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Comment on wes-2022-81

Anonymous Referee #1

Referee comment on "Towards smart blades for vertical axis wind turbines: different airfoil shapes and tip speed ratios" by Mohammad Rasoul Tirandaz et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-81-RC1, 2022

The paper presents a wide set of numerical simulations of a virtual 1-blade Darrieus turbine using different airfoils. The amount of data presented is relevant and represents the main point of merit of the study. However, the results obtained for a single blade are scarcely representative of those a full turbine, since blade-to-blade interaction is lost, as well as the effect of turbine solidity on flow induction. This is reasonable for a first study but limits the validity of the conclusions. Double-checking the outcomes for at least 2 or 3 configurations in case of a 2- or 3-blade turbine could help understanding the validity of the analysis.

The term “morphing” is used throughout the paper. However, if this reviewer understood correctly, all simulations refer to an individual geometry tested under different conditions. The authors should more carefully alternate the terms “morphing” with “changing” or “modifying” for better transparency.

“Morphing” a blade during the revolution (second scenario considered) means that the flow induction changes at each azimuthal position, thus the behavior of the blade cannot be reconstructed as the sum of different “pieces” coming from different simulations. This part of the study must be re-thought carefully.

In addition to this main concern, a few additional points should be considered:

- Lumped references (like [23-33] or [42-46]) should be avoided. The authors should try to emphasize the contribution of each cited reference.

- The Reference section is well populated. However, the authors discarded a number of important references on VAWT design and simulation. The following readings are suggested since directly related to the present work:
  - http://dx.doi.org/10.1016/j.renene.2015.06.048
  - http://dx.doi.org/10.1016/j.energy.2015.12.111
  - http://dx.doi.org/10.1016/j.enconman.2014.10.038

- The choice of a blade-spoke connection at 0.5c makes all the analysis more complicated, since the pitching moment comes to play (see DOI: 10.1115/1.4034940). Moreover, the authors did not mention anywhere in the paper the impact of flow curvature effects (thicker airfoils in particular may result in ineffective virtual ones) – see: http://dx.doi.org/10.1016/j.enconman.2015.09.053. While these two phenomena are directly captured by CFD and are thus included in your analysis, the impact should be mentioned and possibly analyzed to help the reader interpreting the outcomes of the study.

- A literature study is referenced for the AoA calculation. However, that study has been recently overcome by a new one that is recommended for consideration by the authors: https://doi.org/10.1016/j.enconman.2020.113284

A discussion is present about the feasibility of a morphing blade system. However, it is strongly recommended to expand this section. Points to be addressed: 1) “time” for the actuators to move the airfoils in case of a variation along the revolution (it seems indeed unfeasible); 2) maximum change in thickness reasonably allowed by a constructive technology; 3) fatigue; 4) energy spent for morphing vs. increase in efficiency.