EXPERIMENTAL INVESTIGATION OF MONO LEAF SPRING TO BE USED AS A REPLACMENT FOR LIGHT WEIGHT AUTOMOBILE SPRING

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ABSTRACT

The main use of Leaf springs is in suspension system to absorb shock loads in automobiles like light motor vehicles, heavy duty trucks and in rail systems. Leaf springs carries lateral loads, brake torque, driving torque in addition to shock absorbing. The benefit of leaf spring over helical spring is that the ends of the spring may be guided along a definite path as it deflects to act as a structural member in addition to energy absorbing device. The suspension leaf spring is one of the potential items for weight reduction in automobiles unsprang weight. The main aim of our project is to study and analyses the leaf spring of Bolero Vehicle which is made up of carbon fiber, epoxy glass and Kevlar material. The 3 D model of leaf spring was drawn with the help of CATIA software. The experimental testing was carried on UTM. The analysis was carried out with the help of ANSYS software. The comparative analysis was carried out between the Analytical and experimental results. After making the comparative analysis result and conclusion was drawn.Hand Lay-up technique was used to make a carbon epoxy leaf spring. A single carbon epoxy composite leaf spring is compared with EN45 steel leaf

Keyword *Leaf springs, composite, Epoxy, ANSYS, UTM , Dynamic Testing.*

1. Introduction

A leaf spring takes the form of a slender arc-shaped length of spring steel of rectangular cross-section. In the most common configuration, the centre of the arc provides location for the axle, while loops formed at either end provide for attaching to the vehicle chassis. For very heavy vehicles, a leaf spring can be made from several leaves stacked on top of each other in several layers, often with progressively shorter leaves. Leaf springs can serve locating and to some extent damping as well as springing functions. While the interleaf friction provides a damping action, it is not well controlled and results in station in the motion of the suspension. For this reason, some manufacturers have used mono-leaf springs.

A leaf spring can either be attached directly to the frame at both ends or attached directly at one end, usually the front, with the other end attached through a shackle, a short swinging arm. The shackle takes up the tendency of the leaf spring to elongate when compressed and thus makes for softer springiness. Some springs terminated in a concave end, called a spoon end (seldom used now), to carry a swivelling member.

The leaf spring has seen a modern development in cars. The new Volvo XC90 (from 2016-year model and forward) has a transverse leaf spring in high tech composite materials, a solution that is similar to the latest Chevrolet Corvette. This means a straight leaf spring, that is tightly secured to the chassis, and the ends of the spring bolted to the wheel suspension, to allow the spring to work independently on each wheel. This means the suspension is smaller, flatter and lighter than a traditional setup.

1.1 BASIC TERMINOLOGY

CAD is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.

CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.

CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.

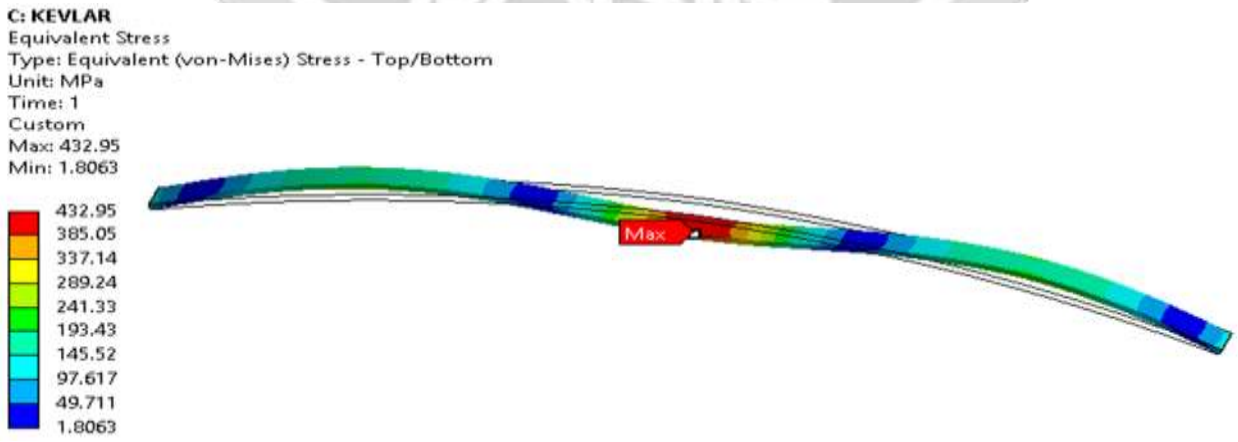
CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.

1.2 ANALYSIS

The **finite element method** (**FEM**), is a numerical method for solving problems of engineering and mathematical physics. Typical problem areas of interest include structural analysis, heat transfer, fluid flow, mass transport, and electromagnetic potential. The analytical solution of these problems generally require the solution to boundary value problems for partial differential equations. The finite element method formulation of the problem results in a system of algebraic equations. The method yields approximate values of the unknowns at discrete number of points over the domain. To solve the problem, it subdivides a large problem into smaller, simpler parts that are called finite elements. The simple equations that model these finite elements are then assembled into a larger system of equations that models the entire problem. FEM then uses variation methods from the calculus of variations to approximate a solution by minimizing an associated error function.

Studying or analysing a phenomenon with FEM is often referred to as **finite element analysis** (**FEA**).

2. FIGURES AND TABLES



3. CONCLUSIONS

- Carbon fiber material has greater strength than other epoxy and Kevlar material
- Maximum reaction force of Carbon mono leaf springs is 5400N
- FEA result are in good relationship with testing result in terms of reaction force.
- Leaf spring are used to isolate vehicle from road vibration. Leaf spring is device which is used in suspension system to safeguard the ,vehicle and traveler from road shock which transmitted to vehicle component and provide safe and comfortable riding.
- Now days weight reduction is become main focus while designing part of vehicle so weight of vehicle can reduced by reducing the weight of leaf spring Weight of leaf spring is reduced by used of composite material there for in present work steel leaf spring of Mahindra bolero replaced by composite leaf spring of carbon epoxy fiber material.

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