

VIBRATION ANALYSIS OF EXHAUST SYSTEM OF AUTOMOBILE VEHICLE

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Abstract: This research investigates the effect of vibration due to exhaust system after combustion of fuel, when considered in case of exhaust system; two types of vibration can affect the exhaust. The sonic pressure waves coming from the exhaust ports, and the vibration of the engine itself because of torquing. Pressure wave vibrations are usually transparent, travelling through the exhaust system to either absorb into or cancel out in the muffler. Actual Dimension create model in modeling software and after harmonic analysis in analysis software. Then create Counter weight mounted model and analysis that model.

Index Terms - Vibration, 3D Model, Harmonic Analysis, Counter Weight Model

I. INTRODUCTION

An exhaust framework is typically funneling used to direct response exhaust gases from a controlled ignition inside a motor or stove. The whole framework passes on consumed gases from the motor and incorporates at least one exhaust system. Contingent upon the general framework plan, the exhaust gas may course through at least one of: Cylinder head and ventilation system a turbocharger to expand motor power. An exhaust system to diminish air contamination. A suppressor (North America)/silencer (UK/India), to decrease commotion. The exhaust is in charge of directing and treating hurtful gases discharged by the motor, other than diminishing the clamor of the vehicle. Despite the fact that not the most recalled when purchasing a vehicle, it is critical for the best possible working of the vehicle and for the conservation of the earth. It comprises of three primary parts, associated by the exhaust channels, masterminded between the motor and the vehicle's tailpipe. The initial segment of the framework is the gatherer. It is associated straightforwardly to the vehicle motor and, to withstand the high temperatures to which it is oppressed it is created in cast iron or treated steel.

It comprises of channels that gather substances created amid the terminating of fuel and direct them to the fumes. In this part, the synthetic response happens and the gases become less destructive. As it goes through the catalyze, the gases go through the clay center, responding with the current respectable metals.

The middle suppressor comprises of a voice with openings and cameras that work as a reverberation box. They diminish the clamor created by the motor. In this manner, they mirror the high-recurrence sound waves with the goal that they mostly counterbalance. The commotion decrease is guaranteed by the back suppressor situated toward the finish of the fumes, before the back. It is in charge of catching the most intense clamors from a structure framed by certain divisions. At the point when gases head out starting with one suppressor then onto the next, commotions and vibrations decline because of the crash inside the suppressor. After this procedure, the gases are tossed into the air by the back at all unsafe way that is available.

That is the reason it is vital to add the exhaust upkeep to the quality utilization of the vehicle. The vibrations made in vehicle motors exchange to the silencer ventilation system, these incessant vibrations cause breakage in silencer ventilation system. Two kinds of vibration can influence the fumes: the sonic weight waves originating from the exhaust ports, and the vibration of the motor itself due to torquing. Weight wave vibrations are typically straightforward, going through the exhaust framework to either assimilate into or counteract in the suppressor. These waves are consonant, similar to the vibration of a speaker, yet they are generally too moment to even think about causing clamor through part development. Motor vibrations, then again, can without much of a stretch shake your exhaust pipes enough to cause segment rattling or effect.

II. OBJECTIVE

- Improve the life of component.
- Increase the overall performance of vehicle

III. 3D Model of Actual Exhaust System

3D model created in solid works modelling software with actual dimension of Wagon R car exhaust system. In the software first of follow create all part and after all part are assemble.



Figure 1-1 Exhaust manifold

In figure 1-1 its exhaust manifold that part are directly connected to the engine. That part it's a link of vibration. The vibration is two way occur in exhaust system .first one engine will vibrated during the burning of fuel and motion of converting reciprocating to rotary. Second one is the highly pressures exhaust gas will be directly contacts with exhaust manifold.

