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ANALYSIS OF EPOXY CARBON COMPOSITE MATERIAL MONO LEAF SPRING, COMPARISION WITH STEEL LEAF SPRING

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ABSTRACT

Now a days in automobile sector weight reduction is most important criteria for lowering the cost & high performance. For weight reduction composite material is good option to solve weight related problems. In this paper we describe analysis of composite material with steel material comparision. For analysis purpose we can use FEA software. The objective of this paper is comapre things like different loading conditions stresses, weight savings etc. Now days automobile companys intrest to change steel leaf springs into composite materials leaf springs because of high strength to weight ratio, good corrsion resistance etc.

Result shows weight reduced near about 80 % as compare to steel material. The leaf spring is moulded in CATIA software & then import into ANSYS simulation software.

Keywords:- *Composite material, Epoxy carbon, leaf spring, ANSYS etc.*

I. INTRODUCTION

Leaf spring:- In automobile leaf spring mainly worked as suspension system to absorb the shocks loads during running conditions. It carries lateral loads, brake torque, driving torque in addition to shock absorbing system. The advantage of leaf spring is the end of spring may be guided along a definite path. For leaf spring required minimum modulus of eleasticity, maximum strength etc.

In this research paper we shows that the weight reduction due to less of number of bunches in composite materials.

Fig. no. 1 Conventional leaf spring

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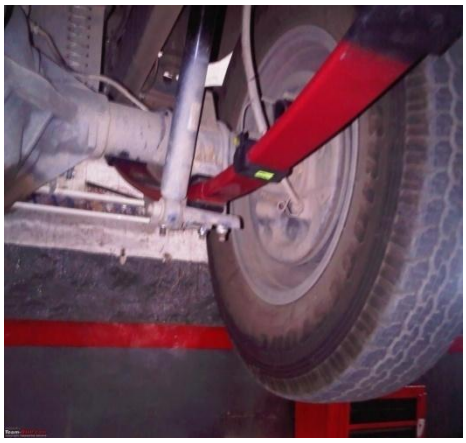

Fig. No. 2 Composite leaf spring

II. LITERATURE REVIEW

Avinash Sharma et.al [1] under this paper weight reduction can easily achieved by using composite materials instead of conventional steel, but there occurs a problem during the operation while using the composite leaf spring i.e. chip formation when the vehicle goes off road. Therefore there is an immense scope for the future work regarding use of composite materials in leaf springs to reduce the overall weight of the vehicle as well as the cost of the vehicle.

Syambabu Nutalapati et.al[2] in this research paper As leaf spring contributes considerable amount of weight to the vehicle and needs to be strong enough, a single composite leaf spring is designed and it is shown that the resulting design and simulation stresses are much below the strength properties of the material satisfying the maximum stress failure criterion.

Ghoadka A.P. et.al [3] in this research work observed that the composite leaf spring is lighter and more economical than the conventional steel spring with similar design specifications. It is observed that the weight reduction of mono leaf spring is achieved up 84.94% in case of composite than steel.

Pankaj Saini et.al [4] in this research work the static analysis results it is found that there is a maximum displacement of 10.16mm in the steel leaf spring and the corresponding displacements in E-glass / epoxy, graphite/epoxy, and carbon/epoxy are 15.mm, 15.75mm and 16.21mm. And all the values are below the camber length for a given uniformly distributed load 67 N/mm over the ineffective length.

Shiva shankar et.al[5] under this research work it is observed that the composite leaf spring is lighter and more economical than the conventional steel spring with similar design specifications.

N.V. Hargude et.al [6] in this research work Ride comfort and life of Composite Leaf Springs are also more when compared to Steel Leaf
Springs.

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III. FEA PROCEDURE

1] Creating 3D model of leaf spring in CATIA software.

2] Solve 3D geometry in neutral format.

3] Import 3D drawing in simulation software that is ANSYS.

4] Defining material properties.

5] Mention the data like, Poissions ratio, Youngs moduls values etc.

6] Define boundary conditions etc.

7] Applying the loading conditions.

8] Evaluate thease results.

