



IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

“STATIC ANALYSIS OF HEAVY VEHICLE LEAF SPRING BY USING FEA METHOD”

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ABSTRACT

We know that the spring plays very essential part of every automobile for suspension point of view. Leaf spring is the main type of suspension system which is used in many light and heavy vehicles.. Reducing weight while increasing or maintaining strength of products is getting to be highly important research issue in this modern world. When the rear wheel comes across a bump or pit on the road, it is subjected to vertical forces, tensile or compressive depending upon the nature of the road irregularity. These are absorbed by the elastic compression, shear, bending or twisting of the spring. The mode of spring resistance depends upon the type and material of the spring used. Further when the front wheel strikes a bump it starts vibrating. Composite materials are one of the material families which are attracting researchers and being solutions of such issue.

Key Words: Leaf spring failure, fracture mechanism, failure modes, composites, failure analysis.

I. INTRODUCTION

1.1. Leaf Springs

A leaf spring is the simple form of spring commonly used for the suspension in wheeled vehicles. Leaf spring is mainly made up of steel, but due to issue of weight today most of the automobile companies used composite materials for the manufacturing of leaf springs. The composite materials used like E-Glass/Epoxy, Graphite/Epoxy, and Carbon/Epoxy etc. The classification of leaf spring included as Elliptical, Semi Elliptical, Three quarter Elliptical, Quarter Elliptical, and Teraservers. The leaf spring mainly consists of different parts like Master leaf, Center bolt, central clamp, Eye, and Rebound clip. So, here in this paper we try to review all these previous journals for better understanding the work done. In previous researchers the analytics and software's determine the load carrying capacity. Material based study is used for light weight transformation of vehicles at various loading conditions used for working and checking of load durability. The paper also included the study and work which held in past and gives the brief study about the work performed by researchers in previous journals. The details of my study on previous papers are present in the next section (Literature survey). II. LITERATURE REVIEW The section here shows the review of previous journals based on study and analysis of leaf spring. The study in this section is subdivided into number of categories on the basic of work done in past. A. Analysis of Leaf Spring on the Basis of Material and Its Compositions. Shishay Amare Gebremeskel et.al [1] material plays very important role in every manufacturing process. The paper also describes and solves the major issues of vehicles weight through use of composite material E-Glass/Epoxy composite shown in Fig. 1. Their work focuses on constant cross section design, weight reduction, and design. The result shows that shear stress is much less than the shear strength ($\tau = 3\text{mpa}$) and the design is safe even for flexural failure. They focus on their work for design of leaf spring used in three wheelers.



Figure.1 leaf spring

II. PROBLEM STATEMENT

As weight assumes a significant job in choosing the effectiveness of a car. The leaf spring utilized for the most part is made of steel which are very cumbersome and one of the expected things for weight decrease in cars since it accounts 10-20% spring weight conveyed by its own. To keep away from this hindrance and solace riding characteristics an endeavor is to be made in supplanting the material with cutting edge materials like composite materials. This work is predominantly centered around the usage of Thermoplastic polyimide with 30% carbon fiber fortified (composite material) by supplanting steel En 45 in traditional leaf springs of a suspension framework to lessen item weight, improving the security, solace and solidness.

III. METHODOLOGY

ANSYS is broadly useful limited component examination (FEA) programming bundle. Limited Element Analysis is a numerical technique for deconstructing an unpredictable framework into little bits (of client assigned size) called components. The product actualizes conditions that administer the conduct of these components and illuminates them all; making a thorough clarification of how the framework goes about in general. These outcomes at that point can be introduced in classified, or graphical structures. This kind of investigation is ordinarily utilized for the structure and improvement of a framework excessively complex to break down by hand. Frameworks that may fit into this classification are excessively mind boggling because of their geometry, scale, or administering conditions.

ANSYS is the standard FEA showing device inside the Mechanical Engineering Department at numerous schools. ANSYS is likewise utilized in Civil and Electrical Engineering, just as the Physics and Chemistry offices.

