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Design and Analysis of Leaf Spring in Heavy Trucks

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ABSTRACT

This challenge describes design and experimental analysis of composite leaf spring fabricated from glass fiber strengthened polymer. The goal is to examine the weight sporting ability, stiffness and weight savings of composite leaf spring with that of metallic leaf spring. The layout constraints are stresses and deflections. The dimensions of an current traditional metallic leaf spring of a heavy truck are taken.

Substituting composite structures for conventional metallic systems has many advantages because of higher specific stiffness and electricity of composite substances. The vehicle enterprise has proven improved interest in the replacement of steel spring with glass fiber bolstered polymer composite leaf spring due to excessive strength to weight ratio. This work deals with the replacement of conventional steel leaf spring with a Mono Composite leaf spring the use of E-Glass/Epoxy. The layout parameters have been selected and analyzed with the goal of minimizing weight of the composite leaf spring as compared to the metal leaf spring.

The software program used is PRO/E for modeling and ANSYS for analysis.

INTRODUCTION

A leaf spring is a easy form of spring generally used for the suspension in wheeled cars. Originally known as a laminated or carriage spring, and every so often called a semi-elliptical spring or cart spring. It includes a number of flat plates of various lengths held together with the aid of clamps and bolts. These are ordinarily utilized in motors.

Semi-elliptic leaf springs are nearly universally used for suspension in mild and heavy business vehicles. The advantage of leaf spring over helical spring is that the ends of the spring may be guided along a specific direction as it deflects to behave as a structural member similarly to strength absorbing tool. Thus the leaf springs may deliver lateral hundreds, brake torque, using torque and many others., similarly to shocks.

LITREATURE SURVEY

This bankruptcy outlines some of the recent reports published in literature on substitute of steel leaf spring with the composite leaf spring [1]The leaf springs soak up the vehicle vibrations, shocks and bump loads (Induced due to road irregularities) via spring deflections, in order that the[2] potential strength is stored in the leaf spring and then relieved slowly. Ability to store and soak up more quantity of stress strength guarantees the secure suspension device. In the present scenario, weight reduction has been the principle recognition of car manufactures. The suspension leaf spring is one of the capacity gadgets for weight reduction in vehicles. Present used material for leaf spring is carbon steel, whose density is more [3]thereby growing the overall weight of the leaf spring. [4]The advent of composite substances made it feasible to

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reduce the burden of the leaf spring without any reduction on the load wearing capacity and stiffness. [5]Studies have been performed on the utility of composite systems for car suspension machine.

Modeling of Leaf Spring:

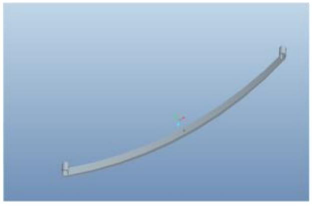


Fig 5.1: Main leaf

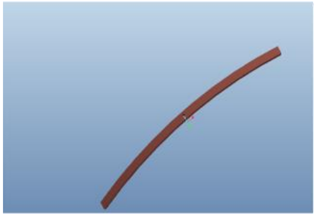
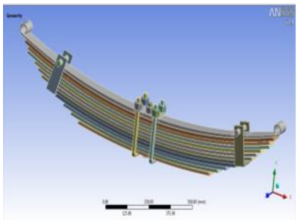
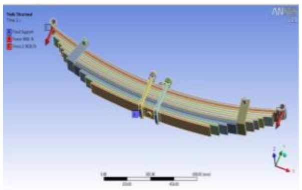


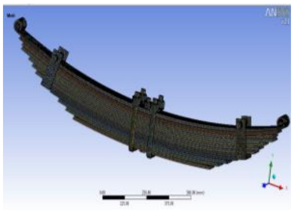
Fig 5.2: Graduated leaf



Geometry



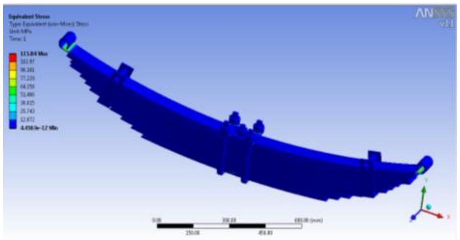
Boundary Conditions



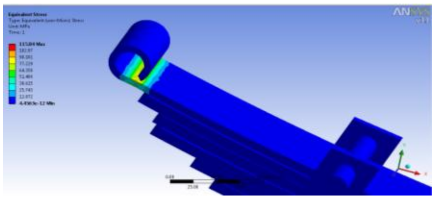
Statistics	
Nodes	406823
Elements	198648

