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Design and Analysis of Composite Leaf Spring

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ABSTRACT

In the present scenario, reducing the weight is the major desire in automobile world. As the conventional steel leaf spring contributes some amount of weight with respect to the total weight of vehicle. So lots of researches are being developed for reduction of weight. This paper deals the reduction of weight in the conventional steel leaf spring with the composite leaf spring. For this purpose various composite materials such as E-glass, epoxy and jute are used in different proportion. This papers also compares the stress, deformation of conventional leaf steel spring with composite leaf spring while loading and unloading, thereby ensuring that the stiffness and efficiency is improved .The three dimensional model are analyzed in CATIA V5R20 and Ansys.

1. INTRODUCTION

During normal operation, the spring compresses to absorb the shock. The leaf springs bend and slide on each other thereby allowing suspension movement. Fatigue failure is the predominant mode of in-service failure of many automobile components. This is due to the fact that the automobile components are subjected to variety of fatigue loads like shocks caused due to road irregularities The sudden loads due to the wheel traveling over the bumps etc. The leaf springs are more affected due to fatigue loads as they are a part of the un sprung mass of the automobile

2. PROBLEM DEFINTION

The leaf spring is not only used to support vertical load but also to isolate road induced vibrations. It is subjected to millions of load cycles leading to fatigue failure. The Introduction of composite materials has made it possible to reduce the weight of the leaf spring without any reduction in load carrying capacity and stiffness.

3. PARTS OF LEAF SPRING

3.1 Master Leaf

The longest leaf known as main leaf or master leaf has its ends formed in the shape of an eye through which the bolts are passed to secure the spring to its supports.

Fig 1. Master leaf

3.2 Graduated Leaf

The other leaves of the springs are known as graduated leaves. In order to prevent digging in the adjacent leaves. It is usual to provide two full length leaves and the rest graduated leaves.

3.3.Eye

Usually the eyes, through which the spring is attached to the hanger or shackle, are provided with of bushing of some antifriction of material such as bronze or rubber.

3.4.Center Bolt

The leaves are held together by means of a band shrunk around them at the centre or by a bolt passing through the centre.

3.5.Rebound Clip

Rebound clips are placed intermediate positions of the leaf spring. These are joints the master leaf and graduated leaves of the leaf spring.

4. LITERATURE SURVEY

Many early vehicles such as the ford model it used transverse leaf springs on both the front and rear suspension in conjunction with a live axle. In the early 1930s, Dante giocoso developed the fiat tapeline which used transverse steel leaf springs and double wishbones in an independent front suspension.

The triumph motorcar company also developed a independent rear suspension with a transverse leaf spring arrangement for their line of small cars in the 1950s. The triumph arrangement, first seen on the 1959 herald was developed in an effort to introduce an inexpensive independent rear suspension. Results were mixed with considerable safety issues surrounding the vehicles tendency to snap into over steer.

Kumaragurubaran.J Raj Kamal M.D Kaliappan S (2015) has discussed about the reduce the noise level to certain percentage in the engine by mounting Deflector on Secondary nozzle. Cold air from the secondary nozzle get affected by the placement of deflector on the secondary nozzle, thereby reducing velocity gradient in narrow direction of flow and increasing velocity gradient in other direction.

Manas patnaik, L.P. Koushik and Manoj Mathew has been carried out on a parabolic leaf spring of a mini loader truck. The spring has been analyzed by applying a load of 3800 N and the corresponding values of stress and displacement are computed. In this work, design of experiments has been applied under various has been is configurations of the spring (i.e by varying camber & eye distance). Camber and leaf span of a parabolic leaf spring was found for optimized stress and displacement value using artificial neural networks. Various networks with different architecture were trained and the network giving the best performance was used for optimization.

