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Design and Analysis of a Heavy Vehicle Leaf Spring

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ABSTRACT: ***Decreasing weight while expanding or keeping up quality of items is getting the chance to be very imperative research issue in this present day world. Composite materials are one of the material families which are pulling in analysts and being arrangements of such issue. In this paper we depict outline and investigation of composite leaf spring. The goal is to think about the stresses and weight sparing of composite leaf spring with that of steel leaf spring. The plan requirement is firmness. The Vehicle Industry has awesome enthusiasm for supplanting of steel leaf spring with that of composite leaf spring, since the composite materials has high quality to weight proportion, great consumption resistance. The material chose was glass fibre fortified polymer (E-glass/epoxy), carbon epoxy and graphite epoxy is utilized against regular steel. The outline parameters were chosen and dissected with the goal of limiting weight of the composite leaf spring when contrasted with the steel leaf spring. The leaf spring was displayed in catiav5r20 and the investigation was finished utilizing ANSYS 17.02 programming.***
Keywords: Brake Torque, Leaf Spring, Resistance Steel Spring, Sprung Weight.

I. INTRODUCTION

Leaf springs are generally used as a piece of suspension structures to ingest daze stacks in autos like light motor vehicles, overpowering commitment trucks and in rail systems. It passes on flat weights, brake torque, driving torque despite daze engaging. The favoured stance of leaf spring over helical spring is that the terminations of the spring may be guided along an unmistakable path as it side-tracks to go about as a helper part despite essentialness holding device As demonstrated by the examinations made a material with most outrageous quality what's all the more, slightest modulus of adaptability the longitudinal way is the most fitting material for a leaf spring. To address the issue of basic resources protection, auto makers are trying to lessen the weight of vehicles in late years. Weight diminishment can be expert essentially by the introduction of better material, design change and better collecting shapes. The suspension leaf spring is one of the potential things for weight decreasing in autos unsprang weight. This achieves the vehicle with more fuel capability and upgraded riding qualities. The introduction of composite materials was made it possible to diminish the greatness of leaf spring with no lessening on stack passing on point of confinement and solidness. For weight diminish in vehicles as it prompts 2477 | P a g e the reducing of un-sprung weight of auto. The parts whose weight is not transmitted to the suspension spring are known as the un-sprung segments of the auto. This fuses wheel get together, axles, and part of the largeness of suspension spring and defends. The leaf spring speaks to 10-20% 0f the un-sprung weight. The composite materials made it possible to diminish the weight of machine segment with no decreasing of the pile passing on confine. Because of composite material's high adaptable strain essentialness accumulating utmost and high calibre to-weight extent differentiated and those of steel. FRP springs in like manner have extraordinary fatigue resistance and strength. Regardless, the weight diminishment of the leaf spring is refined by material substitution and in addition by diagram change. Weight diminish has been the crucial centralization of vehicle makers in the current circumstance. The supplanting of steel with in a perfect world arranged composite leaf spring can give 92% weight reducing. Additionally the composite leaf spring has bring down burdens appeared differently in relation to steel spring. All these will realize fuel saving which will influence countries imperativeness to free since fuel saved is fuel conveyed. The objective of the present work is to setup, separate and propose a technique for make of composite mono-leaf spring

II. LEAF SPRING RATE

The rate of spring is the change of load per unit of deflection (N/mm). This isnot the same amount at all positions of spring, and is different for the spring as installed Static deflection of a spring equals the static load divided by the rate at static load; it determines the stiffness of the suspension and the ride frequency of
The vehicle. In the most cases the static deflection differs from the actual deflectionof the spring between zero and static load, due to influences of spring camber andshackle effect.

