

Evaluation of Ultimate Strength of Jacket Type Structures under Marine Loading

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Abstract: An existing platform should undergo the assessment process if one or more of the following conditions exist: 1) Addition of personnel 2) Increased loading on Structure 3) Damage found during inspection and etc.

A structure should be evaluated based on its current status, accounting for any damage, repair, or other factors affecting its performance. Analyses consist of both design level analysis and ultimate strength analysis. The latter is more desired and common in offshore work. Push-over and nonlinear time-domain analysis methods are acceptable in ultimate strength analysis. The main result of such analysis is Reserve Strength Ratio (RSR). Acceptance or rejection of structure fitness is dependant on this ratio. In conventional push-over analysis, wave dynamic loading is simulated by equivalent quasi static load and dynamic effects such as added mass, damping and inertial force are neglected. However, in time-domain analysis, dynamic effects are considered and subsequently ultimate strength can be estimated better with more precision.

In this current study, two platforms were selected for case study analysis. Push-over analyses and nonlinear dynamic analyses were applied to both platforms and the relevant results were compared to each other. "ABAQUS" software was used for modeling and analysis. Pile-soil interaction is modeled by nonlinear springs and in the meantime analyses took into account the effect of large displacement, plasticity and strain hardening, as well.

In the course of limited investigation, it was concluded that in nonlinear dynamic analysis, reserve strength of jacket structures was estimated to be higher than that of static push-over and that structures can bear more partial failure before global failure.

Keywords: platform, assessment, push-over, nonlinear time-domain analysis, ABAQUS, RSR, failure

1. Introduction

When designers want to ensure the existing structure can withstand new condition after changes in jacket structure, for example, increasing design load or inspection reveals some damages in structure and etc; assessment process is performed [1].

The strength of existing structure under lateral loading can be controlled by appropriate methods. One can be design level analysis where after linear analysis, design criteria should be checked. Another would be ultimate strength analysis. Here, through nonlinear analysis, ultimate strength of structure is estimated and compared to strength of structure in design level [1, 2 and 3]. Static push-over or nonlinear time-domain analysis can be selected as a nonlinear analysis [1]. The main result of ultimate strength analysis method is reserve strength factor introduced by Lloyd and Clawson [4]. Reserve strength ratio (RSR) with same definition is described as follows by Bea et al [5]:

$$RSR = \frac{F_{ult}}{F_D}$$

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