A Study of Design And Analysis of Control Panel Bracket For NVH

S. K. Malunjkar[1], and Prof V. B. Shinde[2]

1 Amrutvahini College of Engineering, Sangamner, A'Nagar, University of Pune, India(422608)

2 Amrutvahini College of Engineering, Sangamner, A'Nagar, University of Pune, India(422608)

ABSTRACT

An engine mounting bracket is one of the most important part of a vehicle that reduces vibrations and harshness for the smooth ride of the vehicle. The important function of an engine mounting bracket is to balance the engine on the vehicle chassis for good balance control when the vehicle is in motion Noise, vibration and harshness (NVH) have become increasingly important automotive branch as a result of demands for increasing vehicle refinement. The need for light weight structural materials in automotive applications is increasing as the pressure for improvement in emissions and fuel economy increases. Use of light alloy content in vehicle has proven to be a successful method of achieving fuel efficiency and environmental concerns. Noise, Vibration and Harshness are the main parameters that increase the discomfort to vehicle ride and these are originated from the engine. The engine mounting bracket plays the important role in reducing NVH and increases comfort. Vibrations can be reduced or dissipated and keeping the stresses under the predetermined level of safety can be done by careful design, analysis and selecting material of brackets. NVH is an important vehicles characteristic motivating to achieve overall customer satisfaction. The aim of this project is to design and manufacture a control panel such that it should sustain that vibration and stresses produced due to vibration so that whole working of a control panel as well as generator should be proper.

Keywords:Control panel, Frequency, Modal Analysis ANSYS, Natural Frequency, Noise, Stress, vibrationAnalysis.

1.Introduction

The need for light weight structural materials in automotive applications is increasing as the pressure for improvement in emissions and fuel economy increases. The most effective way of increasing automobile mileage while decreasing emissions is to reduce vehicle weight. It is well-known from basic Non-linear vibration theory; improvement in the vibration control can be achieved by determining the natural frequency of the engine bracket system well below the frequency band in which excitation exhibits most of the vibratory energy. Lighter weight metals decrease the overall vehicle weight that reduce emissions and improve fuel economy, but lighter vehicle components do not absorb noise and vibrations as well as heavier components, what causes many additional concerns for engineers. Noise, vibration and harshness (NVH) have become increasingly important automotive branch as a result of demands for increasing vehicle refinement. NVH is an important vehicles characteristic motivating to achieve overall customer satisfaction. Noise is defined as any unpleasant or unexpected sound created by a vibrating object and has an increasing importance to vehicle users and environments. Vibration is defined as any objectionable repetitive motion of an object, back-and-forth or up-and-down and represents an important issue closely related to reliability and quality of the vehicle. Harshness is customer perception which creates the impression of lack of isolation from the tire/wheel and suspension system. Harshness is related to the quality and transient nature of vibration and noise, because of vehicle incapacity to absorb vibrations produced by road conditions.It plays an important role in improving the comfort & work environment of a car. The improvement of engine bracket system has been the subject of intense interest for many years. It is necessary to design proper engine bracket for a car. As such, engine bracket has been designed as a framework to support engine. Vibrations and fatigue of engine bracket has been continuously aconcern which may lead to structural failure if the resulting vibrations and stresses are severe and excessive. Prolonged exposure to whole-body vibration in the working environment may lead to fatigue and in some cases it damages the car. Generally, the most important vibration relevant excitations in a car engine can be identified as follows:- combustion force; main bearing reaction forces including mass forces damper function and flywheel whirling, modified by the front-end damper; piston side forces including secondary motion; Camshaft bearing reaction forces including mass forces, opening and closing impacts and bearing impacts; valve opening and closing impacts; valve train forces caused by chain/belt movement or gear drive; gear train forces inside the transmission; drive train reaction forces and moments. It is well-known from basic Non-linear vibration theory; improvement in the vibration control can be achieved by determining the natural frequency of the engine bracket system well below the frequency band in which excitation exhibits most of the vibratory energy. It is in this context, the development of engine bracket can make the engine capable of absorbing vibration. Automotive engine mounting system must satisfy the primary tasks such as engine movement, engine rigidbodydynamic behavior, and vibration isolation. The design and development of mounting bracket through use of Ansys software to achieve the requirements for mounting system. Limits over the development of the mounting systems due to drivability and NVH concerns, provides savings in design resources. NVH is an important vehicles characteristic motivating to achieve overall customer satisfaction. Engine is mostly mounted to the front sub frame and once installed in a vehicle, engine mounting has a significant task in decisive the vehicle vibration characteristics

