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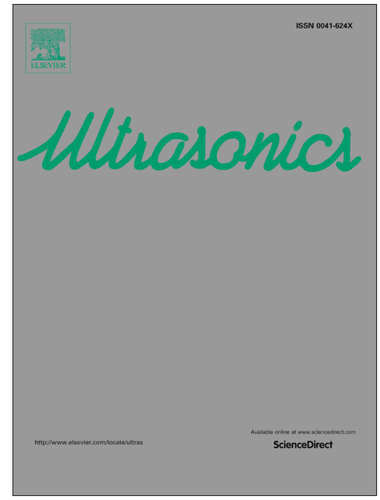

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Abstract

Asymmetric acoustic wave propagation is important for control and manipulation of the acoustic wave signals in various devices. However, previous approach to find optimal asymmetric acoustic transmission (AAT) is through repeatedly adjusting the geometrical parameters, thus causing time-consuming. Here we propose a study on the multi-objective optimization of the AAT, aiming to achieve the widest working frequency range (*fr*) and the highest transmittance peak (η) with regard to the design variables. For this purpose, the Radial Basis Function (RBF) neural work and finite element (FE) method are applied to obtain the valuable data in the procedure. Furthermore, local sensitivity analysis of design parameters on the *fr* and η are analyzed. Ultimately, the Non-Dominated Sorting Genetic Algorithm Ⅱ (NSGA-Ⅱ) is adapted for getting the Pareto-optimal solutions. The optimization results show great improvement for the overall performance of the AAT, which could be potentially significant in designing various sound devices.

Keywords: Multi-objective optimization, RBF model, NSGA-Ⅱ, Working frequency range, Transmittance peak

1. Introduction

Recently, the AAT devices of acoustic waves have aroused great interests because of their prospective potential applications, such as medical ultrasonic devices, acoustic rectifiers and so on [1-3]. The acoustic metamaterials and the transformation acoustics have provided an effective method to the design of the AAT devices. So far, the AAT can be realized by breaking the time-reversal symmetry or the spatial inversion symmetry. Liang et al. [4-6] theoretically and experimentally investigated the AAT of acoustic waves based on the nonlinear mechanism by breaking the time-reversal symmetry. Nassar et al. [7,8] have theoretically proposed the modulated phononic crystals which offers promise for

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