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"VIBRATION ANALYSIS OF FOUR VEHICLE LEAF SPRING"

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ABSTRACT

A leaf spring is a direct sort of spring, generally used for the suspension in wheeled vehicles. It is also maybe the most prepared sort of springing, returning to medieval event. It is also one of the oldest forms of springing, dating back to medieval times. In this project leaf spring CAD modeling done on solid edge software and simulation performed on ANSYS software with static analysis and modal analysis also done. The CAD math is made on the Solid edge itself since its calculation isn't bewildered to such a degree, that is the explanation a singular leaf with two eye end is made with the help of planning math gadget open in ANSYS workbench 19.2. For calculation advancement the length of spring is taken as 1200 mm, camber height is 62.2 mm, width of leaf is 135 mm, thickness of leaf is 11 mm and range of curve is 1000mm which is resolved. which is also too low and this material can sustain the load as the conventional spring material but are thing is positive regarding weight because Carbon fiber is light weight to steel 35 % weight reduction with E -Glass materials.

Key Words: *ANSYS, Solidedge, E- glass, S- Glass, CAD and Leaf spring*

I. Introduction

At first called secured, a leaf spring is a direct sort of spring, generally used for the suspension in wheeled vehicles. It is also maybe the most prepared sort of springing, returning to medieval events. Once in a while insinuated as a semi-round spring or truck spring, it shows up as a thin curve formed. The point of convergence of the roundabout section offers region to the center point, while tie holes are given at either end to associating with the vehicle body. For generous vehicles, a leaf spring can be created utilizing a couple of leaves stacked on head of each other in a couple of layers, often with intelligently shorter leaves. Leaf springs can serve finding and to some degree damping similarly as springing limits. While the interleaf granulating gives a damping action, it isn't all around controlled and realizes in the development of the suspension. Thus creators have attempted various things with mono-leaf springs. A leaf spring can either be added direct to the edge at the two terminations or joined really toward one side, regularly the front, with the furthest edge associated. There were a variety of leaf springs, customarily using "round". "Bended" or "full bended" leaf springs insinuated two round twists associated at their tips. This was joined to the edge at the top point of convergence of the upper round section, the base network was joined to the "live" suspension parts, for instance, a solid front rotate. Additional suspension parts, for instance, following arms, would be required for this arrangement, anyway not for "semi-round" leaf springs as used in the Hotchkiss drive. That used the lower roundabout section, thusly its name. "Quarter-elliptic" springs routinely had the thickest bit of the heap of leaves stuck.. As a substitute for dampers (shields), a couple of creators laid non-metallic sheets in the metal leaves, for instance, wood. Normally when used in vehicle suspension the leaf the two support a center point and finds/not completely finds the rotate.

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II. PROBLEM STATEMENT

As weight accept a huge activity in picking the adequacy of a vehicle. The leaf spring used generally is made of steel which are exceptionally awkward and one of the normal things for weight decline in vehicles since it accounts 10-20% spring weight passed on by its own. To avoid this obstacle and comfort riding qualities an undertaking is to be made in overriding the material with bleeding edge materials like composite materials. This work is transcendently revolved around the use of Thermoplastic polyimide with 30% carbon fiber sustained (composite material) by displacing steel En 45 in conventional leaf springs of a suspension system to reduce thing weight, improving the security, comfort and robustness.

III. METHODOLOGY

ANSYS is extensively helpful restricted part assessment (FEA) programming group. Restricted Element Analysis is a numerical procedure for deconstructing an erratic structure into small amounts (of customer relegated size) called parts. The item completes conditions that manage the lead of these segments and lights up them all; making an exhaustive explanation of how the structure goes about by and large. These results by then can be presented in arranged, or graphical structures. This sort of examination is conventionally used for the structure and improvement of a system unnecessarily complex to separate by hand. Systems that may fit into this arrangement are unnecessarily awesome in light of their math, scale, or directing conditions. ANSYS is the standard FEA demonstrating gadget inside the Mechanical Engineering Department at various schools. ANSYS is moreover used in Civil and Electrical Engineering, similarly as the Physics and Chemistry workplaces. ANSYS gives a viable strategy to explore the display of things or strategies in a virtual circumstance. This sort of thing progression is named virtual prototyping. With virtual prototyping strategies, customers can rehash various circumstances to improve the thing some time before the amassing is started. This engages a reduction in the level of danger, and in the cost of insufficient plans. The multifaceted thought of ANSYS moreover gives an approach to ensure that customers can see the effect of an arrangement with everything taken into account lead of the thing, be it electromagnetic, warm, mechanical, etc.