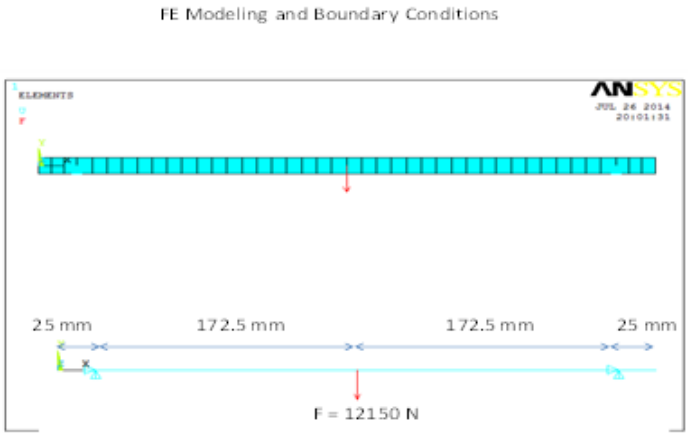

Fig. No.3 Boundary conditions

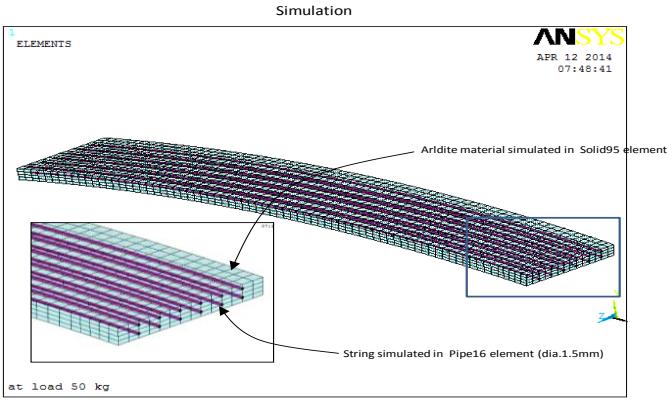

Fig. No 4 Simulations

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IV. DESIGN

Stress analysis of Epoxy Carbon fiber material:-

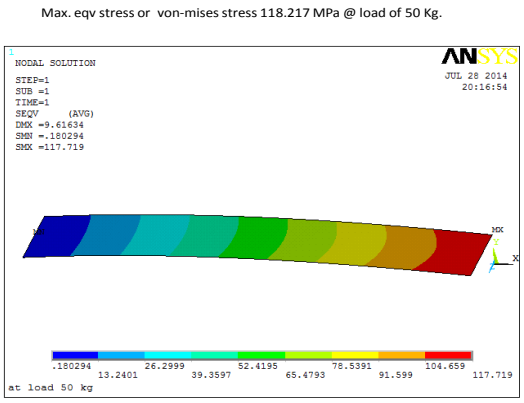

Fig. No. 5 maximum von-misses stress at 50 kg load

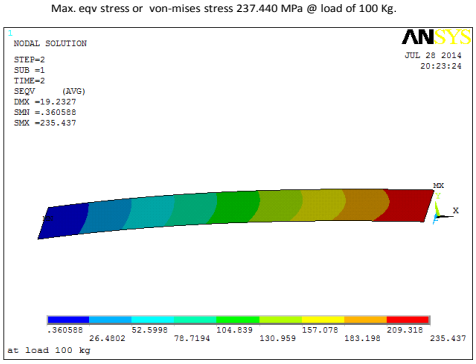

Fig. No. 6 von-misses stress at 100 kg load

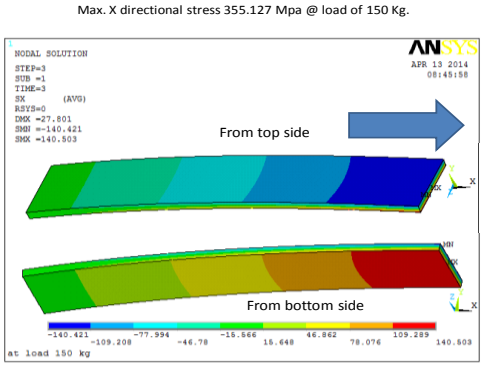

Fig. No. 7 Maximum displacement in horizontal direction at 150 kg load

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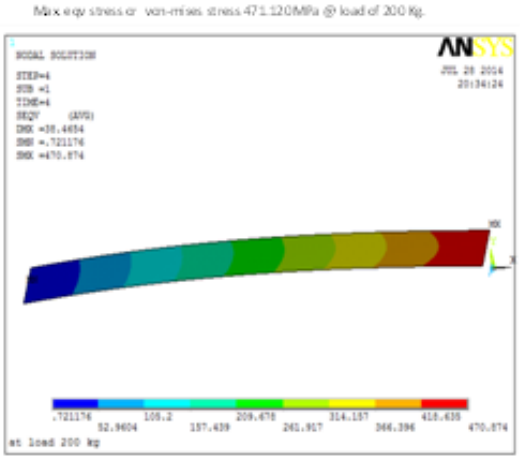

Fig.No. 8 Von-misses stress at 200 kg load

Design analysis of carbon fiber epoxy composite material leaf spring through ANSYS

Sr No	Load in Kg	Von-misses stress In Mpa
1	50	118.217
2	100	237.440
3	150	355.127
4	200	471.120

Design analysis of regular steel leaf spring for Maruti 800 through ANSYS

Sr No	Load in Kg	Von-misses stress In Mpa
1	50	117.719
2	100	235.437
3	150	353.156
4	200	470.874

V. DISCUSSION

Through Software analysis max deflection in horizontal and vertical direction and von misses stress are determined by giving up to 200 kg vertical load in steps of 50 kg rise, at centre of each leaf spring as recommended by manufacturer of LCV car. This deflection & von mises stresses are found satisfactory.

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If we plot displacement V/s load or stress V/s load, it will observe linear because it is linear static analysis. From this analysis we can interpret displacements or stresses below yield pt. observed are realistic, if found crossed yield pt. stresses and deformations are non-realistic.

Through Software analysis natural frequencies and mode shapes are investigated for carbon fiber epoxy composite material leaf spring at one end simply supported while other is sliding contact as applicable in actual use in maruti 8oo car.

