# Analysis of Flow Induced Noise in a Passenger Car Exhaust System - An Experimental and Numerical Approach

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A muffler or silencer is an integral part of the exhaust system and is a device used to prevent sound from reaching the openings of the exhaust duct and radiating as far field noise. Different acoustical design and analysis techniques are used to predict the acoustical performance of exhaust systems. Flow noise from exhaust tail pipe is one of the major noise sources in a vehicle. Flow noise is generated mainly during fast acceleration operating condition due to complex flow behavior. In this paper, we have studied the detailed flow field and tried to establish an analyses procedure for flow noise prediction. The flow analysis is carried out in commercial CFD solver STAR-CCM+. The transient engine boundary conditions are obtained from the experimental testing. The flow noise generated from the muffler was calculated by acoustic analogy of Lighthill using the above boundary conditions. The strong fluctuation of pressure inside the muffler generates the broadband noise in the frequency range 1000 - 8000 Hz and the same is validated with experimental data. The experiment was carried out in a specially designed engine test rig in order to measure the exhaust flow noise. The so developed analysis methodology is found to be effective in predicting the exhaust flow noise early in the concept design stages.



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