Journal of Acoustical Engineering Society of Iran, vol. 3, no. 1, 2015

Investigation of sound transmission through bi-layer functionally graded materials infinite cylindrical shell

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Abstract

In the present study, transmission loss of a bi-layered Functionally Gradient Materials (FGM) cylindrical shell with infinite length, subjected to a harmonic plane wave with a constant axial airflow in the external fluid medium, is studied analytically. In order to calculate the transmission loss at the whole range of frequency; the vibration equations of bi-layered FGM shells in three directions are coupled with Helmholtz acoustic equations of the internal and external fluid of the shell; and solved simultaneously. Modal interaction approach is used to solve the equations; in this approach all variables such as displacement of shells and acoustic pressure are expressed as infinite series, therefore in this study, convergence of the series also is considered. To check the validity, accuracy and efficiency of the present model, results obtained are compared with the results of other researchers. The effect of power law exponent on shell stiffness, volume fraction, elasticity modulus and density of bi-layered FGM shell is shown. Also the effects of the volume fraction and different materials of layers are investigated on transmission loss. Also, the sound transmission loss of bi-layer FGM shell is compared with one layer FGM and aluminum shells. The result shows in the whole range of frequency the transmission loss of FGM bi-layered shell is better than the other shells.

Keywords: Functionally graded materials, bi-Layered cylindrical shells, Sound transmission, Acoustic pressure.

pp. 26-36 (In Persian)

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[DOR: 20.1001.1.23455748.1394.3.1.8.8]

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