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Comment on wes-2021-45

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Referee comment on "2D Numerical Simulation Study of Airfoil Performance" by Nasser Shelil and Fahad Awjah Almehmadi, Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-45-RC1, 2021

- I suggest the following structure for Section 3:

3. Results and Discussions (Which has no content now)

3.1 Model validation

Right now this section doesn't contain any material as result or discussion. Most of the text here can be in section 2.3 (Numerical setup) while talking about numerical simulations' initial and boundary conditions and solution algorithm. I think it's a good idea to merge 3.1 and what you have as 3.2 under this subsection. Basically, in this subsection, you are observing Cl and Cd of 7 turbulence models in order to find the best turbulence model in comparison with experimental results.

3.2 Effect of Angle of Attack (AOA)

From this subsection, only the results from the RSM turbulence model are presented. In this subsection which I suggest containing the material from both 3.3 and 3.4 of the current draft, you can present all the results which represent the effect of AOA.

3.3 Effect of air temperature

3.4 Effect of air speed

3.5 Effect of turbulence intensity

- The first sentence talking about Figure 3. You say it is a comparison of 7 turbulence models and theoretical? What do you mean by theoretical? Maybe you mean experimental.

- AOA<-5: You write: "noticeable deviation between experimental results and experiments". I think you need to correct the sentence.
- AOA>10: you say k-w and RSM have the best approximation. From what I see, the orange line (inviscid) is capturing the experimental results beside k-w. In both Figures 3 and 4, the inviscid model shows relatively the best performance; then, why did you choose RSM for the simulation of the flow in the next subsections? I think you need to explain this clearly.

- Effect of AOA: line 321 of the current pdf. You say on the trailing edge the flow stays laminar even on the higher AOA where we should see the separation. Basically, RSM is unable to capture the separation happening on the trailing edge which maybe can explain the difference between the RSM model and experimental results at AOA>10. However, you call it the reason that airfoil aerodynamic performance and experimental results are in agreement and coincide.

- Effect of temperature:

The aerodynamic characteristics of an airfoil are usually represented by Cl, Cd, and their ratio (AKA L/D), and not lift and drag forces which are directly affected by the air density.

According to the definition of lift and drag force, both of them decrease at the same rate when the temperature increases. As they both decrease at the same rate, they can cancel out each other in L/D and it may have no information about the effect of temperature on the aerodynamic performance of the airfoil. As we see no difference between Cl and Cd profiles in different temperatures. The goal of this section is in the first sentence as "investigating the effect of changing air temperature on the airfoil characteristics"; the

difference between lift and drag force in different temperatures cannot explain this.

Technical comments

- The definition of lift and drag and their coefficients can be relocated from Introduction (line 26 to 35) to section 3.2 where it is more relevant.
- Section 3 starts with the description of the computational grid; this should be in section 2.3 where you talk about numerical simulations which I suggest calling "numerical setup".
- I recommend starting section 3.2 directly by discussing/defining lift and drag etc. There is no need to talk about the turbulence models again.
- Section 2.1 title is suggested to be "Experimental setup".
- Section 2.2 title is suggested to be "Mathematical modeling".

Section 2.2 is devoted to describing 7 different RANS models; thus, it is more impressive to have 7 subsections, each one dedicated to one of the turbulence models. This is much easier to remember and less confusing for the readers. I suggest moving the content of 2.2.2 to 2.2 . Starting 2.2 with the sentence "In CFD, RANS is …"

- Define the abbreviation form of Angle of Attack at the beginning as "AOA" and use it everywhere in the paper instead of the long-form or other forms like "attacks of angel".
- Line 383, the section of TI: change in the drag coefficient with the variation of air temperature! Here you are talking about the effect of AOA.