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STRUCTURAL STATIC ANALYSIS OF SHOCK ABSORBER

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ABSTRACT

Critical part of a suspension system is a shock absorber, connecting the vehicle to its wheels. Shock absorbers are devices that dissipate or absorb the kinetic energy and smooth out an impulse. Suspension system comprise of springs and dampers. The need for dampers arises from the roughness of roads and the roll and pitches associated with vehicle. In this paper a shock absorber is designed and a 3D model is created using CATIA V5 20 software.Structural analysis is done on the shock absorber by using ANSYS R15 software. The analysis is done by considering loads, bike weight, single person and 2 persons. Structural analysis is done to validate the strength.

Keywords: Impulse, Shock Absorber, Stress, Strain.

I. INTRODUCTION

Almost all suspension systems consist of springs and dampers, which tend to limit the performance of a system due to their physical constraints. Suspension systems are usually designed for passenger's safety and do little to improve passenger comfort. To meet the current demands of high speed and safety we must designed and developed such a shock absorber which can sustain more and more vibrations and also improves the safety. There are two basic shock absorber designs in use today: the two-tube design and the mono-tube design. Main components of shock absorber consist of following parts

- Piston rod: It is made of high tensile steel harden and corrosion resistant.
- Main bearing: Its main function is lubrication of total shock absorber.
- Piston ring: It is hardened for long life.
- Pressure chamber: It is made from hardened alloy steel machined from solid with closed rear end to with stand internal pressure up to 1000 bar.
- Outer body: It is heavy duty one piece fully machined from solid steel to ensure total reliability.

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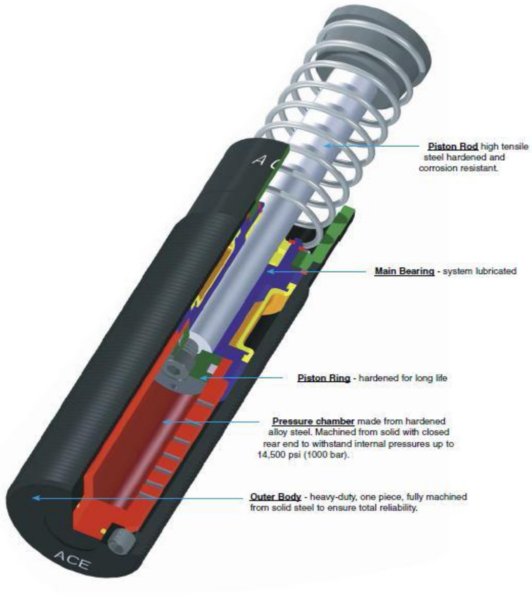

Fig.1.1 Shock Absorber

II. METHODOLOGY

2.1 Design Calculations for Helical Springs for Shock Absorbers

Mean diameter of a coil D=44mm

Diameter of wire d = 6mm

Total no of coils n1= 12

Outer diameter of spring coil D0 = D +d =50mm

No of active turns n= 10

Weight of bike = 125kgs

Let weight of 1 person = 75Kgs Weight of 2 persons = 75×2=150Kgs

Weight of bike + persons = 275Kgs

Rear suspension = 60% Hence 60% of 275 = 165Kgs

Considering dynamic loads it will be double W = 330Kgs = 3237.3N

For single shock absorber weight = w/2= 1618.5N = W

Free length of spring, Lf = 270mm

Spring rate, K =14.44 Pitch of coil, P = 25

2.2 Introduction To Catia

CATIA is a computer aided three-dimensional interactive application and itis a multi-platform computer-aided design (CAD)/computer-aided manufacturing (CAM)/computer-aided engineering (CAE) softwaresuite developed by the French company Dassault Systems.

CATIA supports multiple stages of product development including computer-aided design (CAD), computer-aided manufacturing (CAM) and computer-aided engineering (CAE). CATIA facilitates collaborative

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engineering across disciplines around its 3D experience platform, including shape, design and surfacing, mechanical engineering and systems engineering, electrical fluid and electronics systems design, CATIA enables the creation of 3dimensional parts from 3D sketches,composites, molded, sheet-metal, forged or tooling parts up to the definition of mechanical assemblies. The software provides advanced technologies for mechanical surfacing and BIW. It provides tools to complete product definition, including functional tolerances as well as kinematics definition. CATIA provides a wide range of application for tool design for both generic tooling and mold and die.

