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Review Paper on Design & Analysis of Leaf Spring Using Composite Material

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ABSTRACT
This paper Review a portion of the overall review on the plan, examination and manufacture of composite leaf spring. Leaf springs are one of the most established suspension parts they are still as often as possible utilized, particularly in business vehicles. The writing has shown a developing interest in the substitution of steel spring with composite leaf spring. The suspension framework in a vehicle altogether influences the conduct of vehicle, for example vibration qualities including ride solace, dependability and so on Leaf springs are regularly utilized in the vehicle suspension framework and are exposed to a huge number of differing pressure cycles prompting weariness disappointment. A great deal of exploration has been done for working on the execution of leaf spring. Parcel of materials are utilized for leaf spring. however, it is observed that fiberglass material has better strength trademark and lighter in weight as contrast with steel for leaf spring. In this paper the creator is audited few papers on utilization of substitute materials and impact of material on leaf spring execution.

Keywords - steel leaf spring, ANSYS, PRO-E software

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I. INTRODUCTION

Leaf springs are mostly utilized in suspension frameworks to assimilate shock loads in cars like light engine vehicles, weighty obligation trucks and in rail frameworks. The fundamental capacity of leaf spring gets together as suspension component isn't just to help vertical burden, yet in addition to detach street-initiated vibrations. The conduct of leaf spring is muddled because of its clasping impacts and between leaf contact and so forth It conveys parallel burdens, brake force, driving force notwithstanding shock retain. Springs are urgent suspension components on vehicles, important to limit the vertical vibrations, effects and knocks because of street inconsistencies and make an agreeable ride. The suspension leaf spring is one of the expected things for weight decrease in auto as it represents ten to a fifth of the un sprung weight. The presentation of composites helps in planning a superior suspension framework with better ride quality if it very well may be accomplished absent a lot of expansion in cost and decline in quality and dependability. In the plan of springs, strain energy turns into the central point. In the current situation the primary focal point of car producers is weight decrease of the car. Weight decrease can be accomplished essentially by presenting the better material, plan enhancement and better assembling processes. In vehicles, leaf spring is one of the expected parts for weight decrease as it accounts for 10% - 20% of the un sprung weight. Composite materials have made it conceivable to diminish the heaviness of leaf spring with next to no decrease in load conveying limit and firmness. Composite materials are presently utilized widely instead of metal parts. A few papers were committed to the use of composite materials for cars.

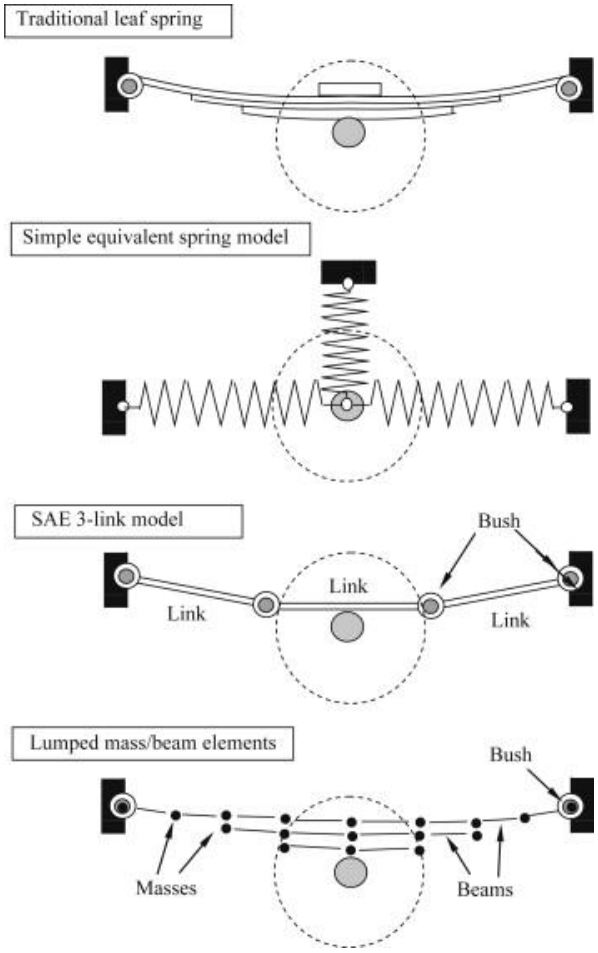

Fig. 1 Type of Leaf Spring

The top leaf is known as the expert leaf. The eye is accommodated appending the spring with another machine part. How much twist that is given to the spring from the focal line, going through the eyes, is known as camber. The camber is given so that even at the greatest burden the avoided spring ought to not touch the machine part to which it is connected. The focal clasp is needed to hold the leaves of the spring.

