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Finite Element Modeling of Upheaval Buckling of Buried Submarine Pipelines

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Abstract

A pipeline containing hot hydrocarbons will expand longitudinally on account of the rise in temperature or frictional effects over a kilometer or so of pipeline and compressive axial stress will be set up in the pipe-wall. Such compressive forces can lead to either lateral buckling in the plane of the seabed or buckling in a vertical plane. Upheaval buckling generally occurs in trenched and buried pipelines, because it is easier for the pipeline to move upwards, against the weight and resistance of the overlying backfill material, than it is for the line to move sideways, against the passive resistance of the undisturbed soil on either side of the trench. In this study, the vertical buckling of buried Submarine pipelines under the influence of temperature and internal pressure are discussed. To ensure the accuracy of modeling, the finite element model of the vertical buckling of the pipe, using ABAQUS software, is modeled then results are compared with the results of Wang et al. (2011) The model based on ALA code by ABAQUS software is presented and then the influence of the initial imperfection on vertical buckling are evaluated. The results indicating the safety temperature in the model with initial imperfection equals 0.02 m has increased respectively 3.79%, 8.1% and 15.99% compared to the models with initial imperfection equal 0.05, 0.1 and 0.2 m.

Keywords: *Buried Submarine pipelines, Vertical buckling, Initial imperfection, Internal pressure, Temperature.*