GA OPTIMIZATION ON SINGLE-CHAMBER MUFFLER HYBRIDIZED WITH EXTENDED TUBE UNDER SPACE CONSTRAINTS

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Mufflers are habitually adopted in gas venting systems under space constraint for maintenance and operation. The shape optimization in the muffler to maximize the sound performance is then highly focused, accordingly.

In this paper, the shape design of a muffler with extended tubes optimized by the genetic algorithm (GA) is presented. A numerical case in eliminating the pure tone noise is introduced. Before optimization, the mathematical model is compared by the experimental data for an accuracy check. The results indicate that the sound transmission loss (STL) is maximized exactly at the designed frequency. Consequently, we demonstrate a successful GA application on the muffler design.

Key words: single-chamber muffler hybridized with extended tube, transfer matrix method, space constraints, GA optimization.

Notations

This paper is constructed on the basis of the following notations:

- \( \text{bit}_n \) bit length,
- \( C_0 \) sound speed (m s\(^{-1}\)),
- \( C_v \) specific heat at constant volume (kJ kg\(^{-1}\) °K),
- \( D \) diameter (m),
- \( \text{elt}_n \) selection of elite (1 for yes and 0 for no),
- \( \text{gen}_n \) maximum no. of generation,
- \( f \) cyclic frequency (Hz),
- \( j \) \( \sqrt{-1} \),
- \( k \) wave number \( (w/c_0) \),
- \( K_e \) stagnation pressure loss factor between point 5 and point 7,
- \( K_e' \) stagnation pressure loss factor between point 2 and point 4,