Jumper Analysis with Interacting Internal Two-Phase Flow

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Subsea production systems require different types of pipelines to transport fluids between components. A typical pipeline in performing this function is a jumper which usually connects a tree with a manifold. Rigid jumpers are standard shaped pipes that can withstand high static and dynamic loads due to internal pressure, temperature and external fluid effects. This is basically a fluid structure interaction (FSI) problem in which internal or external flow interacts with the structure creating stresses and pressures that deforms the pipe, and consequently alters the flow of the fluid. This interaction phenomenon is important when designing a piping system since it is understood that this has effects on fatigue life of the jumper.

The objective of this study is to determine the internal fluid effects on the stress distribution and fatigue life of a rigid M-shaped jumper when 50 % water and 50% air flows through it. The initial velocity of the two-phase flow is 10 ft/s. Numerical simulations were performed to obtain stresses and pressure fluctuations exerted on the wall of the pipe. The purpose is to find regions of large displacements and have a curve of stress versus time that engineers can use to determine the fatigue life of the structure.

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