An overview of automobile noise and vibration control

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In this paper the current state-of-the-art techniques in automobile noise and vibration control are presented. Automobile designers and manufacturers have to pay attention to the global competition of their products, adherence to legislative regulations and passenger/driver comfort while designing an automobile and its components. Designers can take advantage of efficient numerical modeling techniques so that in before the prototype of the automobile is produced, the design can be tweaked and modified by using computer aided models to optimize the design with a target of achieving low noise and vibration levels in the prototype. Here, examples of some typical cases are provided where optimum levels of noise and vibration level are obtained in the design of automobile components using computer aided engineering techniques

1. INTRODUCTION

There has been a continuous growth in the research and development in the different aspects of automobiles. In fact many of the major engineering innovations have finally been implemented in automobiles, and many are also being done at present. Computer aided engineering techniques have helped in the design process, by reducing the time taken for a design analysis and also providing many engineering solutions where designs can be effected without the need for manufacturing prototypes. Computer aided engineering techniques have evolved to determine the vibration response of automobile components and also the noise radiated by such components. Finite element methods have been used for structural analysis to determine the stress induced in components because of the static and dynamic loads they are subjected to. These structural components also respond dynamically to the loads, measured in terms of their vibration. Once the structure vibrates the air molecules next to it are imparted oscillatory motion and these in turn propagate the energy as longitudinal sound waves which are finally incident on the listener's eardrum and then one gets a sensation of hearing. This sound in an automobile is both heard in the vehicle interior by the passenger and the driver as well as outside by the passerby. The aim of a noise control designer is to reduce these sound pressure levels which are either heard by the person inside the vehicle or outside the vehicle. Several computer aided design techniques exist for evaluating the performance of such automobiles in terms of the noise level they generate. And there exist many engineering methods to mitigate the noise. In the

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subsequent sections the major sources of noise generation in an automobile will be presented followed by a discussion on some of the CAE techniques and experimental techniques used to mitigate it. The paper concludes with a section on sound quality, where in the quality of the sound produced by the design can be evaluated so that the design with the most pleasant sound is chosen.

2. SOURCES OF AUTOMOBILE NOISE

In any noise control technique the identification of the source and its characterization is the first and foremost things to be done. Researchers throughout the world have found by measurement and simulations that the primary noise sources in an automobile are the powertrain, tyre/road interaction and wind flow.

2.1 POWERTRAIN NOISE

The conventional internal combustion engine – either the petrol or the diesel engine – is the major source of noise in an automobile. The noise from the engine is mainly due to the combustion process, which in turn is radiated by the engine components like the cylinder block, valve cover, timing chain cover, oil sump and so on. The noise of such an engine is predominantly structure borne and low frequency in nature, typically less than 500 Hz. The radiated noise is usually at the engine firing frequency and its harmonics. In diesel engines it has been found that the fuel pump/injector system is a strong source of engine noise. The turbo-charger which is driven by the exhaust noise also produces a high frequency noise, which is known as the turbo whine with a frequency which is equal to the product of the turbine rotating frequency and the total number of vanes present in the turbo-charger. In large engines, the volume of air which is sucked into the inlet manifold during every cycle of the engine while in operation is also a major source of induction noise. The radiated engine noise increases with the engine speed. Typically IC engines used in an every day automobile operate at around a maximum of 6000 RPM, and the radiated noise has a relatively low frequency content. The gearbox housing and flywheel cover are also responsible for radiating the low frequency noise. The exhaust noise which one hears from an automobile is due to opening and closing of the exhaust valve in every cycle of the engine, and contributes to the air-borne noise one hears from the automobile [1].

2.2 TYRE/ROAD INTERACTION NOISE

Tyres in automobile are designed with a certain tread pattern, so that they provide adequate traction to the vehicle for motion. The pockets in the tread suck in air into the space between the road and the tyre tread, and throw out the air from the pockets while the tyre is rotating. When the vehicle speed increases the frequency of the sucking and throwing out of the air from the tread pocket also increases. This phenomenon produces the high frequency tyre noise one hears when the vehicle is moving at high speeds. The noise levels are so high that at times at high speeds one only hears the tyre road interaction noise and not the powertrain radiated noise. Apart from the tread air pocket noise, the sidewall vibration of a tyre in motion also produces noise. The tyre noise is predominantly a high frequency airborne noise.

2.3 WIND NOISE

When the automobile is in motion, there is a relative motion between the air which is impacting the vehicle and the vehicle body. This air at high speeds also tries to force into the passenger cavity through the gaps between the doors and the frame through the windshield and other seals. This noise is again high frequency in nature and is predominantly air-borne. The wind noise thus heard in the vehicle interior increases with the increase of the vehicle speed.

