

Wind Energ. Sci. Discuss., referee comment RC1
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Comment on wes-2021-104

Anonymous Referee #1

Referee comment on "Vortex identification methods applied to wind turbine tip vortices"
by Rodrigo Soto-Valle et al., Wind Energ. Sci. Discuss.,
<https://doi.org/10.5194/wes-2021-104-RC1>, 2021

General comments

This paper provides an extensive demonstration of the use of vortex identification methods applied to particle image velocimetry measurements. In addition, various numerical differentiation schemes for those schemes using velocity gradients are tested and analysed. Vortex location, vortex core radii and jittering areas are discussed extensively.

The paper is well organized and is clear to read. The introduction reviews literature articles concerned with vortex identification and describes the aims and the paper structure. One of the major criticisms about this paper is the novelty. The methods utilized are very well documented in the literature and adopted in various studies. Their limitations and advantages, including the numerical schemes are quite well known by now, considering also sister literature concerned with helicopter rotor aerodynamics. The authors need to expand more on the novelty of the article. Refer to the specific comments.

Section 2 details the VIM approaches used in this paper and the accompanying numerical schemes. This is well written.

The experimental data used in this work is then described in section 3. The authors do not provide any comprehensive detail on the uncertainty of the experimental measurements which could have an important impact on the uncertainty of the results. Uncertainties of numerical schemes are well discussed but this is not enough to ensure a lucid discussion on the observed divergences between schemes. A discussion on the uncertainties derived from the PIV measurements should at least be made.

Further comments on the results section are expanded upon in the specific comments but in general the results are well presented. The only criticism here is that the conclusions provided are still not fully convincing in light of the above mentioned shortcomings.

In conclusion, the paper currently lacks novelty and requires a more robust consideration of experimental uncertainties and how these could possibly impact the presented results. Nevertheless it is felt that this work presents a worthy analysis which, if refined further, can provide an incremental step in the application of VIMs.

Specific comments

While the paper provides very interesting insights on the use of the different VIMs for vortex tracking, the novelty of the article is still unclear. The advantages of the Graftieaux's approach, which is hailed by the authors as the most suitable approach are already known. The authors should expand more on the novelty of their article in the

introduction section since it is for now not very apparent.

The effects of experimental uncertainty are lacking in the paper. The SPIV data has some level of uncertainty in the results and how this gets propagated in the methods that are being proposed is not very clear. At the very least, a discussion of these effects should be made. This could also have an impact on the Graftieaux approach used. The literature on the uncertainty on PIV should be thoroughly reviewed in order to be able to support your discussion of the effects.

Figure 10 – It is recommended to remove the line plot and use a scatter plot for such representations.

Line 264-267 – The following sentence should be clarified further “Alternative methods such as the prediction from time series vortex locations might be also successful using the rest of the schemes due to the small discrepancy between the vortex center locations between VIMs and schemes; however, more than one vortex age is needed.”

Figure 17 – For completeness the figure needs a colorbar.

Line 333 – It is not very clear whether the authors are rejecting the uneven shedding effects on the observed double peak results.

Line 343 – Do you here mean for vortex kinematics analysis or do you really mean that the methods are simply not suitable for establishing both position and motion of the tip vortices? “In fact, both schemes ignore information either forward or backward from the grid on the implementation of differentiation. Therefore, they are not suitable for vortex analysis.”

Conclusion - For the most part it is felt that the issue of the double peak has remained unresolved in this work. The authors seem to attribute these to purely numerical artefacts. Do the authors feel confident about this conclusion? Could experimental uncertainties also be responsible for this?

Grammar

Line 25 – “It is shown, by using the vorticity to identify the vortices, a high variation in the position of the tip vortices.”

Line 237 – Change “are originated” to “might originate”

Line 269 – Sentence structure is poor here: “the Graftieaux 24-points as well only vorticity magnitude cases are presented.”

Line 365 – “The two peaks found in the jittering...” – please rephrase