

Temperature Effect on Sound Propagation in an Elastic Pipe with Viscoelastic Liquid

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Abstract : Fluid rheology may have essential impact on sound propagation in a liquid-filled pipe, especially, in a low frequency range. Rheological parameters of liquid are temperature-sensitive, which ultimately results in a temperature dependence of the wave speed and attenuation in the waveguide. The study is devoted to modeling of this effect at sound propagation in an elastic pipe with polymeric liquid, described by generalized Maxwell model with non-zero high-frequency viscosity. It is assumed that relaxation spectrum is distributed according to the Spriggs law; temperature impact on the liquid rheology is described on the basis of the temperature-superposition principle and activation theory. The dispersion equation for the waveguide, considered as a thin-walled tube with polymeric solution, is obtained within a quasi-one-dimensional formulation. Results of the study illustrate the influence of temperature on sound propagation in the system.

Keywords : elastic tube, sound propagation, temperature effect, viscoelastic liquid

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