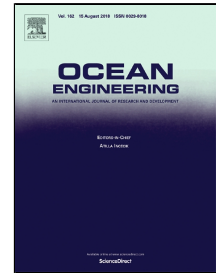


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Coupled analysis between mooring system and VLFS with an effect of elastic deflection of floater

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Abstract

The conventional mooring analysis considers the motion of the floater as a rigid body. However, as the dimension of the floater increases, the elastic deflection of the floater may become significant which can have an impact on mooring tensions. In this paper, based on the three dimensional hydroelasticity and quasi-static mooring analysis method, a coupled numerical analysis method for a Very Large Floating Structure (VLFS) and mooring system is established. The elastic deflection amplitudes and phases of various modes of a VLFS are first computed in regular waves in frequency domain, these are then converted into time series for the specified real sea state, and time domain simulations for the vessel's motion and mooring tension are performed. In the time domain simulation, the displacements at mooring connection points on the vessel include both the rigid motion and elastic deflection of the vessel. A single VLFS module was analyzed together with a mooring system to demonstrate the procedure of the analysis. Furthermore a VLFS consists of three modules with a mooring system was also analyzed. The calculation results match well with the data from model test, which indicates the validity of the numerical method proposed and the computing program developed.

Keywords: mooring tension, hydroelasticity, elastic deflection, static analysis

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1. Introduction

Hydroelasticity analysis of floating structure is attracting more attention as ships and offshore installations are developing towards unprecedented sizes, and the structural elastic deflection is increasingly becoming important to the structural stress level and ultimately safety. However in the analysis of the performance of a mooring system, the commonly adopted method is to calculate the motion of the floating structure as a rigid body and the mooring line tension is calculated, either in frequency domain or time domain, on the basis of the rigid body motion of the floater. For a VLFS, the elastic deflection can cause the change of stress distribution within the structure and will also influence the mooring

line tension due to the displacement and acceleration at the mooring connection points on the vessel. However no previous studies have been seen on the impact of the elastic deflection of the floating structure on mooring tension. For most conventional floating structures, the elastic deflection excited by waves are usually very small and therefore it is acceptable to neglect its effect in the mooring analysis. However, as the floating structure becomes large enough, e.g. over 300m, the elastic deflection may become important to the structural strength and mooring line tension.

Mcloed (1918) firstly built the model of two dimensional quasi-static analysis for flexible cables. In 1940s, Phillips initially did research on dynamic cable and Walton et al. (1959) introduced an innovative method to

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