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RESEARCH ARTICLE

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MODELLING AND ANALYSIS OF COMPOSITE LEAF SPRING FOR HEAVY DUTY VEHICELS

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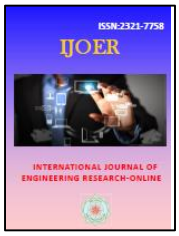

ABSTRACT

The Composites have more quality weight proportion. Among the different kind of composites, fiber-fortified polymer composites are currently used in various sorts of use because of their low expenses of creation, straightforwardness in manufacture and furthermore their high qualities contrasted with other traditional materials. Fortifications in polymers may either be normal or manufactured. The engineered strands incorporate glass, carbon, Kevlar and boron. They have large amounts of particular qualities, yet their fields of utilizations are limited in perspective of higher creation cost.

The present research work looks the trade of material for leaf spring. In show examine the material chose was Structural Steel, Epoxy EN45A and Glass Fiber Epoxy and which are looked at against customary steel. A spring with steady width and thickness was planned in view of Force Motors Trucks Mini Vehicle. Investigation is conveyed by means of limited component examination utilizing ANSYS-WORKBENCH programming. Stresses, redirection, greatest key pressure and least key pressure comes about for both steel and composite leaf spring material were acquired. Examination will be do in the middle of Steel, Epoxy EN45A and Glass Fiber Epoxy which one is most appropriate for substitution of steel leaf spring. From the Results Comparison is done between theoretical and analytical results $\sigma_{Theoretical}$=15.333Mpa and $\sigma_{Analytical}$=14.43 Mpa analytical results are 0.05894% better as per our investigation Glass Fiber epoxy composite is the best material for Manufacturing of leaf spring for Automobiles.

INTRODUCTION

A vast and extensive study of composite materials subjected to properties has been undertaken over many years. The objectives vary from examining the behavior of composite structures under various loads caused by various objects such as leaf spring, mechanical parts in automobiles and other components designed for various purposes for the intention of weight reduction are reviewed. The structures of interest in many applications are commonly composed of E-glass, Carbon, Kevlar, carbon/graphite, Kevlar and glass fiber reinforced polymer matrix composites. In Numerical Simulation we are going to design the leaf spring by utilizing Empirical Formulas leaf spring is to be used in the Automobile vehicle is modelled and analyzed using CATIA and ANSYS15 Software. So as to outline leaf spring analysis. The most critical parameters are:

1. Load to be weighed.

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2. Material selection for Manufacturing of leaf spring

COMPUTATIONAL MODELLING DESIGN CALCULATIONS

Specifications

1. Total length of the leaf spring (Eye to Eye) : 965mm
2. Number of full length leaf(Master leaf): 01
3. Total number of leaves: 05
4. Thickness of leaf : 10mm
5. Width of leaf spring : 50mm
6. Maximum load given on leaf spring : 794.54 N Theoretical calculations of conventional steel leaf spring:

$$\sigma = \frac{W \times l}{n \times b \times t^2} \ldots\ldots (1)$$

$$\sigma = 15.33385 \text{ Mpa}$$

The Geometrical data of hybrid composite leaf spring.

Sl.No	Description	Value
1	Load	794.54 N
2	Length of Spring L	965 mm
3	Width of the Spring b	50 mm
4	Thickness t	10 mm
5	Total number of leaves	5