Characteristics of a Good Suspension Include

1) Maximum deflection consistent with required stability
2) Compatible with other vehicle components in terms of overall ride
3) Minimum weight
4) Low maintenances and operating costs
5) Minimize tire wear
6) Minimize wheel hop
7) Low initial cost 1.1.6 Functions Of Leaf Springs In Design Performs
8) Support the weight of the vehicle.
9) Provide adequate stability and resistance to side away and rollover.
10) Resist cornering effects when negotiating a curve.
11) Provide cushioning

III. LEAF SPRINGS SUSPENSION

Leaf springs are a crucial part of the suspension system of a car. They consist of a number of layers of leaves with a gradation in their size, the bigger layer being on the top with each layer joined to the other. Leaf springs are directly attached to the frame, either at both ends or at one end. For the latter, the front end is attached to the frame while the other end is attached to a short swinging arm through a shackle. The main function of leaf springs is to provide comfort to the passengers by minimizing the vertical vibration caused by the no uniformity of road geometry. Studies show that the desired leaf spring material should have high strength and low modulus of elasticity in the longitudinal direction [127]. In addition, high fatigue resistance is one of the most desired properties for leaf springs, since they carry the entire load of the vehicle and experience dynamic load under driving conditions [128]. Leaf springs are guided by the SAE J1123 standard titled Leaf Springs for Motor Vehicle Suspension—*Made* to Metric Units, and can be full, semi-, or quarter-elliptic with one or more leaves. represents the mono-leaf spring.

IV. QUALITY AND WORKMANSHIP OF LEAF SPRINGS

1) Centre hole: If made with good dies, it will be clean-cut. A poor centre hole may set up additional stresses in the steel, which may cause premature breakage.
2) Trim points: Must be done with good equipment, to avoid cracking, chipping and rough edges.
3) Clips: Must be right size and shape to fit properly.
4) Eyes: Must be tight accurately sized; must be parallel and straight, to avoid setting up excess stresses in the main leaf. If the eye is too small, the bushing may be crushed when forced in. If the eye is too large, the bushing will be loose.
5) Fitting of leaves: Must be accurate, to avoid setting up excess stresses in steel and causing premature breakage.
6) Leaf must be fitted side to side, as well as surface to surface.

