WIND ENERGY SCIENCE DISCUSSIONS

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Interactive comment

Interactive comment on "Characterization and Mechanical Testing of Manufacturing Defects Common to Composite Wind Turbine Blades" *by* Jared W. Nelson et al.

Anonymous Referee #1

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The manuscript addresses defects in composites in the form of fibre waviness. The characteristic fibre waviness observed in wind turbine blades is down-scaled to coupon test specimens, and the effect on mechanical properties is measured and analysed. The topic is relevant, and the experimental approach of the study is interesting and useful. There is however a number of major and minor critical things that need to be addressed before the manuscript can be recommended for publication.

- Figures 1 and 2 are central for the understanding of the approach taken with the measurements of OP and IP waves. These figures must be improved, e.g. by including a schematic drawing of a materials specimen in 3D showing the two types of waves. Also, the ruler representation must be identical. The edge of the material in Figure 2

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should be seen, to be able to identify the difference between OP and IP.

- At page 6, the equation (3) is correct and relevant. It is however not clear how and where the equation is used to scale the fracture strengths of the composites. This must be made clear.

- Table 2. It is not clear how the fibre angles are scaled down to coupon test specimens. There are several errors in the table, e.g. 1.9 mm instead of 1.7 mm, and 7.4 mm instead of 67.4 mm. It is also confusing that OP4A and IP1 are the two baseline settings of mean values, and then placed in the bottom and top of the table, respectively.

- It is not clear how the induced off-axis fibre angles in the specimens correspond to the wanted ones given in Table 2. This needs to be made clear.

- In general, throughout the manuscript, there are error messages at places where references are made to figures and tables.

- At page 4, line 3, it is not clear how the off-axis angle is determined. This must be explained.

- Figures 5 and 6. In each figure, the axes of the two diagrams should be the same, to be able to directly compare the magnitude of the OP and IP waves. It could be considered to show the results of OP and IP waves in the same diagram.

- Figure 6. Why are the results sorted from low to high by observations?

- It can be argued that the use of 3 figures and 1 table for presenting the results of the measured OP and IP waves is too much. It is recommended omitting Figure 6.

- Page 7, line 16, it is not clear how digital photographs were used to measure OP waves. Based on polished cross-sections?

- Figure 8, "Radiographic images"?

- Figure 9, the porosity must be indicated, are they shown by black or white spots?

- Page 9, line 9-11. It is said that the strength degradation correlates well with the average off-axis fibre angle. It would be more correct to say that the correlation between the two parameters is well described by a sine function. Later it is said that the average fibre angle is showing a better correlation than the maximum angle; how to see that?

- Figure 10. Use SI units. The fitting lines in (b) seem to be consisting of two lines (with transition points at about 10 and 13 degrees), and not made with a continuous mathematical function.

- Figure 10. There are no compression data in (a)?

- At page 9, last line, change to "start with fibre dominated failure and transit to matrix dominated failure mode"?

- Figure 11 shows a rather large variation in fibre angles between the 4 layers. This variation must somehow be included in the analysis as an uncertainty parameter.

- At page 10, line 16, it is said that failure stress is normalised by the part thickness. It is not clear how this is done, it needs to be explained.

- Figure 12, It seems that both lines should start in 1. There are many samples with really high content of porosity, up to 14%. How is it ensured that the effect of porosity is not larger than the effect of the OP and IP waves?

- Page 11, line 5, it is said that model predictions of load displacement curves were accurate to within +/-5%; where is that shown?

- Page 11, line 9, "Standard deviations shown for ultimate stress indicate the consistency of each test", what is meant by that?

- Table 3. What is meant by the "Porosity" column?

- Table 5, what are "CMD" and "BMT"?

- In the introduction, p. 1, line 27-28, the terms "advanced composite materials" and

"lower cost composite materials" seem to be in contradiction to each other.

- In affiliations, country is missing.

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