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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on “Development and feasibility study of segment blade test methodology” *by* Kwangtae Ha et al.

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Dear a Referee,

Thanks for your helpful and qualtitative comments.

Belows are my answers.

Major questions

Comment #1: The author should modify the introduction.

Author feedback #1: I changed the paragraph for clarity as below

Also, testing facilities for 100m+ blades are very limited at this moment. Hence, a

reduction in test time and utilizing available test halls are important to accelerate the development cycle of future offshore turbines with 100m+ blades. In this paper, a novel segment test methodology for wind turbine rotor blades is proposed and its benefits are investigated with a numerical simulation. The proposed test methodology decouples a blade root segment and a tip segment to improve test quality and minimize test time by performing both segment tests independently in parallel while meeting the original target bending moment within specific overload limit (5% for flap direction and 10% for lead-lad direction). ——————————————————- Comment #2: For the segment testing method, the optimization for the test setups were performed. However, there was no description on the optimization of the overload distribution in Figure 3 for the full-length testing method. Since the authors compared the extents of the overloads for the two testing methods, test setups for the two testing methods must be optimized first and then the results shall be compared.

Author feedback #2:I changed plot for comparison between experimental data and optimization result for 100% full-scale blade (60m) with a paragraph belows. (also check the attached plot file). Attached Fig.3 shows it. Also,Fig. 10 shows all optimization results for 100%, 80%, 70%, but not experimental test. Test time between experiment (100%)and optimization result (100%) was already mentioned in Fig. 3. The difference was about 4%. So for better visualization, it was not plotted.

As an example, Fig. 3 shows an experimental overload distribution and an optimized overload distribution of a 60m blade in the lead-lag fatigue test. As a result of experimental fatigue test, the inboard areas of the rotor blade have already experienced the calculated loads from 20 years of life, but the test must continue to sufficiently load the under-stressed areas over 65% of blade length. Due to this “over-testing” or “overstressing” of the inboard blade area, structural damage increasingly occurs towards the end of the test, which must be inspected and if necessarily, repaired (DNV-GL, 2015). This can result in delays of several weeks in the process. The numerical optimization of a full-length blade fatigue test setup resulted in a better and reduced overload distribution as shown in Fig. 3, but it still shows under-stressed areas after 75% of blade length. Most of all, the increased test time (reverse of test frequency) cannot be ignored as a future offshore blade is getting bigger. Details of an optimization process will be addressed in section 2.2.

Comment #3: In Figure 12, for the segment testingmethod, the lack of the applied fatigue bending moments between the blade length of 50% and 70% is crucial for the blade certification. Since the purpose of the authors' research is developing a new efficient testing method for the blade certification, the authors must suggest a plausible solution about the crucial problem. Without that, it becomes just a paperwork not able to be used in real industry.

Author feedback #3: Some of information related to this are already mentioned in section 2.1, but I updated the paper with some more sentence for your answer as below.

If special interest between 50% and 70% are required, a significantly greater manufacturing outlay like overlapping segments needs to be performed at the separation point of root segment or a blade dummy representing mass and moment inertia of the tip segment could be fixed to the free end of root section as shown in Fig. 6.

———————— Author feedback on minor questions: Your corrections were very helpful. I corrected everything.

Thanks.

Best regards,

Kwangtae Ha

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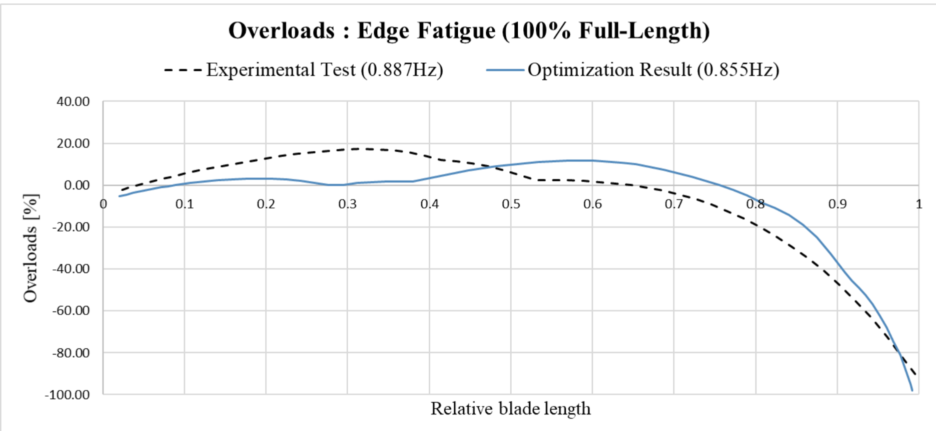

Fig. 1.