

Wind Energ. Sci. Discuss., referee comment RC2  
<https://doi.org/10.5194/wes-2021-163-RC2>, 2022  
© Author(s) 2022. This work is distributed under  
the Creative Commons Attribution 4.0 License.



## **Comment on wes-2021-163**

Vasilis A. Riziotis (Referee)

---

Referee comment on "How should the lift and drag forces be calculated from 2-D airfoil data for dihedral or coned wind turbine blades?" by Ang Li et al., Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2021-163-RC2>, 2022

---

The paper assesses the importance of the collocation point selection on the calculated sectional and overall blade and rotor aerodynamic loads of no-planar rotors, in the context of BEM, lifting line and actuator line methods (all of which based on a 1D representation of the blades).

In order to assess the validity of their assumptions, the authors compare the results of the different implementations for the sectional loads calculation against fully resolved CFD results. The results clearly indicate that the collocation point selection is not of major importance for the calculation of the magnitude of the effective flow velocity but it plays a very important role in the consistent calculation of the CL (consistent definition of the  $\alpha$ ) and the flow direction with respect to which lift and drag forces are analyzed into thrust and tangential force.

The findings of the work are well supported by computations with all the 1D aerodynamic variants, which are compared to fully resolved CFD results.

The paper is well structured and written and it presents important results which are valuable to the research community. Therefore I recommend publication of the paper is WES, after some revision is made to the original text.

- Several comments-corrections (including grammar/syntax) can be found in the accompanying pdf file
- In the beginning of section 2, the statement that the flow in the wake of the rotor is irrotational is incorrect. Please see the comment in the pdf.
- A change which would definitely contribute to improving clarity, is a figure (and the

accompanying discussion) that illustrates the correspondence between 2D Theodorsen theory parameters against the 3D blade sectional parameters. For example, in the text, in eq 1 a Dar angle is defined which is supposed to include the effect of the section motion on the angle of attack. However this clearly should not include pitching angle of the section which however alters the angle of attack. Furthermore, in the same expression, it is not perfectly clear what  $\theta$  angle stands for. The same  $\theta$  notation is used in eq 3 where it represents the pitching motion of the section. However, this pitching motion does not alter the inflow angle which should be the one used in eq 1. Then how all the above angles are transferred in the section of the blade. Furthermore, what is the direction along which heaving motion is defined? In Theodorsen theory this is supposed to be perpendicular to the local inflow velocity. This direction seems to be defined differently in the paper (most probably normal to the chord).

Please also note the supplement to this comment:

<https://wes.copernicus.org/preprints/wes-2021-163/wes-2021-163-RC2-supplement.pdf>