S. Kaliappan, M. D. Rajkamal and D. Balamurali (2016) , the analysis results are presented for impellers A in this Paper and Comparisons of the CFD results for both impellers reveal internal flow features that explain the improved impeller B performance levels in Paper. Computational Fluid Dynamics (CFD) is a tool which aids in conducting or simulating flow through a pump virtually using computer software. An attempt has been made in this paper to improve the performance of a typical centrifugal pump impeller.

Bhushan, Deshmukh, Dr. Santosh and B. Jaju int j engg techsci.Weight reduction is now the main issue in automobile industries. The paper gives the brief look on the suitability of composite leaf spring on vehicles and their advantages. M.Chandru, M.Durairaj,

S.Kaliappan, J.Lokesh, P.Mahaneesh, M.Siva (2018) will be focusing on the mechanical design concept of the AGV which combines knowledge on mechanical parts such as the electric motor, gears, wheels, structure of the AGV, control system and so on.

The objective of the present work is design, analysis and fabrication of mono composite leaf spring. The design constraints are stress and deflections. The finite element analysis is done using ansys software. The attempt has been made to fabricate the explain leaf spring economically than that of conventional leaf spring.

5. METHODOLOGY

Present work is related to the comparative study of "55 SI 7 steel and composite leaf spring" component details. The component is studied for the operation required to convey the different types of loads on it. Designed the component in the required shape and dimensions and analyzed. Design calculations are carried for the component leaf spring with the help of material properties. The material properties, loads and boundary conditions are also specified in the ANSYS software. A fem model of leaf spring, only one leaf is created by using ansys processor. The material properties, loads and boundary conditions are also specified in the ansys processor. Analysis work is done by applying loads on the leaf spring then the results such as stress, strain, total deformation are obtained. The results are compared with material properties of the material used for the component.

6. DESIGN

6.1 Design Parameters of leaf spring

Fig 2. leaf spring designed in CATIA

Table 1. Design parameters of leaf spring

Total length of leaf spring(eye to eye)	1050mm
Arc height at axle seat	170mm
Thickness of leaf spring	60mm
Width of leaf spring	45mm
Outer Diameter of Eye	50mm
Inner Diameter of Eye	44mm

7. ANALYSIS

7.1 Steel Leaf Spring (55Si7)

Tensile strength=572.3Mpa
Young's modulus=190-210Mpa
Poisson's ratio=0.27-0.30
Density=1000kg/m^3

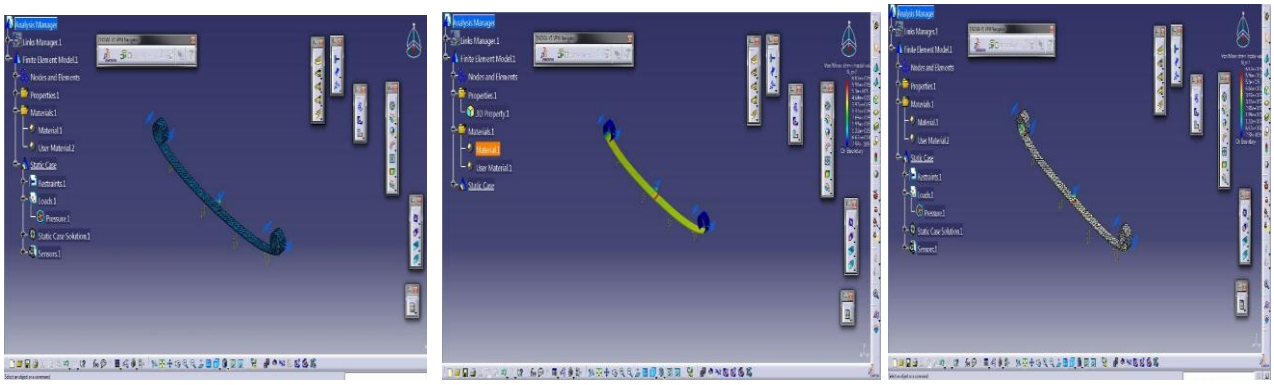

Fig 3. Total Deformation

7.2 Jute/E-Glass/Epoxy Leaf Spring

Tensile Strength= 185Mpa
Young's modulus=21000Mpa
Poisson's ratio=0.22
Density=1460kg/mm^3

