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Analysis and Design of Offshore Met Mast Supported on Jacket Substructure

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Abstract : Wind Energy is accepted as one of the most developed, cost effective and proven renewable energy technologies to meet increasing electricity demands in a sustainable manner. Preliminary assessment studies along Indian Coastline by Ministry of New and Renewable Energy have indicated prospects for development of offshore wind power along Tamil Nadu Coast, India. The commercial viability of a wind project mainly depends on wind characteristics on site. Hence, it is internationally recommended to perform site-specific wind resource assessment based on two years' wind profile as a part of the feasibility study. Conventionally, guy wire met mast are used onshore for the collection of wind profile. Installation of similar structure in offshore requires complex marine spread and are very expensive. In the present study, an attempt is made to develop 120 m long lattice tower supported on the jacket, piled to the seabed at Rameshwaram, Tamil Nadu, India. Offshore met-masts are subjected to combined wind and hydrodynamic loads, and these lateral loads should be safely transferred to soil. The wind loads are estimated based on gust factor method, and the hydrodynamic loads are estimated by Morison's equation along with suitable wave theory. The soil is modeled as three nonlinear orthogonal springs based on API standards. The structure configuration and optimum member sizes are obtained for extreme cyclone events. The dynamic behavior of mast under coupled wind and wave loads is also studied. The static responses of a mast with jacket type offshore platform have been studied using a frame model in SESAM. It is found from the study that the maximum displacement at the top of the mast for the random wave is 0.003 m and that of the tower for wind is 0.08 m during the steady state. The dynamic analysis results indicate that the structure is safe against coupled wind and wave loading.

Keywords : offshore wind, mast, static, aerodynamic load, hydrodynamic load
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