

ACOUSTIC ANALYSIS FOR EFFECT OF EXTENDED INLET AND EXTENDED OUTLET TUBE ON TRANSMISSION LOSS OF SINGLE EXPANSION CHAMBER REACTIVE MUFFLER

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Abstract : The internal combustion engine is major source of noise pollution. The engines finds wide application base as in various manufacturing machineries, locomotives and automobiles. The maximum contribution to noise pollution is shared by exhaust noise and noise which is produced on account of friction of various parts. Muffler is a device used to reduce noise within the exhaust system. It is arranged along the exhaust pipe for the purpose of noise attenuation. In the present work, an attempt has been made to study the effect of extended Inlet and Outlet elements in Single Expansion Chamber reactive muffler on the muffler's capacity of noise reduction (i.e. Transmission Loss). The acoustic behaviour of the muffler is investigated in detail by: (1) the finite element method by using COMSOL Multi-Physics, (2) and Experimental validation by using Two Load Method.

Keywords : *Reactive muffler, Transmission Loss, Finite Element Analysis, Two Load Method.*

1. Introduction

Noise pollution produced by engines becomes a major concern when used in residential areas or areas where noise creates hazard. The exhaust noise is the most harmful. Noise level greater than 80 dB is injurious for human being. Various types of muffler are used to attenuate this noise. The reduction in the level of exhaust noise depends upon the construction and the working procedure of mufflers. Therefore design of muffler plays an important role as it affects the noise characteristics and fuel efficiency of the engine. The exhaust muffler is characterized by numerous parameters like Insertion Loss (IL), Transmission Loss (TL). Transmission Loss (TL) is one of the most frequently used criteria of muffler performance because it can be predicted very easily from the known physical parameters of the muffler. The Transmission Loss could be achieved by analytical, numerical and experimental method. Analytical methods are cumbersome as the associated algebra is complicated therefore many times it is impossible

to solve such problems by analytical methods[1,3]The numerical methods

are general and allow the analysis of all types of mufflers and therefore used for optimization of model of complicated shapes and cost involved is less than experimental methods. In this paper, the Single Expansion Chamber reactive muffler with extended inlet and outlet is examined using Finite Element Method. The detailed design procedure is available in the literature given by M.L.Munjaj [2]. In general, the experimental results are used to verify the results obtained from analytical and numerical methods and also for the evaluation of overall performance of the model, to check whether the model satisfies the design requirements [4].

2. Modeling

The muffler Transmission Loss for the Single Expansion Chamber reactive muffler is evaluated using finite element analysis. The software used for the analysis is COMSOL Multiphysics.[7].The design conditions used for evaluating Transmission

experimental results are in good agreement with FEM results. The small deviation in experimental result from that of FEM result may be attributed to leakage of sound from impedance tube to the surrounding, problems in generating white noise from FFT, inaccurate surface finish quality of Impedance tube.

8. Conclusion

The effect of extended inlet and extended outlet on Transmission Loss of Single Expansion Chamber muffler is analysed. FEM analysis is carried out with Comsol Multi physics while Experimental Analysis is carried out with Two Load Method. The results of FEM and Experimental analysis are in good agreement. It can be concluded that, broadband Transmission Loss can be obtained when both extended inlet and outlet is placed inside the Single Expansion Chamber reactive muffler.

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