

PROCEEDINGS

A Type of Pentagon Plate-Shaped Metamaterial with Resonator Inside to Form a Regular Dodecahedron Metacage

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ABSTRACT

A pentagon plate-shaped metamaterial with resonators inside is designed, and both sides are covered with PVC membranes. The components are designed with sloped exterior walls and can form a regular dodecahedron metacage. The effect of the single component is based on the vibration of the membranes, when the size of two membranes has the same size, the transmission loss appears to be significant around 900 Hz and have another peak around 1400 Hz. When use twelve components to form a regular dodecahedron metacage, with a diameter of less than half a meter, a measurement of insertion loss has been done in the reverberation chamber. It can be found that with random component direction assembly, for the inside noise mitigation, the insertion loss of the metacage shows a peak around 550 Hz. Also, when the sound source is placed outside, it can be found that the metacage can mitigate noise at low frequency level from the outside. In this paper, the COMSOL simulation is also done for the single components, mimicking the experiment in the impedance tube. The results from the numerical simulation can correlate with the experimental results, and to provide the mode shapes of membranes. This work can provide an attempt of using acoustical metamaterials to build a metacage that can mitigate certain low frequency noises and can help with the noise isolation for noisy machines and other sound events.

KEYWORDS

Acoustical metamaterial; metacage; transmission loss; Helmholtz resonator

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