2.3 Model of Shock Absorber

2.3.1 Parts of Shock Absorber

- Top Part
- Helical Spring
- Bottom Part

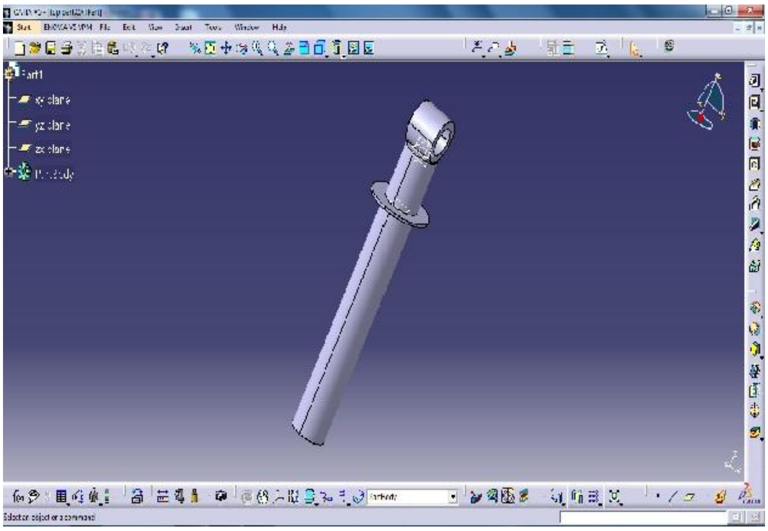

Fig.2.1 Top Part

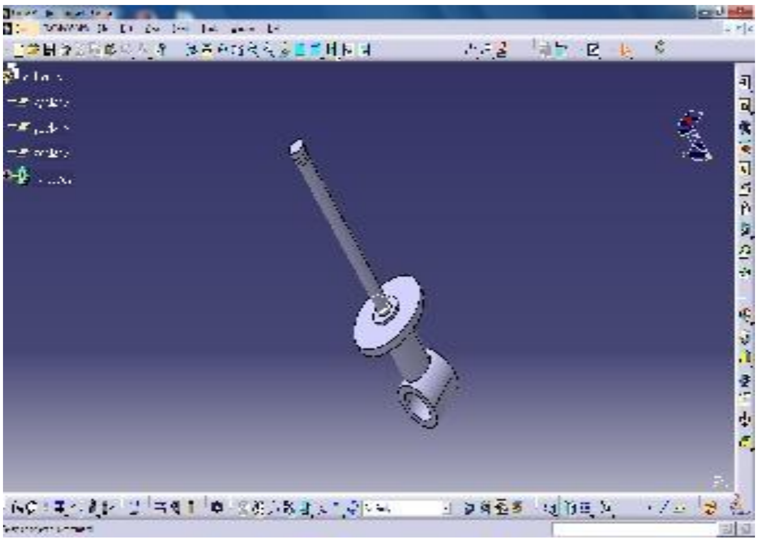

Fig.2.2 Bottom Part

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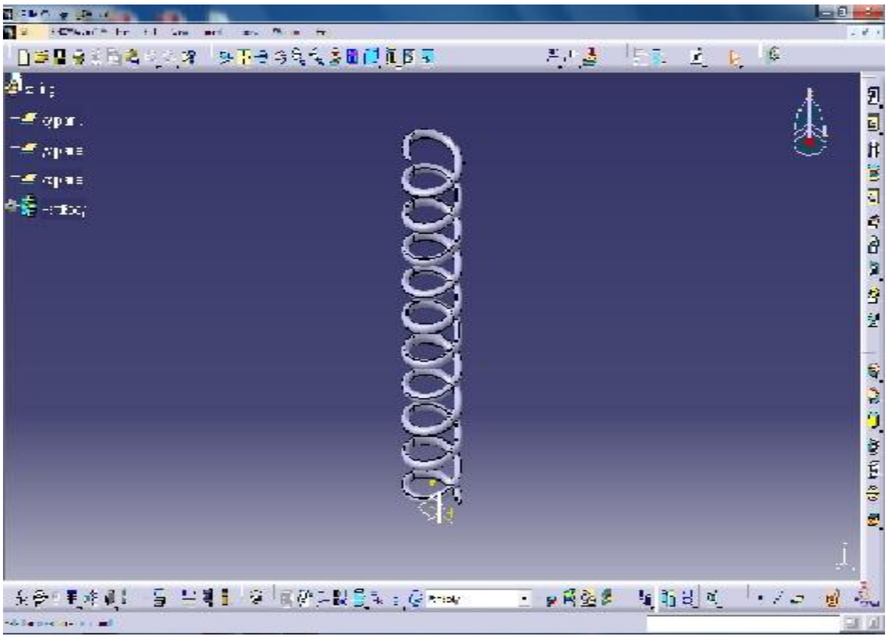

