Optimization of double-layer absorbers on constrained sound absorption system by using genetic algorithm

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SUMMARY
As investigated by the Occupational Safety and Health Act (OSHA) in 1970, noise is highly responsible for the psychological and physiological ills to workers. Therefore, the noise control for an enclosed system with high echo effect becomes essential. Besides, the thickness of adopted sound absorber is occasionally constrained for maintenance, the interest in minimising the noise under space constraint is then arising. In this paper, the shape optimization of double-layer absorber together with genetic algorithm (GA) is presented. Before optimization, one example is tested and compared with the experimental data for accuracy check of mathematical model. Thereafter, a simple optimal program in dealing with pure tone noise of 350 Hz has been pre-run to verify the correctness of genetic algorithm before the design in full band noise being performed. Results show that both the accuracy of mathematical model and the correctness of GA method are acceptable. Consequently, this study may provide a novel scheme with GA in solving the shape optimization of sound absorber on the constrained sound absorption system. Copyright © 2004 John Wiley & Sons, Ltd.

KEY WORDS: double-layer absorbers; transfer matrix method; constrained sound absorption system; GA optimization

1. INTRODUCTION

During the past three decades, there has been a growing interest in problem solving algorithms inspired by natural systems in physics and biology. One of the best known algorithms is the genetic algorithms [1] which have been applied successfully into many disciplines. A great advantage of GA optimizers is that GA is able to locate the global optimum in a near optimal manner without either the first derivative of objective function or the good starting point used in traditional deterministic methods. In practical optimization problems, such nearly optimal solution are usually acceptable because engineers prefer finding a satisfactory near optimal