

Integrated Dynamic Analysis of Semi-Submersible Flap Type Concept

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Abstract : With a rapid development of offshore renewable energy industry, the research activities in regards of harnessing power from offshore wind and wave energy are increasing day by day. Integration of wind turbines and wave energy converters into one combined semi-submersible platform might be a cost-economy and beneficial option. In this paper, the coupled integrated dynamic analysis in the time domain (TD) of a simplified semi-submersible flap type concept (SFC) is accomplished via state-of-the-art numerical code referred as Simo-Riflex-Aerodyn (SRA). This concept is a combined platform consisting of a semi-submersible floater supporting a 5 MW horizontal axis wind turbine (WT) and three elliptical shaped flap type wave energy converters (WECs) on three pontoons. The main focus is to validate the numerical model of SFC with experimental results and perform the frequency domain (FD) and TD response analysis. The numerical analysis is performed using potential flow theory for hydrodynamics and blade element momentum (BEM) theory for aerodynamics. A variety of environmental conditions encompassing the functional & survival conditions for short-term sea (1-hour simulation) are tested to evaluate the sustainability of the SFC. The numerical analysis is performed in full scale. Finally, the time domain analysis of heave, pitch & surge motions is performed numerically using SRA and compared with the experimental results. Due to the simplification of the model, there are some discrepancies which are discussed in brief.

Keywords : coupled integrated dynamic analysis, SFC, time domain analysis, wave energy converters

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