3. COMPUTER AIDED ENGINEERING TECHNIQUES

To reduce the design lead time engineers have adopted computer based numerical techniques for the estimation of the radiated noise and vibration levels in a short time. Nowadays there are many commercial computer codes for such simulations. These simulations are economical and quick to provide a solution before the high cost intensive prototypes can be manufactured. In the following sections some of the popular computer aided engineering techniques are described for noise and vibration control.

3.1 FINITE ELEMENT METHOD

Finite element method (FEM) has evolved as a numerical tool for elastic analysis of structures to determine the stress induced in a component due to both static and dynamic load, amongst others. Durability and fatigue analysis of automobile components are done by FEM. Dynamic analysis, involving free and forced response of automobile components and structures is done by the techniques of FEM. From the forced response analysis of the automobile body, its vibration response in terms of the structural velocity at every finite node point of the computer model of the component/ body is calculated at the desired frequency of interest. FEM is also used to determine the natural frequencies of the components. Automobile designers avoid having a component's natural frequency equal to the forcing or operating frequency and also ensure that no two components have the same natural frequency. This is ensured by generating a modal alignment chart of all components before the prototype is built. FEM is a very computationally intensive process, and large memory and high speed computers are required to solve the FE models. A typical automobile body could have at least around 500,000 FE nodes where the equations need to be solved.

There are many commercial FE software available for solving such problems. Fig. 1 shows the FE model of a truck cab [2]. Recently FEM is also being used for performing thermal domain and electromagnetic analysis in mechanical systems. With the global

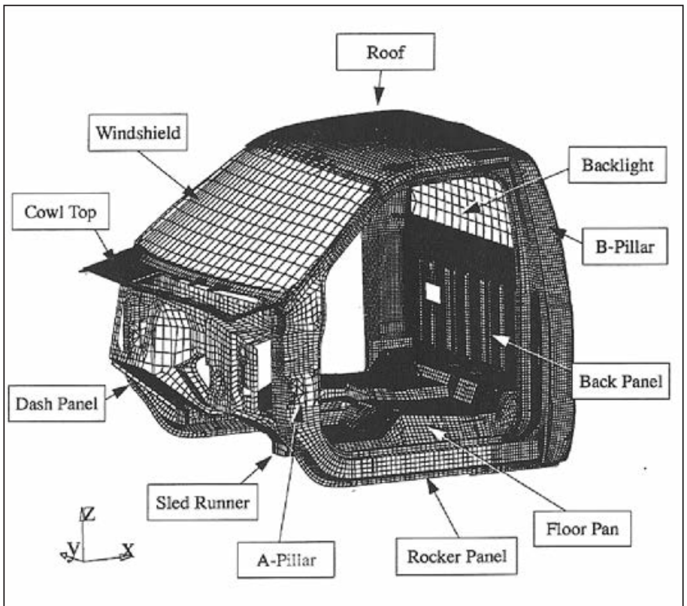

Figure 1. FE model of a truck cab [4]

move towards development of electric and hybrid vehicles, FEM techniques are also being used for analysis of components in these vehicles.

3.2 BOUNDARY ELEMENT METHOD

Unlike the FEM, where the entire three dimensional body has to be discretized, in the boundary element method (BEM) only the boundary needs to be discretized. This reduces the computational requirement to solve the numerical problem. Once the vibration responses from FE are known at the surfaces (boundary) of the automobile body, BEM can be used to determine the acoustic response at a location away from the boundary. This is widely used to predict the radiated noise from a structure (automobile body in the present case) whose surface vibration velocity is known by performing a forced response analysis using FEM. BEM has been used to predict the interior noise levels in the passenger cavity of an automobile, the radiated noise from a powertrain and the design of exhaust mufflers. As the frequency of prediction increases the number of element in the model has to increase for numerical accuracy. The numerical model must be fine enough to represent the distribution of vibration on the surface of the body [3]. With the present day state-of-the-art computational resources available, numerical models for analysis using both FEM and BEM are less than 1000 Hz. Usually all the structure-borne excitations and radiated noise is less than 1000 Hz.

An FEM/BEM combination CAE analysis was done to predict the interior noise level at the driver's right ear (DRE) location due to structural vibrational excitations at the four cab mount locations [4]. Fig. 2 shows the SPL at DRE. It is seen that by varying the sound absorbing material in the cab headliner (roof) the SPL at DRE can be changed. Thus by such a CAE analysis, an effective selection of the sound absorbing material can be made.

