Numerical studies on constrained venting system with reactive mufflers by GA optimization

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SUMMARY

While the space volume of mufflers in a venting system gets constrained, shape optimization to maximize the muffler's performance becomes important and essential. This paper presents a genetic algorithm (GA) for the optimal shape design of mufflers.

The four-pole matrix method which was adopted in evaluating the acoustic performance of sound transmission loss (STL) is used in conjunction with the GA techniques. Case studies of the full band noise inside a venting system are exemplified by the reactive mufflers. Before the GA operation, several examples are tested and compared with the experimental data for accuracy check of the mathematical models. Consequently, GA can provide a quick and effective way for a muffler design work. Copyright © 2005 John Wiley & Sons, Ltd.

KEY WORDS: reactive muffler; venting system; space constraints; four-pole matrix; GA optimization

1. INTRODUCTION

As a result of the investigation made by the Occupational Safety and Health Act (OSHA) in 1970 [1], it was found out that high noise levels can be psychologically and physiologically harmful to workers. Hence, attention is now focused on the noise control of equipment. Moreover, a lower noise design in a product has become an essential factor for sales and profits [2].

In dealing with industrial noise from a venting system, a muffler is habitually used [3]. However, the shape of the muffler is often constrained depending on the operational and maintenance needs in practical design works. Besides, the discussion on the optimal design under space constraints is rarely emphasized. Bernhard [4] has introduced the shape optimization

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