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"Design Of Front Spring Upper By Using FRP"

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***Abstract*—**

Spring seat is the part has been used for McPherson strut and independent suspensions. Mostly this part is made by steel and Indian auto market around 3.5 million cars sold. McPherson strut and single path strut used in India around 65% that is 2.3 million cars are using this spring seat India. In this project work the alternate materials which meet the design requirements are investigated and the they have been implemented to reduce the weight of a system. In this research work, the polyamide composites is implemented the reason is that it provides which the strength with affordable price. The CATIA V5 is used design the model and analysis is done by using the ANSYS simulation software.

Key words : Spring seat , McPherson strut, Polyamide Composites.

I. INTRODUCTION

Today our automotive industries and Universities are focused and doing research in smart transportation solutions. We have challenge in front of us carbon emission reduction, Safety, alternate fuel, mileage improvement

To overcome the challenges, last three decades' industries are moved through lightweight solution with alternate material design and Shape design etc. We have light weighting technology has been implemented with different type of solution. Replace the nonfunctional and only appearance parts are replaced with plastic and BIW weight reduced by reinforcement member design and high tensile low thickness sheet metal have been used since last two decades. As a further steps ahead functional parts also has been started to replace from steel to aluminum to Engineering plastic like polyamide with glass fibers.

Our engineering design become easy and reliable with help of Computer aided design and Computer aided analysis, complicated problems can be solved quickly and lot of design iteration possible to complete with less lead time. As a way forward I would like to expand the research further most common used functional component in automotive to be look in to possibility do the alternate design and I have filtered from tear down analysis McPherson strut components. McPherson Strut is used most of the passenger vehicle has been used so my research will be major beneficial. Passenger vehicles are central to Western society, and contribute to a significant part of our greenhouse gas emissions. In order to reduce emissions, the automotive industry as a whole is working to reduce mass in passenger vehicles in order to reduce energy consumption. One way to reduce mass is to introduce lightweight materials in the body of the vehicle. , McPherson strut is A MacPherson strut uses a wishbone, or a substantial compression link stabilized by a secondary link, which provides a mounting point for the hub carrier or axle of the wheel. This lower arm system provides both lateral and longitudinal location of the wheel. The upper part of the hub carrier is rigidly fixed to the bottom of the outer part of the strut proper; this slides up and down the inner part of it, which extends upwards directly to a mounting in the body shell of the vehicle.

II. PROBLEM STATEMENT

Spring seat is the part has been used for MacPherson strut and independent suspensions. Mostly this part is made by steel. Here the purpose of the study is to suggest the alternative material for the same and also to achieve on weight saving of the material.

III. LITERATURE REVIEW

Julien Wilkin [1] Tenneco Automotive Operating Company Inc. Lake Foresthas invented. The lower spring seat has an annular member extending radially outwardly from the tubular member with a surface for supporting the one end of the coilspring thereon. The tubular member has a portion constructed to deform and collapse in response to a predetermined excessive force experienced by the shock absorber. S. N. Gundre1, P. A. Wankhade [2] have performed finite element analysis of Helical Compression Spring for Electric Tricycle Vehicle Automotive Front Suspension, analysis of coil springs The elastic behavior and the stress analysis of springs employed in this study suspension have been presented and discussed in this paper. The shear stress produced in the spring at the loading condition is in safe as per criterion. The deformation produced by the spring is also in given limit value which is most important to safe hitting the movable part and stability of vehicle during drive and ensure the so we can implement this spring to our electric tricycle. Mouleeswaran senthil kumar, Sabapathy vijayarangan [3] have carried out the analytical and experimental studies on fatigue life prediction of steel and composite multi-leaf spring for light passenger vehicles using life data analysis. Abdel-Hamid I. Mourad , Beckry Mohamed Abdel-Magid , Tamer El-Maaddawy &Maryam E. Grami [4] have presented the study of the durability of fiber reinforced polymer (FRP) materials in seawater and warm environment in this paper. The major objective of the study is to evaluate the effects of seawater and temperature on the structural properties of glass/epoxy and glass/polyurethane composite materials. These effects were studied in terms of seawater absorption, permeation of salt and contaminants, chemical and physical bonds at the interface, degradation in mechanical properties, and failure mechanisms. Solvay Composite Materials [5] They have mentioned different type FRP for automotive application for lightweight solutions. They are offering in different manufacturing solution Evolite™ is Solvay's high-end patented thermoplastic product range for composite applications. EvoliteTM is designed for use in ultra-lightweight composite materials and offers outstanding mechanical properties. Evolite™ thermoplastic composites are available as unidirectional tapes as well as woven and cross-ply laminates on glass, carbon or any other continuous fiber. Senthilkumar Mouleeswaran [6] Design, Manu;A Review Main factors that contribute to fatigue failures include number of load cycles experienced, range of stress and mean stress experienced in each load cycle and presence of local stress concentrations.

