Wind Energ. Sci. Discuss.,
doi:10.5194/wes-2016-6-AC2, 2016

eawe european academy of wind energy
Open Access WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Multi-fidelity Fluid-Structure Interaction Analysis of a Membrane Blade Concept in non-rotating, uniform flow condition" *by* M. Saeedi et al.

M. Saeedi et al.

mehran.saeedi@tum.de

Received and published: 13 July 2016

General comments: how do you see the application of this work for larger sized blade? How is the applicability of this work when you have the pitch control turbines? what will happen in case of storms or guest to the membrane. would it be possible to provide some results also about the loads or vortex shedding frequencies?

Extension of the concept to larger blades should be possible, however more segments are needed along the blade. And the aspect ratio of the segments should be kept within some limits. For a very long segment, higher pre-stress in span direction is needed which might result a very stiff membrane.
Whether the membrane rotor has a better performance for stall-controlled or pitch con-

trolled turbines remains an open question and is out of the scope of this paper. The authors do not mean that the concept should necessarily be utilized for stall controlled wind turbines and are targeting the investigation of the aerodynamic characteristics of the membrane-rotor.
The paper presents steady state simulation, therefore frequency response, vortex shedding effects and the reaction to wind gusts could not be discussed within the current study and should be addressed in a future unsteady study on the membrane blade.

Recommendation for correction before publication.

line 3 -has the length of about 5 m–about should be removed Abstract is too long and does not address well the concept of the paper. Its more like an introduction. It contains some information which should be in the introduction part e.g. line 5 to 9. I would suggest to first introduce what you want to do in this paper. then very short about the method and at the end small section about the results. Move the rest of information to the introduction part.

"About" is used, since the length of the blade is not exactly 5 meters. The Introduction part is revised accordingly

page 2 line 20 to 25 the goal of the paper should be at the very end of introduction section. line 35 should be reformulated. its not very clear to me what you wanna say here.

lines 20 to 25 are moved to the end of the section. In lines 34 and 35 we point out the restrictions on using panel method for flow modeling i.e. with the separation of the flow at higher angles of attack the assumptions in the panel method are not valid anymore.

page 4 section2: I think more information is need about the FSI it self, which method you are using e.g. linear or nonlinear Beam.

The structural problem, composed of membrane, truss and beam elements is solved non-linearly. Based also on the comments from the other reviewer, in the revised ver-

sion more details is provided in the FSI section, e.g. regarding the mapping.

page 5 line 5, please cite to OpenFoam website and also to vortex code you used.

Unfortunately I do not quite get what is meant by "citing the vortex code". An in-house implementation of the vortex panel method is developed and utilized. Citation to previous work where the implementation is used is made as well.

line8 please give more information about CPU type and CPU hrs page 6 I think Eq 1 and 2 are very well known so you can remove them and save some space Same for Vortex panel method, no need to explain it, just cite it from somewhere. If the vortex code is developed by you then maybe you need to cite the paper which relates to this implementation and also the validation. however the validation you presented here its not enough I would say you need more simulations for different AOA.

Hardware information is added in the revised version (3.40 GHz, 8M Cache,15GiB RAM). Section 2.1.2 is shortened by removing the formulas for point source, point doublet and the steady state Bernoulli equation. Citation to the previous paper by the authors, where the implemented panel code was used is already made (Saeedi, 2015). Please check the attached file for verification of the pressure distribution for other angles of attack for a NACA0012 wing with $AR = 6$. We thought, we could save some space by not putting the same type of result for different angles of attack.

page 12, section 3, I guess you can rename it to numerical model,

It is renamed to Model Setup and Results in the revised version.

page 13 section 3.1 I think this part is also repeated, maybe you can remove it

Section 3.1 is the first place in the paper, where form finding results for the membrane blade are presented. The figures show the interaction between membrane and edge cable pre-stress in defining the equilibrium shape of the membrane blade.

page 14, I think for the Fig 10 you can add a plot with deformation in each section along

the span instead of the front view.