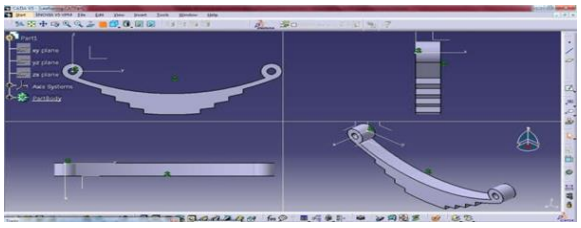

Fig.1:Elevation, Plan, Side view and Isometric view of Leaf spring

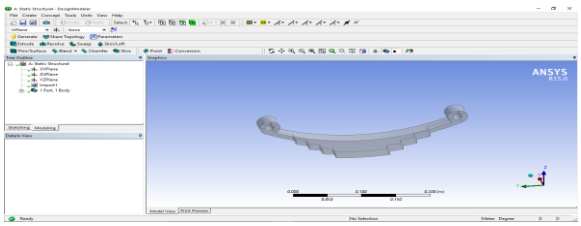

Fig. 2: Leaf spring imported in to Ansys Workbench

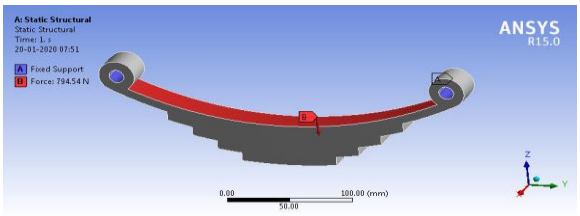

Fig. 3: Applying Boundary conditions in Ansys Workbench

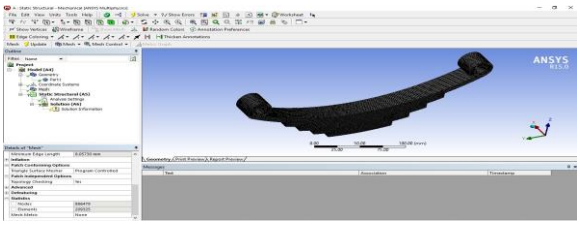

Fig. 4: Fine meshed model in Ansys Workbench

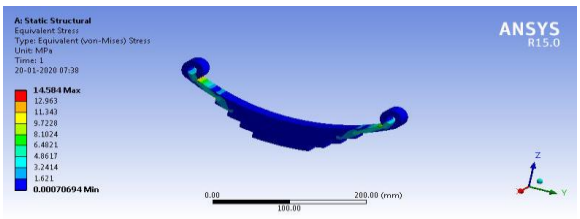

Fig. 5: Equivalent (Von-Misses) Stresses Distribution over the Entire Surface of the leaf spring

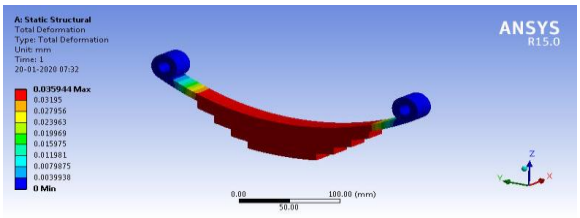

Fig. 6: Total deformation Distribution over the Entire Surface of the leaf spring

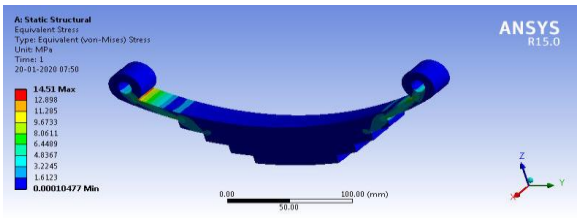

Fig. 7: Equivalent (Von-Misses) stress over the Entire Surface of the EN45Aleaf spring

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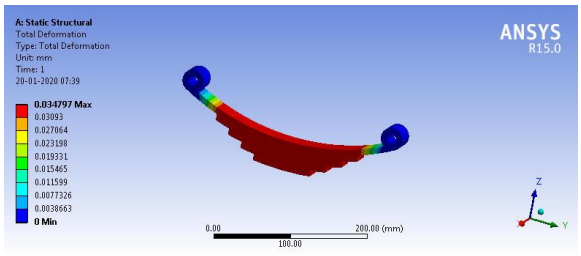

Fig. 8: Total deformation over the Entire Surface of the EN45Aleaf spring

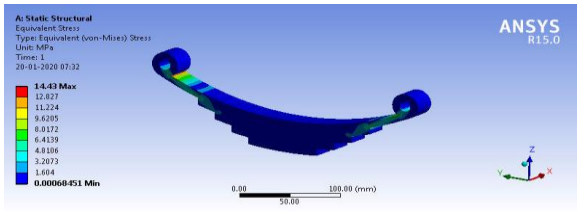

Fig. 9: Equivalent (Von-Misses) stress over the Entire Surface of the Glass Fiber Epoxy Leaf spring

