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Interactive comment on "Full scale deformation measurements of a wind turbine rotor in comparison with aeroelastic simulations" *by* Stephanie Lehnhoff et al.

Anonymous Referee #2

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The paper explains a very promising and useful technique for measuring blade deflections. It shows experimental results obtained from a real turbine, data processing and a comparison with a numerical model.

The major issue in this paper is that the authors found the in-plane displacement to be greater than the out-of-plane one. This is in contradiction with the behavior of any turbine, and should be carefully investigated until the source of the problem is discovered.

The following remarks should also be addressed before the publication.

- It would be nice to add a few statements on how the markers on the speckle pattern are matched with the numerical model.

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Discussion paper

- I think that it's worth citing "Health monitoring of wind turbine blades in operation using three-dimensional digital image correlation" from Rong Wu et al.

- I understand that the illumination conditions are a challenge for DIC, but if I remember well, some authors applied phosphorescent markers, and did the test during the night.

- Almost all of the mathematical formulas are not clearly written. The authors should specify the meaning of all symbols, and the indices of the summations.

- The authors should elaborate on how the geometry of the undeformed blade is taken into account. I'm referring in particular to: cone angle, pre-bend, backward sweep and twist angle.

- Without further analyses, I would expect that most of the correlation between the out-of-place deflection, and the flapwise bending moments, is due to the 1P.

- The comparison between the strain gauges and the numerical model could be expanded by including the Damage Equivalent Loads.

- In figures 20 and 21 the authors compare the DIC measures to 9 numerical simulations, that differ by the turbulence seed. I don't think that this is a fair comparison, as the purpose of doing simulations for multiple seeds is to get accurate statistics. I would thus compute statistics for the numerical simulations (mean, standard deviation, PSD, ...) and compare them to the ones for the measures.

- Figures 22, 23, 24, 25, 28 and 29 are subject to the same problem. I think it would be better to have for each figure: - 1 curve for the mean deflection (over time) from DIC, as a function of the azimuth angle - 1 curve for the mean deflection (over time and seeds) from DIC, as a function of the azimuth angle - 2 curves for the 2 * std from the DIC - 2 curves for the 2 * std from the simulations

- I don't agree with using the FFT on noisy data, because the conditions are never constant, and the time series never periodic. I would instead use the Welch's method.

- For a future work I would recommend to run the numerical simulations using a reconstructed wind field.

Please see the attached document for additional comments.

Please also note the supplement to this comment:
https://www.wind-energ-sci-discuss.net/wes-2020-28/wes-2020-28-RC2-supplement.pdf

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