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Exploring the Possibility of using Carbon and Boron Fibers for Leaf Spring

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***Abstract*:- For the better suspension system in automobile vehicles parts used are leaf springs and shock absorbers. Leaf springs are effectively utilized which absorbs the maximum shock loads for the vehicle.**

The main function of leaf spring is not only to support vertical load but also to isolate road induced vibrations. It is subjected to millions of load cycles leading to fatigue failure. The spring consists of a number of leaves of equal width but varying length, placed in laminations and loaded as a beam.

The objective of this project is to present modeling and analysis of semielliptical leaf spring assembly and comparison of deformation and stress, load carrying capacity, stiffness and weight savings results between steel leaf spring and composite leaf spring under same conditions.

This study gives information about the replacement of steel leaf spring with composite leaf spring assembly made of carbon fiber and boron fiber. The semielliptical leaf spring is to be modeled in solid works and analysis is to be carried out by using ANSYS workbench14 for effective comparison.

***Keywords* :-Leaf spring, steel, carbon & boron fibers.**

INTRODUCTION:-

The vehicle body is to be isolated from road shocks and vibrations by the complete suspension system. Which would otherwise be transmitted to the load and passengers. Regardless of road surface, the tires must also be kept in contact with the road. springs, axles, shock absorbers, arms, roads and ball joints are present in a suspension system. The flexible part of the suspension is the spring. Leaf springs, torsion bars and coil springs are basic types.

light coil springs are usually used by modern passenger vehicles. Heavier springs are used in light commercial vehicle comparatively than passenger vehicles. it can have coil springs at the front. leaf springs are usually used in heavy commercial vehicles at the front and rear.

SPECIFICATIONS OF LEAF SPRING:-

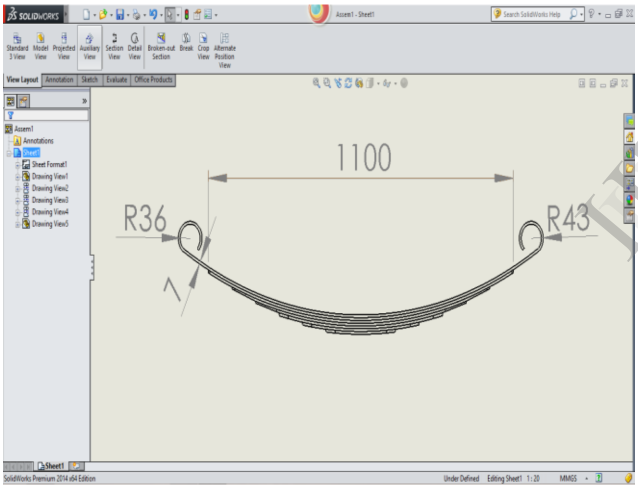
S.NO	PARAMETER	VALUE
1	LOAD ACTING ON THE LEAF	6000 N
2	MASTER LEAF LENGTH	1282.2 mm
3	NO.OF FULL LENGTH LEAVES INCLUDING MASTER LEAF(n_F)	2
4	NO.OF GRADUATED LEAVES(n_G)	5
5	WIDTH OF LEAVES	65 mm
6	LEAF THICKNESS	7 mm
7	EFFECTIVE LENGTH OF THE SPRING (2L)	1020 mm
8	INNER DIAMETER OF EYE	36 mm
9	OUTER DIAMETER OF EYE	43 mm

The graduated leaf lengths are L_2,L_3,L_4,L_5,L_6,L_7 are 1100,930,760,590,420,250 mm respectively.

