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Complex band structure of elastic bulk waves in 1-D viscoelastic phononic crystals

Miranda Jr., E.J.P.(1); Schalcher, L.F.C.(1); Oliveira, V.B.S.(1);
(1) IFMA;

The elastic bulk wave propagation in a 1-D solid phononic crystal with viscoelasticity is investigated. This 1-D phononic structure composed of steel and epoxy is capable of filtering the propagation of bulk elastic waves over a specified range of frequency, called Bragg-type band gaps. The complex band structures are obtained by the extended plane wave expansion (EPWE) considering the solid theory and the standard linear solid model (SLSM) of viscoelasticity. The software MATLAB is used for the simulation. The simulated results obtained by the EPWE consider 21 plane waves for the spatial Fourier series expansion, which is suitable to present good convergence. It should be highlighted the limitation of this study, i.e., it is only valid for small deformations. Regarding the main results, the band gaps are observed with different values of unit cell wave attenuation. The filling fraction and the viscoelasticity increase the unit cell wave attenuation for specific values of frequency. The results can be used for elastic wave attenuation using 1-D viscoelastic periodic structures.