ANSYS gives a practical method to investigate the exhibition of items or procedures in a virtual situation. This kind of item advancement is named virtual prototyping.

With virtual prototyping methods, clients can repeat different situations to improve the item some time before the assembling is begun. This empowers a decrease in the degree of hazard, and in the expense of inadequate plans. The multifaceted idea of ANSYS likewise gives a way to guarantee that clients can see the impact of a plan all in all conduct of the item, be it electromagnetic, warm, mechanical and so forth.

IV. MATERIAL SPECIFICATION AND PROPERTIES

AUXILIARY ANALYSIS OF MASTER LEAF SPRING AT THE VARIOUS LOAD

For the auxiliary examination of ace leaf spring, there are 03 kinds of material utilized and one sorts of burden extend is chosen for better development of the spring. In the current work aftereffect of all materials limited uniquely for greatest pressure incited during the investigation and most extreme distortion in leaf spring body.



Figure 2 Car loader with compressor Model

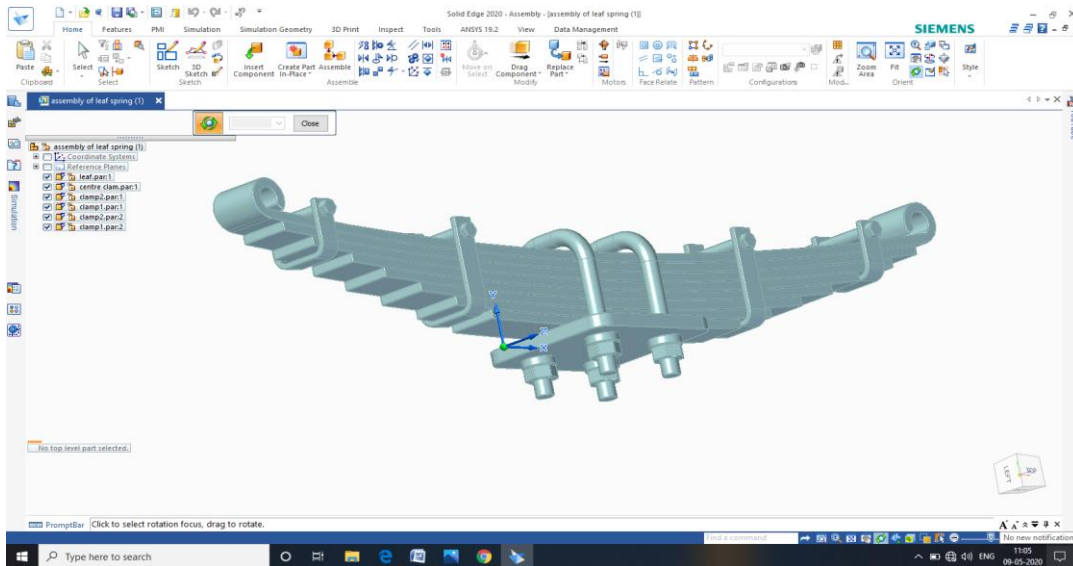


Figure.3 CAD 3D model of leaf spring

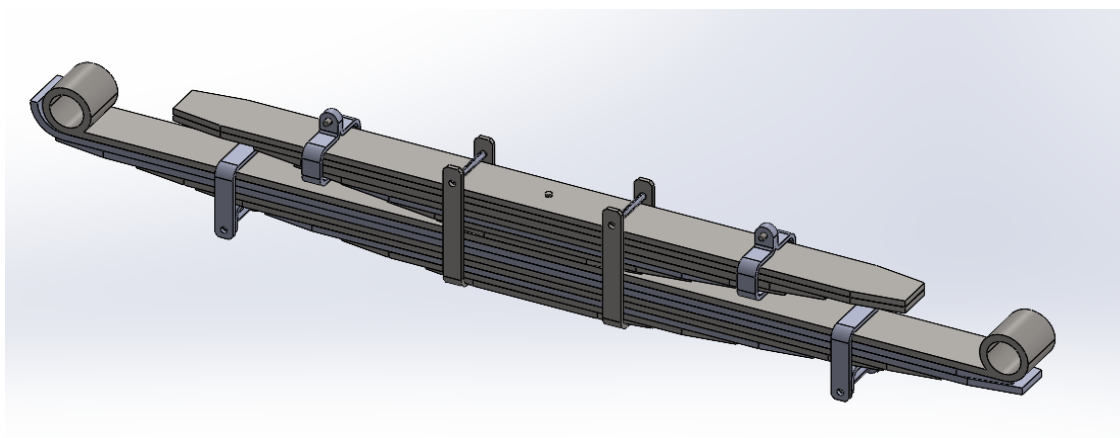


