GA Optimization on Constrained Venting System with Single-Chamber Mufflers

Ying-Chun Chang*    Long-Jyi Yeh    Min-Chie Chiu

Department of Mechanical Engineering
Tatung University
Taipei, Taiwan 104, R.O.C.

Abstract

The shape optimization to maximize the muffler's performance is essential when the space volume of mufflers in a venting system is constrained inside a building. This paper presents a GA (genetic algorithm) [1,2] based on the optimization procedure for the shape optimal design of single-chamber mufflers and the theoretical derivative technique of four-pole matrix [3,4] in sound transmission loss (STL).

The techniques of binary genetic algorithms (BGA): reproduction, crossover, mutation and elitism, together with the commercial MATLAB package [5] are applied in GA searching. A numerical case of noise elimination in full band sound waves is introduced in the present study of shape optimization. Before optimization, one sample is tested and compared with the experimental data [6] for checking the accuracy of mathematical model. To achieve the best optimization in GA, several GA parameters were on trial involving various values. Results showed that the GA operators of crossover, mutation and elitism were crucial during the GA's optimization. Moreover, the proposed optimal design of STL on constrained single-chamber mufflers could provide a quick and economical approach to optimization without having to involve redundant tests.

KeyWords: single-chamber muffler \ venting system \ space constraints \ transfer matrix method \ GA optimization

* Corresponding author: Ying-Chun Chang
E-mail: min-chie.chiu@ctci.com.tw, ljyeh@ttu.edu.tw and ycchang@ttu.edu.tw
Mailing address: Department of Mechanical Engineering, Tatung University,
        40 Chungshan N. Rd., 3rdSec., Taipei, Taiwan 104, R.O.C.