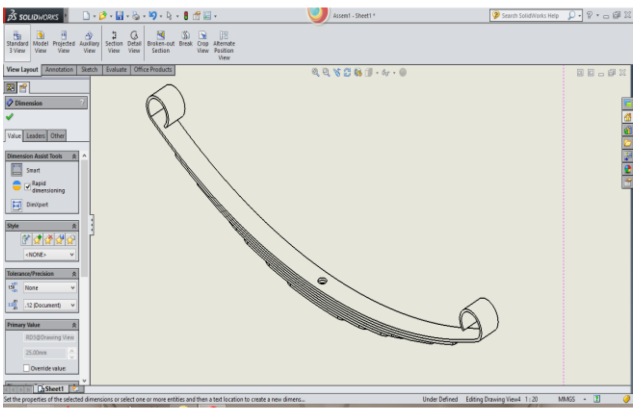
MECHANICAL PROPERTIES OF MATERIALS:-

S.NO	MATERIAL	DENSITY×100 Kg/m3	YOUNGS MODULUS(N/ mm^2)	POISSON RATIO
1	65 SI 7 STEEL	7.850	2.1×10^5	0.266
2	CARBON FIBRE WITH EPOXY RESIN	2.00	2.4×10^5	0.33
3	BORON FIBRE WITH EPOXY RESIN	2.540	3.8×10^5	0.35

