

# Reply to the remarks of the editor to the comments of referee #1 on the manuscript “Brief communication: extraction of the wake induction and angle of attack on rotating wind turbine blades from PIV and CFD results”

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We would like to thank the editor for his complementary remarks to the comments of referee #1. In the following, we present our replies.

## Comment

1. *The reviewer points at two main problems with the paper:*

- (a) *It claims originality. However, a similar analysis was carried out using Mexico-rotor data in the paper by Yang et al. “Extraction of airfoil data using PIV and pressure measurements” from WE 2011. It is required to clearly state the difference between your contribution and the previous paper.*
- (b) *The reviewer claims that it is not the AOA that your method computes, as it is based on the velocity at a point far away from the blades. It is therefore needed that you document that it is indeed the same velocity that you would get at the blade, i.e. the velocity induced by the free vortices corresponding to the one used in BEM analyses*

## Reply:

- (a) We were not aware of the paper by Yang et al. [2011]. In the new version of the manuscript we cite it and compare their results to ours. Some important differences between both papers are described in the following:
  - In the case of Yang et al. [2011], the calculations of the AoA are based on a method that had been developed 5 years before by Shen et al. [2006]. In our case, we introduce and employ a completely different and new method.
  - The method by Shen et al. [2006] requires pressure and PIV measurements. Our method just needs PIV measurements.
  - The results from Yang et al. [2011] only show the AoA for 3 radial positions ( $r/R = 0.6, 0.82$  and  $0.92$ ). In our case, we present it for the whole blade span from the root until the tip.
  - Our paper, in opposition to the one of Yang et al. [2011], not only presents the AoA but also the axial and tangential induction.
  - We compare the results from 3 different methods and discuss their advantages and disadvantages, whereas Yang et al. [2011] does not compare the results with other methods.
  - We compare the experimental results with CFD results, whereas Yang et al. [2011] use the experimental results for adapting the corresponding 3D airfoil polars and running a BEM model.

We believe that both papers are very useful for the scientific community and complement well each other. The focus of Yang et al. [2011] is the extraction of the airfoil characteristics from experimental PIV and pressure measurements and we rather focus on the presentation and validation of a new method.

**(b) A detailed discussion of this issue has been included in the new version of the manuscript, including an analytical demonstration in the appendix.**

2. *Besides there is no explanation of how the measurements were collected. Since the blade is rotating, it is unclear how the PIV data are obtained at the bisectrix. Either the PIV-data are taken in a co-rotating system or they are phase-averaged. If the latter is the case, the full time-history should be shown in order to compare the azimuthal dependence with the bisectrix value and the azimuthally averaged values with the full time (azimuth) history*

**Reply:**

**As explained in the new version of the article, the measurements are phase-locked at the azimuth angle  $60^\circ$  after blade passage. Fig. 2 of the paper shows that the PIV windows were at the 3 o'clock position and the measurements were performed when one of the blades was located at the 11 o'clock position. As we also explain now in the manuscript, the available measurements were averaged over 31 image pairs. The individual image pairs are however not available, so reconstructing the time-history is unfortunately not possible.**

## References

- W. Z. Shen, H. MOL, and S. JN. Determination of angle of attack (aoa) for rotating blades. In Peinke, Schaumann, and Barth, editors, *Proceedings of the Euromech Colloquium – Wind Energy 2005*, pages 205–209, Oldenburg, Germany, 2006. Springer.
- H. Yang, W. Z. Shen, J. N. Sørensen, and W. J. Zhu. Extraction of airfoil data using PIV and pressure measurements. *Wind Energy*, 14(4):539–556, 2011. ISSN 1099-1824. doi: 10.1002/we.441.