

Specific questions and comments to address for the paper entitled ‘Numerical airfoil catalogue including 360° airfoil polars and aeroacoustic footprints’

Summary: In this article, in a first step the authors present a methodology for generating 360° airfoil polars and aeroacoustic characteristics by means of CFD and CAA. Moreover, results are presented for ten different airfoils and the results obtained by the aforementioned procedure are validated against experimental data of well-known airfoils. Moreover, in this work it is shown that by combining two data-sets obtained by different turbulent models and meshing typologies results show good approximation with experimental data. In a second step the authors provide the aeroacoustic characteristics for a wide operation range. Specifically, the corresponding overall sound pressure level for five angles of attack for six different airfoils is presented and the difference between a fully turbulent computation and simulations with fixed transition is assessed.

*Below, my comments are categorized as being either Major concerns or Minor concerns, where the former relate to conceptual technical critiques while the latter relate to grammatical/spelling errors. My recommendation is **major revisions**.*

A: Major Concerns

1. Abstract: In the abstract, the authors have described what they have done, but they do not explain what the main purpose of this paper is (i.e. to use the data for real wind turbine blades). Also a sentence is required explaining the most relevant results of the second section of the paper (regarding the aeroacoustic footprints).
2. Introduction, p1, line 28: Can you reference the following statement with an existing publication? ‘...aerodynamic coefficients for the use in wind energy applications need to be provided for the complete range of angles of attack (from 0° to 360°)’.
3. Introduction, p2, lines 6-7: Can you include a reference to the following statement? ‘These approximation methods are mostly based on a combination of harmonic functions and require certain empirical input parameters’
4. Tools and Methodology, p3, Figure 1: What transition location means?
5. Tools and Methodology, p6: Why do you chose a speed of 40 m/s? You should reference the selection of the inflow velocity, or discuss your arguments for choosing this velocity. Maybe you can compute the relative inflow velocity of a given wind turbine blade, given a standard inflow velocity to the rotor (for example 10 m/s) and knowing the rotational speed of the rotor through the power curve of a given wind turbine. Then you can also justify the selection of the Reynolds number for the analysis. You might include this analysis into your paper.
6. Tools and Methodology, p6, line 14: How did you select the turbulence intensity?
7. Tools and Methodology, p10, line 31: In lines 15-19 you state that you perform simulations for four different combinations of Mach and Reynolds numbers, instead in line 31 of page 10, you state that you perform five different combinations as illustrated in Table 5. Please correct the statements from lines 15-19.
8. Tools and Methodology, p11, line 7: Why did you only consider airfoils with relative thickness smaller or equal than 25%?

B: Minor Concerns

1. Abstract: Please, spell out CFD, CAA and SST.
2. Introduction, p1, line 21: Can you spell out the DLR project RoDeO?
3. Introduction, p1, line 23: Change ‘has’ by ‘have’.
4. Introduction, p1, line 25: Change ‘Blade Element Method (BEM)’ by ‘Blade Element Theory (BET)’.
5. Introduction, p1, line 25: Remove ‘method’.

6. Introduction, p2, line 5: Add a comma after ‘*methods*’.
7. Introduction, p2, line 5: Do you mean ‘*exist*’ instead of ‘*exit*’?
8. Introduction, p2, line 18-19: Sudden change between topics. Can you include a sentence that connects the previous statements with the paragraph that starts in line 19? For example, you can state: ‘*Another problem encountered in full-size wind turbines is...*’.
9. Introduction, p2, line 26: Spell out BPM model please.
10. Introduction, p2, line 28: Spell out TNO model please.
11. Introduction, p2, line 29: Change ‘*In total*’ for another connector, such for example ‘*generally*’ or ‘*commonly*’.
12. Introduction, p2, line 29-30: I don’t understand what do you mean by stating that a separate validation is often lacking in detail. Do you want to say that a separate validation should be required? Rewrite this sentence please.
13. Introduction, p2, line 31-34: Use the same verbal tense for the entire paragraph.
14. Tools and Methodology, p3, line 3: Rewrite the first sentence and explain what is the framework. For example, you can start this fist paragraph as: ‘*A chart illustrating the framework used to generate aerodynamic polars is shown in Figure 1.*’
15. Tools and Methodology, p3, line 6: Spell out TAU.
16. Tools and Methodology, p3, line 9: What LILO and COCO mean?
17. Tools and Methodology, p3, line 13: What the program POT means? Can you spell out this program name?
18. Tools and Methodology, p3, Figure 1: Change the caption of the figure to be more explicit. You can write something like: ‘*Chart describing the framework for generating aerodynamic airfoil polar tables*’.
19. Tools and Methodology, p4, last 3 paragraphs: Combine the last three paragraphs of subsection 2.2 in one paragraph.
20. Tools and Methodology, p6, line 1: What do you mean by ‘*The velocity an airfoil on a wind turbine*’? Maybe you want to say that the relative velocity of a wind turbine blade depends on the radial position, right?
21. Tools and Methodology, p6, line 2: There is no relationship between the second sentence of line 2 page 6 and the sentence that starts in line 3 with ‘*Nevertheless*’. Paragraphs you can rewrite this.
22. Tools and Methodology, p6, line 7: Do you mean from -180 to 180. If not, why 170? And, what is the difference between the first sampling rate of 2 degrees and the second sampling rate also set as 2 degrees? Which are the other regions where the sampling rate is equal to 5 degrees?
23. Tools and Methodology, p6, Table 2: Can you set the exponents as 10^6 instead of e6?
24. Tools and Methodology, p7, line 3: Can you cite any other work from Gerrit Heilers instead of saying that he programmed a set of python scripts? Otherwise omit the reference to the author’s name.
25. Tools and Methodology, p7, line 8-9: You might omit the following sentence: ‘*If one or more computations or even the whole DOE crash due to convergence, other software or hardware errors various techniques for restarting the computations are available*’, since it is not relevant information by the reader.
26. Tools and Methodology, p8, line 10: You are missing the subject of the sentence in the sentence that starts with ‘*Latter*’, and, can you clarify what is set to 2 and why?
27. Tools and Methodology, p8, line 26: Change $c_{l,max}$ to $C_{l,max}$.
28. Tools and Methodology, p9, lines 15-19: Rewrite the paragraph that comprises lines 15 to 19 for a better understanding of the procedure. You can rewrite this paragraph as follows: ‘*Unlike the aerodynamic analysis, where only one representative Mach- and Reynolds number was chosen to determine the aerodynamic coefficients, for the aeroacoustic analysis five different combinations of Mach- and Reynolds numbers are selected. This is because from the aeroacoustic point of view, the flow velocity has a greater impact on the emitted sound than its viscosity.*’

