DinEst 2024
Third Conference on Structural Dynamics
Sevlle, Spain, 12–13 September 2024

# DYNAMIC STRUCTURAL RESPONSE OF FOUR-LEGGED JACKET-SUPPORTED OFFSHORE WIND TURBINE CONSIDERING THE EFFECT OF WIND AND SEISMIC GROUND MOTION DIRECTIONALITY

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**Keywords:** Offshore wind turbines, Jacket, Soil-structure interaction, Ground motion directionality, OpenFAST.

**Abstract.** *The expansion of offshore wind energy in recent years has increased the use of jacket substructures and the seismic analysis of offshore wind turbines has become a relevant factor to consider. Jackets are the second preferred choice of developers and are expected to account for 13.4% of the share in the near future [1]. The depth and seismic risk increase the relevance of soil-structure interaction on the design and on the response of the support structures of these turbines.*

*This study aims at investigating the influence of the direction of wind and seismic ground motion on the structural response of four-legged jacket support substructures for Offshore Wind Turbines located in areas with seismic risk. The response of the system is simulated using an OpenFAST [2] model that takes into account multi-support seismic input, soil–structure interaction and kinematic interaction [3]. The NREL 5 MW wind turbine supported on the jacket designed for the phase I of the OC4 project is considered [4]. The parametric analysis is performed considering different angles of wind and seismic shaking direction according to the quarter symmetry of the structure. Specifically, seven wind directions and thirteen seismic ground motion directions were used. In order to study the seismic response, four different accelerograms have been considered, including accelerograms recorded at onshore and offshore stations. The selected recorded accelerograms are normalized to a common Peak Ground Acceleration (PGA).*

*The study discusses the specific ranges of the angle of misalignment between wind and seismic shaking directions within which the maximum internal forces are expected to be found. This usually occurs when the ground motion is aligned with one of the diagonals of the base of the jacket and not aligned with the wind direction. Combinations with aligned wind and ground motion directions are never the worst case. The shaking direction tends to have a large influence on the peak internal forces.*

*Furthermore, the results show the significance of the aeroelastic damping, with the highest accelerations at the tower top being observed when seismic shaking acts along the side-to-side direction. This phenomenon can also be observed in the trajectories of the nacelle subjected to the different load directions.*

*This work was funded by the Ministerio de Ciencia, Innovación y Universidades and the Agencia Estatal de Investigación of Spain (MCIN/AEI/10.13039/501100011033) and FEDER through research project PID2020-120102RB-I00 and the research fellowships TESIS2022010011 (C. Romero Sánchez) from the Program of predoctoral fellowship from the Consejería de Economía, Conocimiento y Empleo (Agencia Canaria de la Investigación, Innovación y Sociedad de la Información), Spain of the Gobierno de Canarias and Fondo Social Europeo.*

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