Thanks for the nice hint, the figure is updated and added.

page 15, can you put a Fig of you grid around the blade surface near the tip and LE and TE? I would also like to know why you are using wall function?why not y+1? Do you know if the openfoam is validated for wind turbine analysis? can you reference to some works?

The mesh near the trailing edge and the leading edge of the blade is attached as a supplementary file. Using wall function rather than using a mesh with $y^+ = 1$ is for saving computational time. For the studied range of angles of attack the flow is mainly attached and good results are obtained using wall functions.

can you use eps format for your Figs?Fig 13 can be removed.

Apart from the mesh figure other figures are in .eps format. Detailed view of the mesh near the leading edge and the trailing edge region is added in .eps format.

page 16 section 3.3 rename it to numerical instead of simulations

Is renaming "FSI Simulations" to "FSI numerical" meant?

Please also note the supplement to this comment:
http://www.wind-energ-sci-discuss.net/wes-2016-6/wes-2016-6-AC2-supplement.pdf

Interactive comment on Wind Energ. Sci. Discuss., doi:10.5194/wes-2016-6, 2016.

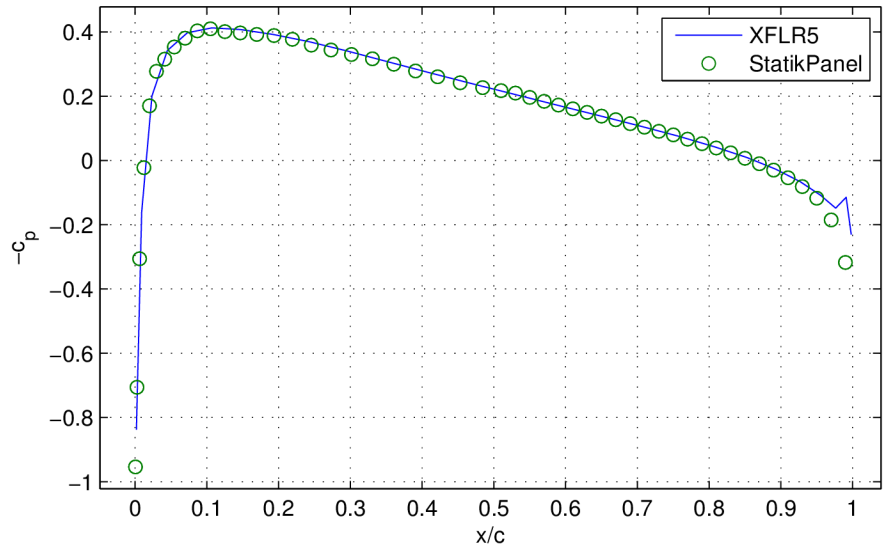
XFLR5
StatikPanel
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−c_p
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
x/c

Fig. 1.

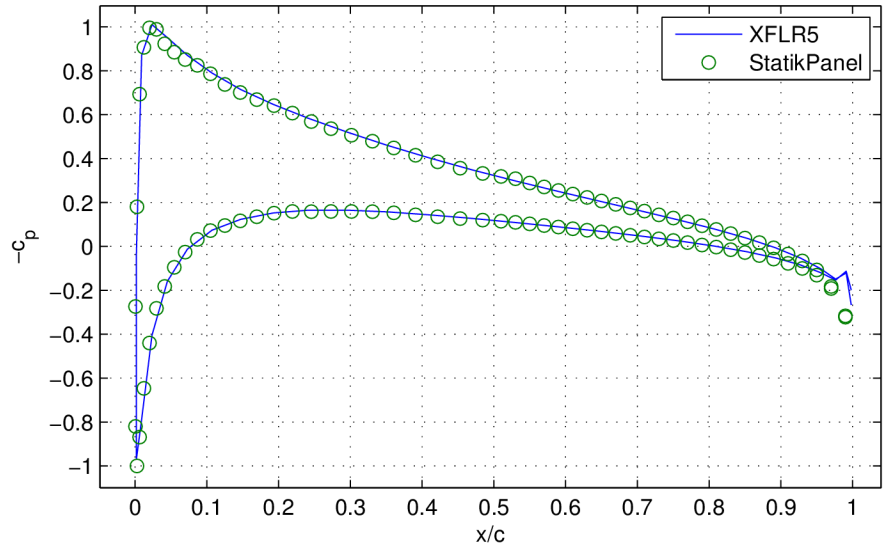
XFLR5
StatikPanel
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−c_p
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
x/c

Fig. 2.