IV. MODELING & SIMULATION

The CAD math is made on the Solid edge itself since its calculation isn't bewildered to such a degree, that is the explanation a singular leaf with two eye end is made with the help of planning math gadget open in ANSYS workbench 19.2. For calculation advancement the length of spring is taken as 1200 mm, camber height is 62.2 mm, width of leaf is 135 mm, thickness of leaf is 11 mm and range of curve is 1000 mm which is resolved. A three dimensional point of view on expert leaf with eye closes are showed up in figure No.5.1

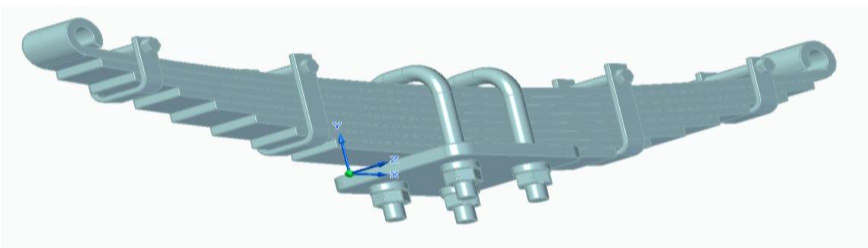

Fig. 4.1 Geometry of master leaf with eye ends

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V. RESULTS

5.1 E – Glass materials leaf spring

