Risk Based Inspection Plan Combined with Fatigue Failure Analysis for Jacket Platform

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ABSTRACT

As an essential role of structure integrity management (SIM), risk-based inspection (RBI) analysis is an indispensable tool to ensure the fitness-for-purpose of offshore jacket platforms. Pushover analysis is employed to calculate RSR value and failure consequence of structural members. And four limit state equations of members are introduced in failure probability analysis. On the basis of risk-based inspection plan, which combined member failure consequence and probability, fatigue failure analysis results are taken into consideration and the final inspection plan is developed. Finally, a case study of jacket platform located in the South China Sea is proposed.

KEY WORDS: SIM, RBI, fatigue failure, risk matrix, jacket platform

INTRODUCTION

Structure Integrity Management (SIM) is an ongoing life-cycle process for ensuring the continued fitness-for-purpose of offshore structures. The SIM process has evolved over the last 30 years to provide industry and regulatory authorities a means to ensure the continued safe and reliable operation of the aging fleet of offshore platforms around the world. The four phases of the SIM process, Data-Evaluation-Strategy-Program, are illustrated in Figure 1.

As an essential role of structure evaluation process demonstrated in API Recommended Practice (API, 2008), risk based inspection (RBI) is an indispensable methodology, which identify the structure inspection intervals based on both the structure failure consequence and probability. More and more researchers are focusing on the application of RBI analysis to the inspection of offshore structures under the framework of SIM these years. Botelho and Petrauskas (1994) calculated the failure probability of ST130 “A” platform in the Gulf of Mexico during Hurricane Andrew. Heredia-Zavoni and Campos (2004) carried out a structural reliability assessment of deck elevations subjected to storm wave loading for fixed platforms in the Bay of Campeche. Narayanan and Mohammad (2009) proposed a recommended practice for the SIM process for offshore structures in Malaysia, including studies by API and ISO and local elements. However, among the related achievements, there is little study presenting the whole calculation and analysis process of structure assessment.

In this study the detailed process of risk-based structure assessment and establishment of inspection plan are proposed. The framework of RBI analysis is illustrated in Figure 2, which includes structure pushover analysis, failure probability estimation, risk matrix establishment and spectral fatigue analysis. Combined with the risk-based inspection plan and