A REIVIEW ON STATIC ANALYSIS OF MASTER LEAF

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ABSTRACT

The intent of 21st century for automotive sector is fuel economy and emissions; due to this the automotive designers are revisiting automotive systems and parts for reducing the mass of the vehicles. For suspension system, leaf spring is one of the key targets for weight reduction because it adds in unsprung mass; which affects the ride of the vehicle. To move further, we are going to optimize the parabolic mono leaf spring for the material as sup11or sup13 and the best possible design parameters to design lightest spring meeting all design constraints as length, width, suspension travel and various design stresses. The basic theory for leaf spring design has been rechecked for authentication with advanced finite element analysis. This paper gives the automotive designer to find out better design for parabolic leaf spring implementation in place of present mono leaf spring on vehicle. The results of this paper give good values for the automotive manufacturer to standardize the design and optimization methodology.

Keywords: *MonoLeaf Spring,, static analysis, Weight reduction*

1.INTRODUCTION

Today automotive manufacturers are faced with several complex challenges. In a highly competitive market, customers are demanding more for their money. Motorists wish cars that propose high performance, comfort, refinement, safety as well as increased vehicle customisation. The automotive industry is also faced with Governments who are consistently introducing legislation that demand improvements in fuel efficiency, reduced emissions, increased recycling and greater safety for both pedestrians and occupants. The circumstances facing the auto industry is most excellently summarised by quoting an article in the Polymotivemagazine "Far-reaching efforts to achieve components that are rigid, strong, safe and at the same time, as light as possible are needed in order to survive in automotive manufacturing".In order to preserve natural resources and cost effects, weight minimization has been the major focus of automotive industries. Now a day's weight minimization can be achieved generally by the replacement of better material, design optimization and enhanced manufacturing process. Springs are important suspension essentials on any vehicle, essentially to reduce the vertical vibrations, impacts and bumps due to road abnormalities and made a cosy ride. The leaf spring suspension holds about 10-20% of vehicle unsprung mass. Thus it becomes an essential component for weight minimization [4]. The mass minimization can be accomplished by selecting better materials and optimized design of leaf spring etc.

There are various types of springs available for suspension system. A leaf spring can be considered as the simple type of spring, normally used for the suspension in vehicles. It's generally like a slender arc-shaped having some length of a steel spring of rectangular cross-section. The axle is placed at the center of the arc, at the end eyes are used for attaching to the vehicle body. From the time 1970s Leaf springs were very general on automotives. The key characteristic that gives the smoothness of a vehicle is its suspension. Now a day's extensively used suspension systems in automotives are the Leaf springs. It is also called as a semi-elliptical spring or cart spring, which is similar to an arc-shaped length of a steel spring with a rectangular cross-section. We can fasten a leaf spring directly at both ends (eyes) of the frame or directly to the one end usually the front end, whereas the other end is attached with the shackle, a short swinging arm. For the smooth riding in very heavy vehicles.

A leafthe automotive manufacturer tends to enhance soothe of user and achieve appropriate stability of comfort riding virtues and economy. The researchers are very fascinated in the replacement of steel leaf spring by some composite leaf spring because of high strength to weight ratio. On the other hand, there is a restriction for the

amount of applied loads in springs. The amplification in applied load creates complexity at geometrical arrangement of vehicle height and erodes other parts of vehicle. So, springs design in concerned of strength and toughness is enormously significant. Minimization of spring mass is also key parameter in enhancement of car dynamic. By substitution of steel leaf spring with composite leaf spring will minimize spring mass in addition to resistance increase under the effect of applied loads. Increasing opposition and innovations in automotive field tends to alter the existing products or replacing old products by new and sophisticated material products. A suspension system of automotive is one of the areas where these innovations are carried out regularly. Leaf springs are generally used in suspension systems to absorb shock loads in automotives like light vehicles, heavy duty trucks and in rail systems [2].

2.PROBLEM IDENTIFICATION

After reviewing the literatures, we identify some of the problem which generally occurs in case of leaf spring. The usual steel leaf spring has various problems identified which are listed as follow:

1. Maximum deformation: because of continuous running of the vehicle there is a declination in the level of soothed offered by the spring.

2. Low strength: It is observed that the leaf springs be likely to break and deteriorate at the eye end segment which is extremely near to the shackle and at the middle.

3. High weight: The usual steel leaf spring having more weight, which additionally influences the fuel efficiency.

3. OBJECTIVES

As we discussed the problem identified and solution methods through the various literatures, now the objective of the research thrust is to replace the existing conventional steel (55Si2Mn90) material through the composite material to reduce the weight and increase the strength.

