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Stability analysis of multi-span viscoelastic functionally graded material pipes conveying fluid using a hybrid method

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Abstract

In this paper, a hybrid method which combines reverberation-ray matrix method and wave propagation method is developed to investigate the stability of multi-span viscoelastic functionally graded material (FGM) pipes conveying fluid. The material properties of FGM pipes are considered as graded distribution along thickness direction according to a power-law. A parametric study is conducted to verify the effectiveness of present method and investigate effects of volume fraction exponent, fluid velocity, internal pressure and internal damping on stability of the FGM pipes conveying fluid. The numerical results demonstrate that the present method provides accurate results by using only a small number of elements and the viscoelastic FGM pipes exhibit some special dynamic behaviors. Moreover, the results also reveal that the natural frequencies of FGM piping system could be adjusted by devising the volume fraction exponent. This particular feature of FGM pipes can be tailored to fulfill the special applications in engineering.

Keywords: Functionally graded material; Multi-span pipe conveying fluid; Hybrid method

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