Bending edge waves on a thin functionally graded cylindrical shell

Rahul Som*[1] and Santanu Manna[1]

[1]Indian Institute of Technology Indore – India

Abstract

The development of the mathematical theory of the bending edge wave started with the work of Konenkov on the thin isotropic plate; after that, many researchers investigated the mechanical behaviour of the bending edge wave on different elastic material plates. Using the asymptotic theory, Kaplunov and his group investigated the behaviour of edge waves on thin elastic shells. This study examined the localized vibration of thin isotropic elastic shells. The kinematic of the shell is governed by the Kirchhoff-Love shell theory. An index grading of the material properties of the shell is considered and varies along the transverse direction of the shell. The surface elasticity theory proposed by Gurtin and Murdoch is included in the model to extract the effects of the mechanical properties of the surface element onto the dispersion of the bending wave on the shell structure. The dispersion relation is obtained by considering a sinusoidal wave propagating along the free edge of the thin semi-infinite shell and decaying exponentially along the longitudinal direction of the shell. The implementation of the asymptotic integration technique on the equation of motion and free edge boundary condition of a circular cylindrical shell enables the extraction of the dispersion of bending wave under a small value of thickness-to-curvature ratio. Analytical and numerical analysis of the resulting dispersion relation is performed, and the results are illustrated with their underlying physics.

*Speaker