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SENSITIVITY ANALYSIS OF JACKET TYPE OFFSHORE PLATFORMS AGAINST WAVE LOADING HAZARD

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INTRODUCTION

As offshore structures require more critical and complex designs, the need for accurate approaches to evaluate uncertainty and variability in computer models, loads, geometry, material properties, and etc has increased significantly. For problems in which randomness is relatively small, it is clear that a deterministic model is adequate. However, when the level of uncertainty and importance of structure is high, stochastic approaches should be employed for system analysis and design. One of the fundamental steps in the structural reliability analysis of structures is to determine the significance of random variables, and how they influence the structural response which can be acquired by sensitivity analyses.

The topic of sensitivity analysis for jacket type offshore platforms against wave loading has been widely considered by different researchers. Sunder and Connor [1] investigated the sensitivity of steel jacket offshore platforms to environmental wave loading utilizing two simplified numerical models under rigid foundation conditions. They studied the effects of wave height, wave period, drag and inertia coefficients, mass and hysteretic structural damping. G. D. Hahn [2] used a simplified model in order to examine the effects of inertia and drag force components, current velocity, fluid-structure interaction, random phase angles and wave cancellation. Haver et al. [3] investigated the sensitivity of the annual failure probability to the selected airgap and current design profile. They demonstrated that the airgap parameter is a crucial parameter regarding the annual probability of structural failure.

With regard to sensitivity analyses of jacket type platforms, the effects of foundation modeling have been neglected in majority of researches on the response of jacket platforms against wave loading hazard. As nonlinear response of the pile foundation is the most important source of potential nonlinearity in the response of offshore platforms, it is cleat that a more powerful model, which is able to consider soil–pile–structure interaction (SPSI), should be employed. Kenji Kawano and Katta Venkatammana [4] conducted dynamic analysis of large offshore structures utilizing the impedance function model for the soil–pile foundation system. Moreover, several studies by Makris et al. [5], Mylonakis and Gazetas [6], Guin and Banerjee [7] have focused on SPSI analyses. Bea performed a series of static pushover analyses on a fixed offshore platform and found that the first nine nonlinear events were concentrated in the foundation piles [8]. Moan et al. demonstrated that the choice of pile/soil modeling method can affect the load distribution and failure mode in the structural model [9].

Although considerable research on soil–pile–structure interaction has been conducted, most of