Wind Energ. Sci. Discuss.,
https://doi.org/10.5194/wes-2020-14-AC1, 2020
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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.

Aniruddha Deepak Paranjape et al.

radha.parikh11@gmail.com

Received and published: 9 May 2020

The authors appreciate the efforts of the reviewer for his valuable comments especially with respect to the content improvement and the improvement of the structure of the paper. The paper has been modified following the reviewer suggestions. However the reviewer has some specific questions which have been answered below:

1. "This type of introductions is somewhat superfluous for a journal like WES. You may skip this and focus somewhat more on "hot spots"for DAWT's if you like. Otherwise skip it."

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Discussion paper

Taking the comments into consideration the introduction has been suitably edited adding clarity.

2. “This is, stricktly spoken, not the case. The direction of the flow is changing across the blades. In the inertial frame of reference the major effect "seen" is a change of total pressure while the axial component of the incoming wind velocity is not changing, at least not when passing the rotor plane.”

   The authors understand the reviewer’s concerns regarding the the introduction of the AD section, it has since been edited keeping the reviewer’s comments in mind.

3. “figure 2 one would not conclude that the area ratio is indeed 1.84. Is there something that I do not understand? Please clarify!”

   The authors concede that there has been a mistake in the manner in which the image was titled. Appropriate corrections have been made.

4. “why do you call this a gene pool? This naming suggest you go for some genetic algorithm to generate new hybrid airfoils, but that is not done, at least not in this article.”

   The term genepool is a bit of a misnomer in this case. The authors simply wanted to highlight that the 12 airfoils are considered as a pool and not a genepool. The term has since been removed from the remainder of the paper.

5.

   (a) “And also add the set value for the thrust on the AD. Then clarify why you have chosed for that number and whether it is constant over the AD or the integrated value over the disk for varying axial velocity.

   (b) and what about the thrust value on the AD? Is that kept constant? Clarify this!

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(c) what value?? (see above remark)!

(d) But I think it is key to provide the calculated thrust on the duct as a function of the thrust on the AD! So please add this information, which is implicitly generated and can hence be provided from your CFD implementation! This will significantly increase the value of this article! And the thrust coefficient is kept constant? And at which value?"

The above question is multi-part but all the questions hint at the fact the details regarding the coefficient of thrust were insufficiently highlighted in the paper. The thrust coefficient is $_T = 0.767$ obtained from experimental data conducted by Dighe et al. (On the effects of the shape of the duct for ducted wind turbines). A moderate value of thrust coefficient has been taken into consideration to evaluate the aerodynamic performance of the diffuser. The value and relevant clarifications have been added to the revised version of the manuscript.

6. "This needs some clarification. Do you mean that the ratio between the diffuser exit area and the area of the location of the AD is constant? And if so, you should provide its value (is it 1.84 as in Igra's experiments or different?). So this means that the angle of attack of the various airfoils considered in this first stage differs from airfoil to airfoil? Please clarify this."

   The area ratio is defined as the ratio of the diffuser exit to the area of the actuator disk plus the tip clearance. The authors understand that there has been some confusion regarding this definition in the paper. The area ratio is maintained constant by keeping the angle of attack of the airfoils as $0°$. This is the basis of the evaluation of the first stage. The revised manuscript has corrected this by keeping common terminologies across the paper for a clear understanding of the concept.

7. "You need to elaborate this. What exactly is your criterion to eliminate airfoils? Is it the achieved velocity augmentation? And since you do not modify the angle of

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attack of a given airfoil it might well be eliminated because it is operating in an off-design operational setting point." The results section and other sections do not clearly highlight the above mentioned concern of the reviewer. The elimination is based on velocity augmentation. The velocity augmentation is compared to the test case and if the criteria of augmentation the airfoil is eliminated and the remaining airfoils are carried forward. The methodology employed is inspired from the one employed by Dighe et al. (On the effects of the shape of the duct for ducted wind turbines).

8. "Can you clarify the importance of this figure? I don't get it. Especially not the importance of the thickness ratio. Is this because of structural considerations? And why not present the camber of the considered airfoils because I can imagine that that is an important parameter creating superior diffuser performance."

   The authors understand that the previous manuscript had not been clear in highlighting the results of the simulations relevantly. The new manuscript has a revamped result section that takes into account the various points the reviewers had made, including appropriate and relevant graphs.

9. "But that would mean that the optimised aoa for e.g. all the Eppler airfoils considered is equal to 15 degrees? I can hardly imagine this! Elaborat on this!!."

   Based on our simulation data the maximum velocity augmentation was found to be almost consistent with a single angle of attack across the airfoil family that was under consideration. Simulations were performed in accordance to the simulation methodology as mentioned in the paper.

10. "A number of observations need to be made with this result:

    (a) the location of the AD does not seem to be in the "throat" of the diffuser. Why not?

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(b) is the area ratio in this case defined as the ratio of the exit area (the diffuser area at the location of the trailing edge) and area of the AD (+tip gap?)

(c) can be clearly seen from the resulting velocity contour that the cp distribution differs from a normal cp distribution (a cp distribution of the same single airfoil). It is quite interesting, and important, that you present some of these pressure distributions in this article. E.g. two cp distributions at either the same a.o.a. or two distributions generating the same Cl. That will certainly help in better understanding the AD-diffuser interaction and hence strongly enhance the value of this article!"

(a) The position of the AD is fixed in the nozzle of the duct, which is the region of the narrowest cross section of the duct. This assumption corresponds to previous work done in the field of DAWT.

(b) The area ratio is indeed the ratio of the exit area and the area of the AD with the tip gap accounted for.

(c) The The authors have considered the suggestion of the reviewer some changes have been made to the new manuscript.

11. "You need to be more precise about the flange. What is the size and how is it mounted on the airfoil. EG: by adding a flange with a length xxx mounted at an angle of yyy degrees with respect to the pressure side of the airfoil...."

    The authors note the suggestion and changes will be incorporated in the new manuscript. However, the flange has been added in accordance with the work performed by El-Zahaby et al. (CFD analysis of flow fields for shrouded wind turbine's diffuser model with different flange angles). The flange length is 30% of the chord length of the airfoil, at an angle of 15 deg with respect to the vertical on the pressure sides of the airfoils.

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12. "It would help if figures 5 and 6 have the same legend."

    Relevant changes will be incorporated in the new manuscript.