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THE ANALYSIS OF SH-WAVES PROPAGATION BEHAVIORS IN PERIODIC
PIEZOMAGNETIC-PIEZOELECTRIC COMPOSITE MATERIALS**Abstract**

Shear horizontal (SH) surface waves propagating in a periodic layered structure consisting of piezomagnetic thin films bonded perfectly with piezoelectric thin films alternately is taken into account. The analytic dispersion relations are obtained for the cases of SH-waves propagation in the direction normal to the interface and along the interface, respectively. The numerical calculations are carried out for the wave filter effect, effects of volume fraction and effective shear modulus ratio on the phase velocity. The results show some significant properties of SH-waves propagation in this kind of structure. Due to the intrinsic coupling properties among multi-fields and the ability of piezomagnetic and piezoelectric composites to facilitate the conversion of energy between electric and magnetic fields, such materials or structures are potential candidates for use as magnetic fields probes, sensors, actuators and microwave devices as well as other electric products, especially in the aerospace exploring application. These possible applications require a better understanding of the static and dynamic performance of piezoelectric/piezomagnetic composite media, such as deformation, vibration and wave propagation, etc. Based on the dispersion equations we obtain with the mathematical derivation, the following conclusions can be drawn: Firstly, when the SH surface wave propagates along the direction normal to the interface, the results obtained in this paper show that the number of stop bands increases with increasing value of volume fraction a , while the width of individual stop band decreases. This meaningful fact can be applied in vibrating insulation of acoustic or mechanical devices. Secondly, effective shear modulus ratio r and volume fraction a have greatly influence on the high frequency waves, while the effects on the low frequency waves are not obvious. Finally, It is found that the variation extent of the phase velocity c vs. volume fraction a has a little difference for each material combination whether the SH surface wave propagates along the direction normal to the interface or along the direction of the interface. The results obtained in this paper can provide some theoretical instructions for the design and application of periodic piezomagnetic-piezoelectric layered structure in acoustic wave and microwave devices.