3.3 STATISTICAL ENERGY ANALYSIS

Another CAE technique for high frequency noise prediction is the statistical energy analysis (SEA) [5]. Because of the element size restriction, for high frequency simulations the FE model has to have a large number of elements, which becomes a computational challenge. SEA deals with the transfer of energy between various sub-systems, the response of a sub-system could be the acoustical pressure or velocity. SEA also assumes that the energy in a sub-system is

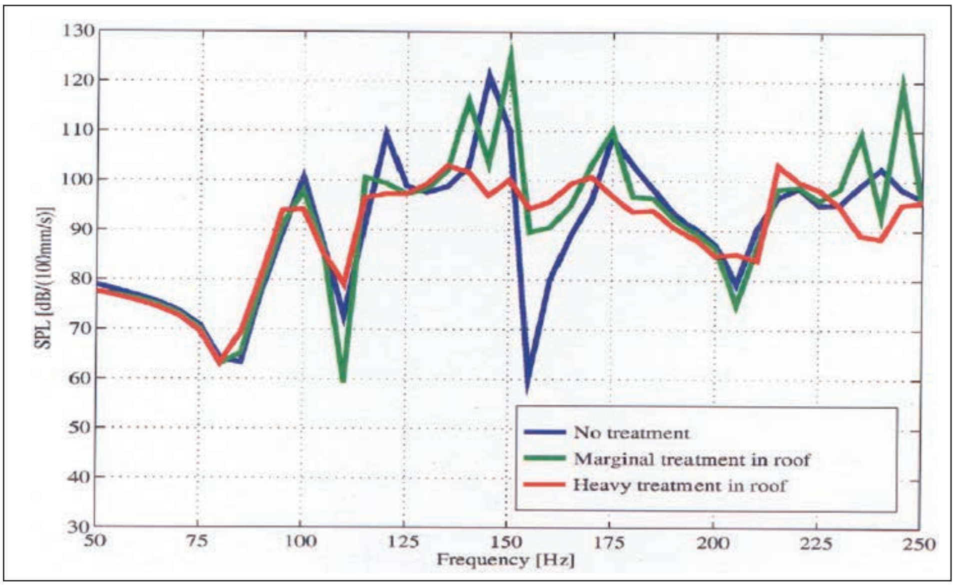

Figure 2. CAE prediction of SPL at DRE with various sound absorbing materials [4]

concentrated at its modal frequency. And at high frequencies, particularly in structures the number of modes increases in a cubic manner. The energy transfer between the sub-systems is governed by a coupling loss factor. The damping in the system is responsible for the dissipation of the energy. The input to the system could be the external excitations of force or sound pressure. For structure-borne excitation usually force or vibration is considered, and for air-borne excitation acoustic pressure is considered. For performing a SEA on an automobile, the major subsystems could be the body structure, doors, windshields etc. Again several commercial computer codes are available for SEA.

3.4 RIGID BODY DYNAMICS

A rigid body is considered to be inelastic, and thus will not deform under the application of force. Such a rigid body in space which is not constrained, and is free to have motion in any direction, will have six predominant motions. Three of the motions are translational and the remaining three being rotational. To study the motion of a vehicle, which is subjected to excitations from the power train and the road while in motion, a rigid body model of the vehicle is created. Rigid body dynamics enables one to understand the ride and handling characteristics of a vehicle on the computer. Though in a proving ground provisions are physically available to study and measure the dynamic response of a vehicle to standard ride and handling maneuvers. To make a rigid model of a system, the geometry of the system along with the mass needs to be known, with the location of the center of gravity, and all the motions will be around the center of gravity of the rigid body. The subsystems are connected by joints which allow a motion in certain degrees of freedom and constraint in the remaining degrees of freedom. For tuning the suspension system of an automobile, the stiffness of the suspension system can be varied to have the desirable response at some of the touch and feel points of the vehicle, like the seat and steering wheel vibration. This type of rigid body dynamics through CAE saves a lot of time and resource, since it is quick and inexpensive, compared to an actual proving ground test.

Fig. 3 shows a truck in a proving ground with potholes on the test track for vehicle ride and handling quality evaluations. Such a track can also be used for durability studies on the automobile components.

3.5 COMPUTATIONAL FLUID DYNAMICS

Flow noise around a vehicle increases significantly with the increase in the relative air speed as a power law. The noise levels produced in the interior of

Figure 3: Pothole track in a vehicle testing proving ground

Figure 4. Passby noise measurements of a truck at a test track

the vehicle is usually reduced by having effective seals around the windshield and doors. The air resistance on the vehicle can be reduced by streamlining the frontal area thus reducing the drag coefficient. Such tests are done using a three dimensional scale model in a wind tunnel. However, again through computational fluid dynamics, by solving the Navier-Stokes (NS) equation or the energy equation the flow and pressure field due to the relative motion of the fluid over the solid body can be studied [6-7]. Engineers have now used CFD to study the noise generated by a radiator cooling fan, air conditioning fan, determining a streamline profile for a high speed vehicle all on a computer, without even building the three dimensional body or doing a wind tunnel test.

