Similitude study of an in-service industrial piping system under high flow induced vibration

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ABSTRACT

Flow induced vibration problem of an in-service duplex stainless steel piping system was investigated in previous research. The investigation required multiple sets of site measurement results at the offshore gas processing platform which raises the concerns of safety and its practicality. A lab scale of the mentioned piping system is preferable to study the flow induced vibration problem at different operating conditions to better understand the dynamic behaviour of this piping system. In addition, most of the dimensional analyses were performed either solely on structure or fluid system. System with flow induced vibration problem has never been attempted and thus it is important to perform similitude study of the piping system prior to fabrication of the lab scale model. Buckingham Pi theorem was applied and the similitude was verified by computational mechanics both qualitatively and quantitatively. The calculated non-dimensional variables of a scaled piping system in describing the flow characteristics which contribute to the structure deformation give similar scale factor, flow pattern and flow induced dynamic deformation and stress in this fluid-structure interacted piping system indicating that geometric, kinematic and dynamics similarity are achieved.

KEYWORDS

Dimensional analysis; Fluid-structure interactions; Piping system; Similitude; Vibration

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