Figure.4 CAD 3D model isometric view of leaf spring

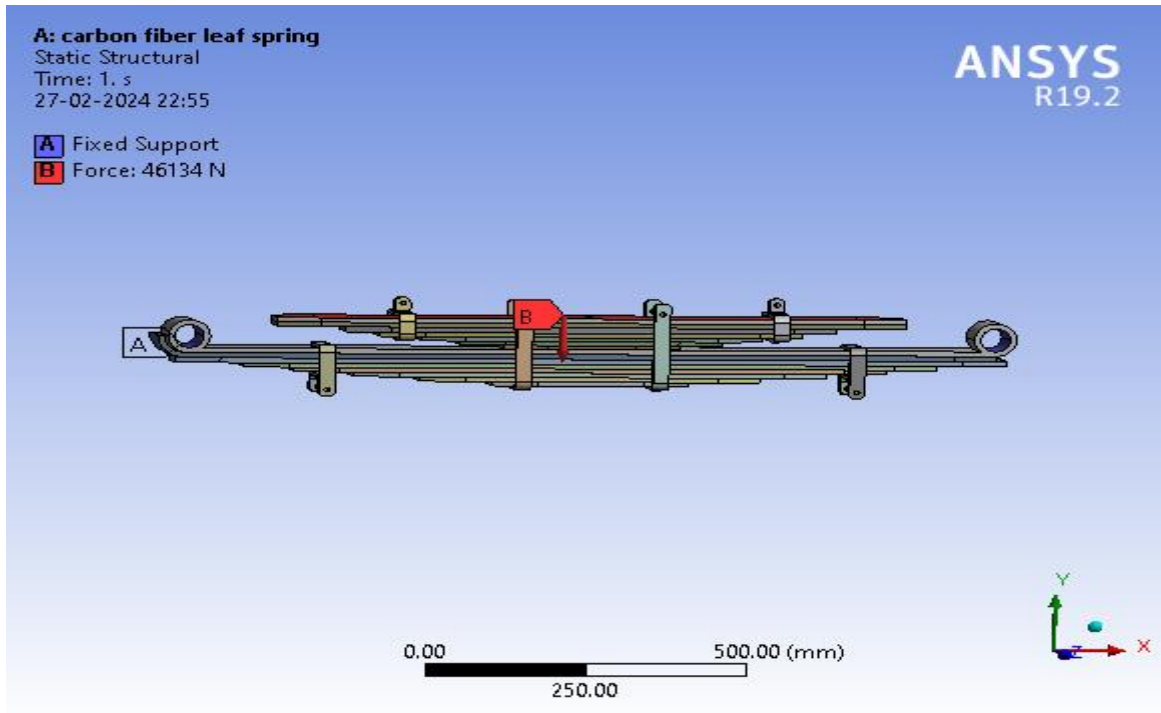


Figure.5 vertical impact load applied leaf spring

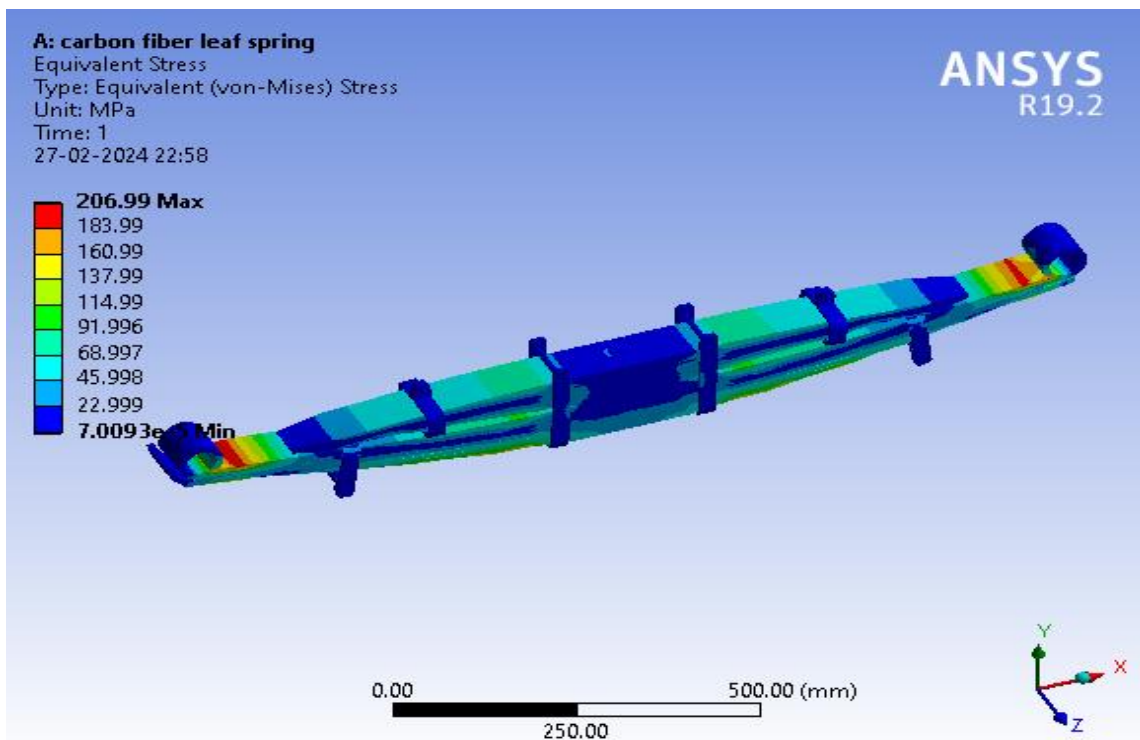


Figure 6 Von misses stress results for Carbon fiber materials

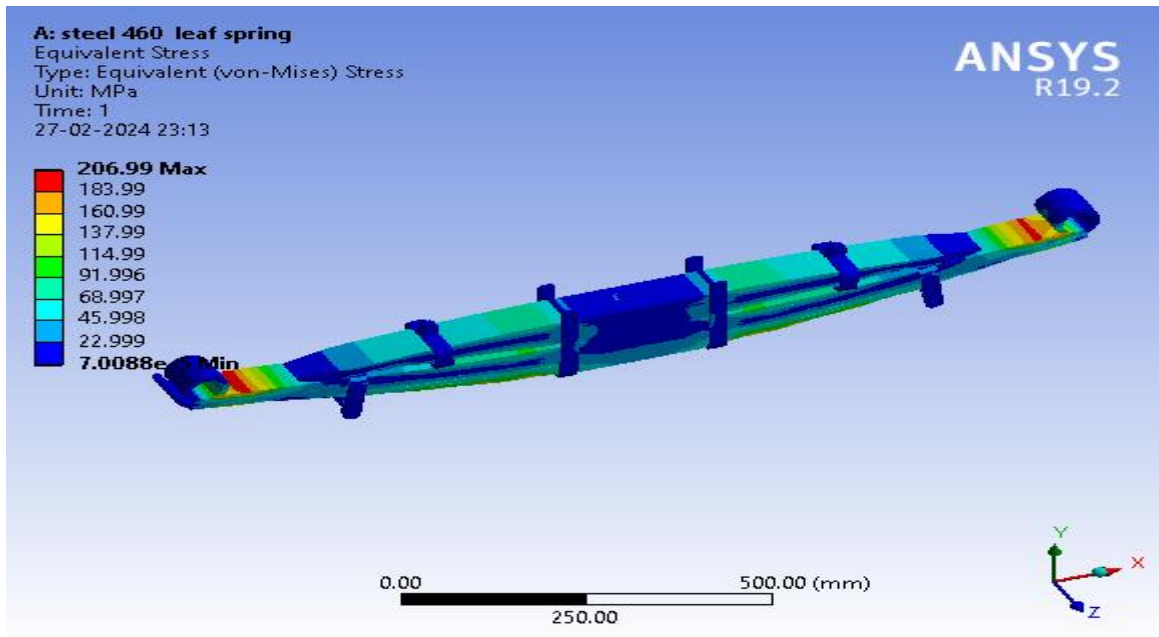


Figure 7 Von misses stresses for steel S-460 materials

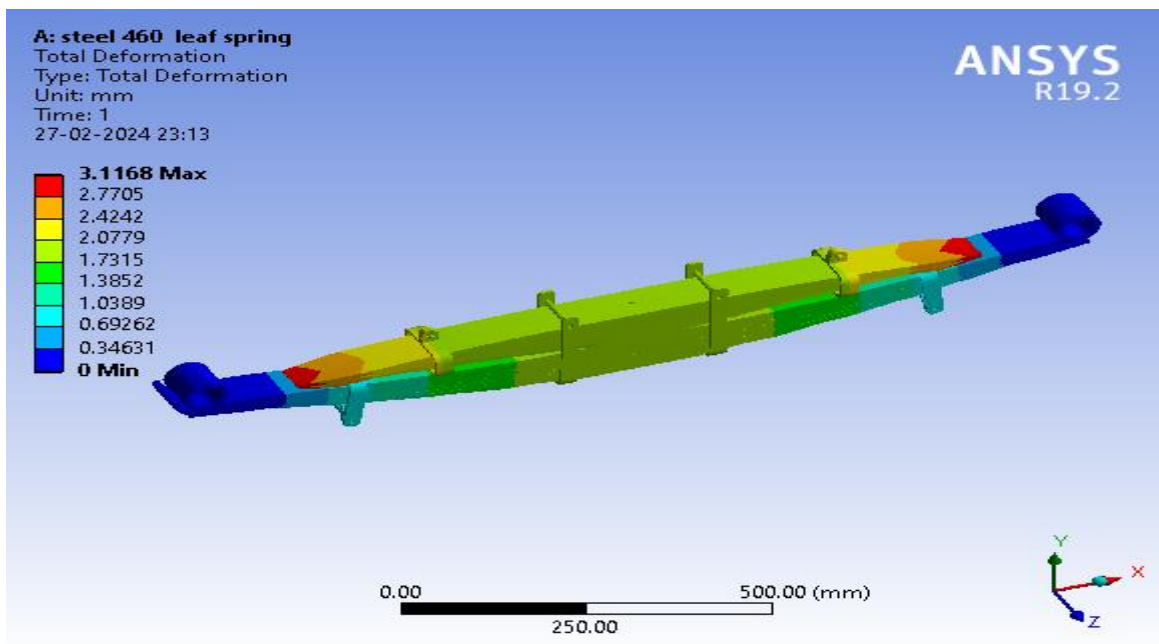


Figure 8. Deformation for steel S-460 materials

V. RESULT

In our study we take exiting model materials Spring steel E glass composite materials which is using cars. Those load centre of spring is mounted 46134 N. Then we take our results for three materials steel S-460 , Aluminum Alloy and Carbon Fibre. In this study find out stress, deformation , frequency and weight value with all three materials.

Find out stress value with all three materials likes steel S-460 , Aluminum Alloy and Carbon Fibre. then stress value are respectively 206.99 MPa, 207.87 MPa and 206.99 MPa

Table 1: Deflection (mm) and maximum stress (MPa) at 46134 N

S.No.	Materials	Deflection in (mm)	Maximum stress in (Mpa)
1.	Carbon fiber composite material	0.0015	206.44
2.	Steel 460	3.1	206.99
3.	Aluminum material	8.7	207.87

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