4. NOISE AND VIBRATION TARGET

Every designer has a problem in hand as to what is the achievable target level in terms of noise and vibration for the automobile? One approach designers take is to design for target levels lower than their competitors or past surrogate designs. Of course these manufacturers and designers are also required to abide by the local regulatory standards for the products.

4.1 NOISE LEVELS IN AUTOMOBILES

An automobile designer has to keep two important parameters in mind while designing for noise levels in a vehicle. First, the interior noise level as heard by the passenger/driver has to be the minimum, since every other manufacturer is putting in efforts to keep the interior noise level as low as possible. Noise control engineers are also looking into the quality of sound as perceived by listeners, and methods to improve the sound quality. Secondly, there are regulations in place as to how much exterior sound from the vehicle as a whole can be heard by a bystander away from the vehicle. There are international standards to measure the passby noise levels for two wheelers and four wheelers. Throughout the world automobile designers strive to ensure that the automobiles manufactured out of their design satisfy the permissible passby noise levels in a globally competitive market. For example, the limits of the passby noise of vehicles manufactured in India after the year 2005 are given in Table 1. The data has been provided by the Central Pollution Control Board (CPCB) of the Government of India. The passby noise levels measurements are made as per the BIS:3028-1998 standard [8] . Essentially the vehicle is made to move at full throttle in a particular gear depending upon the engine power in a straight stretch of 50 m in a free field environment. The

Table 1. Passby noise limits of vehicles manufactured in India after 2005

Sl. no.	Vehicle type	Passby noise level in dBA
1.0	**Two Wheeler**	
1.1	Displacement upto 80 cc	75
1.2	Displacement more than 80 cc but upto 175 cc	77
1.3	Displacement more than 175 cc	80
2.0	**Three wheeler**	
2.1	Displacement upto 175 cc	77
2.2	Displacement more than 175 cc	80
3.0	**Vehicles used for carriage of passengers and capable of having not more than nine seats including the driver's seat**	**74**
4.0	**Vehicles used for carriage of passengers having more than nine seats, including the driver's seat and a maximum gross vehicle weight (GVW) of more than 3.5 tonnes**	
4.1	With an engine power less than 150 kW	78
4.2	With an engine power of 150 kW or above	80
5.0	**Vehicles used for carriage of passengers having more than nine seats, including the driver's seat: Vehicles used for carriage of goods**	
5.1	With maximum GVW not exceeding 2 tonnes	76
5.2	With maximum GVW greater than 3 tonnes but not exceeding 3.5 tonnes	77
6.0	**Vehicles used for transport of goods with a maximum GVW exceeding 3.5 tonnes**	
6.1	With an engine power less than 75 kW	77
6.2	With an engine power of 75 kW or above but less than 150 kW	78
6.3	With an engine power of 150 kW or above	80

passby noise is measured at an offset of 7.5 m from the center of the test track at a calm wind speed condition. Fig. 4 shows the passby noise measurements being done a truck at a test track near IIT Kharagpur. Fig. 5 shows the recorded noise time history during the passby noise measurements. In one instance the passby noise level of a farm tractor was reduced by placing the muffler inside the hood of the tractor, and just having the muffler tail pipe sticking out of the engine. Fig. 6 shows the underhood muffler housed in the farm tractor. Many a times engine encapsulation is done, especially around the fuel pumps to reduce the passby noise.

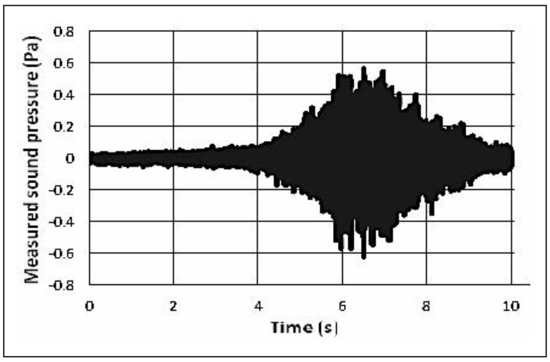

Figure 5. Measured sound pressure time waveform during a passby noise test

Figure 6: Underhood muffler in tractor for reduction in passby noise

4.2 VIBRATION LEVELS IN AUTOMOBILES

The ride and handling characteristics of vehicles are evaluated by the vibration levels at all the touch points like, seat vibration, pedal vibration, steering wheel vibration and rear view mirror shake. There are OSHA (Occupational Safety and Health Administration) standards as to the permissible limit of the vibration a human being can be subjected to. However, again because of global competition, vehicle manufacturers try to minimize the vibration levels at these evaluation points to make a better product, with minimum amount of vibration. Through FEM based CAE analysis design optimization can be done to achieve the same.

