ANALYSIS OF COMPOSITE LEAF SPRING

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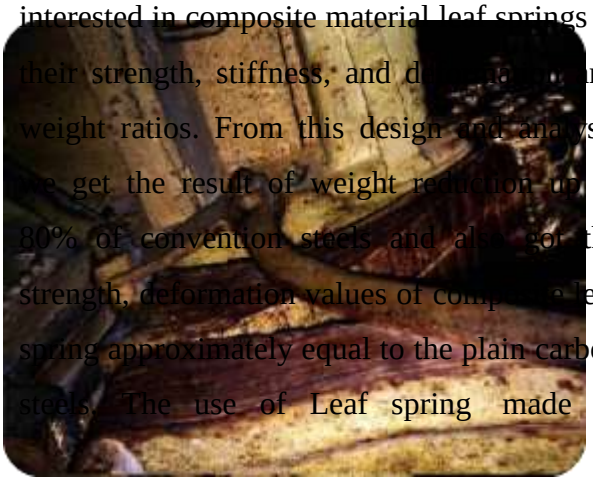
ABSTRACT: Leaf springs are the vital parts of the automobile suspension system. These are manufactured by plain carbon steels. These steels are also called as conventional steels and these materials are having higher density values compared with the composite materials. However, the weight reduction of leaf springs enhances the automobile design criteria and parameters. For this project our aim is to reduce the weight ratio of conventional steel leaf spring with the compensation of leaf springs made of composite material. For weight reduction of leaf springs made of E-glass Epoxy and Jute glass fibres are taken in to the consideration. These leaf springs are analysed in CATIA and ANSYS software applications. The automobile industries are interested in composite material leaf springs to their strength, stiffness, and d[illegible]nd weight ratios. From this design and analysis we get the result of weight reduction up to 80% of convention steels and also for the strength, deformation values of comp[illegible]eaf spring approximately equal to the plain carbon steels. The use of Leaf spring made of composite material in automobile enhances the life of leaf springs and increase the durability of leaf spring.



INTRODUCTION

A leaf spring is a simple form of spring commonly used for the suspension in wheeled vehicles. 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 stiction in the motion of the suspension. For this reason, some manufacturers have used mono-leaf springs.

The longest leaf of the leaf spring is known as the "Master Leaf". The ends of the master leaf are rolled which are known as the "eye". The leaf just below the master leaf is called the "Second master leaf" and the ones after it are termed as "Graduated leaves".

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. The shackle provides some degree of flexibility to the leaf spring so that it does not fail when subjected to heavy loads.

LITERATURE REVIEW

1. Ajay Kaviti, VNR Vignana Jyothi, institute of engineering and technology. Study and review onthe analysis of leaf spring.

- Uniformly load distribution
- Lower cost
- Rough used
- Easier in isolation and tightly attached with working frame.

2. Sagar sing kushwah, Sisecam Flat Glass India Pvt.Ltd. Production Bachelor of Engineering. A Review article of design,Analysis and Comparative study of conventional and composite leaf spring.

- Selection of e-glass/epoxy and Jute glass fibre composite.

3. Togy Abdullah, Gazi University. Department of industrial design (Architecture) prof.Dr. Determination of some physical attributes for wooden construction elements strengthened with woven wire fibre glass.

- The failure elongation of the e-glass/epoxy is 4.8% of entire.

4. Dev dutt Dwivedi and V.K.Jain had done Design and analysis of composite leaf spring. ANSYS14.5 has been used to conduct the analysis. Static structural tool has been used of ANSYS. A three layer composite leaf spring with full length leave. E-Glass/epoxy composite material has been compared with the results obtained for composite leaf spring. E glass/epoxy material is better in strength and lighter in weight as

contrast with conventional steel leaf spring. A wide amount of study has been conducted in his paper to investigate the design and analysis of leaf spring and leaf spring fatigue life. Results demonstrate that composite leaf spring deflection for a particular load is less compared to conventional leaf spring. Stress generated in the E- Glass/Epoxy leaf spring is lower than steel leaf spring.

5. Mahmood M. shokrieh and Davood Rezaei presented work on design, analysis and optimization of leaf spring .The aim of this review paper was steel leaf spring was replaced with an optimized composite one. Main objective of this paper was to obtain a spring with minimum weight that is capable of carrying given static external forces without failure. Here the work is carried out of a four-leaf steel spring which used in the rear suspension system of light vehicles & heavy duty vehicles. The four-leaf steel spring is analyzed by using ANSYS V5.4 software. The finite element results showing stresses and deflections verified the existing analytical and experimentalsolutions.