Fig.2.3 Helical Spring

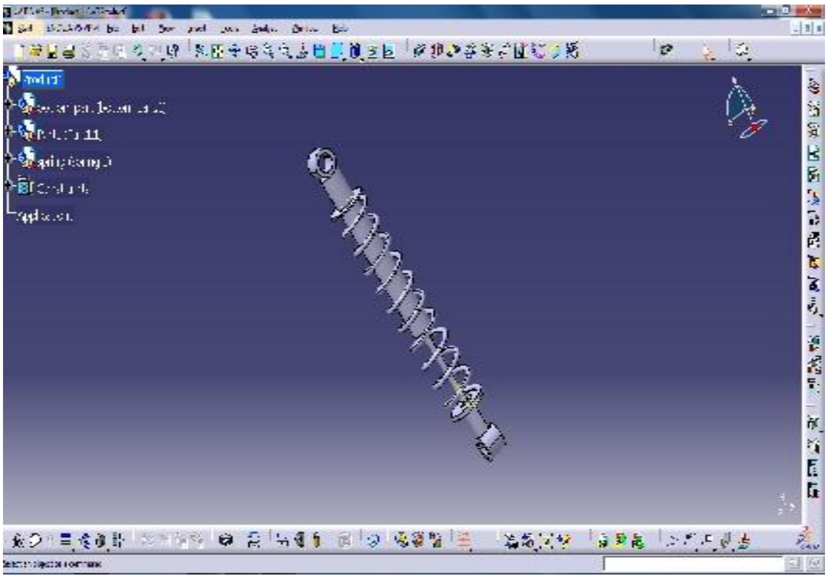

Fig.2.4 Total Assembly

III. RESULTS AND DISCUSSION

In this paper for structural Analysis using the Structural Steel as material and solve the structural analysis by using ANSYS R15 software. In this ANSYS software applying two type loads for finding the difference in Total deformation, equivalent stress and equivalent strain. The following are the properties of the material.

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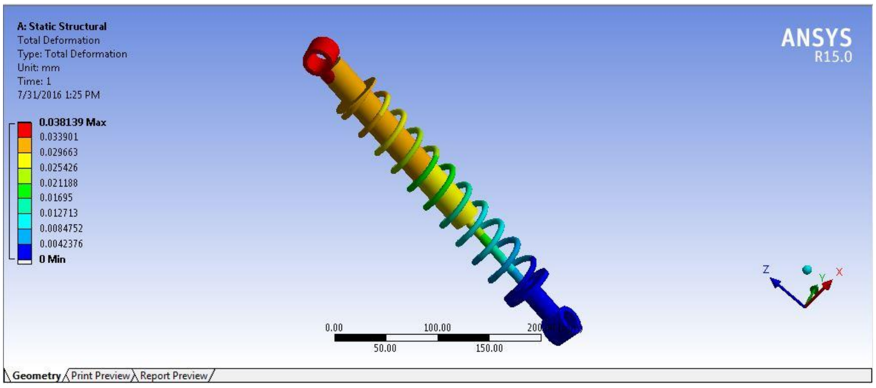
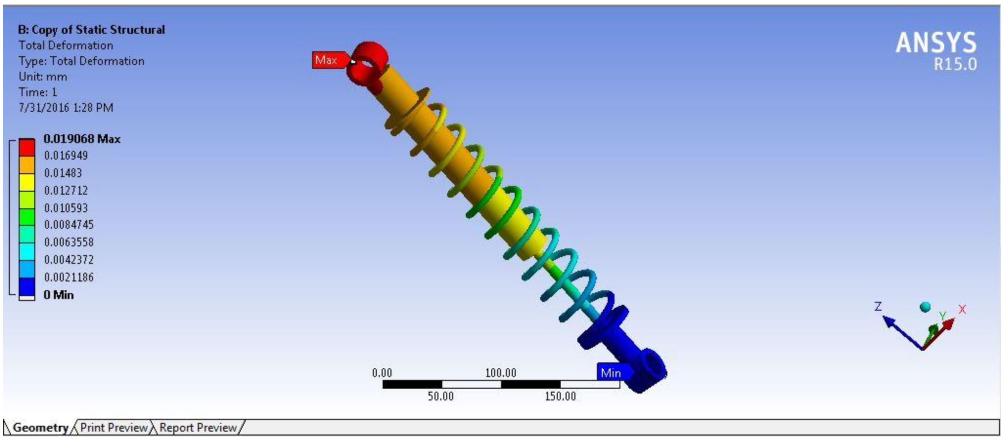
Table.3.1 Material Properties

Sl. No	Material Properties	Values
1	Density	7.85e-6 Kg/m^3
2	Young's Modulus	2e5 MPa
3	Poisson's Ratio	0.3
4	Tensile Ultimate Stress	250MPa

