SELECTION OF JONSWAP SPECTRA PARAMETERS DURING WATER-DEPTH AND SEA-STATE TRANSITIONS

Rueda-Bayona, Juan Gabriel; Guzmán, Andrés; Cabello-Eras, J. J.

Abstract

The design of marine structures requires the simulation of wave parameters that consider sea-state and water-depth transitions. Proper selection of the model coefficients (e.g., alpha and gamma of the JONSWAP spectra) is then required, because of the wave-hydrodynamic nonlinearities during these ocean processes. Therefore, the model coefficient selection should be tested using a nonlinear analysis to assess the effect of the selected spectra coefficients over the modeled wave parameters. The present study performed a design of experiment (DOE)-analysis of variance (ANOVA) and probability analysis to assess the effect of alpha and gamma parameters over the significant wave height (Hs) and peak period (Tp) during sea-state and water-depth transitions. The DOE-ANOVA demonstrated for the mean and extreme wave states of the study area that alpha and gamma parameters positively affect the Hs behavior in deep and intermediate waters. Furthermore, the standardized effects of alpha and gamma over the Tp during extreme wave states suggest quadruplets of wave-wave interactions. The joint and normal probability distributions of alpha and gamma for extreme and normal waves showed a Gaussian distribution, allowing identification of specific alpha and gamma values for the JONSWAP spectra model. The selected alpha and gamma parameters were then validated through the comparison of the modeled Hs (JONSWAP) against other local studies. Considering its relevance in design strategies for offshore structures, this research contributed to the understanding of the nonlinear effects of alpha and gamma parameters over the Hs and Tp during variations of water depth and wave states, easing the selection of the model coefficients.

Keywords

DOE-ANOVA, JONSWAP spectra, Numerical modeling, Probability, Waves