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Topsides and Jacket Modelling for Floatover Installation Design

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Abstract

Production platform topsides designed for installation by the floatover method offer significant advantages in terms of layout, fabrication and reduced hook-up. Hence, floatover has become popular, particularly in areas where heavy lift vessels are not readily available.

In planning floatover installations, a thorough understanding of the system dynamics and environmental site data are necessary to allow reliable design loads to be assessed. In this, the competing needs of minimizing risk and maximizing installation seastates must be recognized. This paper aims to add to this understanding, focusing particularly on the important contributions to the design loads of the way in which structural flexibility and the size of the gap between barge and jacket is modelled.

Floatover topsides are often set on large steel jackets, such as the six recently completed in the Caspian Sea for Azerbaijan. The jackets are relatively flexible and approximations which are reasonable for more rigid (typically concrete) sub-structures are not appropriate. This paper gives a description of how steel jacket / topsides behaviour can be modelled during floatover using the jacket Eigen modes. The modelling of barge fenders and the behaviour of elastomeric mating units is also covered.

Values are given for the order-of-magnitude stiffnesses and effective masses of typical steel jacket, topsides and the mating units to bring these quantities into perspective. Results of typical time simulations using a simplified jacket-barge model are reported, indicating the importance of stiffness, mass and gap size in impact analyses. Using typical limiting environmental data, examples are given of the operability analyses required to assess the likely waiting times for floatover.

It is recognized that the Caspian is relatively benign with short tow distances (allowing the fields to be reached within readily forecastable windows) and is therefore well suited to floatover. If the floatover method is to be safely extended to more remote / exposed fields, the application of methods such as those given in this paper will become more important.

Introduction

The topsides floatover method is fairly well known and has been described in detail by Salama, Suresh and Gutierrez (1999) for installation onto a steel jacket and by Chudacek, Roberts and Visser (2002) for installation onto a concrete platform.

Floatover was initially proposed for sites where the occurrence of calm conditions could be guaranteed. Subsequent developments include the use of large actively controlled hydraulic rams [Tribout, Emery and Weber (2007)] to allow rapid weight transfer and large movements between the barge and the substructure.

As topsides weights increase and the method is employed at sites requiring large air gaps, barge transportation stability has become limiting and jacking systems, including large stroke rams [Gerner, van der Temple, Zoontjes and de Groot (2007)] and rack and pinion systems [Cholley and Cahay (2007)] have been proposed to enable the topsides to be transported at a lower elevation. A review of current systems and the use of "friction fenders" is given by Seij and deGroot (2007).

In the Caspian, the environment is generally mild in the summer months (May-August). Schedule constraints, however, have led to installations being carried out in October-November. Adequate limiting sea states have therefore been required.