DESIGN OF LEAF SPRING ASSEMBLY IN SOLIDWORKS:-

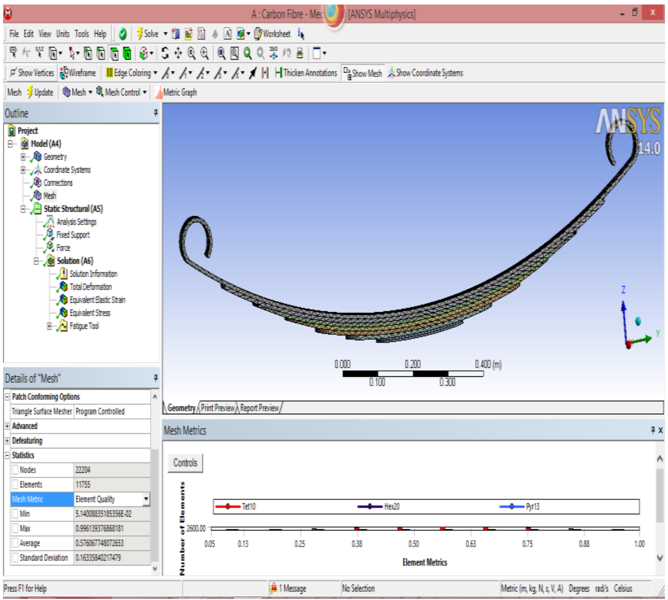


ISOMETRIC VIEW OF LEAFSPRING:-

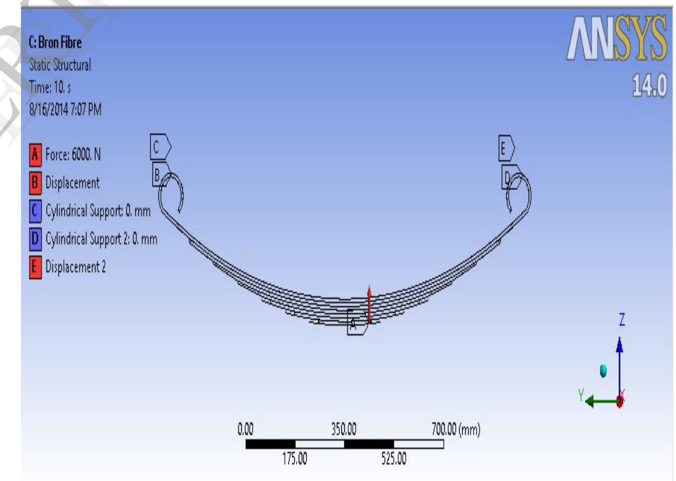


ANALYSIS OF LEAFSPRING IN ANSYS WORKS BENCH 14:-

MESHING OF LEAFSPRING ASSEMBLY:-



BOUNDARY CONDITIONS:-



DEFORMATION ANALYSIS:-

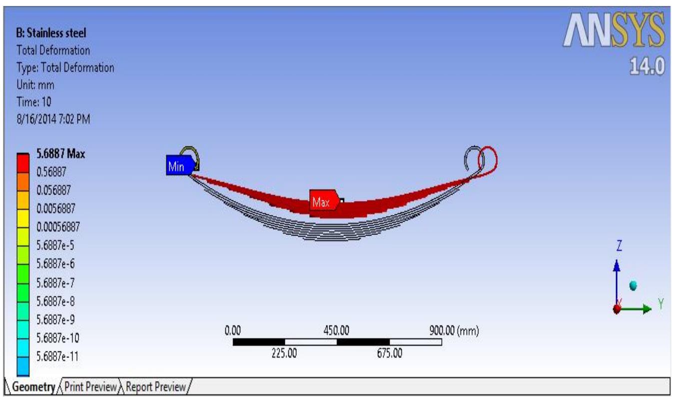


FIG (A) **STAINLESS STEEL**

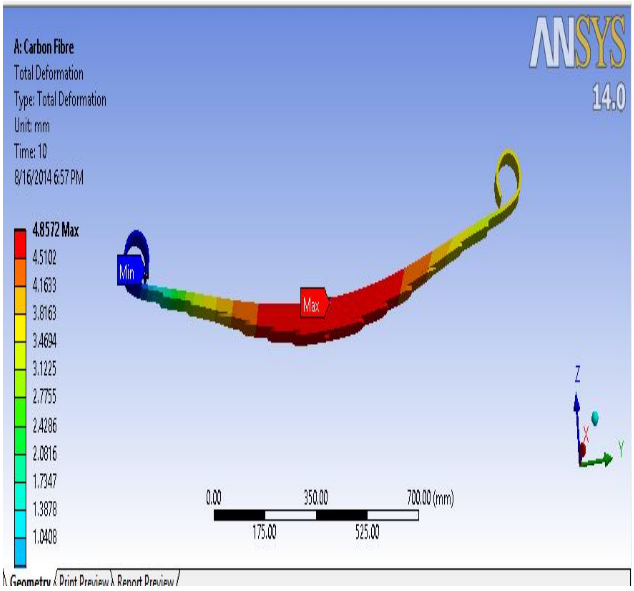


FIG (A) STAINLESS STEEL

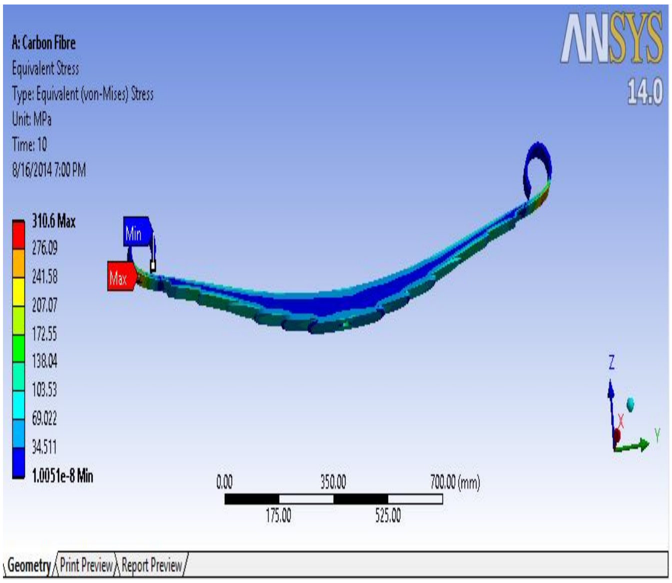


FIG (B) CARBON FIBER

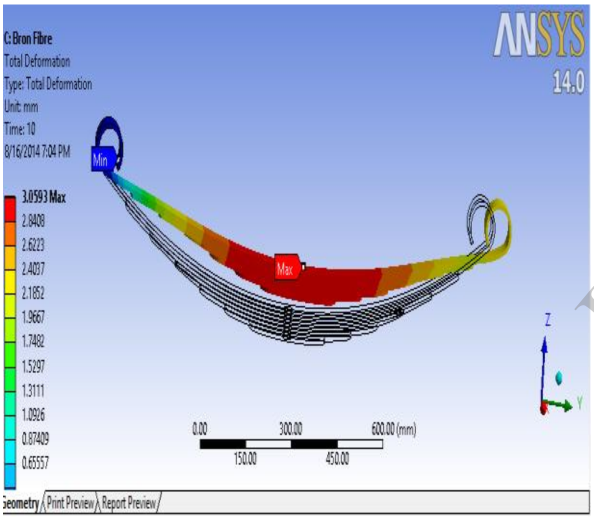


FIG (B) CARBON FIBER

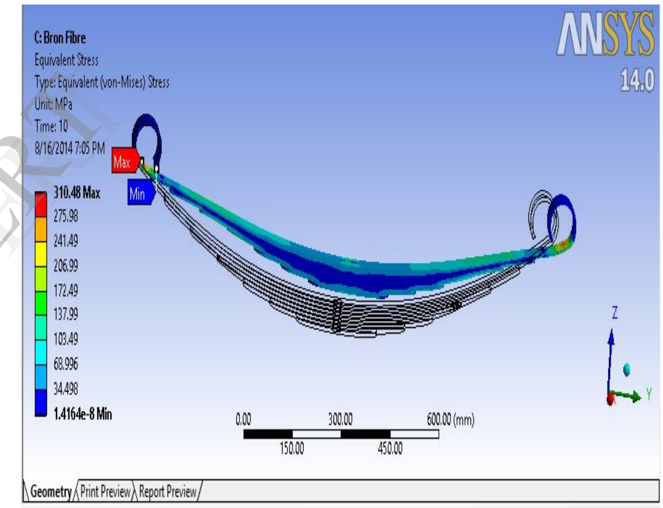
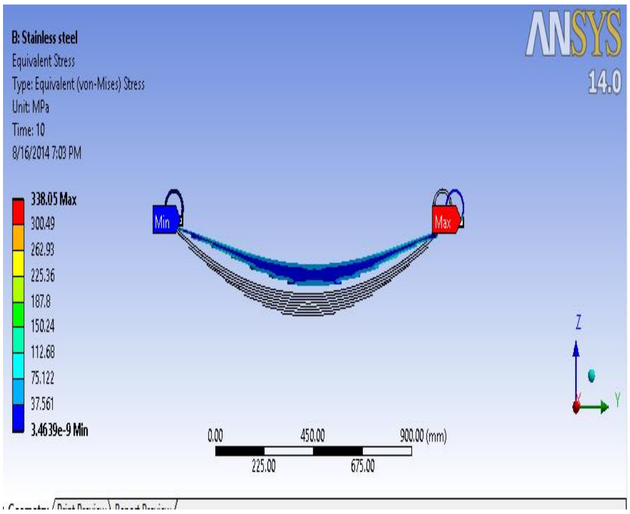


FIG (C) BORON FIBER

FIG (C) BORON FIBER

STRESS ANALYSIS:-



RESULTS:-

FEA RESULTS

S.NO	PARAMETER	STEEL	CARBON FIBRE WITH EPOXY RESIN	BORON FIBRE WITH EPOXY RESIN
1	DEFORMATION(mm)	5.6887	4.8572	3.0593
2	STRESS (Mpa)	338.05	310.6	310.48
3	STRAIN	0.0017766	0.001301	0.00082086
4	WEIGHT	20 KG	5.123 KG	6.5 KG

ANALYTICAL RESULTS

S.NO	PARAMETER	STEEL	CARBON FIBRE WITH EPOXY RESIN	BORON FIBRE WITH EPOXY RESIN
1	DEFORMATION(mm)	6.374	5.577	3.52
2	STRESS (Mpa)	411.75	411.75	411.75

CONCLUSION:-

On basing the modeling of leaf spring assembly using professional engineering, solid works and ansys workbench 14. A relative study has been made in between the conventional leaf spring and composite leaf spring assembly with respect to deformation and stress.

Analysis from the experimental results of testing of leaf spring assembly under sudden load containing the deformation is listed in result table. As the composite leaf spring is able to with stand the sudden load. It is concluded that it is better position to take shock loads as it is having the toughness.

And also strength to weight ratio increases. It is got all the mechanical properties of conventional leaf springs. And so they can be replaced when the technology of this is mastered or widely used.

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