2. Control panel of a generator

A control panel is a set of displays that indicate the

measurement of various parameters like voltage, current and frequency, through gauges and meters. These meters and gauges are set in a metallic body, usually corrosion proof, to protect from the effect of rain or snow. The panel may be set up on the body of the generator itself, which is usually the case with small generators. If they are mounted on the generator, they typically have vibration proof pads that help isolate the control panel from shocks. Control panels for a larger industrial generator can be completely separate from the generator and are typically large enough to stand upon their own. These units may also be shelf-mounted or wall-mounted next to the generator, which is common inside an enclosure or internal applications like a data center. Control panels are usually fitted with buttons or switches that help to operate the generator such as a switch-off button or turn-on key. The switches and gauges are usually grouped on the basis of functionality. This makes the panel friendly and safe for use since it minimizes the possibility of an operator accidentally selecting or executing the wrong control. Imagine trying to shut down a vibrating generator with a spring loaded lever in the middle of the night and you will appreciate why having a simple cut of switch at the control panel makes sense.

2.1 Working of control panel

The control panel is becoming an increasingly complex piece of electronics with a microprocessor that can manipulate input from sensors to help give feedback to the machine to manage itself. One such feedback could be the temperature, indicating overheating, other examples would be over/under speed and low/high oil pressure. Typically, a heat sensor inside the generator would sense the buildup of heat in the generator body and pass this to the microprocessor in the control panel. The microprocessor will then take effective measures to regulate the performance of the machine including shutdowns if, for example, the oil pressure is too low or the coolant temperature is too high, leading to buildup of heat. In industrial situations, this functionality of control panels is becoming increasingly critical. The microprocessor or microcontroller is embedded in the circuitry inside the control panel and is programmed to take in the sensor input and react to that with the programmed control rules. Control panels can be combined with an Automatic Transfer Switch (ATS) to maintain the continuity of electrical power. The ATS detects an outage of power when your local grid fails. It signals the control panel to start the generator. Depending on the type of generator being used, the control panel may activate glow plugs (for diesel) for an adjustable length of time. It will then start the generator using an automatic starter, similar to the one you engage when you turn the keys in the ignition of your car in the morning. As soon as the engine of the generator reaches an optimum speed, the starter is disengaged. The ATS then switches to the generator power, and you can go back to business as usual, without having to frantically scramble to figure out what caused power loss. This aspect of a control panel makes it extremely useful in homes during bad weather and in industrial situations for ensuring mission-critical continuity.

3. Literature Review

Umesh S. Ghorpade, D. S. Chavan, VinaayPatil, Mahindra Gaikwa has studied the engine mounting bracket. Vibration and fatigue analysis has been carried out to know the structural failure. Structural failure will occur if vibrations and stresses are excessive and severe. Prolonged exposure to whole-body vibration in the working environment may lead to fatigue and in some cases it damages the car. Generally, the most important vibration relevant excitations in a car engine can be identified as follows:- combustion force; main bearing reaction forces including mass forces damper function and flywheel whirling, modified by the front-end damper; piston side forces including secondary motion; camshaft bearing reaction forces including

mass forces, opening and closing impacts and bearing impacts; valve opening and closing impacts; valve train forces caused by chain/belt movement or gear drive; gear train forces inside the transmission; Drive train reaction forces and moments. Automotive engine mounting system must satisfy the primary tasks such as engine movement, engine rigid body dynamic behavior, and vibration isolation. The design and development of mounting bracket through use of Ansys software to achieve the requirements for mounting system and optimize the mount

Lakshmi Kala, V.RatnaKiran with the above stated work done by the previous authors, theseAuthors have taken non-linear vibrational theory into consideration. Improvement in the vibration control can be achieved by determining the natural frequency of the engine bracket. To achieveIsolation, natural frequency must be away from the excitation energy to avoid resonating condition.Also, NVH is an important vehicles characteristic motivating to achieve overall customer satisfaction. The main role of engine mounting system as one of the principle vehicle vibration isolating systems, besides suspension system, is to reduce the noise and vibration perceived by driver and to improve the ride comfort.

Dr.YadavalliBasavaraj, Manjunatha.T.Hthese authors have focused more on avoiding resonance and damping of frequency. If there exist unbalanced loads in engine body, resonant vibration occurs. This resonant vibration increases if chassis has unitary or frameless construction. This has forced designers to direct their attention to the development of high quality engine mounting devices in order to ensure that improved comfort in riding and silencing shall not be offset by fatiguing vibration effects. In this paper an engine mounting bracket is designed toreduce the transmission of engine vibration to the chassis.