29. Tools and Methodology, p11, line 2: Change '*Radius*' by '*radius*'.
30. Tools and Methodology, p12, caption of Figure 6: By writing $f_{max} = 10...60$ kHz, do you mean maximum frequencies from 10 to 60 kHz? Can you clarify this statement please?
31. Tools and Methodology, p12, line 7: Change the dashes that enclose '*spectrally resolved*', or you can include a space before and after the dashes.
32. Tools and Methodology, p12, line 20: Change the dashes that enclose '*in motion and regarding the directivity function towards the observer*', or remove them.
33. Tools and Methodology, p13, line 12: Remove '*Aeroacoustic Results*'.
34. Tools and Methodology, p13, line 17-18: Write eq.1 or simply equations 1 and 2. Same applies for equation 3 in line 18.
35. Tools and Methodology, p13, line 19: Change the dashes that enclose '*in the guise of Power Spectral Density (PSD)*', or you can include a space before and after the dashes.
36. Tools and Methodology, p14, Figure 9: Change the labels of Figure 9 to L_p (dB) and f (Hz), and include the values of the y-axis.
37. Tools and Methodology, p14, Caption Figure 9: Change '*...test condition at 4° angle of attack...*' for '*...test condition for an angle of attack equal to 4°...*'
38. Aerodynamic and Aeroacoustic Results, p16, Figures 10, 12 and 13: Be consistent with the plot labels and the text. If in the text you use C_l use the same nomenclature for the plot labels instead of $CLift$.
39. Aerodynamic and Aeroacoustic Results, p16, line 3: Change C_{lmin} by $C_{l,min}$.
40. Aerodynamic and Aeroacoustic Results, p17, line 6: Space needed between *than* and -16° .
41. Aerodynamic and Aeroacoustic Results, p17, Figure 14 and 15: Be consistent between the labels of the figure and the text.
42. Aerodynamic and Aeroacoustic Results, p18, line 2: Change C_{lmax} by $C_{l,max}$. The same applies for the rest of the text.
43. Aerodynamic and Aeroacoustic Results, p19, line 21: Change $1e6$ to 10^6 .
44. Aerodynamic and Aeroacoustic Results, p22, line 10: Space needed between '*Method 2.*' and *At*.
45. Aerodynamic and Aeroacoustic Results, p22, line 21: Include Figures from 26 to 55 in an Annex Section.
46. Aerodynamic and Aeroacoustic Results, p26, line 4: Remove '*Processing of the aeroacoustic data*'.
47. Aerodynamic and Aeroacoustic Results, p26, line 5: Remove '*Spatial results*'.
48. Aerodynamic and Aeroacoustic Results, p26, line 7: Remove '*Overall sound pressure levels*'.
49. Aerodynamic and Aeroacoustic Results, p26, line 16-17: Remove '*Directivity functions*'.
50. Aerodynamic and Aeroacoustic Results, p27, Figures 58 to 63: Change the labels of Figures to L_p (dB) and f (Hz), and include the values of the y-axis.
51. Aerodynamic and Aeroacoustic Results, p27, line 9: Include a space between the numbers and the units, $l_c = 0.101$ m.
52. Aerodynamic and Aeroacoustic Results, p29, line 2: Change the dash before the text '*even in RANS mode*', or you can include a space before the dash.
53. Aerodynamic and Aeroacoustic Results, p30, Figure 64: Change the labels to OASPL (dB) and α ($^\circ$), and include the values of the y-axis.
54. Aerodynamic and Aeroacoustic Results, p30, caption of Figure 64: By writing $f = 0, 125...12, 5$ kHz, do you mean frequencies from 0,125 to 12,5 kHz? Can you clarify this statement please?
55. Summary and Discussion, p32, line 2: Can you include a reference to the approach proposed by Sørensen?