World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:16, No:12, 2022

Elastodynamic Response of Shear Wave Dispersion in a Multi-Layered Concentric Cylinders Composed of Reinforced and Piezo-Materials

Authors : Sunita Kumawat, Sumit Kumar Vishwakarma

Abstract : The present study fundamentally focuses on analyzing the limitations and transference of horizontally polarized Shear waves(SH waves) in a four-layered compounded cylinder. The geometrical structure comprises of concentric cylinders of infinite length composed of self-reinforced (SR), fibre-reinforced (FR), piezo-magnetic (PM), and piezo-electric(PE) materials. The entire structure is assumed to be pre stressed along the azimuthal direction. In order to make the structure sensitive to the application pertaining to sensors and actuators, the PM and PE cylinders have been categorically placed in the outer part of the geometry. Whereas in order to provide stiffness and stability to the structure, the inner part consists of self-reinforced and fibre-reinforced media. The common boundary between each of the cylinders has been essentially considered as imperfectly bounded. At the interface of PE and PM media, mechanical, electrical, magnetic, and inter-coupled types of imperfections have been exhibited. The closed-form of dispersion relation has been deduced for two contrast cases i.e. electrically open magnetically short(EOMS) and electrically short and magnetically open ESMO circuit conditions. Dispersion curves have been plotted to illustrate the salient features of parameters like normalized imperfect interface parameters, initial stresses, and radii of the concentric cylinders. The comparative effect of each one of these parameters on the phase velocity of the wave has been enlisted and marked individually. Every graph has been presented with two consecutive modes in succession for a comprehensive understanding. This theoretical study may be implemented to improvise the performance of surface acoustic wave (SAW) sensors and actuators consisting of piezo-electric quartz and piezo-composite concentric cylinders.

Keywords : self-reinforced, fibre-reinforced, piezo-electric, piezo-magnetic, interfacial imperfection
Conference Title : ICAEW 2022 : International Conference on Applications of Electromagnetic Waves
Conference Location : Cairo, Egypt
Conference Dates : December 15-16, 2022