Specific comments on the modeling
1. While keeping one quarter of the trailing vortices can be viewed as a compromise in order to have low cost, a comment should be added. For a 3 bladed wind turbine this choice prevents the blade to sense the wake of the preceding blade which may play a role at low wind speeds.

- For the fast dynamic response we are mainly concerned about the most important effects from the blade itself. In the GENUVP vibration results there was only a very small influence from the other blades visible when more periods of oscillation were simulated, but instead the work in one oscillation stayed almost constant.
- This is also consistent with the 2D shed vorticity computation, where the shed wake from other blades is ignored.
- An option to include the aerodynamic interaction between blades on the far wake BEM grid (which is likely the reason for the post pitch step oscillations in the free wake code in Section 8.2.1) will be investigated in the future.

2. The split in X and Y components of W in eq (2) should be explained

- The X and Y components contain the contributions according to the two exponential functions in eq 1.
- There is only one component if the acceleration method proposed in Section 6 of the article is used.
- These explanations will be included in the revised article.

3. Adopting eq (1) suggests that the expansion of the wake should be taken into account indirectly by adjusting the constants. Was this aspect considered?

- At low wind speeds where the wake expands it is only convecting quite slowly, so after 1/4 rotation we are still close to the rotor plane and we expect that this effect on the near wake part is negligible.

4. In unsteady conditions the wake will also include radial vortex elements. Eq (15) intends to take into account the effect on the bound vorticity. In this eq the normal to the lifting line velocity v_r regulates the result. Does v_r correspond to the quasi-static set-up?

- The relative velocity is updated in each time step (as in the dynamic stall / shed vorticity model).

5. Since the near wake elements carry constant circulation, in unsteady conditions Kelvin's theorem will be violated. Was the option of switching to linear circulation distributions considered?

- It has been considered, however
    - the iteration procedure makes sure that the constant circulation trailed during a time step is not unrealistically high (which might otherwise lead to instability).

  - because the model is fast and used in an aeroelastic code, the chosen time steps will be in the order of 1 to 2 degrees blade rotation per time step, so they are small enough to ensure good results with constant circulation
  - implementing a linear distribution has so far been found difficult due to the approximations in the model

6. The CL slope of 2π originates from thin airfoil theory. This is not the case with thick airfoils. It would be interesting to check whether switching to different slope would improve the results.

- the 2π slope is only used in the approximation procedure for the relaxation factor (Section 5.2)
- the 2D unsteady airfoil aerodynamics (dynamic stall) model uses the actual slope of the airfoil
- the quasi steady circulation as basis for the unsteady circulation buildup is depending on the quasi steady lift coefficient from the airfoil polar
  - therefore the trailed vortex strength is also based on the lift coefficient from the airfoil polar
- the influence of using thick airfoil based time constants in the indicial functions for the 2D dynamic stall has been found to be small in [Bergami, L., Gaunaa, M. and Heinz, J. (2013), Indicial lift response function: an empirical relation for finite-thickness airfoils, and effects on aeroelastic simulations. Wind Energ., 16: 681–693. doi:10.1002/we.1516]

7. The implementation contains several constants. The question is whether they depend on the blade design or they can be regarded as universal

- The constants are either based on thin airfoils (2D models) or on the wake geometry (near wake model)
- it is shown how the constant Φ changes with helix angles in [Pirrung, G. R., Madsen, H. A., Kim, T., and Heinz, J. (2016) A coupled near and far wake model for wind turbine aerodynamics. Wind Energ., doi: 10.1002/we.1969.]
- so far we approximate the blade as a straight lifting line for the modeling of the near wake dynamics. Including prebend/sweep and deformations in the blade model would in principle also change the constants, mainly Φ

8. It is clear that the main concern is to keep the cost low. How does the run time compare with a pure BEM simulation?

- The computational effort for the aerodynamics is much higher than in a BEM simulation. In the context of an aeroelastic model, where the structural part is responsible for a large part of the computational effort, the near wake model can be used without a drastic increase in computational time. HAWC2 simulations have been found to run approximately 5-50% slower when the near wake model is enabled compared to BEM aerodynamics. The additional effort depends on the discretization (number of aerodynamic points and distribution), blade geometry and operating conditions, so it is difficult to give a single estimate.

Specific comments on the results
1. Figure 12. If the simulations take into account the proper pitch, why is the margin to instability smaller at 25m/s? Could that be due to the fact that at 25m/s the wake is convected faster than in the case of 8m/s?

- one assumption is that the computation is done without prior induced velocity
  - in the 8 m/s case where the induction is generally larger this larger induction will in practise help stabilise the computation
  - the large effect of the blade refinement indicates that the instability comes from the tip vortex, which is resolved over more trailed vortices in the fine case.

2. Full pitch steps: The discussion is based on two metrics: the slope of the axial force during the step and the post-step shape of the variation. With respect to the slope, the discussion could also include the angle of the spiral which should be bigger at more inboard stations. This may offer an additional explanation why BEM is in better agreement at r=31m for both steps as compared to the far outboard section. Also the fact that the post step oscillations seen in the free-wake model do not appear in the coupled model simulations may suggest that the exponential approximations of the dynamics of the circulation (and angle of attack) act as filters in particular as regards the radial wake vortex elements
(See previous point 4).

- The angle of the wake helix is included in the near wake model, so that should not be a reason for disagreements between the codes.
- The post step oscillations occur at 3p frequency and are likely due to the blades passing by the wake of the previous blades after the pitch step.

3. Partial pitch stepping: Although the load variation at r/R=0.45 is smooth in the coupled and free wake results as compared to BEM, the specific characterization may be misleading – smoothening is often connected to numerical damping or filtering while in the present case there is a physical mechanism that is driving this difference. The trailing vortex shed at the turning point will increase the incidence towards the root and decrease it on the other side.

- Yes, we clearly see the modeling of a physical mechanism by the free wake and the near wake code.
- A sentence making this more clear will be added in the article.

4. Aerodynamic work computations: The results clearly indicate that BEM modeling is conservative (mainly with reference to Case 2 in Table 2 for which the results are not subjected to dynamic inflow modeling specifics). However the damping in the edgewise mode remains negative. Did the simulations only considered the rotor and how the specific result can be interpreted?

- The simulations are purely aerodynamic and computed with a stiff turbine at fixed rotation speed.
- From these results, it appears that both shed and trailed vorticity reduce the absolute value of the aerodynamic work => positive damping and negative damping get smaller

- This is in agreement to the findings published in [Pirrung G, Aagaard Madsen H, Kim T. 2014. The influence of trailed vorticity on flutter speed estimations. Journal of Physics: Conference Series (Online). 524. Available from: 10.1088/1742-6596/524/1/012048], where negative damping of a flutter mode occured at a slightly higher relative speed when trailed vorticity was enabled