Wind Energ. Sci. Discuss.,
doi:10.5194/wes-2016-27-RC1, 2016

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Interactive comment on "Modal dynamics of structures with bladed isotropic rotors and its complexity for 2-bladed rotors" *by* Morten Hartvig Hansen

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Received and published: 10 October 2016

In my opinion the article presents a very interesting approach on periodic modelling the structural dynamics of wind turbines. The periodic dynamics for wind turbines are derived based on their Lagrangian. An eigen-mode analysis is presented using Hill's method for the periodic system. The method fully recovers the indeterminacy present for periodic models. The approach is applied to 2 and 3 bladed wind turbines.

The article is very well written technically and all the derivations are correct. It adds value to the field of modelling for wind turbines and uses a clear and correct borderline in the terms modes and degrees of freedom, which is often not correctly used in the today's literature. From my point of view there are some minor things the author might

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take into account.

Specific comments:

*) First, I think the article is a bit verbosely written at some parts. Some sentences are too long and it would be easier for the reader if sentences are shorter. For example, the last sentences in the abstract has over 60 words. From a readability point of view this is too much. There are other examples in the article where readability could be improved (for example, first sentence in 4.4. is also rather long). I think going over it one more time focusing on that will help.

*) First sentence on page 2: Here the author could be more precise. For readers not fully familiar with the transformation of the modes onto the fixed frame it would be helpful pointing out that each SET of modes of the individual blades (e.g., flapwise, edgewise, etc) is transferred to symmetric, (anti-symmetric), regressive and progressive modes.

*) End of section 2.1. a bit more physical insight could be given on the individual meaning of the matrices to guide the reader through the derivations a bit better.

*) It is probably worth having on or two sentences on the Largrangian modelling approach, which will help starting section 2.1. from a readability point of view.

*) The Model Assurance Criterion at the end of Section 3.2. could be explained shortly or referenced.

Result section:

*) To be honest it took me quite some time to understand figure 5-15. Specifically I got confused with the numbering of the modes 2-12 and how they relate to diagram 4. I think it is not straightforward to the reader that if the modal amplitude in on mode is the highest, it gets named after that mode and ends up as name tag in Figure 4. Probably a table would help here.

*) How is the mentioned naming decided on, as some modes change their highest contribution in the periodic eigen-vector (as in Figure 8).

*) Can the scaling factor of 10 for the drive train be physically be motivated?

*) The author mentions a threshold of 10% when a component of the eigenvector is plotted/considered or not. However this might change with rotor speed. How is this handled?

*) In the result section I do not understand why actually N=3 has chosen for the three bladed rotor if the 3rd harmonics seems to be close to 0 anyway. Further, for the 2 bladed rotor the decrease is linear (in the log scale), so it is not immediately obvious why N=7 is chosen and not 9 or 5 or something else. I really like the figure and the discussion in 4.3. as it explains why the Coleman works that well for a three bladed rotor (dominance of the N=1 term).

*) Figure 16 and Line 11 on p 26: “The tower fore-aft mode in Figure 16 couples again with $\pm$1/rev asymmetric rotor modes. . .” Shouldn’t that be a coupling of DoFs, as a mode per definition is decoupled (orthogonal) from all the other modes?!

*) I really enjoyed reading section 4.6. Probably a bit more weight can be put on this outcome as I think it isa major contribution and handles some misunderstandings in common literature.

*) From my experience (and from the results in the paper) the Coleman transformation works pretty well when the rotors are isotropic, so it would be interesting to see - and add value to the approach - what happens if applied to higher level of anti-isomorphic characteristics for a 3-bladed rotor, for example on the blades (however this might be future work).

Technical corrections:

*) Typos:

Page 3, Line 10: I think it should be "can be used to decompose" instead of "decomposed" Page 9, Line 2: "with more than two" instead of "mode than two"

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