International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 03 | March - 2022 ISSN: 2582-3930

A NOVEL ENGINE MOUNT USING NATURAL POLYMERS AND ITS VIBRATIONAL ANANLYSIS.

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Abstract:-*To isolate the vibrations of the Engine and rotating machineries, engine mounts are been used. Engine mounts are the clamps or brackets by which the Engine mounted on the chassis of vehicle. In this project a new engine mount is specially designed and developed by composition of natural polymers and experimentally assessed for an improved performance with an existing rubber based engine mount. The Main characteristics of the engine mounts are mainly influenced by two variables, the material and the design. Hence the design of the engine mount becomes the critical aspect in terms of isolating the vibrations. The changes are made in the dimensions of the existing engine mount design for better vibration absorption, and a new mount is developed by composition of natural polymers(Hydrogenated nitrile rubber + Viton rubber) in different ratios and will undergo experimental vibrational analysis and also calculating the properties of the mount when compared it with the existing rubber based engine mount. The main purpose of this project is to examine the vibrations observed & performance improved by the engine mount.*

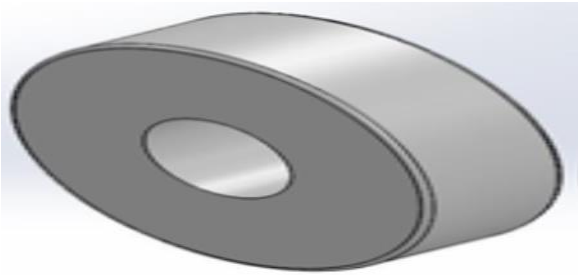
Keywords: - *Hydrogenated nitrile rubber, Viton rubber, Minitab Software, Mounting, vibration.*

Introduction:- In vehicles, the non-stop motion of reciprocating and rotating parts is accountable for the generation of vibrations. Nowadays due to an increase in capacity and a decrease in engine weight, the frequency of emitted vibrations is very high. Generally, engine mounts are made of natural rubber and metal and are used for connecting a car frame to its engine. The metal portion acts as a connector among the engine and its frame to the engine on one side and to the frame on the other. The flexibility is provided by the rubber mount between them so that the vibrations caused in the engine does not transmit to the frame. Engine mounts used by newer cars are slightly different but the purpose is the same which is isolating vibrations from the engine to frame. The variety of engine mounts used may vary from vehicle to vehicle. If engine mounts aren't, vibrations get transmitted to the body. This impacts the consolation of the passenger and the functioning of many components of the engine**.** And developed a design to meet the pre-requisites of the engine mount using parameter improvement technique. Tested the functions are developed a design using finite element analysis (FEA) With which design sensitivities analysis is developed a mathematical model using Minitab software.

Dynamic stiffness and amplitude of vibration have to be made dependent for achieving this objective. At low frequencies, the stiffness of the active elastomeric mounts will be very high. The properties of the material being used should be optimum for withstanding high-frequency vibrations. New elastomers like nitrile rubber, Viton rubber were used and compared with natural rubber. And designed a hydraulic engine mount for the eradication of high-frequency vibrations. Detailed a semi-experimental method for constructing the excitation force with the help of acceleration data measured. In the following sections material selection, fabrication and experimental analysis have been discussed. In this paper, experimental analysis of a specially designed engine mount is detailed. The materials tested are nitrile rubber and Viton rubber. The tests are carried out at two engine speeds to assess the comparative performance of these two selected materials for the engine mount.

Cad Model Design:- The CAD model of the radical engine mount particularly accommodates the round frame that is executed purposely to have the higher surface location. This circular frame is hooked up with the aid of arc-like systems so that vibrational force can be transmitted easily at some stage in the frame of the mount. in the Centre of the mount, there is a directly structure helping the round body which serves the reason of taking effect forces at high frequencies made up of nitrile rubber due to its excessive impact electricity in comparison with Viton rubber. The holes are covered for fitting the engine mount within the clamp of the engine body. The scale is concerned with appreciating the prevailing mounts for a -cylinder tractor engine as reference. The material used for the mount is Viton rubber due to its high mechanical properties like excessive shear strength and fatigue strength. The dimensions of the present engine mount are modified and manufactured an engine mount

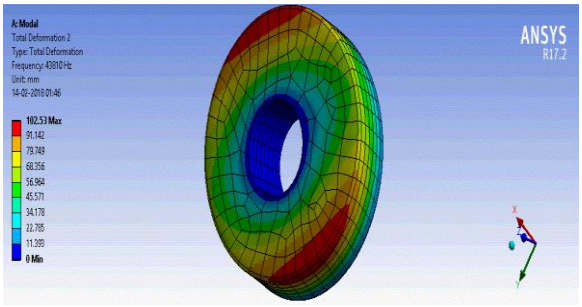
Model Design –Catia-v5 software



Model Analysis Using FEA:-

Mount design was developed in catiav5 software. The model was saved in the IGES format and then imported into ANSYS for FEA. The fixed support boundary condition is applied on the bottom part of the mount. Fine meshing is done for better analysis of the mount. After performing the model analysis, the result is taken out at a particular frequency. The stress caused in the mount at the working frequency since the impact is at the Centre, the maximum stress is also observed at the Centre. The composition of rubber becomes an advantage as it distributes the whole force throughout the mount