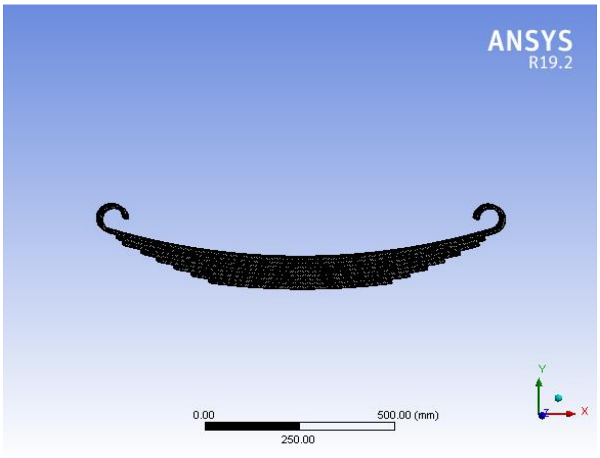

Figure 5.1 Leaf spring meshing

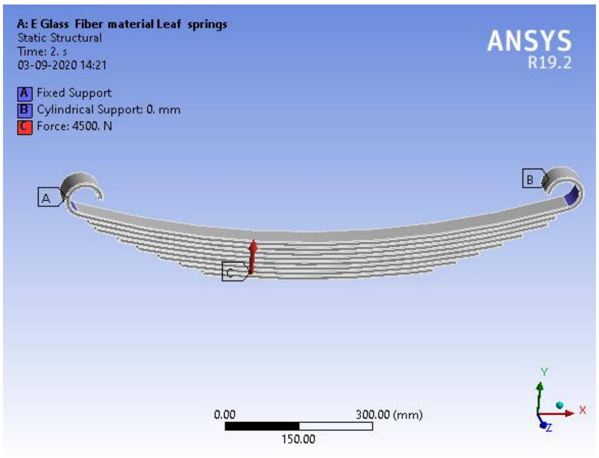

Figure 5.2 Boundary Condition E – Glass materials all boundary condition applied

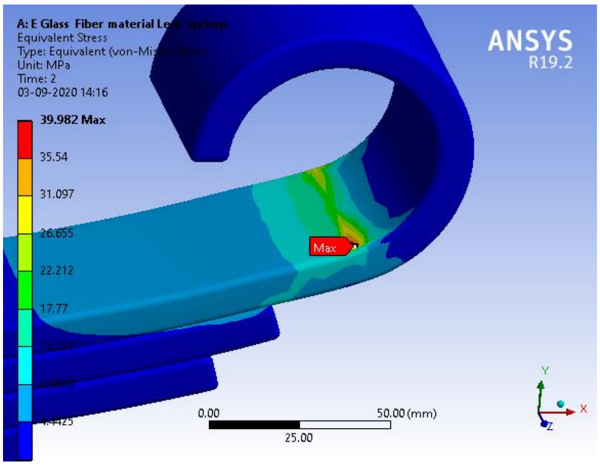

Figure 5.3 Von mises stress results for E-Glass fiber materials zoom in

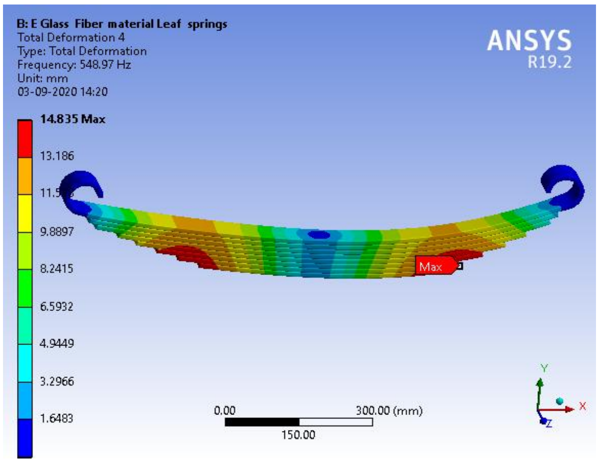

Figure 5.4 Deformations results for E-Glass fiber materials at mode 4 with higher frequency at 548.97 Hz with modal analysis

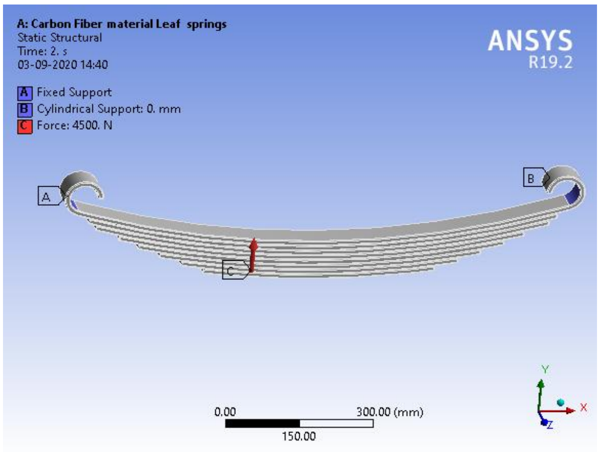

Figure 5.5 Boundary Condition Carbon Fiber materials

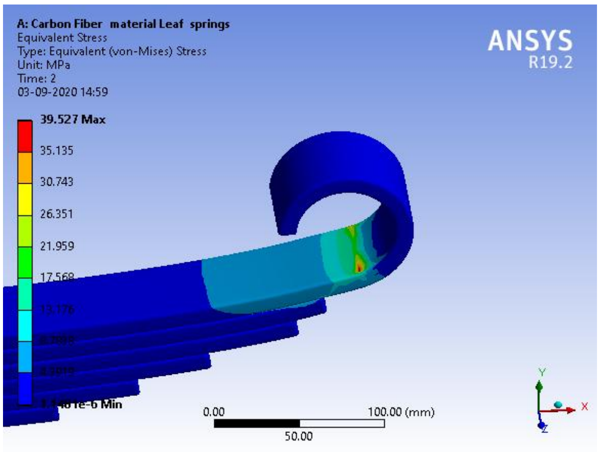

Figure 5.6 Von mises stresses for Carbon Fiber materials in zoom

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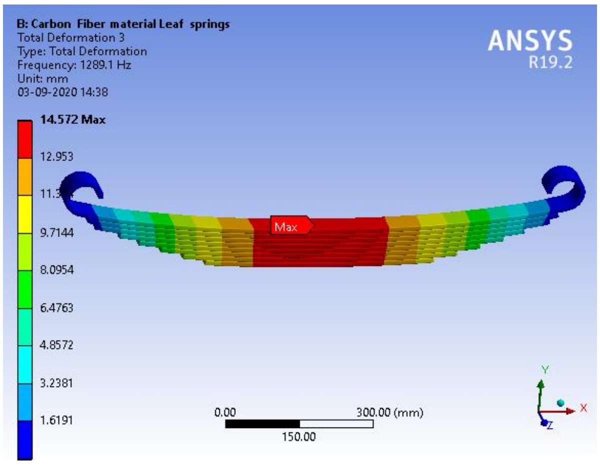

