

Result On Design Development & Analysis of Elliptical Leaf Spring Mount Vibration Isolation

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ABSTRACT

An engine mount is a application component that attaches the engine bracket to the chassis or frame of engine application implement .The engine is connected to the application body by spring mount which are important for smooth operation. An engine mounting should isolates the body from engine-generated noise and vibration. The engine mount must also hold the engine in place and restrict it from moving. Engine vibrations have two major sources such as intermittent pulsing due to ignition in the engine cylinders and inherent unbalances in the reciprocating components of the engine. The frequency of the vibration depends on the number of cylinders, number of number and speed of engine. Higher frequency range is commonly observed in hand held agriculture machine driven by two stroke petrol engines. These high frequency vibration are major source of discomfort when these machinery such as sprayers, wedge trimmers, grass cutters etc are hand held or shoulder mounted or back held. Significant work has being done in area of vehicle engine vibration damping but not much research is found in these low cost machinery Hence in our attempt we shall develop an composite half elliptical spring mount and to a comparative study to conventional spring mounts available in market for same application.

Keyword: Engine Mount, Agriculture Machine, Isolation, Damping.

1. INTRODUCTION

Composite half elliptical spring mount is a vibration and shock isolator designed specifically for mobile applications and is suitable to protect the application user against shock and vibration in the hand / arm held agricultural application. The larger power produced by the engine must transfer smoothly to the application without rattling the application too much or twisting the engine as a result of the generated torques on the crankshaft. The engine must be kept tightly in place and not move excessively due to the inertial loadings or the road inputs. An engine mount is a application component that attaches the engine bracket to the chassis. The engine is connected to the application body by several mounts, which are important for easy operation. An engine mount should isolate the passengers' cabin from engine-generated noise and vibration. An engine mount also hold the engine in place and restrict it from moving. Material selected for the spring is SS-316 and Polueurathane material use as filler in the spring. Both two materials having resistance to corrosion and will operate efficiently under various temperature ranges . The higher damping efficiency is obtained by polymer which has a very low static stiffness. Mathe matical model of the Composite half elliptical leaf spring engine isolation mount to damp engine vibration and noise will be developed. Geometrical dimensions will be developed graphically using Ansys Work-bench 14.5. The experimental validation part of the vibration reduction by implementation of Composite half elliptical leaf spring engine isolation mount will be done using a test rig developed for this purpose and comparative study will be carried out to study the vibration reduction by conventional spring mount and the Composite half elliptical leaf spring engine isolation mount.



Fig 1: Elliptic Leaf Spring Mounts

2. LITERATURE REVIEW

Mohammed MathenullaSharif, N. SreenivasaBabu, Dr. JaithirthaRao[1]

The aim of this paper is to design and analyze composite mono leaf spring of constant width and thickness having the same bending stiffness of semi-elliptical laminated leaf spring. Stress analysis was done by using analytical method and results obtained by analytical methods are compared with ansys. The results obtained by analytical methods showed good agreement with ansys results.

T. Bhanuprasad, A Purushotham[2]

If number of layers are increased for same thickness the vibrations are less. In this paper we are concluding that using composite S - Glass Epoxy is advantageous. The major disadvantages of composite leaf spring are the matrix material has low chipping resistance when it is subjected to poor road environments which may break some fibers in the lower portion of the spring. This may result in a loss of capability to share flexural stiffness. But this depends on the condition of the road.

Ghodake A.P., Patil K.N[3]

This paper describes design and FEA analysis of composite leaf spring made of glass fibre reinforced polymer. The dimensions of an existing conventional steel leaf spring of a light commercial vehicle are taken for evaluation of results. The 3-D modeling of both steel and composite leaf spring is done and analyzed A comparative study has been made between composite and steel leaf spring with respect to Deflection , strain energy and stresses.

Vijaya Lakshmi, I. Satyanarayana[4]

The objective of this paper is to compare the load carrying capacity, stiffness and weight savings of composite leaf spring with that of steel leaf spring. The design constraints are stresses and deflections. The dimensions of an existing conventional steel leaf spring of a Heavy commercial vehicle are taken Same dimensions of conventional leaf spring are used to fabricate composite multi leaf spring using material unidirectional laminates. Pro/Engineer software is used for modeling and COSMOS is used for analysis. Static & Dynamic analysis of Leaf spring is performed using COSMOS.

Edward Nikhil Karlus, Rakesh L. Himte, Ram Krishna Rathore[5]

The automotive manufacturer tends to enhance soothe of user and achieve appropriate stability of comfort riding virtues and economy. The researchers are very fascinated in the replacement of steel leaf spring by some composite leaf spring because of high strength to weight ratio. On the other hand, there is a restriction for the amount of applied loads in springs. The amplification in applied load creates complexity at geometrical arrangement of vehicle height and erodes other parts of vehicle.

S. Rajesh, G.B. Bhaskar[6]

A three layer parabolic leaf spring of EN45 has been taken for his work. The CAD modeling of parabolic leaf spring has been done in CATIA V5 and analysis was done by ANSYS -11. The finite element analysis (FEA) of the leaf spring was carried out initially discretizing the model into finite number of elements and the nodes by applying the boundary conditions.