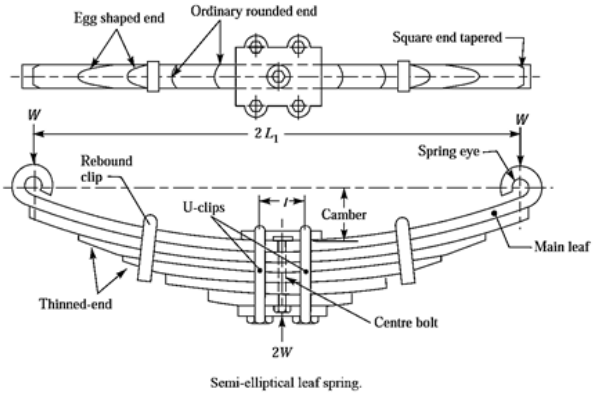

Fig. 2 Semi-Elliptical Leap Spring

II. LITERATURE REVIEW

M. M. Patunkar, et al. Vinkel Arora, et al.[1]in their work has done design and analysis of conventional mono leaf spring standard eye end and casted eye end. CAD modeling was done in CATIA and analysis was done in ANSYS under similar loading conditions for parameters like deformation von-mises stress, normal stress etc. They have concluded that for similar static load application, when standard eye is replaced with casted eye deflection was increased by 5.4%. von-mises stress was reduced by 3%. Normal stress was increased by 19.08% and minimum factor of safety reduced by 13.1%. Further they have concluded that CAE tools are economic and less time consuming with result variation in a specified range as compared to experimental testing.

Kumar Krishan, et al.[2] in their work has done design and finite element analysis of conventional SUP9 steel multi leaf spring including two full length leaves in which one is with eyed ends and seven graduated length leaves. Finite element modeling was carried out in CATIA V5 R17and was imported in ANSYS11 for finite element analysis. Bending stress and deflection observed from the finite element analysis was compared with the experimental results under full and half load application. They have observed 0.632% variation in deflection and 10.11% variation in bending stress under full load application and 0.632% variation in deflection and 17.95% variation in bending stress under half load application which is negligible. They have concluded that CAE tools give batter results with negligible variation and the design was safe from failure under given load conditions.

Mr.Abdul Rahim Talib Talib, Aidy Ali, G. Goudah, Nur Azida Che Lah and A.F. Golestaneh[5] worked on developing a composite based elliptic spring for automotive applications. After that using

this conclusion they have change steel leaf spring by composite material and analyze it with same loading condition. They concluded that composite elliptical springs have superior fatigue performance than steel. They consider light and heavy trucks with steel elliptic spring for analysis of fatigue performance and weight reduction by using ANSYS software. The objective is to compare the load carrying capacity, fatigue performance and weight savings of composite leaf spring with that of steel leaf spring. Also they have compared the finite element result of fatigue life and weight reduction with existing analytical and experimental result. The conventional steel leaf spring and weight reduction ratio is achieved Dev dutt Dwivedi and V.K.Jain[6] 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 used. Conventional steel leaf spring results have 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.

Pankaj Saini, Ashish Goel, Dushyant Kumar[4] etc. studied on design and analysis of composite leaf spring for light vehicles. Main objective of this work is to compare the stresses and weight saving of composite leaf spring with that of steel leaf spring. Here the three materials selected which are glass fiber reinforced polymer(E-glass/epoxy),carbon epoxy and graphite epoxy is used against conventional steel. The design parameters were selected and analyzed with the steel leaf sprin From results, they observed the replacement of steel with optimally designed composite leaf spring can provide 92% weight reduction and also the composite leaf spring has lower stresses compared to steel spring.. From the static analysis results it is found that there is a maximum displacement of in the steel leaf spring. From the result, among the three composite leaf springs, only graphite/epoxy composite leaf spring has higher stresses than the steel leaf spring. From results its proved that composite mono leaf spring reduces the weight by 81.22% for E-Glass/Epoxy, 91.95% for Graphite/Epoxy, and 90.51 % for Carbon/Epoxy over steel leaf spring. Hence it is concluded that E-glass/epoxy composite leaf spring can be suggested for replacing the steel leaf spring from stress and stiffness point of view.

III. CONCLUSION

From the literature review it is seen that the goal was to acquire a spring with least weight that is prepared to do conveying given static outer powers by limitations restricting stresses and removals. For that the steel leaf spring is supplanted by composite leaf spring. Composite leaf spring is better than utilizing steel leaf spring. The exhibition of steel leaf spring was contrasted and the composite leaf spring utilizing scientific and test results. FEA are utilized for expectation about the absolute life cycle and exhaustion life of composite and steel leaf spring. Results show that the composite leaf spring is lighter than regular steel leaf spring with comparative plan particulars however not forever is cost viable over their steel partners. The regular recurrence of composite leaf spring is higher than that of the steel leaf spring and is far enough from the street recurrence to stay away from the reverberation. The burdens in the composite leaf spring are a lot lower than that of the steel spring. Composite materials have more flexible strain energy stockpiling limit and high strength to weight proportion as contrasted and those of steel subsequently, it is inferred that composite leaf spring is a compelling substitution for the current steel leaf spring in auto.

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