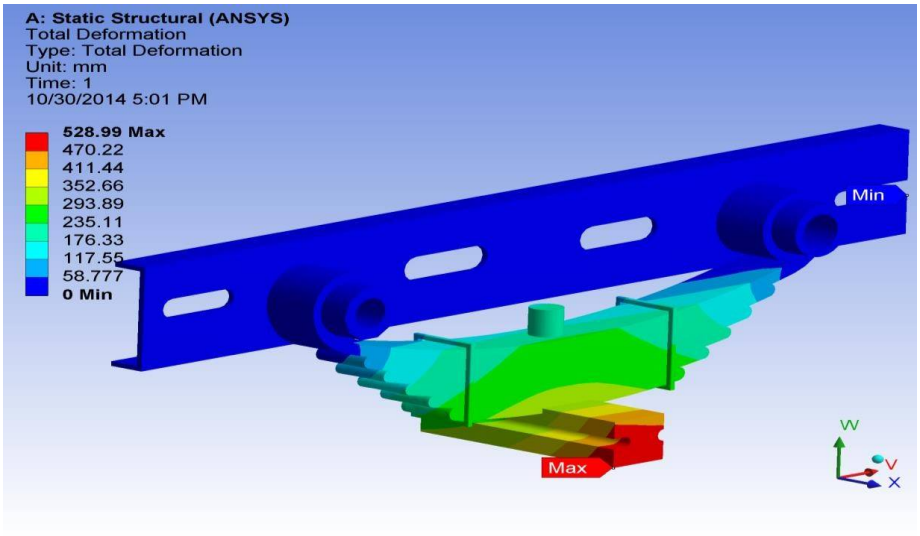

Figure1: Deformation of Parts appear in Red Colour

V. PROBLEM DEFINITION

Even though leaf springs are the oldest type of automotive suspension, it continues to be a popular choice for solid axles. Though simple in appearance, a leafspring suspension causes many problems in modeling. The establishment and evolution of the finite element method (workbench) has contributed greatly to thesolution of many engineering problems, particularly in situations where analytical methods become too complex, and experimental techniques appear inappropriate because of either difficulty in application or instrumentation, or of the high costs which may be involved. One pronounced advantages of workbench lies in the fact that it can be used to solve a class of problems with only minor modifications once the model, boundary conditions, and accuracy have been tested and proven. The increasing computing power associated with faster processor speed and greater data storage capacity has also been a catalyst in developing FE applications. 2.2 Problem Statement:- There is currently much interest in deformation analysis of multiple bodies in contact. One such case is the design and analysis of the automobile leaf springs. In order to accurately model the deformations and vibrations of the leaf springs nonlinear finite-element procedures are need to be employed with the advent of development of the contact analysis it is appropriate to apply the contact analysis technique in the analysis of the leaf springs. Methodsfor modeling the contact and friction between leaves of the spring are to be developed. Thus it is appropriate to have perfect nonlinear finite element methodto analyze the leaf springs. Effect of varying different parameters life width, lengthand thickness of the leaf spring are to be investigated with the help of the commercial work bench package ANSYS.

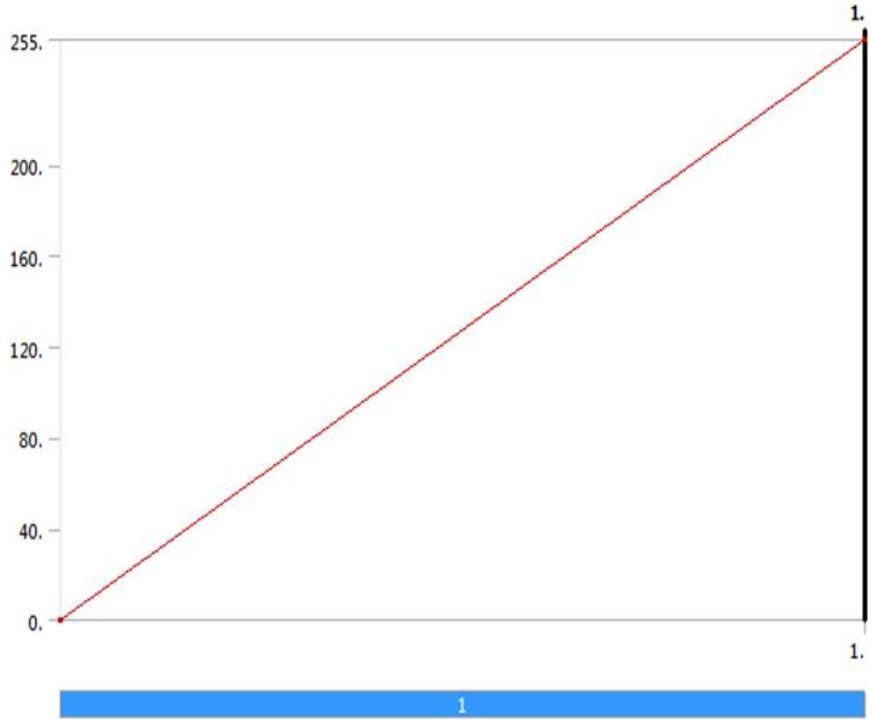

Figure2: Graphical represent of Load Analysis Diagram

Table 1: Finite Element Analysis Approach

Unit System	Metric (m, kg, N, s, V, A) Degrees rad/s Celsius
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Celsius

VI. CONCLUSIONS

Structural steel and e glass epoxy resins deformation, stress and strain values are tabulated e glass epoxy resins have little deformation, max stress and less strain so fabrication of leaf spring by using e glass epoxy resins are best suited Future work: The future work of this project is to produce with fewer prices and that material should have required stresses should with stand these loads and that material also have elastic properties and should have good suspension.