R D V Prasad , P.Venkatarao, P.Venkatarao[7]

Leaf Spring is a critical load bearing element that connects wheel to the chasis in an automobile application. The Suspension leaf spring of one of the potential items for weight reduction in automobiles in order to achieve increased fuel efficiency and improved ride characteristics. The introduction of fiber reinforced plastics (FRP) made it possible to reduce weight of the product without any reduction in load carrying capacity and stiffness.

M. Raghavedra , Syed AltafHussain, K. PalaniKumar[8]

This paper describes design and analysis of laminated composite mono leaf spring. Weight reduction is now the main issue in automobile industries. In the present work, the dimensions of an existing mono steel leaf spring of a Maruti 800 passenger vehicle is taken for modeling and analysis of a laminated composite mono leaf spring with three different composite materials namely, E-glass/Epoxy, S-glass/Epoxy and Carbon/Epoxy subjected to the same load as that of a steel spring.

Spring Mounts – Elliptic Leaf Type (Naval "X" Type)[9]

This type of vibration and shock isolator was designed specifically for shipboard or mobile applications. They are particularly suitable to protect delicate shipboard equipment from shock due to underwater explosions or sudden stoppage of vehicles for vehicle-mounted equipment.

3. VIBRATION ANALYSIS RESULTS

Sr .No	Load (gm)	Speed (rpm)	Acceleration m2/Sec	Frequency Hz
1	1500	1315	315	415
2	2000	1275	356	408
3	2500	1245	372	417
4	3000	1205	394	426
5	3500	1185	410	434
6	4000	1155	427	444
7	4500	1020	425	448

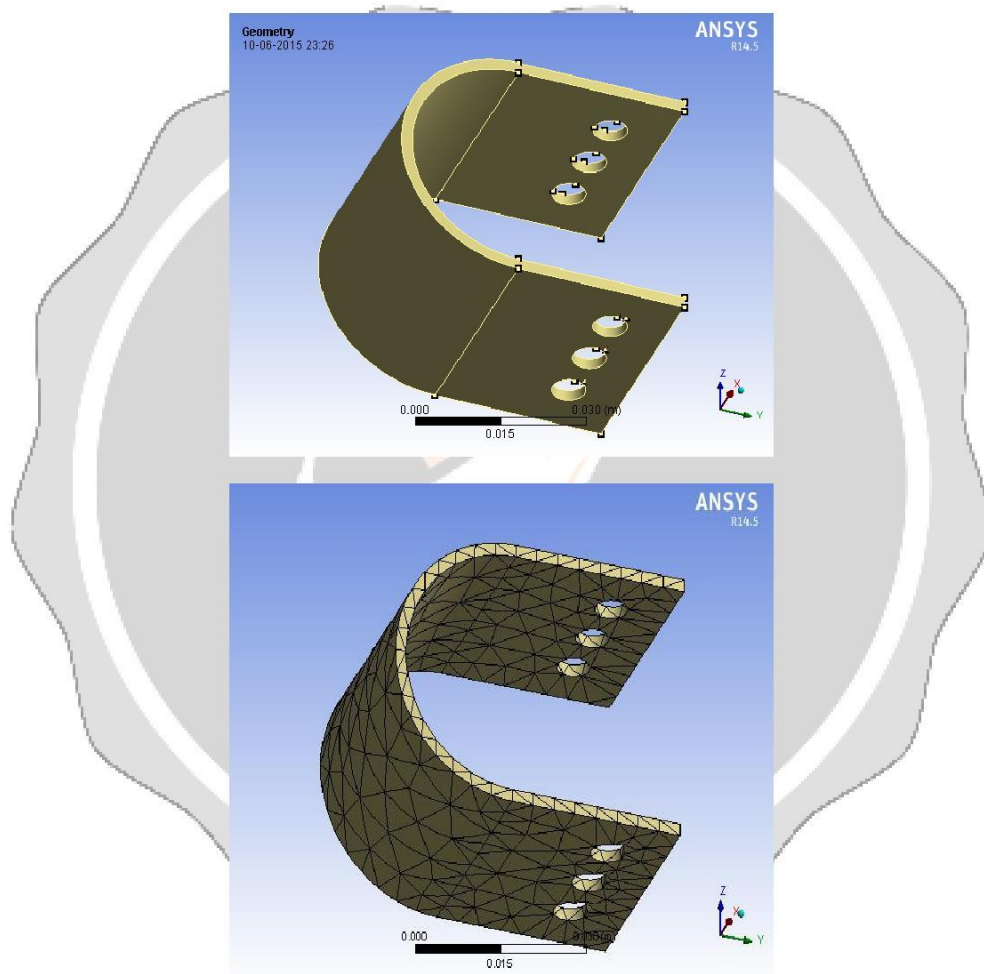
Table 1: Vibration analysis results of conventional rubber mount