FE Model Mesh

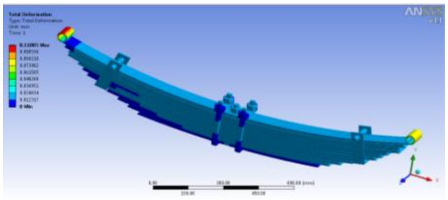
Carbon Steel at 1000@each Eye



Von Misses Stress < Yield Stress>



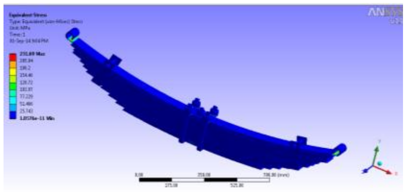
EQUIVALENT STRESS AT EYE.



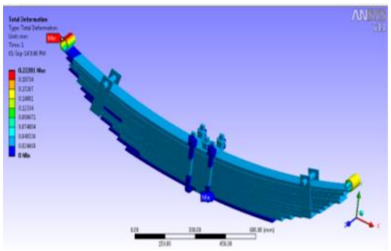
Deformation

Foreign Reactions=Applied forces

Carbon Steel at 2000@each eye



Von Misses Stress< Yield Stress>



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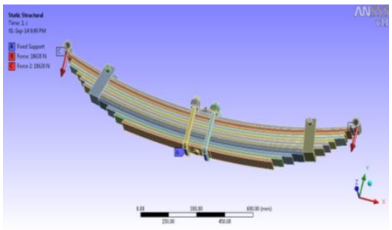
Deformation



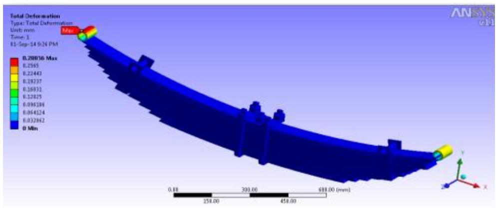
Details of "Force Reaction"	
Type	Force Reaction
Location Method	Boundary Condition
Boundary Condition	Fixed Support
Options	
Result Selection	All
Display	All Time Points
Maximum Value Over Time	
X Axis	1.1812e-004 N
Y Axis	39240 N
Z Axis	5.4092e-005 N
Total	39240 N
Minimum Value Over Time	

Force Reaction = Applied Forces

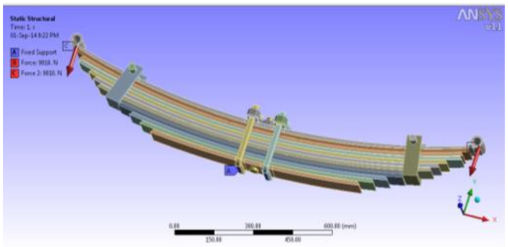
Carbon fiber for 1000KG at each eye

Details of "Force Reaction"	
Type	Force Reaction
Location Method	Boundary Condition
Boundary Condition	Fixed Support
Options	
Result Selection	All
Display	All Time Points
Maximum Value Over Time	
X Axis	1.1812e-004 N
Y Axis	39240 N
Z Axis	5.4092e-005 N
Total	39240 N
Minimum Value Over Time	

E Glass at 1000KG @ each Eye

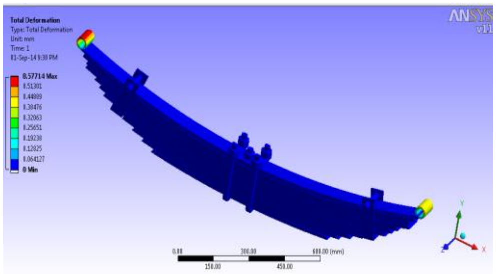


Von misses Stress<Yield Stress>

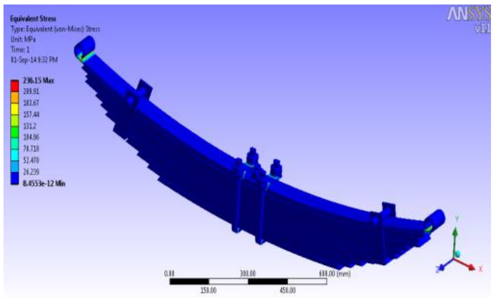


Details of "Force Reaction"	
Type	Force Reaction
Location Method	Boundary Condition
Boundary Condition	Fixed Support
Options	
Result Selection	All
Display	All Time Points
Maximum Value Over Time	
X Axis	7.3769e-005 N
Y Axis	19620 N
Z Axis	1.9443e-005 N
Total	19620 N
Minimum Value Over Time	
X Axis	7.3769e-005 N