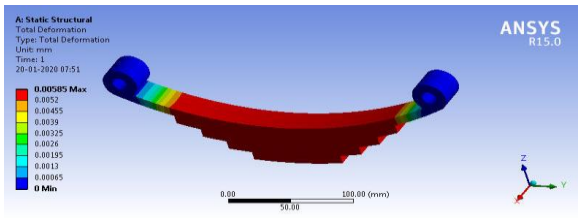

Fig. 10: Total deformation over the Entire Surface of the Glass Fiber Epoxyleaf spring

Results from Structural Analysis

S.No	Material	Von-Mises Stress	Von-Mises Strain	Total Deformation
		(Mpa)		(mm)
1	STRUCTURAL STEEL	14.584	$8.24e^{-04}$	0.035944
2	EPOXY EN45A	14.51	8.06^{e-04}	0.034797
3	GLASS EPOXY	14.43	$1.3481\ e^{-4}$	0.00585

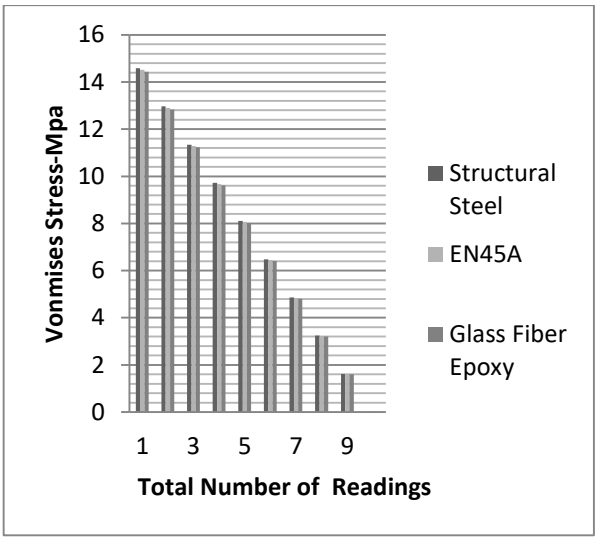

Fig. 11: Graph plot for vonmises values in between Structural Steel Vs Epoxy45A and Glass Fiber Epoxy

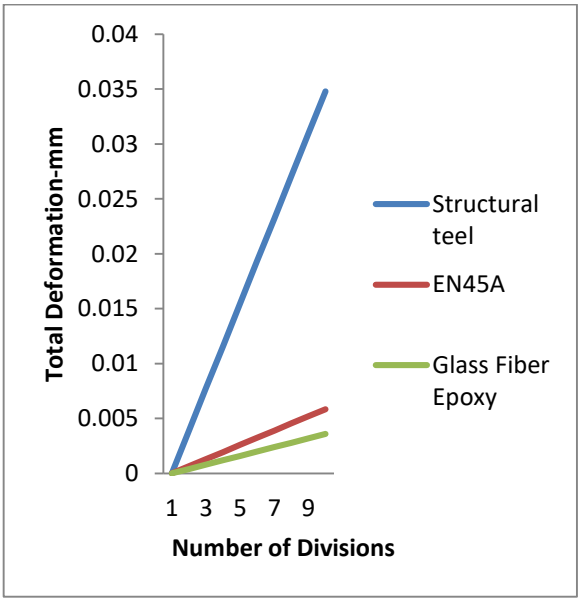

Fig. 12: Graph plot for Total deformation values in between Structural Steel Vs Epoxy45A and Glass Fiber Epoxy

Results from Modal Analysis

S. No	Material	Total Deformation (mm)					
1	Structural Steel	83.7	87.47	110.82	157.06	157.06	167.69
2	Epoxy EN45A	36.469	36.506	53.602	53.602	60.541	68.934
3	Glass Fiber Epoxy	35.88	40.079	40.079	42.283	62.301	65.705