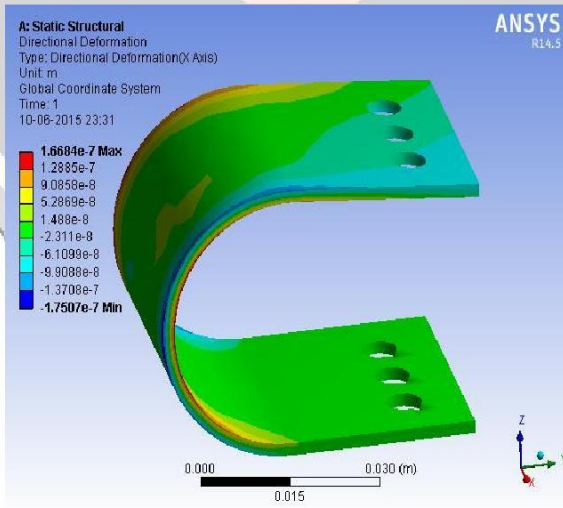
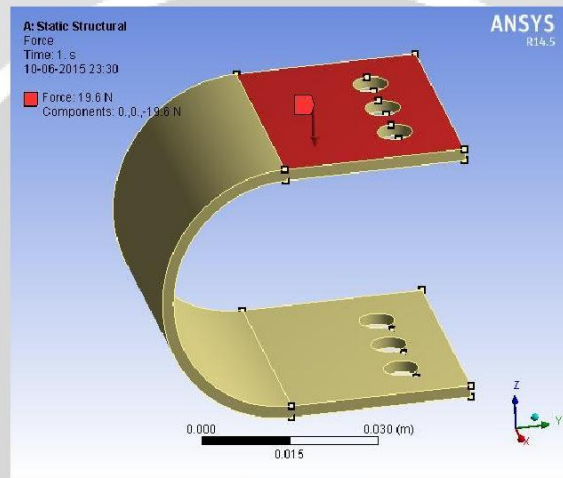
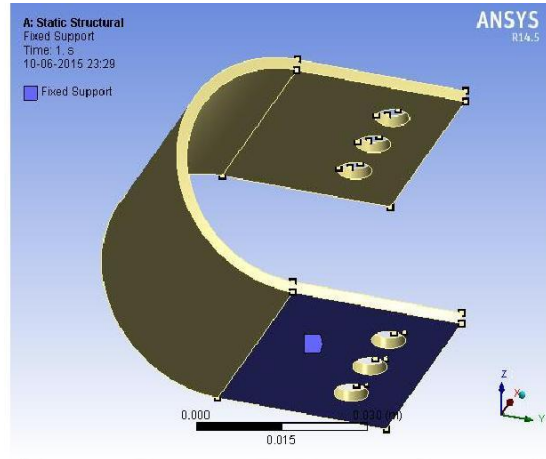
Sr No	Load (gm)	Speed rpm	Acceleration m2/Sec	Frequency Hz
1	1500	1310	256	367
2	2000	1265	264	372
3	2500	1225	276	380
4	3000	1215	281	376
5	3500	1165	288	384

6	4000	1145	291	389
7	4500	1030	296	386

Table 2 : Vibration Analysis Results Of Elliptical_Leaf Mount

4. ANALYSIS OF ELLIPTICAL LEAF SPRING





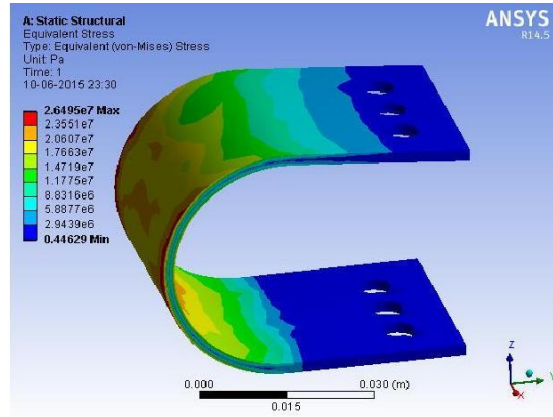


Fig 2: Ansys Analysis Of Elliptical Leaf Spring

Part Name	Theoretical Allowable stress N/mm ²	Theoretical maximum stress N/mm ²	Equivalent Von-mises Stress N/mm ²	Maximum deformation mm
Elliptical Leaf	600	0.06	2.64	1.66 x 10 ⁻¹⁰

Table 3: Stresses On Elliptic Leaf Spring

Maximum stress by theoretical method and Von-mises stress are well below the allowable limit, hence the elliptical leaf is safe. Elliptical leaf shows negligible deformation under the action of system of forces.

5. CONCLUSION

A procedure to design, development and analysis of elliptical leaf spring has to established . A elliptic leaf spring made up of SS-304 has been designed. Conclusion will be drawn on the basis of theoretical and experimental results. As load increases on machine, speed decreases and acceleration as well as frequency also increases The stresses in the Elliptical leaf spring leaf are much lower than that of conventional rubber mount . This advanced equipment should be able to quantify the problem with the current system. A comparative study has been made between conventional rubber mount & elliptical leaf spring mount vibration isolation .

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