

OHN10106240536

Effect of Pile- Soil- Structure Interaction on Dynamic Characteristic of Sample Jacket Type Offshore Platform by Experimental and Numerical Investigation

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Abstract. *Dynamic response of Pile Supported Structures is highly depended on the Pile Soil Structure Interaction. In this paper, by comparison of experimental and numerical dynamic response of a prototype jacket type offshore platform for both hinge based and pile supported boundary conditions, effect of soil-pile-structure interaction is studied. Jacket and deck of a prototype platform is installed on a hinge-based case first and then platform is installed on eight skirt piles embedded on continuum monolayer sand. Dynamic characteristics of both cases of platform in term of natural frequencies, mode shapes and modal damping are computed and compared with the others.*

Numerical simulation of responses for the studied structure is also performed for both cases using capability of ABAQUS software. The 3D model of ABAQUS is created using continuum elements for soil and piles, and beam elements for jacket and deck elements. Mohr-Coulomb model and pile-soil contact theory are used for considering nonlinear inelastic soil properties. It is observed that dynamic characteristics of the system changes significantly due to soil-pile-structure interaction. Meanwhile, finite element model can also predict this effect accurately for the studied platform in small range of deformation.

Keywords: *Steel Jacket type Offshore Platform; Soil-Pile-Structure Interaction; Experimental Modal Analysis; Finite element.*

1. Introduction

Pile foundations are a part of many structures such as jacket type offshore platforms used to transfer loads from superstructure to the soil layer. When external forces such as earthquake, wind or wave act on pile-supported structures, structural, soil and pile displacements are independent of the others. Response of the soil-pile influences the motion of the structure, and the motion of the structure influences the response of the soil-pile, which is termed as soil-pile-structure interaction (SPSI). The effects of SPSI are prominent for pile-supported structures such as heavy structures resting on soft soils, high-rise buildings and jacket type offshore platforms. SPSI has an important effect in analysis result of jacket type offshore platforms. Meanwhile, dynamic characteristic and response of such a structure is highly depended to dynamic pile-soil structure interaction.

There are considerable researches on dynamic soil-pile-structure interaction (Mizuno 1987). Some procedures have been developed for considering this effect in evaluating of the dynamic response of steel jacket platforms. The simplified double-step method in which uncouples superstructure and pile systems portions is the first and less