In one instance in a farm tractor there was excessive steering wheel vibration when the engine was started and idling. Through a CAE modal analysis it was found that the natural frequency of the steering wheel was coincident with the engine firing frequency. Then, through a design modification of the steering wheel its natural frequency was shifted away from the engine firing frequency. Thus, the steering wheel vibration was reduced by avoiding the resonance condition [9].

5. NOISE CONTROL STRATEGY

The very first step in noise control is to rank the noise source in terms of the level of noise they produce and also know the frequency content of the noise source. Typically, in an automobile the high noise sources at moderate speeds are the powertrain including the exhaust noise, followed by the tire/road interaction noise and the wind noise. However at high speeds the above order changes. In Fig. 7 the measured SPL when the truck-chassis was idling is shown, it is shown that the high noise producing areas are around the rear of the engine near the flywheel housing [10].

Once the noise sources has been ranked, some of the noise control measures which can be introduced are; have close dimensional tolerances between the mating parts, provide lubrication between the mating parts and reduce the speed of the rotating shaft, if possible. Another noise reduction technique used in automobiles is to apply a dampening coating and appropriately apply structural stiffeners to reduce the sound radiation efficiency.

5.1 AIRBORNE AND STRUCTUREBORNE NOISE PATH CONTROL

Apart from noise control at source the noise can be controlled by controlling the impedance of the path through which the vibro-acoustic energy flows. In an automobile there are two important paths of energy flow, one being the structure and the other being the fluid (air). A typical structure borne-path in an automobile is of the sound heard in the passenger cavity

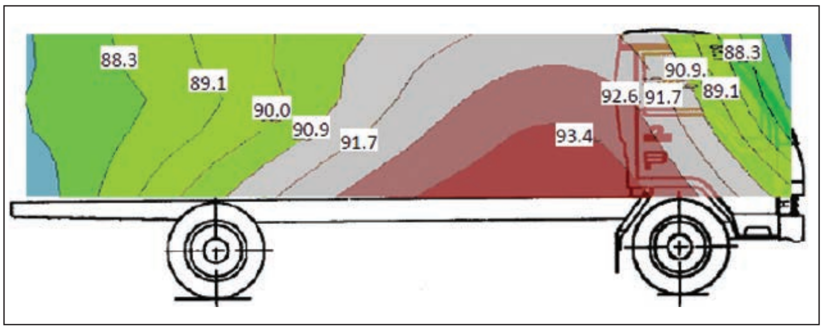

Figure 7: Radiated noise map of a truck

due to the vibrations from the powertrain transmitted through the elastomeric engine and body mounts. Thus by proper selection of the stiffness of these mounts, the structure-borne noise can be reduced. Same technique can also be used in the suspension rate selection for reduction of noise levels in the passenger cavity due to road excitations.

The airborne path is predominantly the path taken by the fluid transferring the vibro-acoustic energy. This is reduced by having sound absorbing materials in the path, for example, a sound absorbing material lined duct for the heating, ventilating and air-conditioning (HVAC) unit placed in the instrument panel (IP) or dashboard of the vehicle.

Another way to reduce the airborne noise is by having triple layer seals on the edges of the door, so that it completely shuts off the air flowing around the door edges at high speeds to flow into the passenger cavity. The firewall can be made up of sound blocking materials, which will reduce the noise transmitted from the engine component to the passenger cavity.

5.2 ACOUSTICAL MATERIALS

Acoustical materials used for noise control can be broadly classified into three categories, namely (a) Sound Absorbing Materials, (b) Sound Barrier Materials and (c) Damping Materials [11]. The sound absorbing materials absorb sound over a large frequency range, and are usually supported or glued to a rigid material. The sound absorbing materials have many pores in them, and the sound energy is lost to this material by the viscous interaction at the walls by the sound waves propagating through them. These materials are characterized by the normal sound absorbing coefficient as a function of frequency which has a value between 0 and 1. The thicker the sound absorbing material the better is its sound absorbing property. Manufacturers provide the sound absorbing property of these materials with a NRC (Noise Reduction Coefficient) value in their product catalogs. Fiber glass, open cell polyurethane foam, cotton and coir are typical sound absorbing materials used for noise control in automobiles. Recently, we at the Indian Institute of Technology Kharagpur jute materials have been successfully used as a sound absorbing material for noise control [12]. The normal specific sound absorbing coefficients of different materials measured at the laboratory as per the ASTM E-1050 standard is provided in Fig. 8[13].

Sound blocking materials are characterized by the amount of sound energy they block. A good sound blocking material is a bad sound absorber. Heavy elastomer sheets, thick glass sheets and thick metal plates are used as sound barrier materials. Whereas a combination of sound absorbers and blocking material is used in automobile headliners, door trims and floor carpets. The sound blocking or barrier materials are usually classified by the transmission loss and they are characterized by their Sound Transmission Class (STC) rating. The heavier the surface density the better is the sound blocking property. There exists an international standard to measure the transmission loss/STC rating of such barrier material [14].