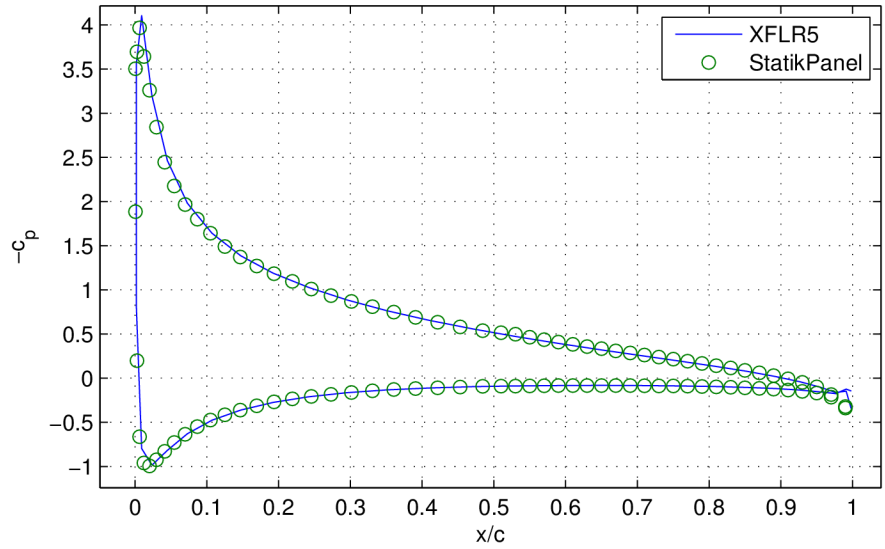
XFLR5
StatikPanel
$-c_p$
x/c
4
3.5
3
2.5
2
1.5
1
0.5
0
−0.5
−1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Fig. 3.

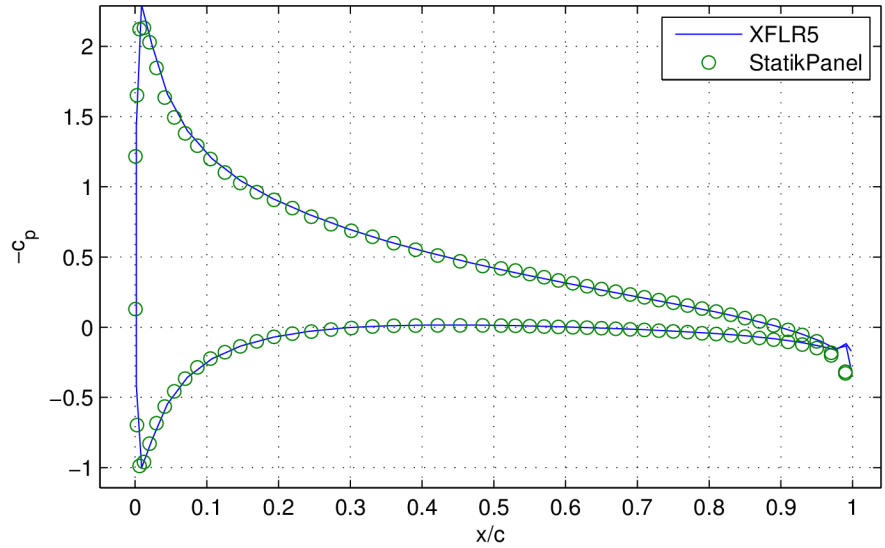
XFLR5
StatikPanel
$-c_p$
x/c
2
1.5
1
0.5
0
−0.5
−1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Fig. 4.