Graduation Project

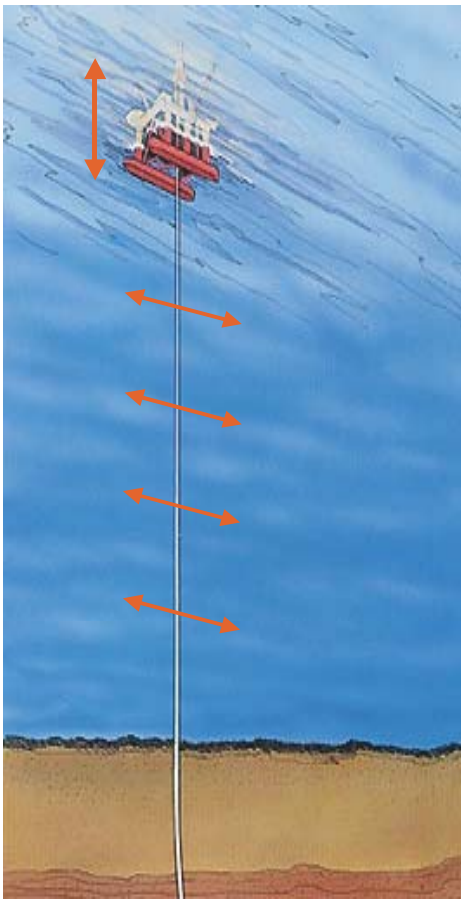
Afstudeerrichting: Structural Mechancis or Offshore Technology

Dynamical behaviour of Deep-Water Risers

Introduction

During the last decade, some major changes take place in the offshore industry. These changes were associated with new oil and gas fields, which were discovered in severe environments, at the depth of 1500 and deeper. Nowadays, offshore companies do not possess knowledge on how to design risers (vertical pipes, which connects the wells to the floating platform) which could reliably facilitate such deep-water exploitation.

The emphasis of this project will be placed on *understanding of the dynamical behavior of such (long and slender) risers.*



Scientific Description

The peculiarity of the dynamic behaviour of deep-water risers is related to the spectrum of natural frequencies of these risers. This spectrum is quite dense in the sense that the natural frequencies are located close to each other (the longer the riser, the denser the spectrum). Because of this, and the huge weight of the riser, it can loose its stability in the following manner. The heave vibration of a floating platform or a vessel, to which the top of the riser is attached, can cause a perceptible variation of the riser tension in time. This variation can lead to parametric resonance, i.e. to instability. Since the spectrum of the natural frequencies is dense and the variation of the tension is quite perceptible, the zones of parametric resonance that are related to different modes can intersect, amplifying the instability. This effect can have a significant influence on dynamics of marine risers.

Solving the problem

Firstly, a model will be developed for the deep-water riser. Secondly, an attempt will be made to study the model (semi)-analytically employing a perturbation method. Then the instability zones will be determined by making use of the Galerkin method and a numerical approach.

The emphasis of this study will be placed on intersection of the zones of parametric resonance and their non-linear dynamic interaction.

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Date: 7 Nov, 2003

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