Damping material is used for noise control by applying them to sheet metals which are under resonance. Areas which have high vibration amplitudes during resonance can be coated with damping materials to reduce their vibration levels, for example the coating of an engine oil pan, or pasting a damping sheet to the door panel. These materials are quantified by their damping factor, which is measured by the half-power point method in the laboratory, by a very simple cantilever beam excitation

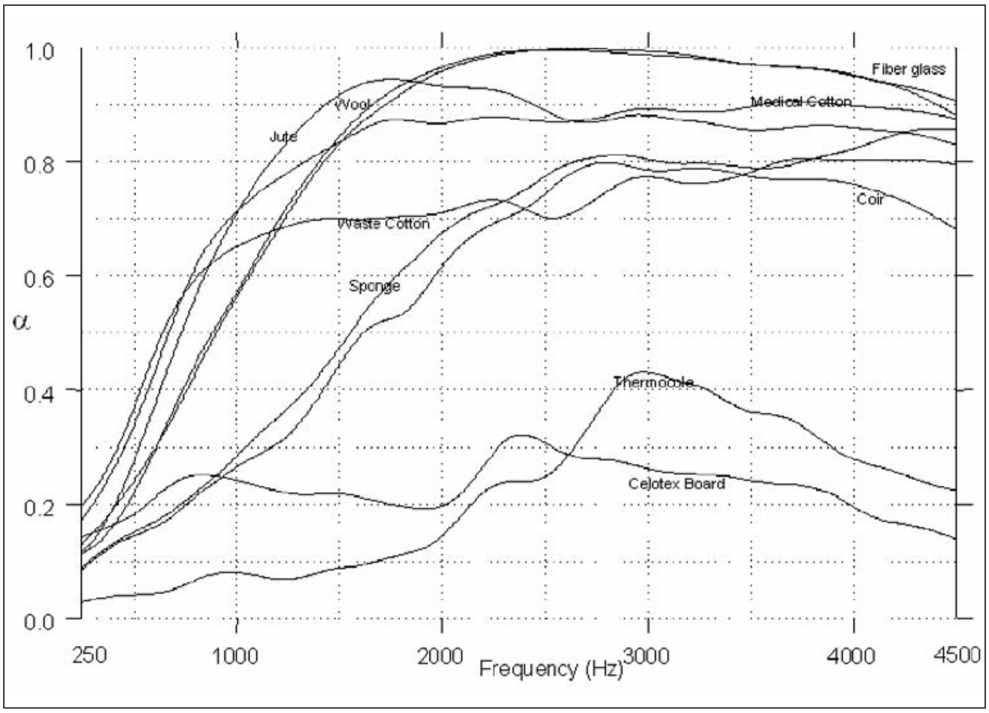

Figure 8. Sound absorption coefficient of different materials[11]

technique [15]. Dynamic Mechanical Analyzer (DMA) is available to estimate the damping factors of materials at different temperature as well, since these properties are also temperature dependent.

6. NOISE AND VIBRATION TESTING

Prototypes and surrogates of automobiles need to be tested for validation of the CAE analysis. From such tests, data are acquired using multi-channel data acquisition system for input to the CAE models and compliance with mandatory regulatory requirements. Normally these tests are done in proving grounds where different track conditions are made, like potholes, washboard, rumblers, wet track etc. The tests in the proving grounds are normally for testing the vehicle and its components for durability analysis and vehicle ride and handling. However for noise and vibration testing the tests are usually done in a hemi-anechoic chamber with a chassis dynamometer to motor the vehicle. The hemi-anechoic chamber, has its four sidewalls and roof lined with wedged shaped sound absorbing material and a hard floor. A free field environment is created in a hemi-

Figure 9. Hemi-anechoic chamber used for autmobile noise measurements [16]

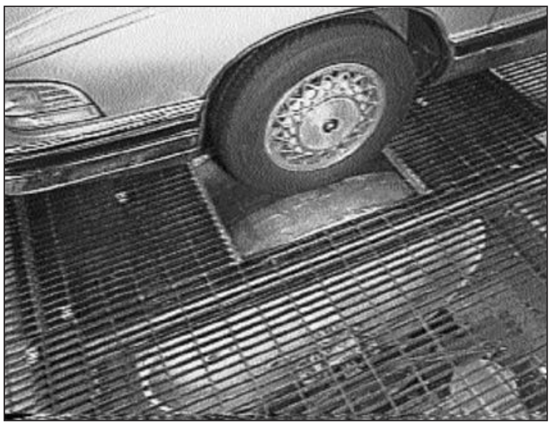

Figure 10. View of a chassis roll dynamometer [16]

