Journal of Acoustical Engineering Society of Iran, Vol. 5, No. 2, 2018

Optimization of sound transmission loss in a finite-length FGM plate using multi-objective genetic algorithm

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Abstract

In this paper, the optimization of sound transmission through finite-length Functionally Graded Materials (FGM) plates by the use of genetic algorithm is studied. The main objective of this paper is to identify and optimize the effective parameters for sound power transmission of these structures. In this regard, at first, the dynamic equations of the plate are obtained using the classic theory of thin plates, then the wave propagation governing equations are extracted according to the Roussos theory. Next, the Transmission Loss coefficient (TL) of the structure is calculated by applying the boundary conditions. The effect of parameters effective on sound transmission loss is numerically investigated and optimization of sound transmission loss is executed by applying multi-objective optimization using Non-dominated Sorting in Genetic Algorithm (NSGA). The purpose of optimization is to maximize the sound transmission loss of FGM plate with minimization of its weight simultaneously, and the critical frequency of the plate is also considered as the problem constraint. The results show that the FGM material, plate thicknesses, layers layout, plate dimensions, power law exponent and the angle of incidence play an important role in reducing the sound power transmission through these structures.

Keywords: Sound transmission loss, FGM plate, Power law exponent, Genetic algorithm, Optimization.

pp. 12-21 (In Persian)

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[DOR: 20.1001.1.23455748.1396.5.2.3.9]

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