ANALYSIS

Complete Introduction to ANSYS is separated by 5 parts:

1. Design Modeler:

ANSYS Design Modeller training course is for users that want to create and modify geometry in preparation for analysis in ANSYS CFD (Computational Fluid Dynamics) or ANSYS CSM (Computational Solid Mechanics).

2. ANSYS Meshing:

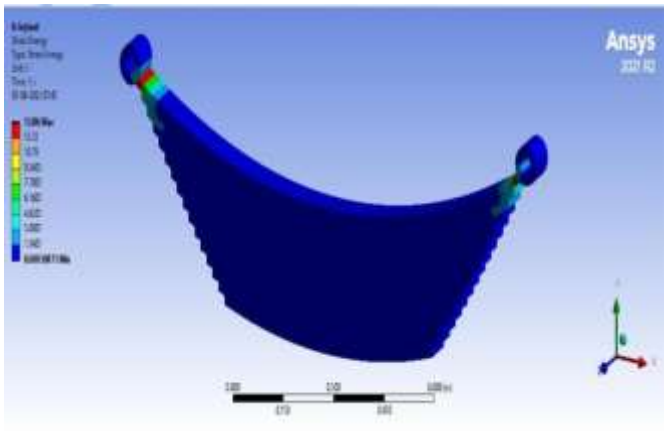
ANSYS Meshing is a component of ANSYS Workbench and the next generation meshing platform.

3. ANSYS Mechanical:

ANSYS Mechanical provides

solutions for many types of analyses including structural, thermal, modal, linear buckling and shape optimization studies.

4. ANSYS CFX:



ANSYS CFX software is a high-performance, general purpose computational fluid dynamics(CFD) program that has been applied to solve wide-ranging fluid flow problems for over 20 years.

5. ANSYS Fluent:

ANSYS Fluent software contains the broad physical modelling capabilities needed to model flow, turbulence, heat transfer, and reactions for industrial applications ranging from air flow over an aircraft wing to combustion in a furnace, from bubble columns to oil platforms, from blood flow to semiconductor manufacturing, and from clean room design to wastewater treatment plants.

The basic procedure involved in the ANSYS is

1. Preferences

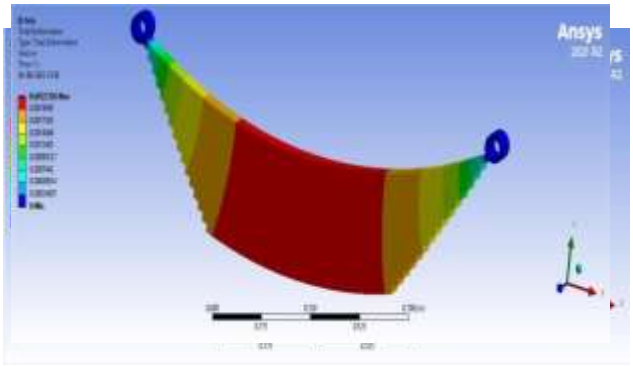
2. Pre-processor

a. Material properties

b. Meshing

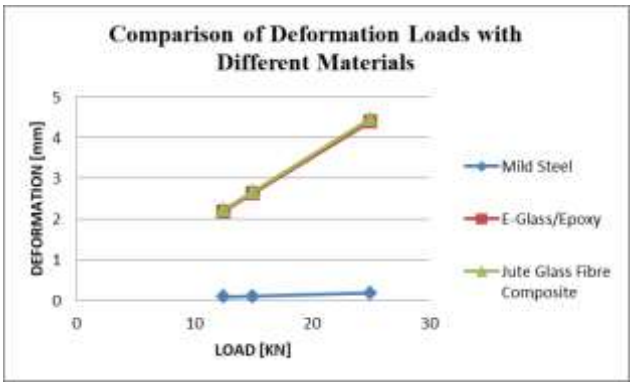
c. Loads

3. Solution



4. General post processor

RESULTS AND DISCUSSIONS



CONCLUSION

From this analysis it is seen that the objective is to obtain a spring with minimum weight that is capable of carrying given static external forces. For that the steel leaf spring is replaced by composite leaf spring. Leaf spring made of composite material is better than using steel leaf spring. The performance of steel leaf spring was compared with the composite leaf spring using FEA.

Results show that the leaf spring made of composite material is lighter than conventional steel leaf spring with similar design specifications but not always is cost effective. Composite materials have more elastic strain energy storage capacity and high strength to weight ratio as compared with those of steel therefore, it is concluded that leaf spring made of composite material is an effective replacement for the existing steel leaf spring in automobile.

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