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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.

A. Vire (Referee)

a.c.vire-1@tudelft.nl

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General comments

The manuscript presents the results of numerical simulations of a semi-flexible and non-rotating membrane blade under steady inflow conditions. The overall paper is clear, interesting, and fits within the journal scope. However, the simulation setup (e.g. mesh) should be improved to assess the effects on the results. A mesh convergence analysis should be included. Finally, more details about the numerical methods and models could be added.

Specific comments

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Discussion paper

- Page 3, line 7: you mention that the workflow can be iterated to improve the performance of the blade. What performance are you referring to: aerodynamic performance of the blade or accuracy of the FSI simulation?

- Page 5, line 8: give details of computers and simulation setup when comparing the run times.

- Section 2.1.1 is not very detailed compared to section 2.1.2. You could include more details about the numerical method and models, such as the equations, boundary conditions and wall functions used in the RANS model, and the algorithm to show how the non-matching mesh mapping works.

- Page 6: last paragraph of section 2.1.1: it is not very clear what is done to avoid the computational cost of re-meshing, since you also mention "solving the mesh motion problem". As a side note, you mention "a FSI simulation [...] needs to update the mesh at each iteration". This is not true for all FSI techniques. For example, in our embedded techniques [1,2], re-meshing or updates of the fluid mesh is not necessary. Only a solid-concentration field is computed. I would encourage you to add a short review of the different FSI modelling techniques in section 1, including also the work of others.

[1] Viré A, Xiang J, Pain CC, "An immersed-shell method for modelling fluid-structure interactions", Philosophical Transactions of the Royal Society A, 373(2035) (2015).

[2] Viré A, Xiang J, Milthaler F, Farrell PE, Piggott MD, Latham JP, Pavlidis D, Pain CC, "Modelling of fluid-solid interactions using an adaptive-mesh fluid model coupled with a combined finite-discrete element model", Ocean Dynamics 62, 1487-1501 (2012).

- Page 10, fig 6: why is the pressure coefficient different than 0 at the trailing edge (the same question applies to Fig 18)? What is also the error made on the maximum cp compared to XFLR5?

- Page 11, line 9: how is the mapping done? Is it conservative despite the non-matching

meshes?

- Page 15, fig 12: why did you choose this grid topology instead of a c-grid? A c-grid would avoid very thin cells at the leading and trailing edges and could improve convergence and cp results at these locations.

- Page 16, line 1: details of the wall functions should be provided here or in the theoretical section 2.1.1. The same comment applies to line 10 about the mesh motion algorithm.

Technical corrections

- Throughout the manuscript, references should be between brackets [].

- Page 2, line 6: adaption -> adaptation

- Page 3, line 5: in FSI -> in the FSI

- Page 3, line 6: by evaluation of the -> by evaluating the

- Figure 1 caption: Analysis

- Page 5, last line: add point at the end of sentence

- Page 6, line 1: Navier-Stokes (NS)

- Page 6: line 3: constant viscosity and density

- Page 6: line 7: The SIMPLE

- Page 6: line 9: calculate the kinematic

- Page 9, line 8: In Eq (18), v_∞ is...

- Page 9, line 20: of the developed panel

- Page 10, line 20: interaction -> interactions

- Page 16, line 5: FSI_CFD us -> is

- Page 16, line 6: use the panel

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