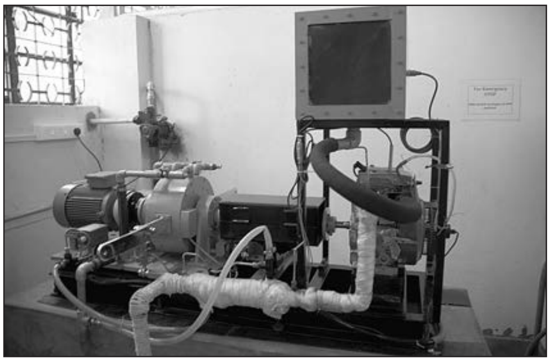

Figure 11. Instrumented engine-eddy current dynamometer test rig

anechoic chamber. The noise and vibration measurements on the power train are usually done in an engine test cell, where again the walls are lined with sound absorbing materials, wherein the engine is usually loaded by a dynamometer, and the engine test cell operations are controlled by an operator through a computer aided instrumented panel.

Fig. 9 is a hemi-anechoic chamber which is used for noise and vibration studies in an automobile. Fig. 10 is a view of a chassis roll dynamometer which is used to study tyre noise. Fig. 11 shows an IC engine-eddy current dynamometer which is used for engine fault diagnosis and experiments on remote triggered virtual laboratory on automotive systems at our institute.

7. MUFFLER DESIGN

Mufflers are used to reduce the radiated noise from the exhaust of an engine. Mufflers are broadly of two categories, (a) reactive and (b) dissipative. Reactive mufflers are usually used in automobiles and are made of tubes with perforations and baffles, enclosed in a shell. The reactive mufflers reduce noise by an impedance mismatch of the inlet acoustical wave. Generally they are designed for low-frequency noise reduction. Dissipative mufflers, are usually mufflers lined with sound absorbing materials, and they are effective for high frequency noise reduction. Dissipative mufflers are generally avoided in automobiles, because the burned particles in the exhaust can clog the pores of the sound absorbing lining in the dissipative muffler and render them ineffective.

Mufflers are evaluated by three parameters, namely (a) Noise Reduction, (b) Insertion Loss and (c) Transmission Loss. The mufflers are designed by evaluating the outlet acoustic velocity and pressure to that of the inlet acoustic velocity and pressure, with that of the transfer function of the individual muffler elements [17]. Commercial software are available in which a library of the transfer function for various reactive muffler elements exist. The cut section view of a perforated muffler used in a farm tractor is shown in Fig. 12. The test setup to measure the transmission loss of the muffler in the laboratory is shown in Fig. 13. The predicted and measured transmission loss of the muffler is shown in Fig. 14.

Figure 12. Inside view of the tractor muffler

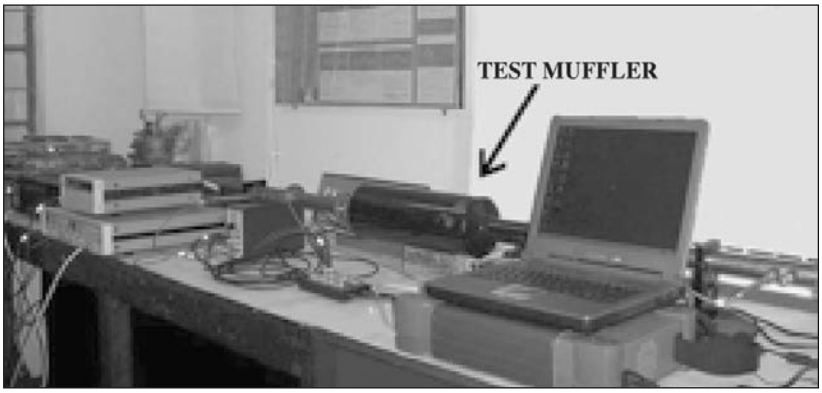

Figure 13. Transmission loss testing setup for muffler [17]

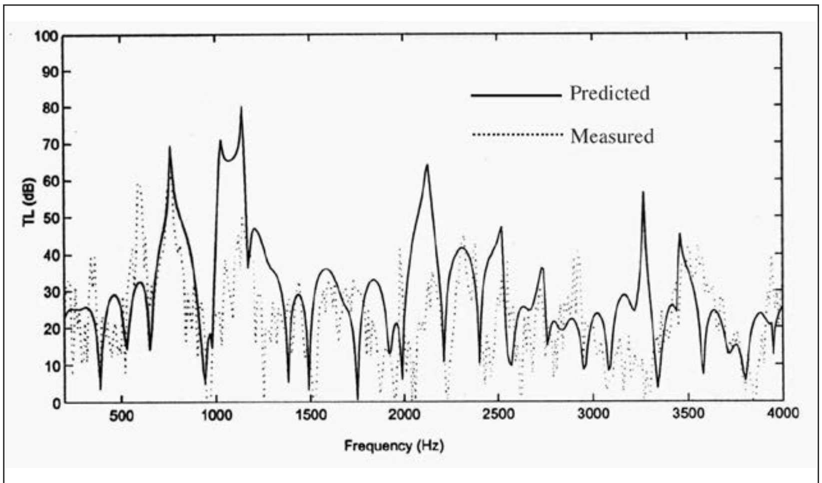

Figure 14. Measured and predicted transmission loss of the muffler [17].

