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Comment on wes-2022-35

Anonymous Referee #1

Referee comment on "Atmospheric rotating rig testing of a swept blade tip and comparison with multi-fidelity aeroelastic simulations" by Thanasis Barlas et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-35-RC1, 2022

Short summary

The authors wrote a follow-up paper regarding blade tip design. The first parts, cited in reference in the present work, deal with tip design optimisation and wind tunnel test. The results presented in the current article, show a comparison between: numerical simulations of several level of fidelity and field test using the Rotating Test Rig available on the DTU campus. Ideal and turbulent simulations were performed for the all numerical set-ups except the CFD due to high resources required. Comparison by mean of spanwise loading is made. An interested behaviour noted, is the highly 3D flow at the tip captured changing the AoA and force direction in ways that BEM, LL and NW cannot capture yet.

Comments

Overall, the data shown and topic are very interesting and well presented. However, I have a few comments which can clarify a few doubts and improve the paper's quality:

- The tip model design chapter (chapter 2), is unnecessarily long since it has been referenced several times in the authors previous work. Shortening this chapter will allow for more detailed results (see comment 10 and 12). Similarly, the Figure 2 to Figure 5 are interesting but similar plots are already cited in previous works.
- The Figure 1 should be kept for the sake of showing the object of study, but the rules regarding technical drawing are not followed. The dimensions should be above (or below) arrowed lines. The way it currently is, is confusing.

- In the chapter 4.5, the Figure 10 has already been used in previous work. Instead, a plot detailing the sectional cuts and axis convention used as detailed in lines 167 to 169 could have a better value.
- Line 185, “Most of the simulations shown here use transitional polars” does it mean that it was calculated using 2D or 3D CFD using a transition model ?
- The numerical simulations were not all done for the same amount of time, was a sufficient level of convergence achieved for all solvers ? Why not, using a similar amount of time for all?
- It is mentioned, that the Prandtl tip correction is used. How confident are you about the correction applied to a highly swept blade tip ? Has the correction model been updated to account for the tip shape ?
- The 3D CFD simulations show that the root vortex is only located at the transition part between boom and tip. Was it seen in the experiment, using the installed cameras and tufts for instance ? Was there any radial flow noted ?
- Chapter 5.1 “Spanwise load distribution”. For the -5° case, I would not say that the forces are “well captured”. The numerical model show a clear decrease along the span, while the experiments show the same load level for the first 2 points and a small decrease for the third one. I don’t think the trend is captured. Moreover, with only 3 experimental points (the tip being an outlier) it is difficult to conclude in that specific case. However, the other cases show great similarity between the simulations and experiments.
- For clarity, maybe use a single legend for all plots for the Figure 11. The same can be said for all the figures comparing results (Figure 12, 13, 14, 16, 17).
- The authors mentioned several times wind tunnel tests, it will be interesting to include the wind tunnel results in the plots, to see the whole picture: simulation, wind tunnel, small scale field tests. Similarly, the pressure coefficient plot (Figure 9) could be compared with 3D CFD results, especially for the Section 4 (if available).
- The Figure 12 seems to show that the CFD is “less accurate” than the LL and NW. For the section 1 it is as far from the experiments as the BEM in opposite direction. The other sections are more in line with the rest. Has it been investigated ? Can the swept shape be not suitable to the meshing strategy adopted here ?
- The Figure 17 and associated description doesn’t not add much information since the standard deviation is already present on Figure 16. This paragraph could be replaced by the comparison with wind tunnel data and/or presentation of some aerodynamic parameters along the tip depending on the simulation method and field data (if available): induction, angle of attack, power coefficient,…