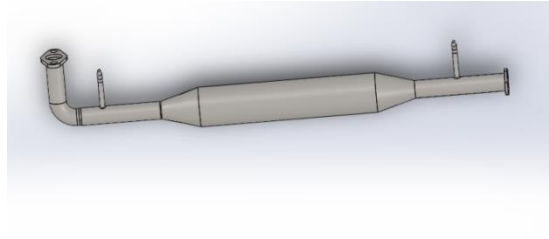


Figure 1-2 Catalytic Converters

Second most important part of exhaust system is catalytic converters .two type of catalytic converters are available in market first is two –way catalytic converters & second is three-way catalytic converters the main function is to reduce the harmful gas that come from engine. In figure 1-2 3D model of catalytic converter.

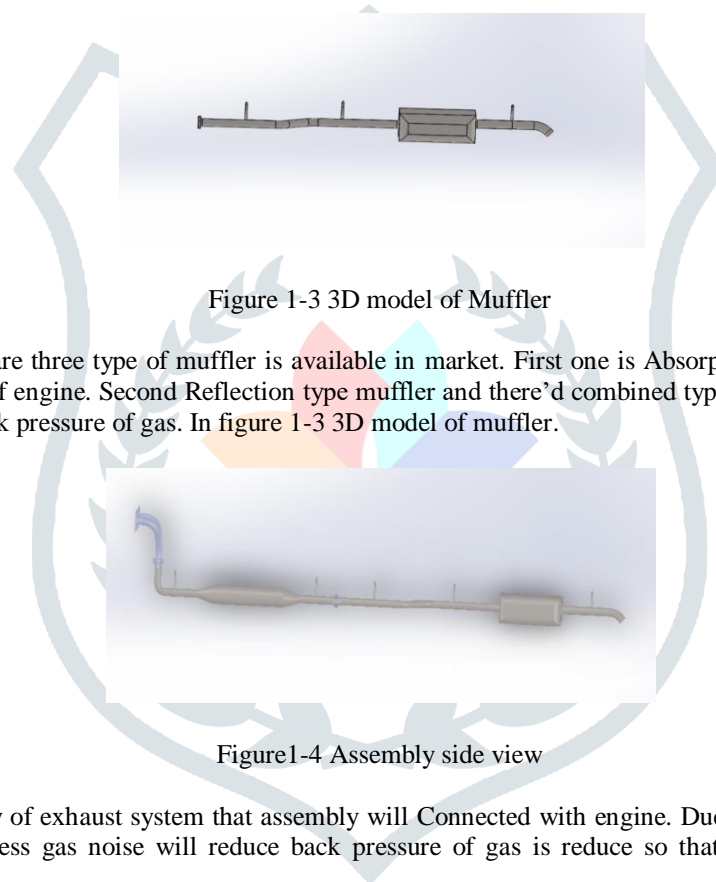


Figure 1-3 3D model of Muffler

Third part is muffler there are three type of muffler is available in market. First one is Absorption type that it's absorbing the noise that will coming out of engine. Second Reflection type muffler and there'd combined type of muffler that type of muffler are reduce noise as well back pressure of gas. In figure 1-3 3D model of muffler.



Figure1-4 Assembly side view

Figure 1-4 all part assembly of exhaust system that assembly will Connected with engine. Due to exhaust system harmful gas will be converted in harmless gas noise will reduce back pressure of gas is reduce so that are most important system of automobile.

IV. Actual 3D Model Analysis in ANSYS

In ANSYS Software first Step is Selection of Engineering Material and after that post processing in which the geometry will be meshing Show in figure 1-6. After that giving the boundary condition exhaust manifold and hanger and nut bolt are fixed. And self load force condition is applied to geometry.

