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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Assessment of Wind Turbine Component Loads Under Yaw-Offset Conditions" *by* Rick Damiani et al.

Anonymous Referee #2

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The paper investigates the effect of yaw offset on applied loads to a utility-scale wind turbine blade. The paper starts with a simple analytical model and the authors add up to the complexity of the problem by including different factors. A numerical study is conducted and experimental data are presented for validation purposes. The paper has a logical flow and authors made a good effort to justify their findings. However, a few things need to be addressed to clarify the objectives of the study and to make the paper understandable for a wide spectrum of readers. Below is the summary of the comments:

-The paper deals with the applied load on a blade with a focus on applied loads in the skewed condition. Authors showed that stiffness characteristics of the blade are the key factors in determination of the load statistics and the fatigue response of the blade.

Utility-scale blades are certified through a full-scale test which includes both static and accelerated fatigue loadings. Authors should clearly comment how such an analysis can be incorporated into design, certification or health monitoring of the blades to either improve the structural design of the blades or minimize the yaw offset load effects.

-Figure 1 should be revised. It may not be clear for readers to differentiate between the yaw offset and other parameters by looking at the coordinate system used in the Figure 1.

-Page3, Line 16. There should be at least one reference here justifying the comments of the authors on thrust loads and conflicting predictions by literatures and industry experience.

-Page 9, Line 14. Fix the typo "75th ".

-Figure 6. The labels/units for x-axis are missing. Figures should be standalone.

-Authors need to include a paragraph in introduction section and review the works that have been done so far on characterization of fatigue and aerodynamic loads in wind turbine blades and then work toward the effect of yaw offset on the applied loads to the blade. This may include the work that has been done on the load characterization in blades including full-scale or subcomponent tests and numerical assessments. Authors should at least review the works that have been done in NREL on this topic. Check the papers below:

Madsen, P. H., Pierce, K. G., & Buhl, M. L. (1998). Predicting ultimate loads for wind turbine design. National Renewable Energy Laboratory.

Mücke, Tanja, David Kleinhans, and Joachim Peinke. "Atmospheric turbulence and its influence on the alternating loads on wind turbines." Wind Energy 14.2 (2011): 301-316.

Ekelund, Thommy. "Yaw control for reduction of structural dynamic loads in wind turbines." Journal of Wind Engineering and Industrial Aerodynamics 85.3 (2000): 241-

262.

Castaignet, Damien, et al. "FullâĂŘscale test of trailing edge flaps on a Vestas V27 wind turbine: active load reduction and system identification." Wind Energy 17.4 (2014): 549-564.

Asl, M. E., Niezrecki, C., Sherwood, J., & Avitabile, P. (2016). Design of scaled-down composite I-beams for dynamic characterization in subcomponent testing of a wind turbine blade. In Shock & Vibration, Aircraft/Aerospace, Energy Harvesting, Acoustics & Optics, Volume 9 (pp. 197-209). Springer, Cham.

Bossanyi, E. A. "Wind turbine control for load reduction." Wind energy 6.3 (2003): 229-244.

Thomsen, Kenneth, and Poul Sørensen. "Fatigue loads for wind turbines operating in wakes." Journal of Wind Engineering and Industrial Aerodynamics 80.1 (1999): 121-136.

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

Haenler, M., U. Ritschel, and I. Warnke. "Systematic modelling of wind turbine dynamics and earthquake loads on wind turbines." In European Wind Energy Conference and Exhibition, pp. 1-6. Athens, Greece: European Wind Energy Association, 2006.

Kong, Changduk, J. Bang, and Y. Sugiyama. "Structural investigation of composite wind turbine blade considering various load cases and fatigue life." Energy 30.11 (2005): 2101-2114.

Eydani Asl, Mohamad, Christopher Niezrecki, James Sherwood, and Peter Avitabile. "Similitude analysis of thin-walled composite I-beams for subcomponent testing of wind turbine blades." Wind Engineering (2017): 0309524X17709924.

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