

## ***Interactive comment on “An investigation of unsteady 3D effects on trailing edge flaps” by Eva Jost et al.***

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General comment:

The paper investigates three dimensional and unsteady effects of a moving trailing edge flap on the aerodynamic loads of DTU 10 MW reference turbine through CFD analysis. Emphasis is given on less understood till now three dimensional effects which are definitely not captured by existing state-of-the-art BEM based aeroelastic tools used in the assessment of load alleviation capabilities of flaps. The work is very interesting and relevant to the research work recently undergone in EU funded projects INNWIND.EU and AVATAR.

Specific comments:

C1

-In section 2, consider moving equation 2 up below equation 1, and add “According to Theodorsen’s method the lift is given by:” and explain the terms of the equation afterwards.

-In section 2, I believe it is not mentioned in the text what is the amplitude of the periodic flap motion used in deriving the results of figure 2. An idea could be to plot transfer function results of  $DCL/D\beta$  in figure 2 instead of DCL.

-In section 3.5, second paragraph. It would be instructive for the reader if you describe in detail inflow/operational conditions that lead to the dimensionless parameters used in the 2D analysis. For example inflow velocity, rotational speed (or tip speed ratio), spanwise position of the section.

- In section 4.1, page 10, below line 10, it is the effect of the induced drag that the authors are describing. When the flap angle increases, lift increases so the intensity of the trailed vorticity increases, and therefore downwash and induced drag increases while effective AoA decreases. The opposite happens at negative flap angles. A similar discussion is made on section 4.3. It is again the effect of the induced drag that differentiates the  $C_{dmean}$  over  $C_d$ . The comment here is that it seems that discussions in sections 4.1,4.2 and 4.3 are somehow separated although they should be finally linked together. Especially the results of figure 16 and 17 must be linked to the results of figure 10,11 and 12. Also the concept of the induced drag (which is a consequence of course of the downwash effect) could be introduced.

-Also in section 4.3. Why do we need AoA for in a CFD simulation? The only reason why we would like to have a consistent definition of the AoA is in order to be able to compare against BEM or lifting line models and tune them. Perhaps this objective should be pointed out in the text because otherwise the need for paying so much attention on extracting AoA is not clear.

-The term downwind/upwind is used for the effect of induced velocities. Perhaps it would be better to use upwash/downwash.

C2

Technical comments. Some editorial typo/syntax changes,

-Page 2, line 17, "However the blade parts next to the flap...", could be better to replace "next" by "adjacent"?

- Page 2, line 23, "...which in turn influences (in the) blade loads"

-Page 3, line 25, "Both is (are)..."

-Page 7, line 13, "...corresponding to the sixth (six times or sixth harmonic) of the rotational velocity"

-Page 9, line 12, "...not updated (in) every time step..."

-Page 9, line 16, "...correspond to reduced (of) frequencies..."

-Page 9, line 18, "A higher (frequent) frequency..."

-Page 10, below line 5, It is not clear what does the sentence in the parenthesis mean (respectively 0.2 in Fig.10a). Also the next sentence could be re-phrased. In simpler words it is the superposition of two variations with the same frequency by different phases that causes the effect.

Page 10, line 13, "...appear (appearing)..."

Page 12, The caption of Table 2 makes no sense. Could be integral quantities for constant flap position.

Page 14, First sentence of section 4.3 could be re-phrased. Moreover you can define influence on what?

Page 14, line 15, "...but (strongly) strong.

Page 14 line 16, "...as driving and thrust force components..."

Page 16, first sentence, "an FFT"

Page 16, before last sentence. "In the following...", please re-phrase.

C3

Page 16, line 19, "Even though a beginning hysteresis...", consider re-phrasing to "Even though hysteresis begins to develop in 2D..."

Page 18, line 8, "...with regard to..."

Page 19, line 4, "Unlike the oscillating cases..."

Perhaps punctuation should be also checked.

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C4