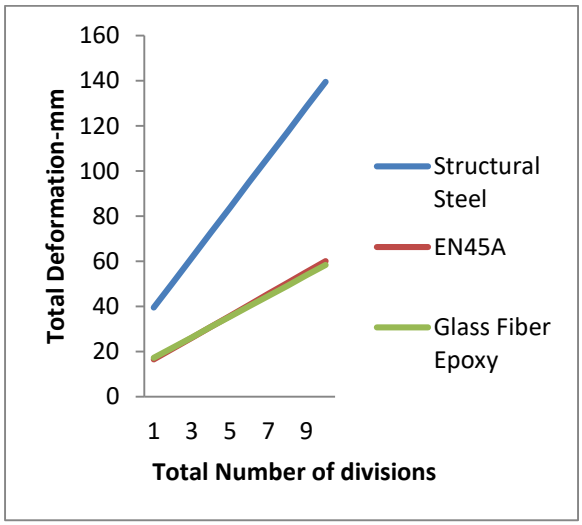

Fig. 13: Graph plot for Total Deformation values in between Steel Vs Epoxy45A and Glass Fiber Epoxy

CONCLUSION

The FEM Analysis Report Reveals the Following Results:

From the Simulation Report and Graphical Representation Finite Element Analysis of Automobile leaf spring by varying Different Materials the Vonmises Stress, Vonmises Strain , Deformation and Frequencies generated in Glass Fiber epoxy is less than Epoxy EN45A, is less than Steel the Maximum stress generated in Glass Fiber epoxy design is Safe and it will improve the Component Life time.

For Designing and Manufacturing of Camshaft Vonmises stress plays an Vital role the vonmises stress of Glass Fiber epoxy < Epoxy EN45A <Structural Steel (14.584Mpa<14.51Mpa<14.43Mpa)

Total deformation (0.035944mm<0.034797mm<0.00585mm) Modal analysis Total deformation values on leafspring is 167.69mm:68.934mm:65.705mm

From the Results Comparison is done between theoretical and analytical results σTheoretical=15.333Mpa and σAnalytical=14.43 Mpa analytical results are 0.05894% better as per our investigation Glass Fiber epoxy composite is the best material for Manufacturing of leaf spring for Automobiles.

REFERENCES

[1]. M.Raghavendra, Syed AltafHussain, V.Pandurangadu, K,Palanikumar " Modeling and Analysis of Leaf spring under the static load condition by utilizing FEA" International Diary of Modern Engineering Research, Volume2, Issue 4, July-Augest2012.

[2]. Godatha Joshua Jacob, M.Deepak," Design and Analysis of Leaf spring in a Heavy Truck"International Journal of Innovative Technology and Research, Volume 5, Issue no.4, June-July2017

[3]. Harmeet singh, Gurinder singh brar "Characterization and Investigation of Mechanical properties of Composite materials utilized for Leaf spring" Elsevier, Maials Proceeding India,2017.

[4]. 4.S.Jaya Kishore, M.Lavakumar "Auxiliary Analysis of Multi-Plate Clutch" paper distributed in International Journal of Computer Trends and Technology (IJCTT) volume 4 Issued 7- 2013. ISSN:2231-2803.

[5]. Mohd Hafiz Bin Ghazal (Daniel) Chang "Kinematic Modeling and Analysis of a Cam Based CVT for a Capstone Design Project Experience" Proceedings of the 2007 ASEE North-Central Sectiom Conference

[6]. Jason Meyer" Design and Analysis of Camshaft by Changing Parameterswhich Causes Failure" IJISME, ISSN:2319-6386, Volume-1, Issue-6, May 2007.

[7]. Mohammed Shazia, et.al, " Fatigue Analysis of a Twin-Camshaft utilizing Finite Component Analysis" IJERT Volume 8, Number 142009.

[8]. Vivekanandan, Kumar.M" Modeling, Design and Finite Element Analysis of Camshaft" IJCET 2013ISSN:2277-4106.

[9]. Dave Marmik.M, Kothari kartik.D" Static structure Analysis of Diesel Motor Camshaft" IJSR-Volume:2, Issue:5, May-2013,ISSN:2277-8179.

[10]. R.V.Wanjari, T.C.Parshiwanikar" Failure of Camshaft" IJITEE ISSN: 2278-3075, Volume-2, Issue-6, May2013.