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DEVELOPMENT OF AN UNCERTAINITY INSENSITIVE HEALTH MONITORING METHOD FOR OFFSHORE JACKET PLATFORM USING MODEL UPDATING AND FUZZY LOGIC SYSTEM

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Abstract

Steel jacket-type platforms are by far the most common kind of offshore structures. The main criterion in the maintenance of these structures, as any other structures, is ensuring of the structural safely performances during their design service life [1]. This research is an experimental investigation on a laboratory model of a jacket platform for developing a robust damage detection technique which is less sensitive to both measurement and analytical model uncertainties. Fuzzy logic system (FLS) and probabilistic analysis is developed for global damage detection and Linguistic classification of damage.

1. Introduction

Since its inception sixty years ago, the offshore structures industry has been growing at a fast rate. The literature on fixed offshore structures is huge. Wisch [2] provides an insight into the first 50 years in the history of this industry. Steel jacket-type platforms are by far the most common kind of offshore structures and they have been widely utilized for various purposes including offshore drilling, processing and support of offshore operations. For instance, numerous offshore platform jackets have been constructing at the Persian Gulf where benefits of the vast gas and oil natural resource endowment and supplies much more than 40 percent of world fossil energy reserves. The principal criterion in the maintenance of an offshore structure, as in the case of any other structure, is to ensure that the structure safely performs its intended functions during the design service life. The recent disaster of oil spill in Golf of Mexico emphasizes the importance of the problem for the marine industry.

Monitoring of the structures is essential for ensuring their safety. The process assumes greater significance in the case of offshore platforms, since major parts of the structure are under water which makes the visual inspection process much more difficult and on the other hand, they are highly vulnerable to damage due to the harsh marine environment [3]. There are a large number of methods currently available for the inspection of structures [4]. Existing methods include those based on examination of changes in natural frequencies, mode shapes or mode shape curvatures. Doebling et al. [1] published a state of the art review on vibration based damage identification methods.

On the other hand, among various vibration-based damage detection methods, those based on updating structural model parameters can be reduced to the solution of constrained optimization problems [5]. The bulk of research on SHM has been developed over the last decade on data acquisition, feature extraction and data reduction techniques.