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Vibration Reduction Design of Two-Dimensional Periodical Triangular Concave Structure

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ABSTRACT

In modern engineering, situations that require vibration reduction often come with specific pressure requirements. Mechanical metamaterials have the advantages in mechanical loading and low-frequency band gap vibration reduction. To ensure that the structure has a wide and low-frequency band gap while having a pressure resistance, a two-dimensional triangular concave negative Poisson's ratio structure with strong pressure resistance is introduced. The internal structure is designed according to the principle of local resonance. The band structure and intrinsic modes of the two-dimensional triangular concave model are calculated by the finite element method through simulation software. The band gap of the structure can be actively regulated by altering the geometric and material parameters, and the mechanism behind the formation of the band gap is further analyzed. The simulation results show that the addition of locally resonant phononic crystals makes the two-dimensional triangular concave model form an obvious band gap. By optimizing the geometric parameters and material parameters, the band gap can be widened, the starting frequency of the band gap can be reduced, and the pressure resistance of the overall structure can be improved. The research results provide a new feasible scheme for simultaneous realization of pressure resistance and vibration reduction, and provide ideas for active control of the band gap.

KEYWORDS

Negative poisson's ratio structure; local resonance principle; band gap; vibration damping

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