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(Research Article)
Design and simulation of a nonlinear acoustic rectifier based on phononic method crystals

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Abstract

Rectification has been one of the revolutionary topics in electronics and electromagnetics. The emergence of rectification in acoustics can also lead to tremendous changes in technological applications. Phononic crystals are one of the new topics in acoustics, and by employing this tool, unusual properties including sound insulation in acoustic applications have emerged. In this article, to achieve the initial design, a linear sound insulation structure based on phononic crystals is presented, exhibiting acoustic insulation properties. In the following, by adding a non-linear environment to the linear section, the possibility of rectification of that system at different frequencies has been investigated and analyzed. In the investigations, it was shown that the one-way passage of sound waves is possible by nearly 100% by adding a non-linear medium, so that sound waves with a certain frequency radiated from the side of the non-linear medium have the ability to completely pass through the rectifier, but with the entry of these sound waves in the same frequency from the linear side, are completely rectified. The rectification capability presented in this research can open the way for laboratory scientists to provide new technological applications by constructing and conducting research in such an efficient and simple environment.

Keywords: Nonlinear acoustic rectifier, Linear sound insulator, Phononic crystal, Band gap.

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