SM24L_12222

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Optimal Design of Lossy Bandgap Structures

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Elastic or acoustic (commonly refereed to as phononic) bandgap structures may find application for vibration suppression and for noise insulation purposes. The periodic arrangement of two materials with different properties may inhibit the propagation of waves at certain frequencies and for the infinite medium total reflection of the wave occurs. So far focus has almost entirely been devoted to the wave-reflecting properties and not to the effects, possibly beneficial for applications, of dissipation in the bandgap structures. This work presents a systematic method for the optimal design of bandgap structures for two objectives: 1) minimum wave transmission through the structure and 2) maximum dissipation of wave energy in the structure. The structures are obtained as optimal distributions of two materials where one is lossy, and the design methodology is based on the method of topology optimization, recently used to design bandgap structures with optimized wave reflection.

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