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Comment on wes-2021-49

Anonymous Referee #1

Referee comment on "Experimental study of the effect of a slat on the aerodynamic performance of a thick base airfoil" by Axelle Viré et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-49-RC1, 2021

The manuscript describes a well setup experimental investigation on the impact of a slat device on a relatively thick wind turbine airfoil. The conclusions are well founded and agree with current results obtained by other working groups. The state of konwledge is well captured and reported.

Nevertheless, there are a few topics that need to be addressed, which are outlined according to their appearance in the text.

page 5, table 1: The setup of the different cases for slat positions is hard to remember thruoughout the manuscript. It is suggested to rearrange the table for clarity:
columns; gap
rows: deflection
entries: config letters
This would make it clearer afterwards to see, which configs have same angle and which have same gap

page 5, line 83f: Can you give any details on the geometric properties of these vortex generators as they are different from those listed a few lines down. How do they compare to other experiments of 2D wings

page 5, line 87ff: Is there a refenece on the design of these values for the VGs - as they differ from those reported by Godard & Stanislas (2006, https://www.sciencedirect.com/science/article/pii/S127096380500163X) to be optimal. Godard & Stanislas also linked the optimal height to the boundary layer thickness, not to the wing chord. So, what are the assumptions on the boundary layer thickness for selecting the VG parameters.

page 6, line 94: the number of pressuere ports seems quite low number for pressure integration, especially on the slat nad espcecially for drag (in case where the wake traverse data gets doubtful). Did you check the pure integration error.

page 6, line 99f: The correction of Allen & Vincenti (NACA TR-782, 1944) is not a correction of the pressure distribution but a correction of the lift and moment coefficients as well as the effective incidence. They can be applied to the integrated values from the uncorrected pressure distribution. But the drag term is often omitted (see AGARD-AG336) especially for 2D airfoil measurmments since measurment inaccuracy of the drag coefficient can have a high impact on the corrected values of lift and pitching moment coefficient. The pressure distribution should be only corrected by teh blockage/wake-blockage corrections to take into account inaccuracies in static pressure and flow velocity.

page 6, eqs. 2-6. Please be precise to the referenceing of the corrections. Not all terms are found in AG-336 and NACA TR-782 (e.g. terms t1 and t2), and most likely origin from the older AGARD AG-109. c, h and t are not explained.

page 7, line 134: Incase results should be disregarded since they are definitely questionable, it would be better to not show them at all.

page 7, line 136: referecne to fig 8 is out of sequence (decribed before Fig.7)

page7, line 138: "except" in which sense? The mentioned increase of stall angle and lift coefficient is also there for this case - or is it the 2.5 increase factor?

page 7, line 139f: please explain, why cambering delays the stall? Usually, it doesn't increase the angle of attack where stall occurs, but the lift coefficient at same incidence.

page 7, line 140f: please be precise whether you discuss the lift coefficent at same incidence or the maximum lift coefficient. Anyhow, the mentioned comparison is hardly observed in Fig.5

page 7, line 142ff: sure? or is it due to the scale - the high values in the separated regime make the differences in the low alpha range hardly visible. In fact, one would expect a drag increase in the low incidence range with the slat due to the additional friction losses. And the drag reduction at higher incidenes is simply by suppressing the separation!

page 8, figure 6, The scaling of the drag coefficient is emphasizing the differences in the regime where the fllow is separated (and where drag measurements are questionable). It would be better to change the scale to lower CD values (e.g up to CD=0.2) highlighting the differences in the attached flow regime, which are not visible due to closeness of values and size of symbols

page 8, line 158: typo: insert "by" ahead of "Steiner"

page 8, line 161: This is a misleading argumentation. Since this is a channel, of course the pressure on both sides is similar. But it is not the high pressure on the slat lower side but the slat circulation that reduces the pressure level on the main wing (see Smith (1975))

page 11, figure 10: as a hint for future research: It is hard to argue on the boundary layer state without a clear reference. Thus, it is usual to place an artificial dustrubance somewhere in the laminar region to see the color difference of laminar and turbulent wall temperature

page 11, line 190: Be careul with the naming "clean airfoil" - decide whether it means "swithout tripping" or "without slat"

page 12, line 201: not "past" - or if yes, please tell how, you get IR images of the free air flow.

page 14, figure 16: A direct comparison to the data in fig 9 in one graph would help to see and explain the differences.
In fact, as the lower side is that much affected, this seems to be more than just an effect of laminar/turbulent transisiont, but there is a risk of over-tripping. In this view, the reference used is dealing wiht dstributed roughness elements, while the used method is a zig-zag-tape. It my be likely (and supported by the reults, that the tripping is too thick for only removing the risk o the lamaminar seperation bubble, see e.g. AIAA-1997-0511. All in all, you should decide, whether you really want to open up this question in this context. In fact, to verify that the tripping wa appropriate, a more detailed study on different trippings would be needed. to exclude "overtripping".

page 16, line 228f: There is definitely an optimum slat position, wee Woodward & Lean, 1993 (AGARD-CP-515) !

References:

Reference ot AGARD AG-336: in case of summary report the edoir shall be named:
Ewald, B.F.R. (ed.), Wind Tunnel Wall Correction, AGARDograph 336, AGARD, 1998.

Reference to Allen & Vincenti: The Report NACA TR 782 is of 1944.

Reference to "Jaume": the last name of the first author is "Manso Jaume" - or only "Manso" (it's Spanish, thus two last names are common) - please also correct in the text (page 2, line 44).