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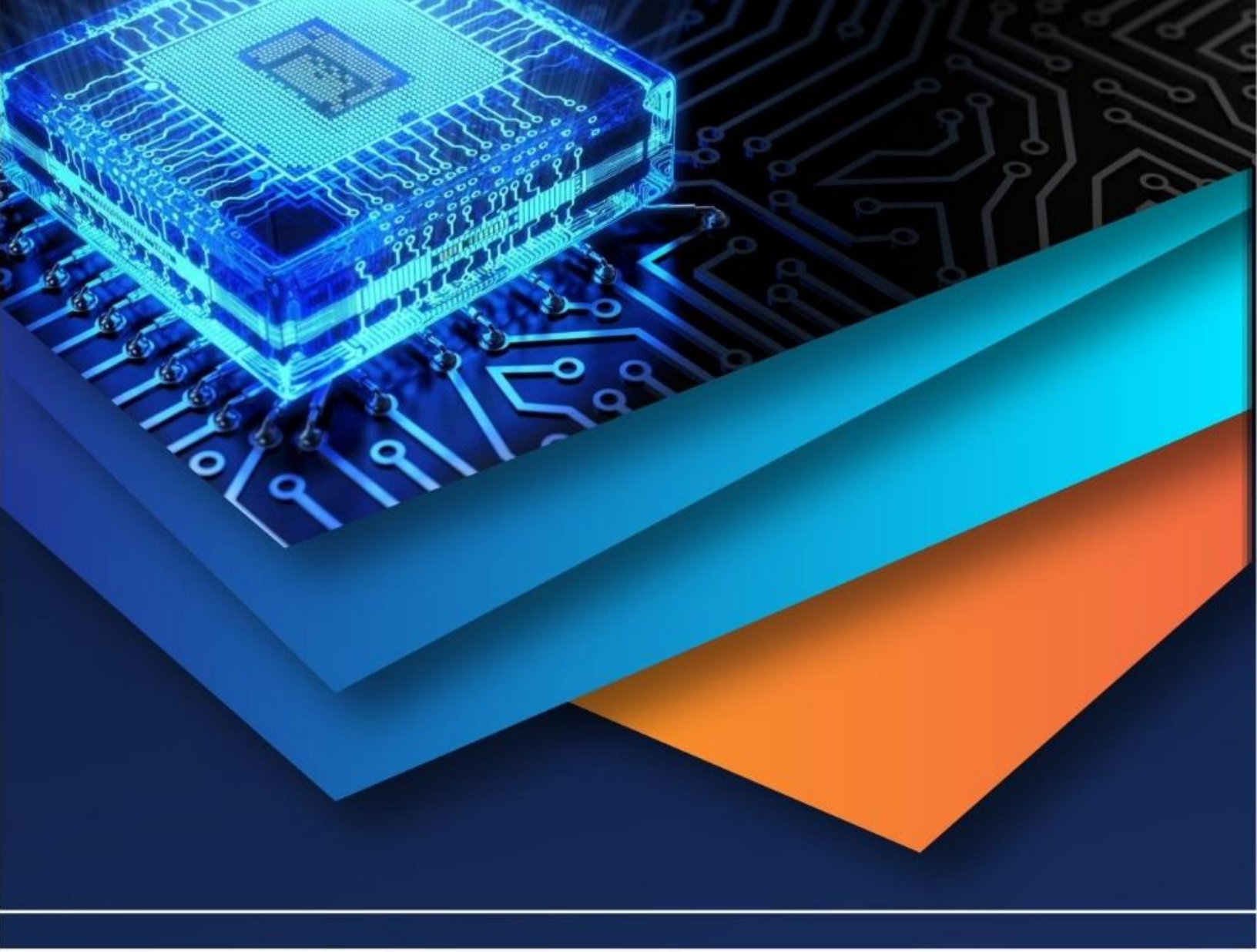

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