VI. CONCLUSION

Experimental results of loading & deflection are matching with the FEM results hence we can replace carbon fiber leaf spring material at steel leaf spring due to advantage of reduction of weight by 80%.

Stress level is also shows 9 % difference in both the springs of steel & carbon leaf.

Future Scope:-

If it is possible to manufacture (high cost) a composite leaf spring in one piece; this eliminates all the numbers of piece steel spring and thus minimizes the overall weight, vibrations and the total cost.

It is concluded that CAE tools provides a cost effective and less time consuming solution in comparison with the experimental testing but the results may vary in the specified range.

REFERENCES

1] N.V. Hargude , "Review of composite material mono leaf spring", International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 5, May 2014.

2] Gulur Siddaramanna SHIVA SHANKAR, "Mono Composite Leaf Spring for Light Weight Vehicle – Design, End Joint Analysis and Testing", ISSN 1392–1320 MATERIALS SCIENCE (MEDŽIAGOTYRA). Vol. 12, No. 3. 2006.

3] Pankaj Saini, "DESIGN AND ANALYSIS OF COMPOSITE LEAF SPRING FOR LIGHT VEHICLES", International Journal of Innovative Research in Science, Engineering and Technology,Vol. 2, Issue 5, May 2013.

4] Ghodake A. P., "Analysis of Steel and Composite Leaf Spring for Vehicle", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE),e-ISSN: 2278-1684 Volume 5, Issue 4 (Jan. - Feb. 2013).

5] Avinash Sharma," Design and Analysis of Composite Leaf Spring –
A Review", International Journal of Engineering Trends and Technology (IJETT) – Volume 9 Number 3 - Mar 2014.

6] Syambabu Nutalapati, "
Design And Analysis Of Leaf Spring By Using Composite Material For Light Vehicles", International Journal of Mechanical Engineering and Technology (IJMET) ,Volume 6, Issue 12, Dec 2015, pp. 36-59, Article ID: IJMET_06_12_005.