MonaliDeshmukh, Prof. K R Sontakke in this paper, authors have studied harmonic response and vibration damping of an engine mounting bracket. If the brackets have their resonance frequencies close to the operating engine frequencies, then the large amplitude of vibration get generated which may cause its fatigue failure or breakage, thus reducing its estimated or desired life. And if the harmonic response values of bracket is more than acceptable range it results in to generation of noise. Hence it is required to check the harmonic response of designed bracket. Vibration damping can be either provided by using separate dampers (anti-vibration mounts) orby suitably deciding the material and dimensions of the brackets. During its operation, the undesired vibrations generated by the engine and road roughness can get directly transmitted to the frame through the brackets. This may cause discomfort to the passenger(s) or vibrations might even damage the chassis. Existing bracket design is optimized to meet the above requirements.

Vishal Kadam, Prof NishantS.Kulkarni in this paper authors have studied complete 16 degrees of Freedom mathematical model of a vehicle is considered for analysis which consist of powertrain (engine), chassis four wheels as mass and engine mounts, suspensions and tyres as stiffness. In this work a optimization programme is developed which gives engine vibration and mount displacement from softer stiffness to harder one and find optimum value of engine mount stiffness using mathematics.

4. Problem Statement

An engine mounting bracket is one of the most important part of a vehicle that reduces vibrations and harshness for the smooth ride of the vehicle. The important function of an engine mounting bracket is to balance the engine on the vehicle chassis for good balance control when the vehicle is in motion. But due to the different problems there is a problem of noise and vibration this vibration is then transferred into another parts such as passenger compartment and other vehicle parts.so this vibration is also transferred on to the control panel of the generator, due to this vibration

different elements of a panel such as voltmeter, ammeter, oil,temp ,coolant ,fuel gauges, relays etc. also face the vibration so due to this vibration this elements should not work properly and also affect the whole working of a generator.Syscad techno solution find this vibration problem in a control panel of a generator so to reduce this vibration problem this work is doing. And also they design and produce a better product relative to the competitors The aim of this project is to design and manufacture a control panel such that it should sustain that vibration and stresses produced due to vibration so that whole working of a control panel as well as generator should be proper.