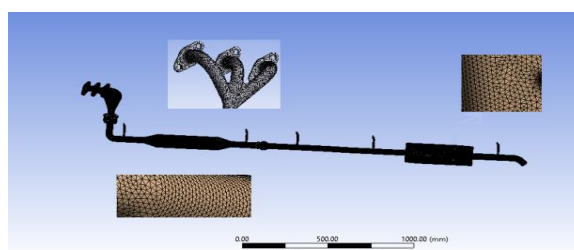


Figure 1-5 meshing geometry

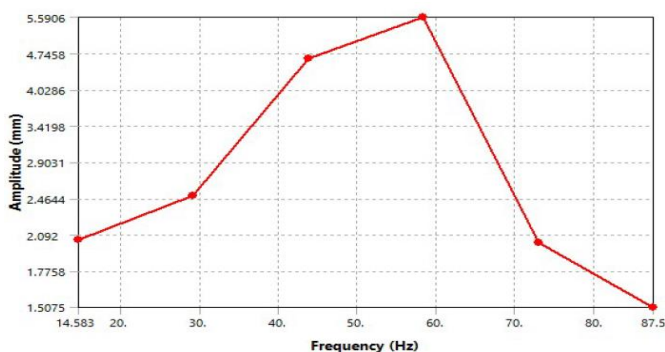


Figure 1-6 Amplitude v/s Frequency

V. 3D Modified Model & Analysis in ANSYS

The Different method is to overcome vibration at tail point so that one of that is mounting a counter weight at different amount of mass and position. Due to mounting a mass at different point that mass restricted the movement of exhaust system so due to that vibration of tail pipe its reduce.

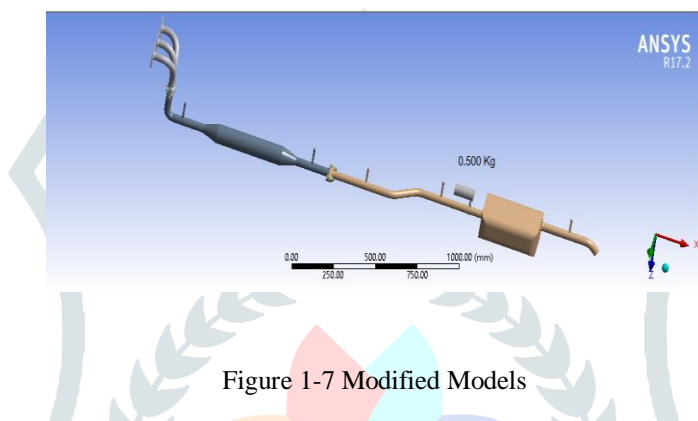


Figure 1-7 Modified Models

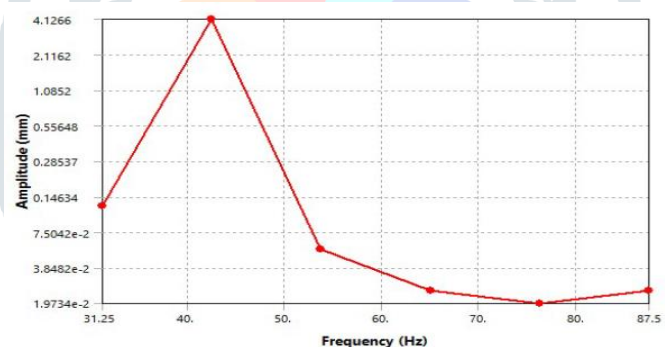


Figure 1-8 Amplitude v/s Frequency

VI. Conclusion

The defined problem was analysed accordingly and the corresponding outputs were taken and compared. It is clear that, the usage of counter weight is beneficiary as it has good vibration absorption prosperity. The following table gives the maximum amplitude and its corresponding frequency for two models. The mounting of counter weight the 26.12% amplitude will be reducing and 27.35 % forcing frequency will also be reduce. That way the life of hanger rubber will increase and performance of vehicle also be improved.

Table 1-1 Results

Problem	Amplitude	Forcing Frequency
Actual	5.5906 mm	58.5 Hz
Counter Weight	4.1266 mm	42.5 Hz

VII. ACKNOWLEDGMENT

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