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Vibration Control of Offshore Jacket Platforms with Hybrid Damping Systems

[*Ali Akbar . Golafshani* علي اكبر گل افشاني]

[*Majid . Kashani* مجيد كاشانى]

[*Amin . Gholizad* امين قلى زاد]

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1- Introduction

Offshore platforms, located at severe environmental conditions, are generally subjected to two types of environmental loading; normal-condition loads such as wave-induced hydrodynamic forces and extreme-condition loads like seismic excitations [1]. Among classified categories of environmental loads of offshore platforms, those of great importance are wave-induced hydrodynamic forces in normal conditions and seismic excitations in extreme conditions.

Adjustable parameters of a vibration control system for offshore platforms are generally designed by considering only one type of environmental loadings; either normal-condition loads to mitigate fatigue damage or extreme-condition loads to guarantee collapse prevention. So, it is important to investigate the effectiveness of vibration control system, designed for the more influential type of external loading, when subjected to another type. Also it is ideal for the system to have an acceptable performance in both normal and extreme conditions.

Vibration control of offshore platforms has been studied by many researchers such as Vandiver and Mitone [2], Kawano and Venkataramana [3], Kawano [4], Abdel-Rohman [5], Lee [6], Suneja and Datta [7], Suneja and Datta [8], Terro et al. [9], Vincenzo and Roger [10], Ou et al. [11], Ou et al. [12], Suhardjo and Kareem [13], Wang [14], Mahadik and Jangid [15], Li et al. [16], Zribi et al. [17], Patil and Jangid [18] and Ou et al. [19]. All of them have found it effective to use control mechanisms for mitigation of vibrations induced by different environmental loads. But it should be noted that none of the previous works has investigated the effectiveness of vibration control systems, considering both normal-condition and extreme-condition loadings.

The purpose of this paper is to compare the seismic performance of dampers optimized for wave loading with that of dampers designed for seismic excitation, and to present methods for enhancing the seismic performance of dampers optimized for wave load, such as using hybrid damping systems, in which one damper is optimized for wave loading and the other is designed for quake excitation. It is intended to improve seismic effectiveness of vibration control system