Abstract

Pipes conveying fluid have significant applications in a wide range of industrial and engineering applications. Recently, this topic has been crystallized into a dynamical model for analyzing the fluid-structure-interaction (FSI) which has vast applications in aerospace, aerodynamics, ship motion, medical engineering, etc.

The general solution for the vibration equation of conservative pipes conveying fluid is derived in this paper. From this solution, the frequency and critical buckling velocity equations for pinned–pinned, clamped-pinned, and clamped-clamped pipes conveying fluid are obtained semi-analytically in terms of the pipe parameters.

A new experimental approach for estimating buckling critical velocities from measuring several natural frequencies at relatively small flow rates is presented. The results show good agreement between the estimated and theoretical critical velocities in case of pinned-pinned and clamped-pinned pipes. However, for clamped-clamped pipes, the accurate estimation requires
higher flow rates. This method can serve using a relatively low pump discharge and simple fluid circuit instead of high discharge pumps which demand complication in the fluid circuits.

References


Index Terms

Computer Science
Information Sciences

Keywords

Pipe conveying fluid, Critical buckling velocity, Stability