Wind Energ. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/wes-2021-70-RC2, 2021

Comment on wes-2021-70

Georg Raimund Pirrung (Referee)

Referee comment on "Experimental analysis of radially resolved dynamic inflow effects due to pitch steps" by Frederik Berger et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-70-RC2, 2021

The article describes dynamic inflow experiments that are analyzed in great detail and shed some light on some of the less well known aspects of the subject.
Some of the findings were somewhat surprising to me, for example that the initial change in the average induced velocity during the pitch step was found to be 28% independent of the pitching direction.
But the measurements are presented clearly and the different measured quantities are consistent, which gives confidence in the experiment.

I suggest minor revision, because I only found some minor inconsistencies or points where further clarification is necessary:

- I think the angle 'theta' is not consistent between Equation (3) and Equations (11) and (12). In Equation (3) it is the sum of twist and pitch, and in Equations 11 and 12 it seems to be the inflow angle.
- Figure 11: I suggest to remove the irrelevant time constant tau_fast where k_free=1
- Figure 16: It could be made a bit more clear what is actually shown in the figure. If I understand it correctly it is abs((u-u_0)/u_0)
- Page 22 line 395 'High deviations are seen for Fthrust between strain gauge measurement and reconstructed loads, especially with the uA model, but also without the model, for both pitch directions.' Was the airfoil data 3D corrected? Without 3D correction the aerodynamics at the inboard sections might be inaccurately predicted by the load reconstruction procedure. This effect would be less visible on flapwise blade root moment and torque due to the short moment arms at the root section.

And I have some more small comments:

- 'tower bottom' bending moment is probably more frequently used than 'tower foot'
- Page 7 line 145 'With the geometrical angle of the rotor segment'. Maybe it is more clear to write 'with the geometrical angle between the chord of the local blade segment and the rotor plane'

- Page 10 line 230 'as a time lag on the angle of attack alpha'. You might add 'and has been extended to take the effect of camber into account'.
- Page 10 line 239 'unsteady aerodynamics model' -> unsteady airfoil aerodynamics model'
- Page 13 line 285 'influnece' -> influence
- Page 23 line 400 'the normalised overshoot for the Mflap and Fthrust is similar per pitch direction, whereas the overshoot in Maero is 3 to 4.5 times higher'. I believe this is because the dynamic inflow effect causes the inflow angle and angle of attack to lag behind the quasi steady value. The thrust and the flapwise moment feel the effect mainly due to a change in magnitude of the lift force (due to the lag of the angle of attack), while the torque feels this change in magnitude and also the change in the projection of the lift force in the in-plane direction due to the lag of the inflow angle (Equation 12). Because the thrust force is determined using the cosine of the inflow angle (Equation 11), the effect of the inflow angle lag is much smaller there.
- Page 28 line 563 'by the shed vortex from the tip due to the fast change in trailed vorticity'. In the literature, sometimes 'shed vorticity' is used to describe vorticity that is parallel to the span, and 'trailed vorticity' to describe vorticity that is perpendicular to the span. Maybe you could instead write 'by the tip vortex due to the fast change in trailed vorticity'