Elastic deformations of floaters for offshore wind turbines: Dynamic modelling and sectional load calculations - DTU Orbit (29/12/2018)

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To achieve economically and technically viable floating support structures for large 10MW+ wind turbines, structural flexibility may increase to the extent that becomes relevant to incorporate along with the corresponding physical effects within aero-hydro-servo-elastic simulation tools. Previous work described a method for the inclusion of substructural flexibility of large-volume substructures, including wave-structure interactions through linear radiation-diffraction theory. Through an implementation in the HAWC2 simulation tool, it was shown that one may incorporate the effects of additional modes on substructure and wind turbine response as well as predict the excitation of substructure flexible modes. This work goes one step further and describes a method to calculate internal substructural stresses that includes dynamic effects. In dynamic calculations, the substructure flexibility is considered through a reduced set of modes, selected based on their relevance to the external load frequency range, and represented with a superelement. The implementation of this method in aeroelastic simulation tool HAWC2 and wavestructure analysis programWAMIT is described, highlighting the practical challenges. A case study of the DTU 10MW Reference Wind Turbine installed on the Triple Spar concept is presented to illustrate the method. The results show that the substructure flexible modes, global platform motion and wind turbine loads can influence sectional loads within the substructure.

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