Development of a methodology to generate a digital twin of a floating offshore wind turbine platform

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This Works present a methodology developed for the generation of a digital twin (DT) for structural health monitoring and assessment of the W2Power floating offshore multi-wind turbine platform (https://enerocean.com/w2power-es/). The structural dynamics of the system platform and towers is approximated in the modal basis using a Modal Matrix Reduction (MMR) technique, where a large number of modes (in the order of 1000) are used to accurately approximate the equivalent high fidelity solution obtained by a finite element model. Once the modal basis is obtained, the structural dynamics equations in the modal basis is fully coupled with the time-domain seakeeping hydrodynamic solver SeaFEM. This hydro-elastic framework enables to perform hydro-elastic simulations under environmental loads.

From this point, two different methodologies to create a DT are presented: the first one based on obtaining modal response amplitude operators (MRAOs) of the structural response under linearized wind and wave loads; the second one based on direct simulation including non-linear external loads but only using those most significant modes using a structural energy criteria. This DT is implemented on an IOT platform where actual measurements from the W2Power 1/6th scale prototype will be monitored and compared with the DT.

This work is developed under H2020 projects Fibregy (Development, engineering, production and life-cycle management of improved FIBRE-based material solutions for structure and functional components of large offshore wind enerGY and tidal power platform; https://fibregy.eu/).