Figure 5.7 Carbon Fiber material deformation result at mode 3

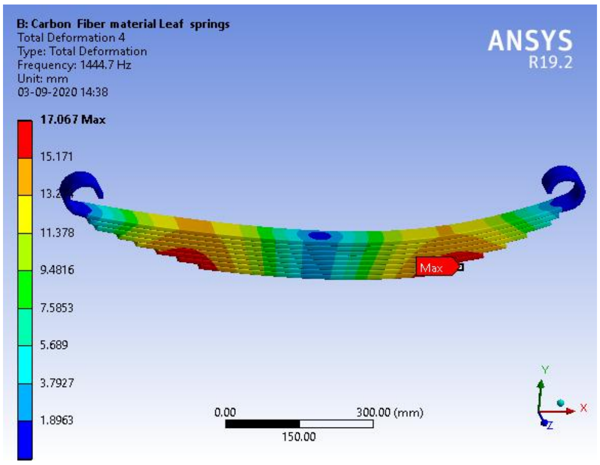

Figure 5.8 Carbon Fiber material deformation result at mode 4

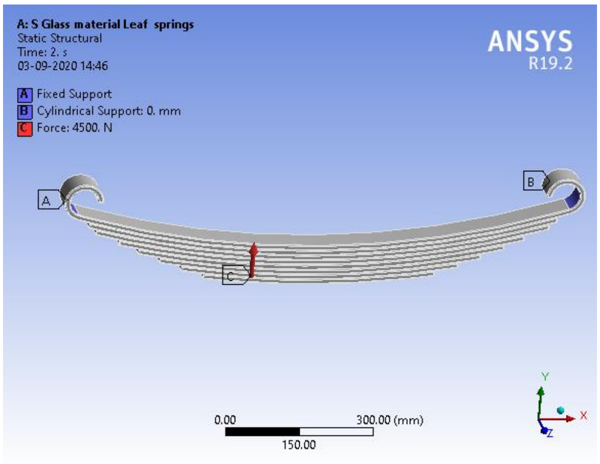

Figure 5.9 Boundary Condition S Glass Fiber materials

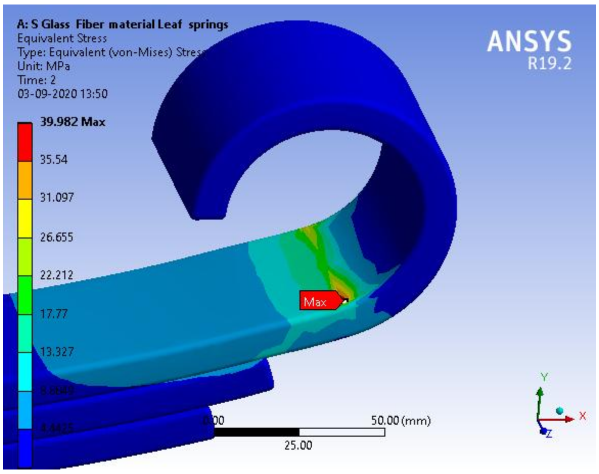

Figure 5.10 Von misses stresses for S Glass Fiber materials zoom in

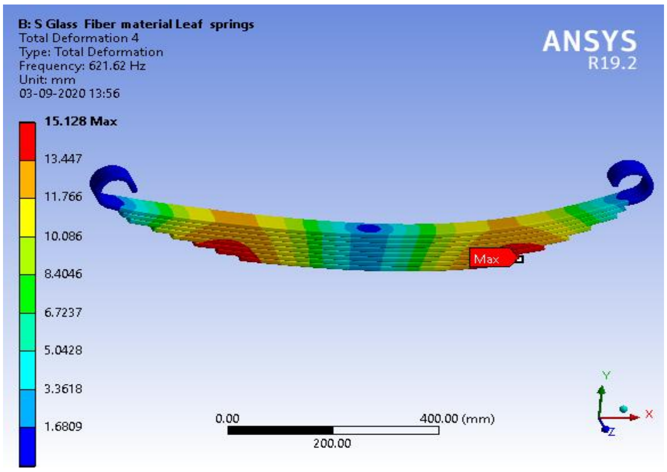

Figure 5.11 S Glass fiber material deformation result at mode 4

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Table 5.1: Deflection (mm) and maximum stress (MPa) at 4500 N

S.No.	Materials	Deflection in (mm)	Maximum stress in (Mpa)	Frequency (Hz)	Weight (Kg)
1.	E- Glass composite material	14.83	39.982	548.97	11
2.	S- Glass fiber composite material	15.12	39.98	621.62	10
3.	Carbon Fiber composite material	17.067	39.5	1444.7	7

VI. CONCLUSION

The following conclusion can be drawn from above work:-
For E- Glass spring – the mean deflection developed in the master leaf spring at load of 4500 N is 14.85 mm at maximum frequency 548.97 Hz. So cause of vibration because level of frequency is more compared to Carbon fiber material.
Deflection developing is 17.06 mm which are too low at low frequency with 4 mode 538.32 Hz. which is also too low and this material can sustain the load as the conventional spring material but are thing is positive regarding weight because Carbon Fiber is light weight to steel 35 % weight reduction with E -Glass materials

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