Wind Energ. Sci. Discuss.,
https://doi.org/10.5194/wes-2018-69-AC1, 2019

Interactive comment on "Qualitative yaw stability analysis of free-yawing downwind turbines" *by* Gesine Wanke et al.

Gesine Wanke et al.

gesine.wanke@suzlon.com

Received and published: 10 January 2019

Thanks a lot for your effort and the very helpful feedback on our work. Answer to the specific comments: 1. Turbine blade number and regulation The turbine is three-bladed and originally with a variable speed generator and pitch regulation, with a constant power control strategy. However, the controller is not implemented and for all shown calculation and simulations a prescribed rotor speed and pitch angle are used according to the wind speed. 2. Rotor shaft intersection The rotor shaft intersects with the yaw axis and there is no offset between the shaft and the yaw axis. 3. Nomenclature list Nomenclature list can be implemented for a new article version. 4. Citation of Madsen 2018 The article is not published yet, however, we would prefer to cite their work if it is published by the time that a final version of this article is published. The full

BEM-code implementation is heavily based on their work and is a major reason for the relative good agreement between the simple BEM and the HAWC2 results. However, in case that it is not published by the time we submit a final version of the article, we will consider to add their work to the acknowledgements instead. 5. "Wind Turbine Engineering Design" by Eggleston and Stoddard Thanks for the additional reference, it will be checked. 6. Cost-effective solution It is true, that the yaw torque during normal operation will be lower for the free yawing downwind configuration. However, a full alignment with the wind direction cannot be guaranteed. Even without a tilt angle for the shaft, the tower fore-aft bending will result into such a tilt angle and therefore yaw misalignment. A misaligning effect can also be expected from any horizontal wind gradient or wind shear. A yaw misalignment will result into a significant power loss and therefore a decreased AEP. Considering the full turbine costs in terms of levelized cost of energy (LCOE) the whole yaw system has a very small impact. Even if a significant saving on the associated bearings could be achieved the impact on the LCOE will be very low. The loss in power due to misalignment, and the associated cost on the AEP on the other hand will be relatively high. The tower wall thickness is designed for maximum bending moment resulting from load cases with a turbine shut down and there are no cost savings associated with a change in the yaw concept. This study does not allow a conclusion if a downwind concept in general would be beneficial. However, there is no major cost advantage expected comparing a free-yawing downwind concept to a controlled yawing concept. 7. Equations in the appendix Authors will double-check these for a new article version

Answer to technical corrections (for questions only, requests of change will be implemented in a new article version): P(age)1 L(ine)21 – turbine tilt means the tilt angle of the shaft Figure 1 –grey lines in the vector triangles the grey lines in the vector triangles are supposed to show the original vector triangle as if the described effect was not present. It will be considered to delete the grey lines for clearer figures in a new version. P11 L12 steady state velocity triangle The steady state is describing the velocity triangle of Figure 4. This will be stated clearer to avoid confusion. Tis should also clarify the comment for the next line: the derivation is based on the inflow triangle, which does not include the induced winds on the rotor. These are associated later to the triangle, when the matrices are calculated in Matlab.

Interactive comment on Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2018-69, 2018.