4. ASSUMPTIONS

In order to achieve the above listed objectives, we make the following assumptions:

1. Automobile is assumed to be stationary.

2. There are 4 parabolic leaf spring two at rear axle and two at front.

3. Static study is performed for rear single parabolic leaf spring.

4. The conventional leaf spring Material is EN 47 .

5. PROBLEM FORMULATION

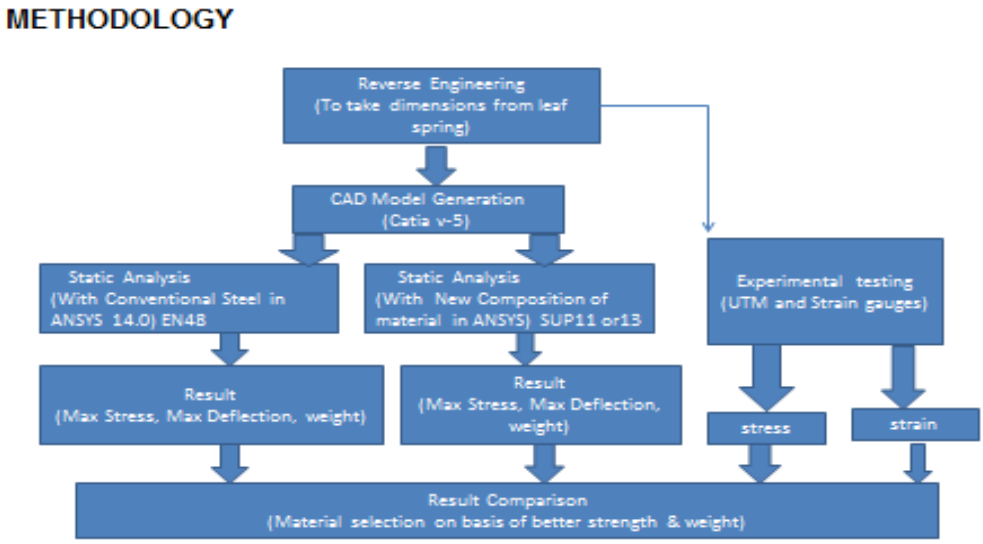
The problem identification, objective and hypothesis has been prepared in previous sections now to devise the problem the parabolic leaf spring (PLS) taken into consideration is that of a mini loader truck (MAHINDRA PICK-UP) having the following specifications as

1. Kerb Weight [15] : 815 kg
It is the definite weight of the truck exclusive of any cargo or passengers on it. It's the basic weight that is used in exclusion to estimate the entire weight of the vehicle with cargo and passengers.

2. Loading Capacity [15] : 1 Tonnes
It is the maximum load, which can be carried by the vehicle**.**

3. Max Gross Vehicle Weight (GVW) [15] : 1550 kg
It is the entire weight of the loaded vehicle. This comprises the vehicle itself and the cargo that is loaded inside that vehicle**.**

6.**Methodology**



7.Experimental procedure

Fig.Test rig of leaf spring

The chemical composition of EN47 spring steel used was C-0.56 si-0.21 mn-0.80 s&p-1.04 cr-0.018 weight %. The mechanical properties are: yield strength of 1134 MPa, ultimate tensile strength of 1158 MPa. The test material was first heat-treated at 1191 K, and oil-quench hardened. It was tempered at 793 K. This gave a brinell hardness of HB of 335. For the purpose of testing specimens, a steel strip, 1260 x 60 ·x 08 mm thick was used. The arc height was measured using an Almen gauge. In the experimental analysis the comparative testing of steel leaf spring are taken. The deflection or bending tests of both the spring should be study is on the universal testing machine. Move the plunger up to desired height so that we can fix the fixture and leaf spring

for test. Fix the position of fixture. On the fixture place the specimen. Set the universal testing machine. Apply the loads in steps of 20 kg gradually. Note down the deflection readings. The studied spring model was installed in seat buses and subject to fluctuating loads and environmental conditions typical of an urban bus. The service conditions were thus the usual for this type of mechanical suspension component. The spring manufacturing process, this is conducted entirely. The thick sheets of steel obtained by hot rolling. Essentially, it involves cutting, forming and punching of the leaves, hardening by quenching and tempering, surface finishing by shot peening, and assembly of individual leaves by inserting a bolt through their central hole and fastening them, at the ends, with two clamps. Testing of steel leaf spring are takes place on UTM. The steel leaf springs are tested by using leaf spring test rig. The experimental set up is shown in Fig. The leaf springs are tested following standard procedures recommended. The spring to be tested is examined for any defects like cracks, surface abnormalities, etc. The spring is loaded from zero to the prescribed maximum deflection and back to zero. The load is applied at the centre of spring. The vertical deflection of the spring centre is recorded in the load interval of 186 N. Static test of steel mono leaf spring.

8.CONCLUSION

1.To Compare the Load and Deflection Using experimental and analytical method for leaf spring of EN47 and Leaf spring SUP 11/13
2. To compare the stiffness and weight savings with SUP 11 with conventional leaf spring. Optimize the master leaf for weight,strength,cost.

9.FUTURE SCOPE

For future work, we anticipate that the further reduction in weight is possible by means of applying the modern shape optimization techniques to achieve an effective shape of the leaf spring.
Based on these investigations will be further performed and in future the shape optimization can lead us to a proper shape of the composite leaf spring.

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REFERENCES

[1] “A novel methodology with testing and simulation for the durability of leaf springs based on measured load collectives”byBasaranOzmena,Alper Guzelb-2015.

[2] “Optimization Of Mono Parabolic leaf Spring ” by Edward Nikhil Karlus, Rakesh L.Himte-2013.

[3] “Nonlinear Analysis of Leaf Springs of Functionally Graded Materials” byDipendra Kumar Roya-2012

[4] “Large deflection stiffness analysis of parallel prismatic leaf-spring flexures” byD.M. Brouwera J.B. Jonkera-2012

[5] “Premature fracture automobile leaf springs” by J.J. Fuentes E.J. Herrera-2008

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