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Acoustic wave propagation through multilayer Thue-Morse structures containing two, three and four materials of Cu, Al, MgO and Pb

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Abstract

In this paper, the acoustic wave propagation in multilayer Thue-Morse structures has theoretically been studied. The composing layers were assumed do be Cu, Al, Mgo and Pb materials. Two, three or four different materials have been used in a typical structure. By using a perpendicular incident acoustic wave, the transmission coefficient was calculated and then by its old, the frequency gaps wasinvestigated. These structures can have different applications such as acoustic filters, acoustic insulations, acoustic diodes, etc. it is shown that the quantization of the transmission coefficient with respect to the number of layers in an assumed structure, can be utilized to use minimize the materials used in an experiment to fabricate a structure with the desired frequency gap. Now, the frequency gaps and their positions on the frequency axis are tunable by using the Thue-Morse structures. Finally, the effects of the number of layers, total system length, material type and the arrangement of the layers on the frequency filtering have been studied. It is also shown that the 4-material systems can filter a wider range of frequencies than the 3-material ones and 3-material systems can filter a wider range of frequencies than the 2-material ones.

Keywords: Acoustic wave propagation, Thue-Morse multilayers, Frequency gap, Transmission coefficient.

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