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Interactive comment on "Two-dimensional numerical simulations of vortex-induced vibrations for wind turbine towers" *by* Axelle Viré et al.

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The authors thank the Reviewer for their detailed and positive feedback. We have taken the feedback into account in the revised manuscript. Changes are highlighted in red. Each comment is further addressed below.

++ General ++ Referee: Some of the variables used in the text are not properly introduced. I suggest to include an acronym section in the manuscript, or alternatively to make sure that all the symbols are properly described.

Response: Thanks for pointing this out. We scanned the whole manuscript and edited

the text to define all the variables that were not properly introduced.

++ Title ++ Referee: The title could be misleading, since no wind turbine tower is modeled in this work. I would suggest to make it more explicit, stating that a 2-D cylinder was simulated (in conditions that are representative of wind turbine towers). It should be mentioned that the content of the paper is very clear regarding this point later on.

Response: The title has been changed accordingly.

++ Abstract ++ Referee: Change "verified by considering" by "validated by considering". It is a more appropriate word in this context.

Response: The wording has been changed accordingly.

++ Introduction ++ Referee: Line #28: I think you should be more cautious with the statement "Although wind turbines towers are tapered, they resemble a circular cylinder". The tapering of the tower may indeed have non-negligible consequences on the VIV phenomenon, and in addition wind shear can be also present. This will introduce more frequencies into play, making the VIV phenomenon much more complex [Balasubramanian et. al (1998), Bal-asubramanian et. Al (2001), Bourguet et .al (2011), Bourguet et .al (2013) , Hover et. al (1998)]. So someone might think that the proper way to simulate the VIV of towers could be to perform "a series of 2D simulations" corresponding to the inflow conditions at different heights (as presented in WESC 2019). In addition, the spring-based structural model employed in this work may also present some limitations when compared to the 3D structure.

Response: We agree that our statement could be misleading. We have therefore changed it and also added some references.

Referee: Line #20: It is interesting to emphasize if the four works mentioned here were based on computational studies and/or experiments.

Response: This is clarified in the text.

++ Section 2.2 ++ Referee: More details about the “modal condensation” of the tower should be provided. - What model of tower is being represented?. Could you provide some dimensions and structural properties?. Will the conclusions of this work hold for other towers? - More details about how the modal analysis is performed and the passage to a 2D geometry are necessary.

Response: We now provide more information about this in the text. The three-dimensional tower is divided into 40 segments with 6 degrees-of-freedom at each node, leading to stiffness and mass matrices of dimensions 246x246. Solving the system K-omegaˆ2*M=0 returns the natural frequencies of all the modes and the eigenvectors. Modal mass/stiffness is obtained by pre-multiplying and post-multiplying the mass and stiffness matrix by the eigenvector of the first bending mode. The procedure should be generic enough so that it also holds for other towers.

*****Recommendations***** Referee: I missed a Figure showing the mesh, even if it is described in the document. It could be useful to understand how it expands from the wall surfaces to the inner CFD domain. Eventually you could show how the mesh is deformed for the cases with important cylinder displacements.

Response: We added 2 figures to show the mesh topology.

Referee: There is not comment regarding the wakes. This could be interesting, probably in combination with the discussion of the freely oscillating cylinder.

Response: We added some discussion on the phase angle and vortex patterns for the freely-oscillating cylinder.

*****Comments***** Referee: The discussion concerning the “St” vs. “cylinder natural frequency” competition (page #15) reminded me of the study of Bourguet and Triantafyllou (2016), that is also a very relevant work.

Response: Thank you very much for pointing this out.

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