Title of Diploma Thesis

Response Analysis of a Free Span Offshore Pipeline in Contact with the Seabed

Author

Sofia Georgiadou

Academic Year

2013-2014

ABSTRACT

In the present diploma thesis the dynamic behavior of one of the four offshore pipelines for oil transportation existing in Greece is examined. This pipeline is located in the northern Aegean Sea, (offshore area between Kavala and Thasos island) and it is used for transporting the oil resulting from the exploitation of the existing subsea hydrocarbon deposit. A frequently investigated in the last few years phenomenon, which is also observed in the case of the examined pipeline, is the formation of free spans along the pipeline length-due to erosion.

Considering the above, the objective of this thesis is the investigation of the effect of various factors/parameters on the dynamic behavior and the structural integrity of the aforementioned free span offshore pipeline. The numerical modeling of the physical problem was implemented using the finite element software ABAQUS, considering the pipeline as a beam. The structural model of the pipeline consists of three-dimensional elements, while the interaction of the pipeline with the soil was implemented by attributing nonlinear spring behavior to the soil. The wave and current loading was taken into account through the AQUA module of ABAQUS. The dynamic analysis of the pipeline was performed in the time domain. As far as the parameters that were investigated, these parameters are: different design conditions, wave and current characteristics, the friction angle of the soil, the length of the span and the boundary conditions at the ends of the pipeline. The dynamic behavior of the free span pipeline was assessed in terms of displacements and stresses. Finally, a buckling analysis was carried out according to the most recent internationally applied codes.

Keywords: Offshore pipelines; Free span; Numerical modelling, Dynamic behaviour; Pipe-soil interaction; Hydrodynamic loading.