5. Methodology

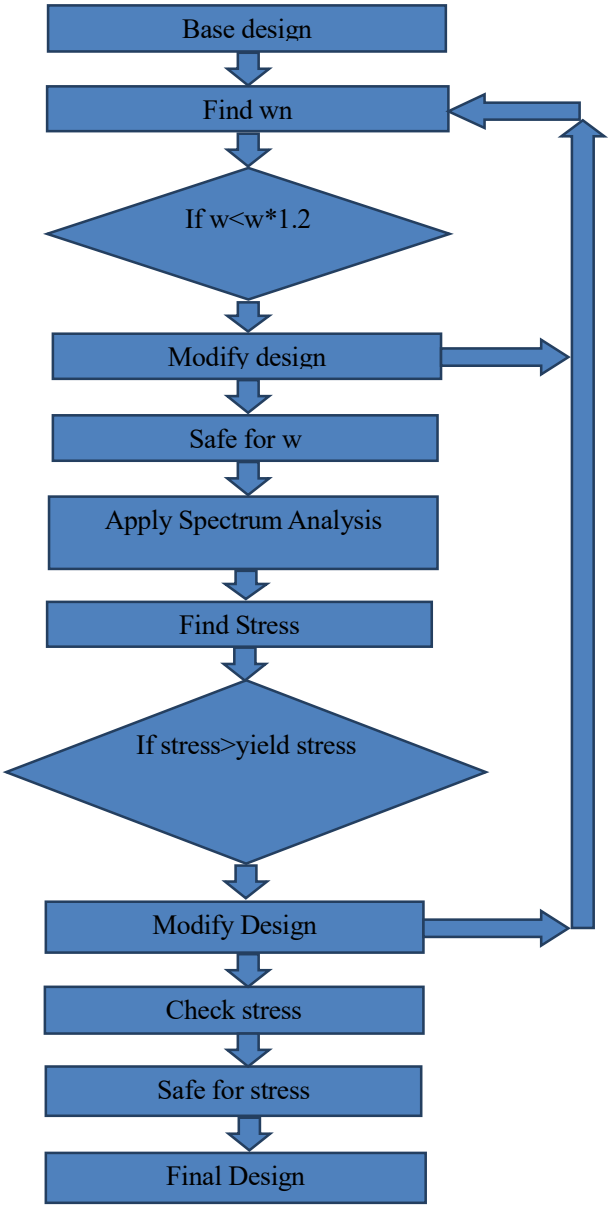

Fig1. Flowchart

5.1 Block Diagram of a Control Panel

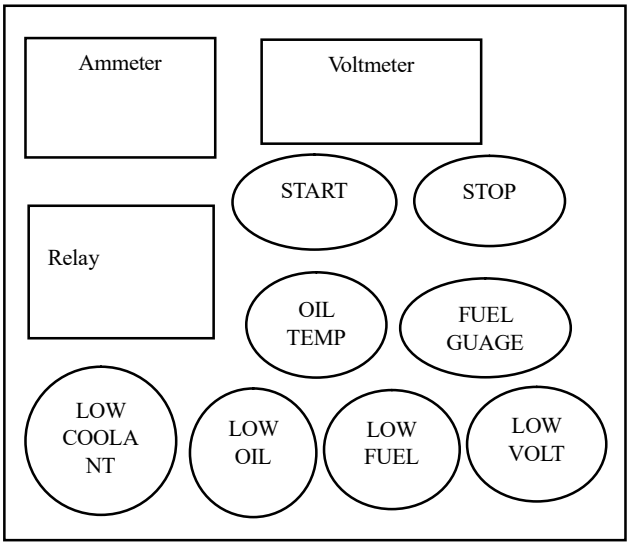

Fig 2. Block Diagram of a Control panel

6. Design and Analysis of a control panel

6.1 CAD Model

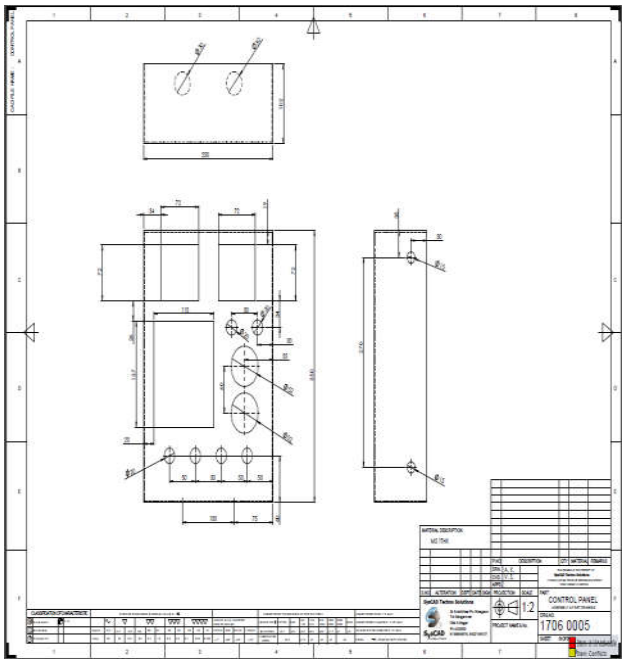

Fig 3 CAD Model

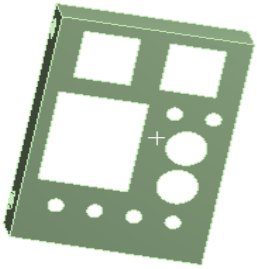

Fig 4 Isometric View

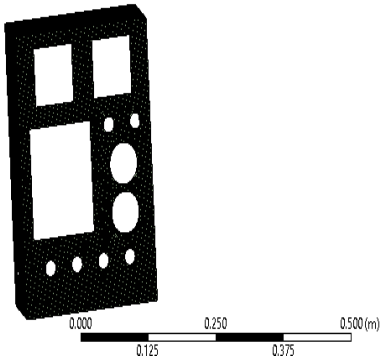

Fig 5 Meshing

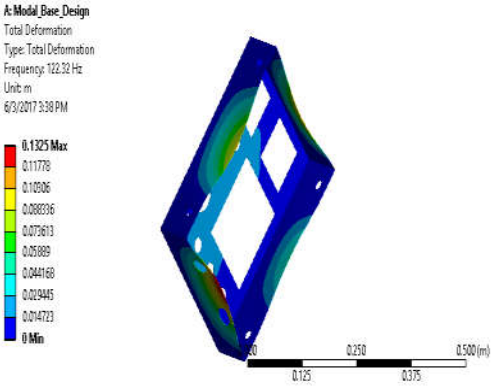

Fig 6 Total deformation mode 1

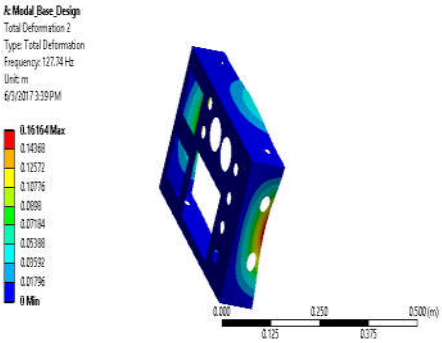

Fig 7 Total deformation mode 2

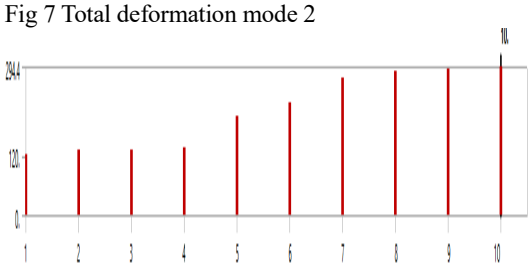

Fig 8Graphical representation of Frequency DistributionAt Diffent node

Table 1 Modal analysis result for control panel

	MODE	Frequency (Hz)
1.	1.	122.32
2.	2.	127.74
3.	3.	130.09
4.	4.	132.67
5.	5.	196.11
6.	6.	223.47
7.	7.	273.91
8.	8.	285.13
9.	9.	288.03
10.	10.	294.37

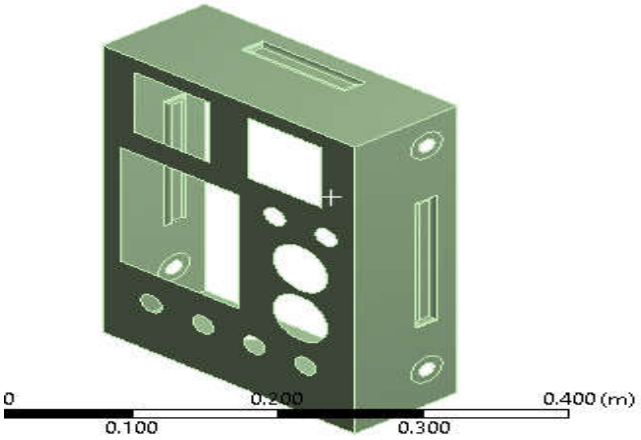

Fig 9 Embossing on a Panel

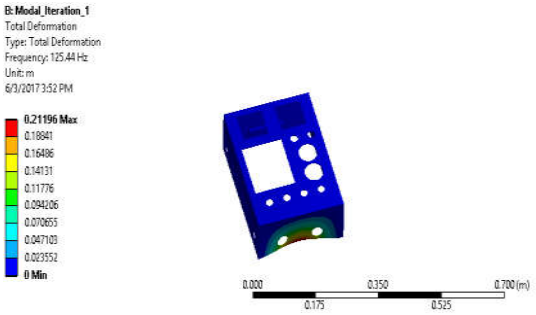

Fig10 Total deformation mode 1

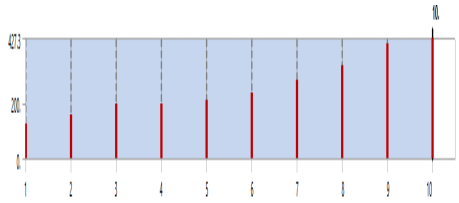

Fig 11 Graphical representation of Frequency Distribution At Diffent nodeAfter embossing

Table 2 Modal analysis result for control panel after embossing

	Mode No	Frequency (Hz)
1.	1.	125.44
2.	2.	152.8
3.	3.	191.7
4.	4.	194.16
5.	5.	209.03
6.	6.	230.05
7.	7.	277.9
8.	8.	332.75
9.	9.	406.67
10	10	427.28

7. Conclusion

This paper provides a brief overview of a control panel bracket of a generator its working and how analytically it proves that after increasing natural frequency NVH factor may get reduced**.** From the study of a control panel Bracket of A generator it is concluded that Noise,Vibration Harshness are the main parameter that increases the discomfort to systemand this originated from the engine .for the proper functioning of a control panel bracket the NVH Factor should be in control or it is negligible ,so for this result it is necessary that we increase the natural frequency of a components that vibration get reduced. for that embossing was done on a control panel Bracket so the natural frequency get increases Once the Vibration is reduced then Automatically NVH Factor is in Control and the result is proper functioning of a control panel bracket of a generator.

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