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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Multi-element ducts for ducted wind turbines: A numerical study" *by* Vinit V. Dighe et al.

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The authors highly appreciate the efforts of the reviewers for their valuable comments; this enabled improving the quality of the manuscript. The authors carried out the following revision to the manuscript:

Reviewer 1

1. In the introduction, the presentation of ducted HAWTs technology is not very clear especially as far as their working principle is concerned.

Additional statement detailing the principle of DWT is added.

2.The reviewer recommends to verify the validity of the adopted approach by re-

analyzing a few selected configurations, especially at high deflection angles, with an unsteady CFD approach.

The authors verified and validated the effects of unsteady flow in the numerical validation section. The authors response to this is that although unsteady simulations increase the level of description of the unsteady flow due to the multi-element duct-AD interaction, the computing cost issued by going from RANS to URANS does not justify the scope of the current study, where the effects of distributed AD loading, wake rotation, divergence and inflow yaw angle are totally ignored.

3.Upon examination of Figures 7,8 ,10, 11, however, the discrepancy between the two methods seems to be much higher.

The authors re-checked and rectified the numbers.

4. Some errors are present in the paper

The authors rectified the errors.

Reviewer 2

1. Which is the contribution to the paper of the panel method?

The panel method, as expected, proved incompetent when tested for 'more aggressive' duct geometries. However, the panel method was able to capture the global trend and the local maximum for the parametric study investigated in $\frac{1}{10}$ the time required for RANS computations.

2. The application of a steady CFD scheme does not count for the effects produced by the passing wakes shed by the rotor and by the flow radial non uniformity, both on the flow field inside of the duct and, in particular, on the inner wall.

The response to this review is identical to the response 2 for Reviewer 1. The authors verified and validated few selected configuration using URANS approach. The authors found that although unsteady simulations increase the level of description of the unsteady flow due to the multi-element duct-AD interaction, the computing cost issued by going from RANS to URANS does not justify the scope of the current study, where the effects of distributed AD loading, wake rotation, divergence and inflow yaw angle are totally ignored.

3. It is not clear why authors prefer to refer to a 2D symmetrical scheme rather than to an axis symmetrical one, which is definitively the most suitable one to represent a rotating machine as a turbine, even in a simplified and steady simplification.

An axisymmetric domain would be indeed suitable for the RANS computations; it would be computationally efficient. However, panel code is written suitable for a planar configuration, where axisymmetricity is achieved using a symmetric condition along the centre line axis. For reasonable comparison, similar boundary conditions are chosen for RANS computation.

4. very short description of the "FAN condition" should be reported in the paper for clarity reasons and reader's convenience.

The authors added a short description for the clarity of the reader.

5. The reference Re number is not reported in the paper, not for the val- idation cases, nor for the application ones. Please provide.

The authors specified the Re number in the appropriate sections of the manuscript.

A comparison of the obtained results to the 1D momentum theory applied to ducted wind turbines, at least in terms of maximum expected power augmentation coefficient, should be included in the paper. Please provide.

The authors included the comparison of r_{max} calculated using CFD methods with the AMT approach. Moreover, the calculation for the same is presented in the appendix section.

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