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GRAVITY-BASED OFFSHORE WIND TURBINE DYNAMIC RESPONSE ANALYSIS UNDER COMBINED WIND AND WATER WAVES ACTIONS

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Abstract. Gravity based foundations are usually used for small and medium size offshore wind turbines installed in shallow and intermediate water depths. In this work, the dynamic response of a reference wind turbine of 5MW rated power with this kind of foundation is studied, taking into account the soil-structure interaction. To this end, a strategy based on a coupled finite element and scaled-boundary finite element methods is adopted. It is considered that the wind turbine is subjected both to wind and water waves loads. The action of turbulent aerodynamic loads is computed with OpenFAST while that of the water waves is computed with OpenFOAM following a highly non-linear streamFunction model with a $\kappa-\epsilon$ turbulence model, using a volume of fluid strategy. Different mesh discretizations are convenient for each model, so non-matching grids are unavoidable. Therefore, a convenient algorithm was developed and used to transfer the data between the sub-problems. Information like displacements, velocity and stresses at specific locations of the tower, its foundation and the soil are analyzed and compared with reference data in order to assess the capabilities of the proposed strategies and their implementation.

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