

Prediction and Control of Transmission Loss to Improve Motorcycle Muffler Sound

N. Bhatia¹, U. Mohite¹

¹Mahindra 2 Wheelers, Pune, India

Abstract

Mufflers are devices used to attenuate engine exhaust noise. Muffler design has become more challenging as the customers look out for good exhaust sound quality, especially for motorcycles. Performance of a muffler in an automotive exhaust system is characterized by Transmission Loss (TL), insertion Loss (IL) and radiated noise levels. TL is defined as the ratio between the incoming and the outgoing acoustic energy. TL is a property of muffler alone and is independent of the source. The scope of the present work is to predict TL for motorcycle muffler.

In the present work, TL is predicted for a muffler of single cylinder motorcycle engine. Based on the muffler layout and flow, volume mesh for different regions is modelled, so that boundary conditions can be conveniently defined in COMSOL Multiphysics®. Using the Acoustic Module, boundary conditions such as continuity and sound hard are applied at appropriate locations. Perforations on pipe are defined by giving porosity details for the perforated area. For porous materials such as glass wool, flow resistivity is defined in poroacoustic model available in COMSOL Multiphysics. Unit pressure is given as input at inlet and plane wave radiation condition is applied to both inlet and outlet boundaries as shown in Figure 1.

Results: Noise levels for the existing muffler at engine idling condition were recorded in testing and increase in noise levels at low frequencies was desired. To achieve this, the transmission loss at low frequencies was reduced by carrying out modifications in the existing muffler (Figure 2). With modified muffler, the desired increase in noise levels at low frequencies was achieved.

Conclusion: Transmission loss for a muffler of single cylinder motorcycle engine is predicted. Based on analysis results, modifications in muffler can be carried out in the design stage to achieve desired noise levels. Thus it helps to reduce time and cost involved in product development.

Reference

1.COMSOL Multiphysics Documentation, Acoustic Module User's guide.

Figures used in the abstract

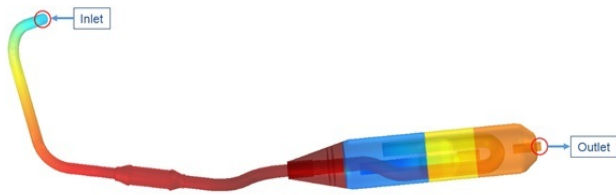


Figure 1: Inlet and Outlet boundaries of Existing Muffler.

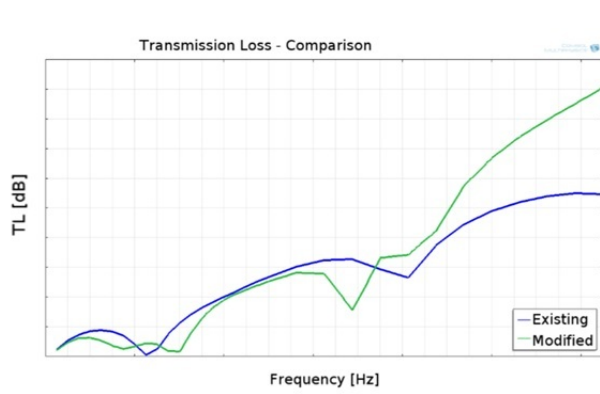


Figure 2: Transmission Loss - Comparison.