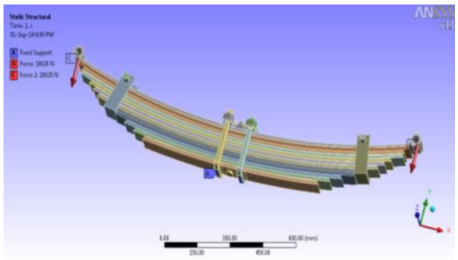
E Glass at 2000@ each Eye



Total Deformation

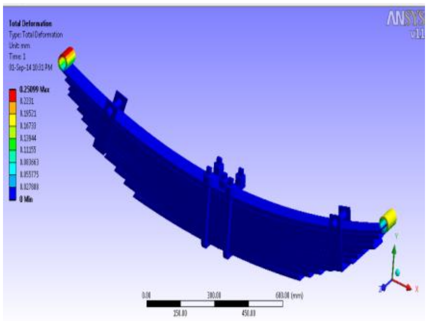


Von misses Stress<Yield Stress>



Details of "Force Reaction"	
Type	Force Reaction
Location Method	Boundary Condition
Boundary Condition	Fixed Support
Options	
Result Selection	All
Display	All Time Points
Maximum Value Over Time	
X Axis	1.1812e-004 N
Y Axis	39240 N
Z Axis	5.4092e-005 N
Total	39240 N
Minimum Value Over Time	

S Glass at 1000@ each Eye



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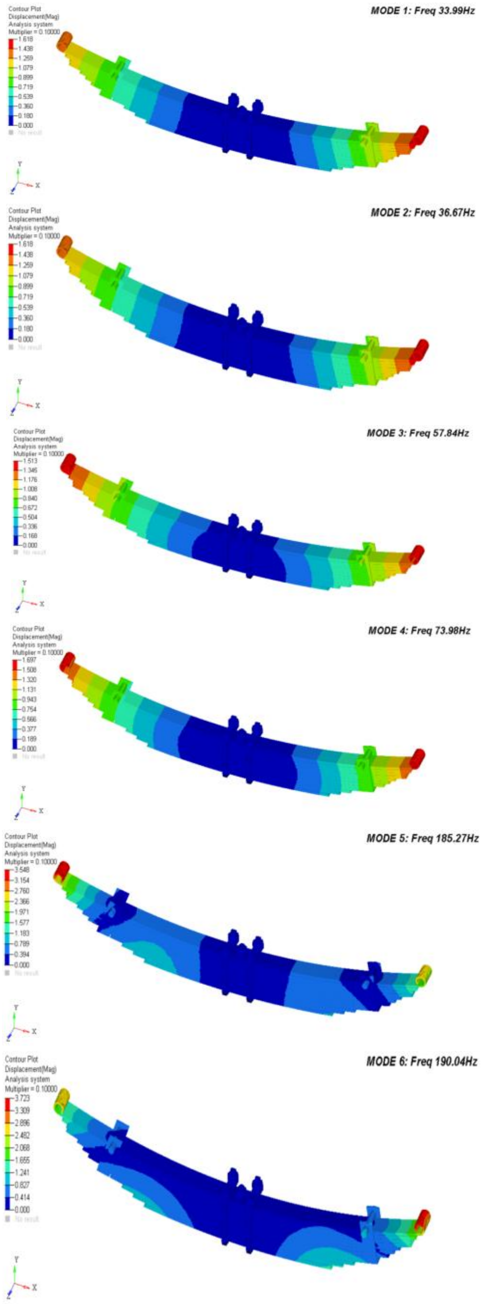
CARBON FIBER



RESULTS AND CONCLUSIONS:

- It was determined that the deflection inside the composite leaf spring turned into almost same so we can say that composite spring had the identical stiffness as that of metallic spring.
- It turned into observed that the composite leaf spring weighed most effective 39.4% of the steel leaf spring for the analyzed stresses. Hence the weight loss received.
- By reading the design, it turned into determined that each one the stresses in the leaf spring were well within the allowable limits and with accurate thing of safety. It become discovered that the longitudinal orientations of fibers inside the laminate offered proper strength to the leaf spring. Ride first-rate is normally quantified as the herbal frequency of a suspension device.
- Suspension system herbal frequencies much less than 1 Hz will cause motion illness in a vehicle's passengers, and suspension machine natural frequencies extra than 2.5 Hz will offer a "harsh" journey.

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[5].Georg Rill, Norbert Kessing, Olav Lange and Jan Meier: Leaf Spring Modelling for Real Time