7. SOUND QUALITY

Sound quality is the study of the perception of noise as heard by a human being only. Earlier in noise control, a reduction in the sound pressure level was considered desirable since a noise reduction has been achieved. However, for the same level of noise, one noise may sound pleasant than the other to the human ear. So there was a need for establishing other features of the noise by which a measured noise can be characterized. Some of these parameters are known as the sound quality metrics like the loudness, speech interference level, tonality, articulation index, etc. Many commercial sound quality software are available using which these sound quality metrics can be estimated. Sound pressure level measured is usually presented in the dBA scale, however if one computes the other sound quality metrics, a better correlation with the human perception and the measured sound quality parameters can be obtained.

In order to accurately reflect the perception of sound as is heard by a human being using two ears with a three dimensional spatial sound field, measurements using a human torso with two microphones placed at the ear locations on the torso are used instead of a single microphone as is done for passby noise measurements of a vehicle. Any design modifications to improve the sound quality can be evaluated by computing the sound quality metrics after the sound has been measured through a human audio torso simulator (HATS). Edited sound files can be played back on a headphone for jury evaluation, to decide on the most acceptable sound wave and thus the design. Fig. 15 shows the sound quality jury evaluation being done in the laboratory.

Figure 15. Sound quality jury evaluation using HATS in the laboratory

8. CONCLUSIONS

This paper provides in brief some CAE based case studies which have been used to control the noise and vibration in automobiles. A brief description of the various CAE techniques used by engineers round the globe has been presented. The significance and importance of CAE techniques over traditional prototypes testing and evaluation has been demonstrated. The importance of sound quality as a measure of the design has been pointed out. A comprehensive engineering method can be developed for noise and vibration control in automobile using above CAE techniques.

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RESIDENTS IN FAVOUR OF NOISE BARRIERS

New noise barriers will be built as part of the New NY Bridge project based on overwhelming support from local residents. "The public has spoken and they overwhelmingly support the construction of sound reducing traffic noise barriers as part of the New NY Bridge Project," said Brian Conybeare, Governor Cuomo's Special Adviser for the New NY Bridge Project. "This is another way we trying to make this the most inclusive and transparent infrastructure project in the history of the state. We will continue to include input from local residents and other stakeholders as the project moves forward." In June, the New York State Thruway Authority, the New York State Department of Transportation (NYSDOT), and the Federal Highway Administration (FHWA) invited local residents to vote on the placement of proposed noise barriers. Noise barriers are recommended as a form of traffic noise abatement only if they are determined to be both feasible and reasonable. According to Thruway and NYSDOT noise policies, as well as FHWA noise regulations, once a noise barrier is deemed both feasible and reasonable, 'benefited receptors', defined as property owners and/or residents of properties that would receive at least a five decibel reduction in noise level as a result of the proposed noise barriers, have an opportunity to cast a vote either for or against its construction. The voting results show the benefited receptors overwhelmingly favor having noise barriers constructed and based on their support the walls will be built as part of the New NY Bridge Project.

STOP NOISY COAL TRAINS

An anti-coal train lobby group has called for a curfew on coal wagons travelling throughout the night in suburban Ipswich (Queensland) after a rising number of noise complaints. Stop Brisbane Coal Trains spokesman John Gordon said the noise from coal trains travelling along the Ipswich line between 8pm and 6am was disrupting some residents' sleep. The additional noise complaints are down to more coal trains travelling through Ipswich to the Port of Brisbane. "SBCT sources on the ground are reporting increased coal train traffic that is now running 24/7 through Toowoomba, Ipswich and Brisbane," Mr Gordon said. "We are fielding reports in each of these centres of coal train movements at all hours of the night and morning." A spokesman for the Transport and Main Roads Minister Scott Emerson said there had been no complaints about coal train noise. The spokesman added there would be no changes to current operations. Ipswich MP Ian Berry said he would look into any possible action, but said coal had been hauled along the Ipswich line for many years. Mr Gordon said the noise pollution created by the older diesel engines was becoming too much for some residents. "The noise generated by these behemoths has to be heard to be believed. It is horrendous," he said.