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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Benefits of sub-component over full-scale blade testing elaborated on a trailing edge bond line design validation" *by* Malo Rosemeier et al.

Anonymous Referee #2

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The paper deals with the advantage of subcomponent testing of utility-scale blades over the full-scale testing. A computational study is carried out on the structurally critical regions of the blade to determine the strain levels during a full-scale test. The study provides interesting insights on strain distributions for the edge-wise and flap-wise bending modes along the length span of the blade and discusses the effect of different stress ratios on allowable fatigue cycles. Authors justify the advantage of sub-component testing over the full-scale test based on the testing duration and proximity to the target loads. The paper is well-written however a few points need to be addressed. Below is the summary of the comments:

-1/15 In the introduction section, the subcomponent testing is somehow presented as a substitute for full-scale testing which is not realistic. Coupon testing of the materials and the final full-scale test are both required for certification of utility-scale blades. However, subcomponent testing can bridge the gap between the coupon and full-scale tests and increase the assurance of the blade manufacturer/designer for use of new materials or designs in a blade before a full-scale test. Subcomponent testing may not replace the need for a final full-scale test but it has the potentials to be considered as a standard intermediate test for utility-scale blades. Subcomponent test can also expedite and facilitate the introduction of new materials into wind turbine blade manufacturing industry.

-4/7 Reference should be added to give the readers examples of the use of DIC technique and full-field measurements in subcomponent testing. See the papers below:

Zarouchas, D. S., Makris, A. A., Sayer, F., Van Hemelrijck, D., Van Wingerde, A. M. (2012). Investigations on the mechanical behavior of a wind rotor blade subcomponent. Composites Part B: Engineering, 43(2), 647-654.

Asl, M. E., C. Niezrecki, J. Sherwood, and P. Avitabile. "Experimental and theoretical similitude analysis for flexural bending of scaled-down laminated I-beams." Composite Structures (2017).

Asl, M. E., C. Niezrecki, J. Sherwood, and P. Avitabile. Similitude analysis of the strain field for loaded composite I-beams emulating wind turbine blades. InProceedings of the American Society for Composites: Thirty-First Technical Conference 2016 Sep.

-5/10 It might not be not clear for readers where the 10% length span is measured from. Either a figure should be added to address that or authors can explicitly mention that it's measured from the root section of the blade.

- Section 3, The paper is supposed to discuss and compare the full-scale test to sub-component test. Although the authors' comments on full-scale testing have been fairly supported by simulation data, there are no significant data or quantitative measures to support their comments on subcomponent testing side. Authors should either include simulation data to justify their comments on subcomponent testing or cite the references which include such data or elaborate on their reasoning to support their insights on subcomponent testing. For instance, page 8 line 11 reads “while in an SCT setup any of the loading scenarios for the different wind speed bins which are shown can theoretically be replicated..”. It’s not clear how this scenario could possibly be implemented in reality. There are no diagrams, figures, references or at least a detailed explanation. Same thing on page 11 lines 1 through 7.

-Authors should expand the literature review and provide the readers with a broad perspective of the different approaches and techniques that have been developed so far for subcomponent testing of wind turbine blades. In the literature review, authors should also comment on the limitations of the developed subcomponent techniques to give the readers a realistic assessment of the state-of-art techniques that have been developed to date for structural performance assessments of utility-scale wind turbine blades. This should include the experimental techniques using DIC, analytical tools such as similitude analysis and scaled subcomponents or computational models for fracture in the adhesive joints. See the papers below:

Ji, Y.M. and Han, K.S., 2014. Fracture mechanics approach for failure of adhesive joints in wind turbine blades. Renewable Energy, 65, pp.23-28.

Laustsen, S., Lund, E., Kühlmeier, L. and Thomsen, O.T., 2014. Development of a HighâĂŘfidelity Experimental Substructure Test Rig for GridâĂŘscored Sandwich Panels in Wind Turbine Blades. Strain, 50(2), pp.111-131.

Eydani Asl, Mohamad, et al. "Similitude analysis of thin-walled composite I-beams for subcomponent testing of wind turbine blades." Wind Engineering (2017): 0309524X17709924.

Fernandez, Garbiñe, Hodei Usabiaga, and Dirk Vandepitte. "Subcomponent develop-

ment for sandwich composite wind turbine blade bonded joints analysis." Composite Structures 180 (2017): 41-62.

Asl, M. E., Niezrecki, C., Sherwood, J., Avitabile, P. (2014). Application of structural similitude theory in subcomponent testing of wind turbine blades. In Proceedings of the American Society for Composites (pp. 8-10).

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