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Interactive comment on "Computational Analysis of High Lift Generating Airfoils for Diffuser Augmented Wind Turbines" *by* Aniruddha Deepak Paranjape et al.

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April 7th 2020 by Gerard J.W. van Bussel TU Delft, The Netherlands

1 Summary

The manuscript presents a rather straightforward numerical analysis of a 2D configuration consisting of two mirror-imaged airfoils with an actuator surface in between them. This is a numerical simplification of an axisymmetric diffuser augmented rotor, with the aim to assess its performance in terms of augmented flow velocities at the actuator surface. Twelve different airfoils have been considered and numerically simulated for

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a given geometric setup. After an evaluation of these airfoils a reduced number (9) of airfols is selected for a second series of simulations. In this second series the angle of attack of the airfoils is varied and from that result a third limited selection was made of 6 remaining airfoils. For these airfoils the effect of an added “flange” on the performance is numerically investigated. These efforts result in a best performing shroud airfoil, the Eppler E423.

2 Quality

The numerical simulation are performed according to state of the art technology using commercial available software. As such the quality of the simulation and hence the results are good.The information presented around the setup and simulations is not always complete, and this should be repaired, but that is a fairly minor issue.

3 Limitations

But what is considered limited in the study, in fact it is considered too limited, is the scope of the work. The whole effort was aiming for selecting a best performing airfoil for a given diffuser setup. But from the performed simulations a lot more useful and important information can be drawn, and this was not done, or at least not presented. Since there is such a very straightforward goal, the section on Results and Discussion is hardly used to reflect on the approach and the simulation results. It is more or less confined to presenting the "best" and the "worst" geometry and the corresponding numbers.

4 Suggestions for increasing the value of the work

4a. Content improvement: In order to make the manuscript a lot more valuable, and to my opinion also bring it quality-wise to a proper WES manuscript is that the authors should to go back to their simulation results and extract more key data. So extract more results from the various simulations already performed, present these as well, and then write a decent in which you discuss the results. Additional information should e.g.

contain the pressure distributions around a selected set of airfoils at around optimal angles of attack. The main reason for this interest in the cp distributions is that these will be distorted compared to the distribution over an isolated airfoil, mainly due to the presence of the actuator “disk” (a 2 dimensional energy extracting device) in between the two mirror-imaged airfoils. The distortion not only shows the local effect of the actuator disk on the cp distribution around the airfoil, but also the change in the overall lift and drag.

And these Cl and Cd and their changes compared to the ” isolated airfoil” values are key parameters in proper understanding of DAWT energy extraction and performance principles. Determination of the radial component of the aerodynamic force on the shroud is a direct indicator of the effectiveness of the shroud, under the presence of the actuator disc. And determination of the axial component (the thrust on the shroud) is key for understanding the momentum exchange principles for DAWT’s.

This means that I would strongly recommend the authors, if possible, to re-assess their results of the performed numerical simulations, extract airfoil pressure distributions for selected numerical setups, compare some of them with the isolated airfoil pressure distributions. Then determine lift- and drag coefficient and/or radial and axial force (thrust)coefficients on the duct and present them.

4b. Manuscript structure improvement: Elaborate on the present and the new findings in an extended Results section. Then write a separate Discussion section in which you reflect on the approach and the results. And then come up with a short final Conclusions paragraph.

The more detailed comments and suggestions can be found as review comments in the annotated PDF file which is attached to this review

Attachment: wes-2020-14 review GvB.pdf

Please also note the supplement to this comment:

https://www.wind-energ-sci-discuss.net/wes-2020-14/wes-2020-14-RC1-supplement.pdf

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