Wave-in-Deck Load Analysis for a Jack-Up Platform

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This paper describes the prediction of environmental loads on a typical three-leg jack-up platform under freak wave conditions. Considered were cases where the air gap is small and the hull is subject to impact-related wave-in-deck loads. The technique to predict wave loads was based on the use of a validated CFD code that solves the Reynoldsaveraged Navier?Stokes equations. This code relies on the interface-capturing technique of the volume-of-fluid type to account for highly nonlinear wave effects. It computes the two-phase flow of water and air to describe the physics associated with complex free surface shapes with breaking waves and air trapping, hydrodynamic phenomena that had to be considered to yield reliable predictions. The Stokes fifth-order wave theory initialized volume fractions of water, velocity distributions in the solution domain, and timedependent boundary conditions at inlet and outlet boundaries. This paper demonstrates that this technique can be a valuable numerical tool for preliminary designs as well as subsequent safety assessments. In particular, it shows that effects of different operating and design parameters on wave-in-deck loads, such as wave direction, wave height, wave period, and wind speed, can be evaluated with an affordable computing effort.

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