DYNAMIC BEHAVIOUR OF STEEL JACKET PLATFORMS

by

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CERTIFICATE

This is to certify that the thesis entitled, "DYNAMIC BEHAVIOUR OF STEEL JACKET PLATFORMS" being submitted by Mr.R.P. Singh to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy is a record of the bonafide research work carried out by him. Mr.R.P.Singh has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis which to my knowledge has reached the requisite standard.

The thesis, or any part thereof, has not been submitted to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

The object of the present work is to study the dynamic response characteristics of steel jacket platforms under regular waves. The structure analysed for the dynamic response is a plane frame version of the steel jacket platform used in the North Sea Forties Field by BP. The structural properties associated with the frames in the orthogonal plane are taken into account. The soil-pile, the pile-structure and the structure-water interactions are taken into consideration.

The soil-pile-structure system is divided into two subsystems: (i) the soil-pile subsystem and (ii) the jacket subsystem. Each subsystem is appropriately modelled and the equations of motion are written in the generalized coordinates. In the present investigation Novak's formulation has been adopted to evaluate the impedance functions of the piles at their interface with the leg members of the jacket platform. The soil is taken as linearly elastic, isotropic and homogeneous.

Using the modified Morison equation the hydrodynamic forces on the structure are calculated for the actual submergence (from the sea bed to the free water surface) of the members; the drag and inertia coefficients are taken to be constant. The distribution of the hydrodynamic forces along a structural member is assumed to be

linear. The velocities and accelerations of the water particles are calculated by using the linear (Airy)wave theory; its validity is taken to extend upto the free water surface.

The solution of the equations of motion in the generalized coordinates has been obtained by both in the frequency domain and time domain. The number of generalized coordinates needed for accurate prediction of some of the important structural responses has been determined.

The effects of the foundation flexibility and the fluctuation in the water level on the dynamic response of the platform have been investigated. The errors associated with the drag-term linearization of the frequency domain analysis is estimated. The time-domain and the frequency-domain results are compared with each other and the suitability of the frequency domain analysis for a jacket platform under regular waves is discussed.

TABLE OF CONTENTS