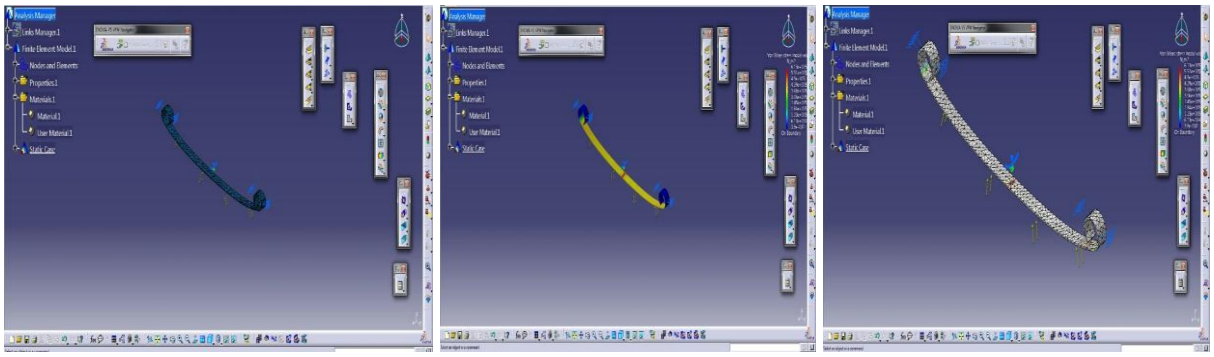

Fig 4. Total Deformation

8. CONCLUSION

The stresses and deflection of steel leaf spring and composite leaf spring are found with great difference in Deflection of composite leaf spring is less as compared to steel leaf spring with the same loading condition. weight and cost are also less in composite leaf spring as compared to steel leaf spring with the same parameters. Composite leaf spring can be used on smooth roads with very high performance expectations. There by we conclude that usage of composite resins will surely improve the efficiency of leaf spring.

REFERENCES

1. Design and Analysis of Composite Leaf Spring :Author -Y.N.V.Santhosh Kumar and M.Vimal Teja (2012).

2. Mono Composite Leaf Spring for Light Weight Vehicle – Design, End Joint Analysis and Testing: Author-Gulur Siddaramanna Shiva Shankar, Sambagam Vijayaragan(2016).

3. Kumaragurubaran.J Raj Kamal M.D Kaliappan S (2015) " Investigation of jet noise reduction using fan flow reductors on CFD ", International Journal of Applied Engineering Research, Vol. 10 No.33, PP- 26003- 26010.

4. Design and analysis of composite leaf spring in light vehicle:Author-Venkatesan M., Devraj D. Helmen (2006).

5. S. Kalipan, M. D. Rajkamal and D. Balamurali "Numerical analysis of centrifugal pump impellor for performance improvement" , International Journal of Chemical Sciences (IJCS) , Volume –14, Issue – 02, May– 2016, PP – 1148-1156 .

6. Performance Analysis of Two Mono Leaf Spring used for Maruti 800 Vehicle:Author- Jadhav Mahesh V., Zoman Digambar B, Y. R. Kharde and R. R. Kharde(2012).

7. S.Kaliappan, J.Lokesh, P.Mahaneesh, M.Siva, " Mechanical Design and Analysis of AGV for Cost Reduction of Material Handling in Automobile Industries" , International Research Journal of Automotive Technology (IRJAT) Volume 01-Issue 1, January 2018, PP.1- 7.

8. Kumarkrishna and aggarwal m.l. (2012)A finite element approach for analysis of a multi leaf spring using cae tools

9. P.Krishna Teja, G. Moorthy, S.Kaliappan, "Finite element analysis of propeller shaft for automobile and naval application" , International Research Journal of Automotive Technology (IRJAT) Volume 01-Issue 1, January 2018, PP.8-12.