Fredrik Henriksson [7] Introducing New Materials in the Automotive Industry Looking at the possible challenge of introducing new materials into products produced in existing production infrastructure, a significant amount of research has been done in the underlying research fields that form the basis of this field; product development research, materials and structural engineering and production engineering research. Personal transport, and the transport sector of the industry, are vital components in Western society, where Sweden could be a suitable example. The transport sector in Sweden contributes to 33% of the total greenhouse gas emissions (measured in C02 equivalents) in the country, with road transports contributing to 93% of these emissions; out of these 93%, passenger cars contribute to 64% of the emissions [8]. This means that passenger cars contribute to approximately 19.6% of the total greenhouse gas emissions in Sweden. These numbers will differ from country to country, but it becomes evident that personal transport and passenger cars have a significant impact on emissions availability of personal transportation (sources indicate a slight shift from work-related transport to leisure-related transport in Sweden, along with tightened regulations on pollution and energy consumption, the automotive industry needs to increase energy efficiency in the vehicles it produces.

IV. OBJECTIVES OF RESEARCH WORK

- ✓ To design the seat spring for Macpherson strut suspension system.
- ✓ FEA modeling of seat spring and analysis of spring.
- ✓ Conduction of Brake Test for seat spring.
- ✓ Conduction of Durability test for seat spring.

Durability Test Conditions :

Sr, No.	Test Description	Durability
1	Direction	Axial
2	Pre Load	ON
3	Amplitude	0 to 5000 N
4	Frequency	3 Hz.
5	Temprature	Room Temp.
6	Cycles	Till Failure

V. RESULT & DISCUSSION

Sr. No.	Time in Seconds	Force in N	Stroke in mm
1	0	-0.31789	0.000106
2	0.01	-0.44505	0.000925
3	0.02	-0.5881	0.003031
4	0.03	-0.5881	0.005081
5	0.04	-0.50863	0.006513
6	0.05	-0.39736	0.007869
7	0.06	-0.31789	0.009625
8	0.07	-0.23842	0.011494
9	0.08	-0.15895	0.013119
10	0.09	-0.19073	0.014581
11	0.1	-0.27021	0.016225
12	0.11	-0.302	0.018019
13	0.12	-0.15895	0.019719
14	0.13	0.17484	0.021294
15	0.14	0.588099	0.022931
16	0.15	1.064936	0.02465
17	0.16	1.509984	0.026313
18	0.17	1.811981	0.027994
19	0.18	1.923243	0.0297
20	0.19	1.796087	0.031363

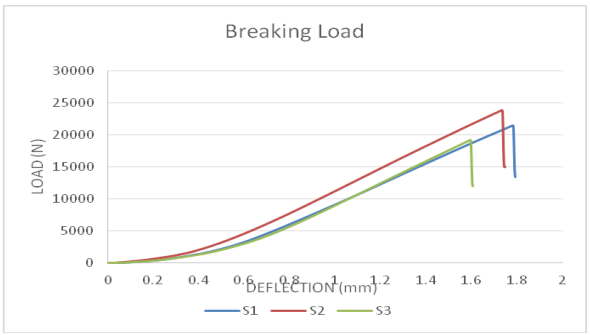

Figure 1 Load Vs Defelction

The above graph has been plotted between the load Versus Deflection for sample all 3 samples of spring. The brake point load for sample two is higher as compared to other two samples. The brake point load for sample three is lowest among three sample, it has been observed as 19221.67 N.

VI. CONCLUSIONS

In analysis I have found FRP Design is safe for given loading condition .Induced Max stress due to load is 69.86 MPa where as the material, chosen is 175 MPa Tensile Strength . The brake point load for sample two is higher as compared to other two samples. The brake point load for sample three is lowest among three sample, it has been observed as 19221.67 N.

So the design FRP is safe in FEA. Primary objective of the project weight saving target achieved from steel seat spring 280g to FRP 126g which is nearly 55% reduction in weight achieved.

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