Model (FEA)Analysis – ANSYS Software

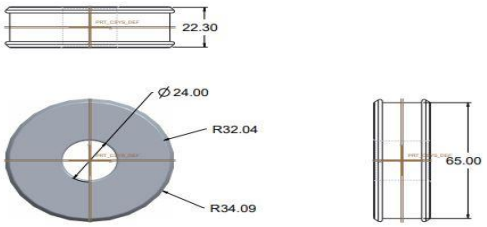


Results of modal analysis	Frequency (kHz)	Working stress (MPa)	Ultimate stress (MPa)	Factor of safety
1000 RPM	**10.28**	**24.375**	**49.26**	**2.105**

Manufacturing Engine mount:- vital rubber has high fatigue and tear resistance than nitrile

Properties. Nitrile rubber is more impact resistance than Viton rubber the rubber block is also used in the middle of the mount to Rubber. Its high resistance to temperature changes and chemical resistance is added advantages along with superior mechanical Distribute the impact force evenly throughout the mount. The existing engine mount is modified to make the engine mounts. A die is used, into which molten material is injected at high temperatures and pressure.

Dimensions of Fabrication Model:-



Fabrication mount – injection molding:-

Vibration Analysis:-

Simpson's tractor diesel engine is selected for analysis of vibration level in normal conditions and with a turbocharger. The vibration analysis is taken with nitrile& Viton composite rubber mount at 750rpm and 1000rpm. The vibrations data are stored for analysis purposes. Integrated electronic Piezoelectric (IEPE) sensors are used to measure the amplitude of vibrations at the engine mount and engine head.

Simpson's tractor engine bed

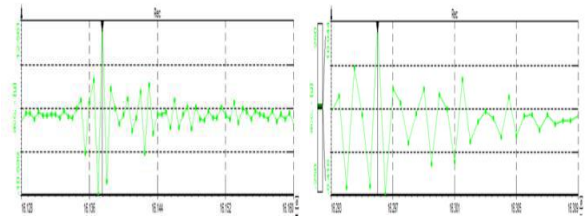
Sensor mounting on engine head

Clamping of nitrile& Viton composite mount

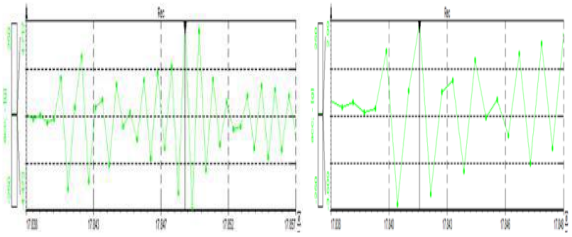
Results & Discussion:-

Vibration analysis was carried out on the composite (nitrile & Viton) and natural rubber engine mount. In this work, DEWE Soft is employed to acquire the required vibration data from measurement devices. the variation of vibration levels on engine head is more for the rubber engine mount than for the composite (nitrile Viton) rubber engine mount. The peak level of vibrations is more in normal rubber mount. In spite of the torque being moderate at 750 rpm, the variation in vibrations is low depicts that the vibration levels of the two mounts showed no variation initially. Therefore, we can conclude that the usage of composite rubber mount is better. Shows that the vibration level at 1000 rpm on engine head, which is very low in composite rubber. At this speed engine gives out maximum power, which results in heavy vibration, and even at this range mean level of vibrations is achieved.

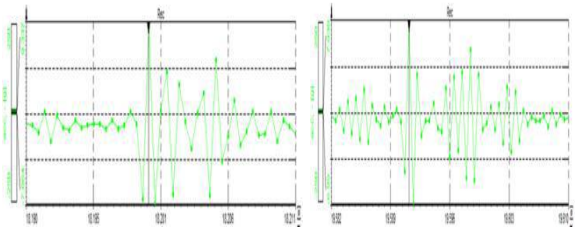
Shows the variation in vibration levels is very much low with respect to the time. With this, we can say that usage of composite engine mount is more advantageous even at high working ranges of engine speed. It is clear that the vibrations produced in the composite engine mount are less than the natural rubber engine mounts. Even the fluctuation in the levels of vibrations is low at high torque and speeds.



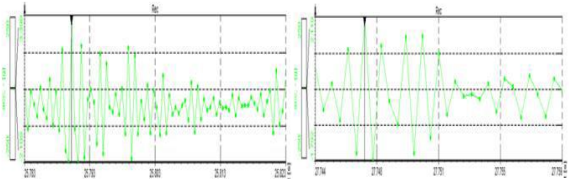
Acceleration response on the engine head at 750 rpm – Normal rubber (left), composite (right)



Acceleration response on the mount at 750 rpm – Normal rubber (left), composite rubber (right)



Acceleration response on the engine head at 1000 rpm – Normal rubber(left), composite rubber(right)



Acceleration response on the mount at 1000 rpm – Normal rubber (left), Fluorocarbon (right)

Results of vibration analysis

Results of vibration analysis	Engine speed rpm	Vibration in engine head in (g)	Vibration in mounting in (g)
	750	12.661	4.717
	1000	9.337	3.398
	750	10.944	2.991
	1000	7.983	2.119

Conclusion:- From the experimental analysis, it can be concluded that the vibrations produced in the composite (nitrile & Viton) engine mount is lesser than the natural rubber engine mount. This increases the capacity of the engine mount to with stand the vibrations for longer time and it ensures the proper functioning of components of engine and comfort of the passengers.