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Optimization of effective geometrical dimensions and studying on absorptive materials for acoustic attenuation performance of muffler

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Abstract

Nowadays, the issue of noise and annoying sounds is one of the major challenges in design of mufflers, that is used to reduce the noise level generated by output current of vehicles' engines. Therefore, the noise generated by the exhaust system can be controlled through predicting and calculating the transmission loss level, which is considerable and cannot be neglected. The investigated muffler has been reported to have an elliptical cross section, three straight porous tubes, four expansion chamber and three divisive plates. Generally, the main purpose of this study is to analyze the acoustic attenuation performance by using the Boundary Element Method. Also, in order to approach maximum transmission loss level, the effective geometrical parameters are optimized by using Response Surface and Taguchi methods. The results of this two methods are compared with each other. Finally, due to non-dependence of the Sound Transmission Loss level at the resonant frequencies on dimentions variation of geometrical parameters, by adding sound absorbing materials to the muffler's shell, the acoustic attenuation performance is increased more than double and the effect of different absorptive materials in this numerical simulation is investigated.

Keywords: Muffler, Sound transmission loss level, Boundary element method, Optimization, Absorptive material.

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