Finite element modelling techniques and testing methods of submerged pipes

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Abstract: *The purpose of the present work is to discuss some FEM procedures and experimental methods that are currently used in the pipeline industry and open the way to the possibility of developing new experimental apparatuses which can provide much more economical alternatives to traditional design codes and tests.*

Keywords: *Pipe, Pipeline, Collapse, FEM, Testing Method*

1. Introduction

Pipelines are used worldwide, onshore and offshore, and have now become vital components in the energy systems of all economically developed countries. Pipelines are designed to accommodate the effects of a wide range of loading conditions resulting from internal and external pressure, bending, etc. during installation and operations. The design calculations for pipelines are aimed at providing a safe, robust pipeline with an economical use of expensive material and installation equipment. Pipeline design calculations have traditionally been based on a limiting stress approach but since 1996 a limit state code has been developed. The use of the limit state approach provides a more comprehensive basis for the calculation of the ultimate conditions for pipes subjected simultaneously to pressure and bending loads. The ultimate state of the pipeline deformation or loading is calculated using a model that describes the characteristic ultimate moment or strain related to the geometry and material properties of the pipe. The design factors are calculated using statistical descriptions of the scatter of test results compared to the mean values together with the statistical descriptions of the variables composing the particular model, e.g. material strength, modulus etc. In the process described above, it is generally assumed that the scatter of tests results from minor and usually random variations in the variables in included in the model. In the case of a pipe, these variations would generally relate to the differences in the geometries of the test pipes from their corresponding nominal values, say for pipe wall thickness, or out-of-roundness.

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