comments helped us improving it further.

The article has been revised according to your suggestions. On top of that, we double-checked the manuscript and took the opportunity to clarify some sentences and correct typos.

Below you can find a point-by-point reply to your comments.

On behalf of all Authors,
yours sincerely,

Alessandro Fontanella

Point-by-point reply to comments

Below you can find our reply (AR) to your comments (AEC).

AEC1 L 83: the quasi-steady theory seems valid for reduced frequency smaller than 0.5. How does this value compare with other studies? Also, how does that translate to motion frequencies of model and full scale turbines?

AR1 Thank you for this comment that helps us to better frame our research.
To answer the comment, we did two things. In section 2.2 we added a reference to a recent paper of C. Ferreira, currently under review, that summarizes results of previous experimental and numerical studies about the aerodynamic response of floating turbines. In this survey, results are reported as function of reduced frequency and this gives a good indication of the reduced-frequency range explored in other studies. Furthermore, we recognize that reporting results as a function of reduced frequency favors comparisons, so we decided to discard the "wake reduced velocity" (the inverse of reduced frequency) we introduced in the first manuscript, and to use reduced frequency in any part of the paper. The test matrix in the appendix now reports the reduced frequency of all tested cases.
We added a short appendix where wind tunnel results are extended to a generic 10MW floating turbine. Here, we check how reduced frequency varies as function of surge-motion frequency and wind speed and based on this information, we notice that it's reasonable to expect quasi-steady aerodynamics in response to resonant surge motion.

AEC2 Fig 2: I suggest to indicate with a dash vertical line the radial position of the end of the blade root (i.e. the radial location at which the circular cross-section of the blade ends).

AR2 Done, and we did the same in Fig. 1.

AEC3 L 176: It might be clearer to describe in a bit more details how the obtained 2D airfoil characteristics are used to decide on the set up for the 3D experiment.

AR3 We agree that it was not very clear how we use 2D data to design the 3D experiment. Hence, we made some modifications to the Introduction and Section 2.2 to better show how 2D data were used. Knowledge of airfoil polars was utilized to ensure that angle-of-attack variation due to surge motion do not cause unsteady airfoil aerodynamics. In this way it is possible to say any turbine unsteady aerodynamic behavior is due to rotor unsteadiness rather than airfoil-level unsteadiness. We added one panel to Fig. 2 to better explain this idea.

AEC4 L 225: Is 5m upstream of the turbine enough to measure U_infty?

AR4 That's correct and in fact it's an error: wind speed was measured 7.15m upstream the turbine rotor. Here the influence of rotor induction should be negligible.