

Risk Assessment of Offshore Platforms for Hurricane and Earthquake Hazards

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Abstract

A risk assessment methodology is presented in this paper for the offshore platforms against hazard events. The primary objective is to evaluate the risk level from the hurricane and earthquake events and to identify possible solutions that could reduce the risks to As Low As Reasonably Practical (ALARP). A structural reliability-based quantitative hazard evaluation method is proposed to estimate the hurricane risk. The platform failure limit state function is defined in terms of environmental load and platform capacity. The platform capacity is determined from non-linear pushover analysis. A parametric relationship of environmental load as a function of wave height is obtained using regression method. Platforms are modeled as a series system composed of deck and jacket including foundation. Uncertainties are included in the parameters associated with environmental loads and platform capacity based on industry experience. The calculated probability of platform failure is used to evaluate the offshore platforms for risk associated with hurricane events.

A semi-quantitative hazard evaluation method is proposed to evaluate the risk level associated with earthquake events. The load factors on base shear at collapse of the platform are derived from the in-place seismic response analysis using non-linear pushover methodology for extreme earthquake events with different magnitudes. The platform failure is defined as formation of a limiting mechanism in the platform structure or foundation. The consequence of platform failure and the probability of platform failure are combined to determine the platform risk associated with the earthquake hazard.

Based on the risk assessment results, risk reduction and/or mitigation measures are recommended for platforms where assessed risks so demand. The developed risk assessment methodology has been incorporated into the risk-based underwater inspection (RBUI) program and long-term structural integrity management system developed for the offshore platforms.

Keywords: Offshore platforms; Hazard evaluation; Risk assessment

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