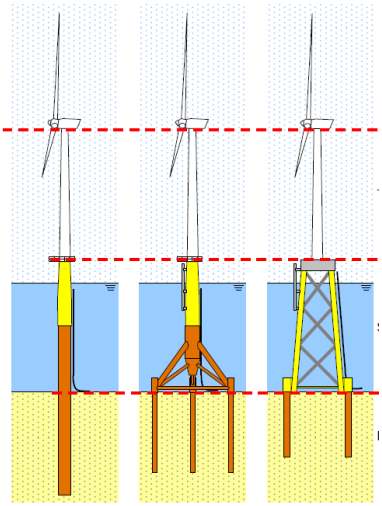
Bachelor thesis / project work / student assistant

Verification and extension of a hydro-elastic simulation tool 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.

Currently, the computation of the hydrodynamic forces is implemented in DeSiO based on the Morison equation, which is an empirical relation for the forces from waves and current on slender cylinders. However, this implementation is not yet sufficiently tested and setting up new models, e.g., of different jacket designs, is so far very cumbersome.



Different types of wind turbine substructures (de Vries et al., 2016)

Therefore, in this work the existing automated creation of DeSiO files for tower and blades, implemented in Matlab, should be extended for substructures. Using this, the computation of hydrodynamic forces in DeSiO should be tested for different substructures by comparing the results with either those of other programs or literature. This will ensure that the hydrodynamic forces are reliably and correctly computed for variable substructures using DeSiO.

Tasks

- Familiarize with DeSiO
- Literature research on hydro-elastic computation methods in the context of wind energy
- Identification of suitable benchmark examples
- Extension of the Matlab tool for DeSiO-input to include substructure models
- Set up and carry out the comparative simulations in DeSiO
- Analysis and discussion of the results

Your profile

- Experience with simulation tools advantageous but not required
- Knowledge of Matlab advantageous
- Knowledge of structural mechanics, fluid mechanics and wind energy advantageous, but not required

Contact

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