Leibniz Universität Hannover

ISD INSTITUT FÜR STATIK UND DYNAMIK

Bachelor thesis / project work / Master thesis

Verification of a new mid-fidelity aeroelastic simulation framework for offshore wind turbines

Background

Offshore wind energy is a central component of the decarbonisation of our energy system. To utilize the potential of offshore wind turbines, they have been and are still growing in size, soon reaching rated powers in the range of 20 MW and rotor diameters of approx. 400 m. Designing such turbines is only possible using new simulation tools which find a middle ground between the computational efficiency of state-of-the-art simulation tools and the accuracy of complex CFD methods. To this end, at ISD we are developing the in-house simulation tool DeSiO for the coupled aero-hydro-servo-elastic simulation of the nonlinear dynamic behaviour of such large wind turbines.

When developing a new simulation tool, verification against other simulation tools and comparison with results published in literature is indispensable to ensure reliability and correctness of the new tool. The approach used in DeSiO, which couples a boundary element method (Unsteady Vortex Lattice Method) to compute the aerodynamic forces and FEM (for geometrically exact beams) to compute the structural behaviour requires further detailed investigation in this regard.

Thus, the goal of this work is to identify suitable aeroelastic benchmark cases, ideally with connection to wind energy, in literature and to reproduce these results using DeSiO, i.e., set up the models and carry out the simulations. Based on the comparison of the results with those from literature, the suitability of our approach should be investigated and possible weaknesses, both in regard to approach and implementation, should be identified.

Tasks

- Literature research on aeroelastic computation methods, especially in the context of wind energy
- Identification of suitable examples for comparison
- Familiarize with DeSiO
- Set-up of models and simulations in DeSiO
- Carry out the simulation in DeSiO
- Analysis and discussion of the results

Your profile

- Experience with simulation tools advantageous but not required
- Knowledge in Matlab advantageous but nor required
- Knowledge in structural mechanics, fluid mechanics and wind energy advantageous

Contact

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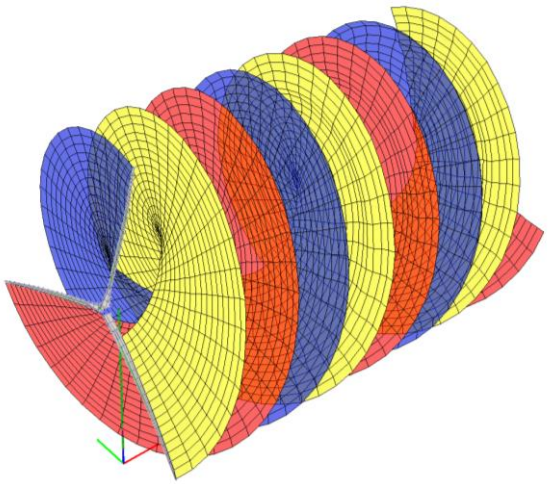

Aeroelastic simulation of a wind turbine using DeSiO