8th. World Congress on Computational Mechanics (WCCM8)
5th. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

NONLINEAR DYNAMIC BEHAVIOUR OF FLEXIBLE RISERS

S. A. Hosseini Kordkheili[1] and Hamid Bahai[2]

[1] Research Fellow
School of Engineering and Design
Brunel University (West London)
Uxbridge, Middlesex
UB8 3PH, UK
ali.hosseini@brunel.ac.uk

[2] Reader
School of Engineering and Design
Brunel University (West London)
Uxbridge, Middlesex
UB8 3PH, UK
hamid.bahai@brunel.ac.uk

Key Words: *Nonlinear Dynamic, Finite Element, Updated Lagrangian, Seabed Boundary Condition, Buoyancy Force.*

ABSTRACT

Flexible risers composed of bonded, unbounded or high strength steel or other alloy materials are slender marine structures which are widely used in offshore production to convey fluids between the well-head and the surface unit. In deep-water applications, because of the low bending stiffness when compared to axial and torsional stiffness as well as owing to vortex induced vibration, a flexible pipe can suffer large displacement vibrations which demand special geometrically nonlinear dynamic analysis [1].

In geometrically nonlinear deformations due to continuously changing configuration of the body, an incremental procedure is needed for solving the equations of equilibrium [2]. Hosseini Kordkheili and Bahai [1] developed a non-linear finite element formulation for large displacement static analysis of flexible risers. In this paper firstly the previously published formulation is modified using a particular linearization method then the further modifications are implemented for nonlinear dynamic analysis of riser structures due to time dependent (follower) loading condition (fluid flow pressure).

A pipe-soil interaction model is also used to identify seabed boundary condition. The effects of buoyancy force as well as steady-state current loading are considered in the finite element solution for riser structures response. The results of some sample solutions are given to illustrate the accuracy and capability of the formulation.

According to the results, the presented formulation gives accurate results which are comparable with those given in the literature.

REFERENCES

[1] S.A. Hosseini Kordkheili and H. Bahai, Non-Linear Finite Element Analysis of Flexible Risers in Presence of Buoyancy Force and Seabed Interaction Boundary Condition, Accepted to appear in *Archive of Applied Mechanics*

[2] K.J. Bathe, *Finite Element Procedures in Engineering Analysis*, Prentice Hall, 1982.