World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:10, No:07, 2016

Effects of Duct Geometry, Thickness and Types of Liners on Transmission Loss for Absorptive Silencers

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Abstract : Sound attenuation in absorptive silencers has been analyzed in this paper. The structure of such devices is as follows. When the rigid duct of an expansion chamber has been lined by a packed absorptive material under a perforated membrane, incident sound waves will be dissipated by the absorptive liners. This kind of silencer, usually are applicable for medium to high frequency ranges. Several conditions for different absorptive materials, variety in their thicknesses, and different shapes of the expansion chambers have been studied in this paper. Also, graphs of sound attenuation have been compared between empty expansion chamber and duct of silencer with applying liner. Plane waves have been assumed in inlet and outlet regions of the silencer. Presented results that have been achieved by applying finite element method (FEM), have shown the dependence of the sound attenuation spectrum to flow resistivity and the thicknesses of the absorptive materials, and geometries of the cross section (configuration of the silencer). As flow resistivity and thickness of absorptive materials increase, sound attenuation improves. In this paper, diagrams of the transmission loss (TL) for absorptive silencers in five different cross sections (rectangle, circle, ellipse, square, and rounded rectangle as the main geometry) have been presented. Also, TL graphs for silencers using different absorptive material (glass wool, wood fiber, and kind of spongy materials) as liner with three different thicknesses of 5 mm, 15 mm, and 30 mm for glass wool liner have been exhibited. At first, the effect of substances of the absorptive materials with the specific flow resistivity and densities on the TL spectrum, then the effect of the thicknesses of the glass wool, and at last the efficacy of the shape of the cross section of the silencer have been investigated.

Keywords : transmission loss, absorptive material, flow resistivity, thickness, frequency
Conference Title : ICCME 2016 : International Conference on Computational Mechanical Engineering
Conference Location : Montreal, Canada
Conference Dates : July 14-15, 2016