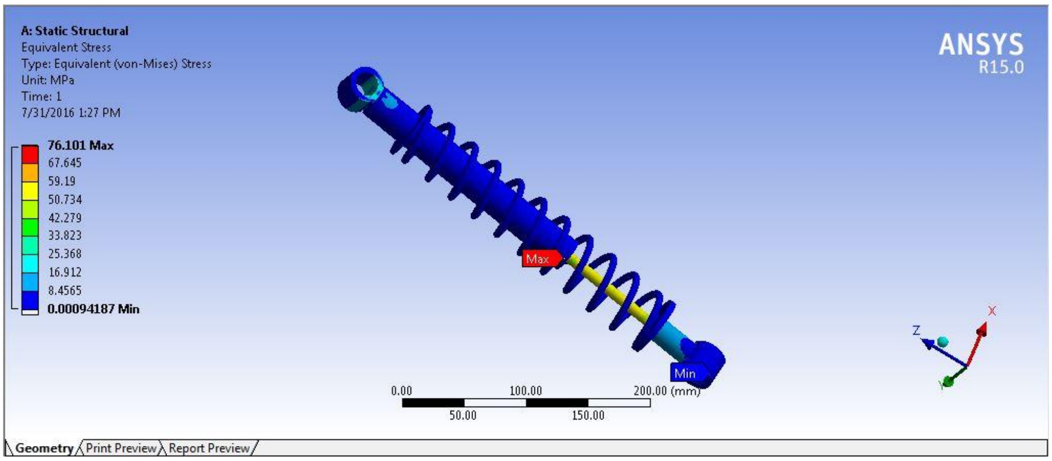


(a)

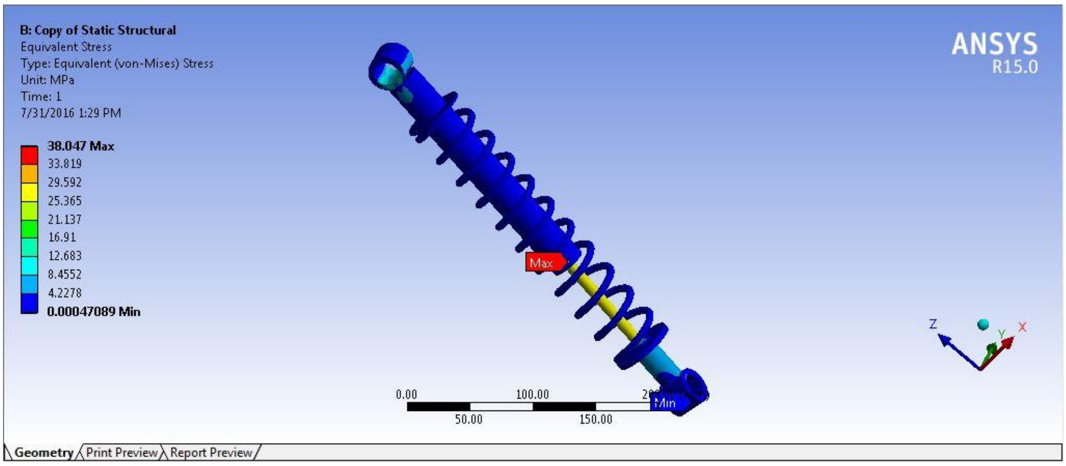


(b)

Fig.6.(a) total deformation at 3237.3nand (b) total deformation at 1618.5n

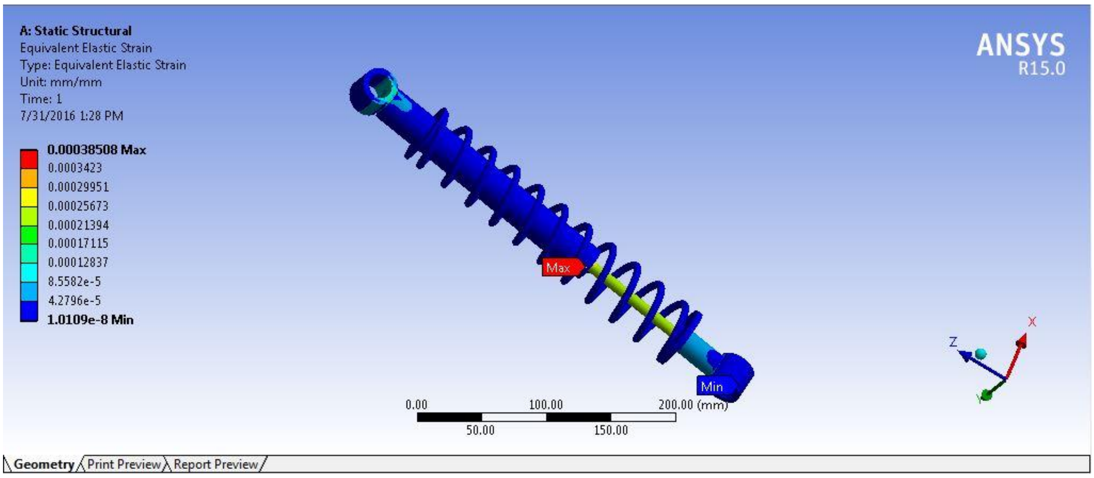


(a)

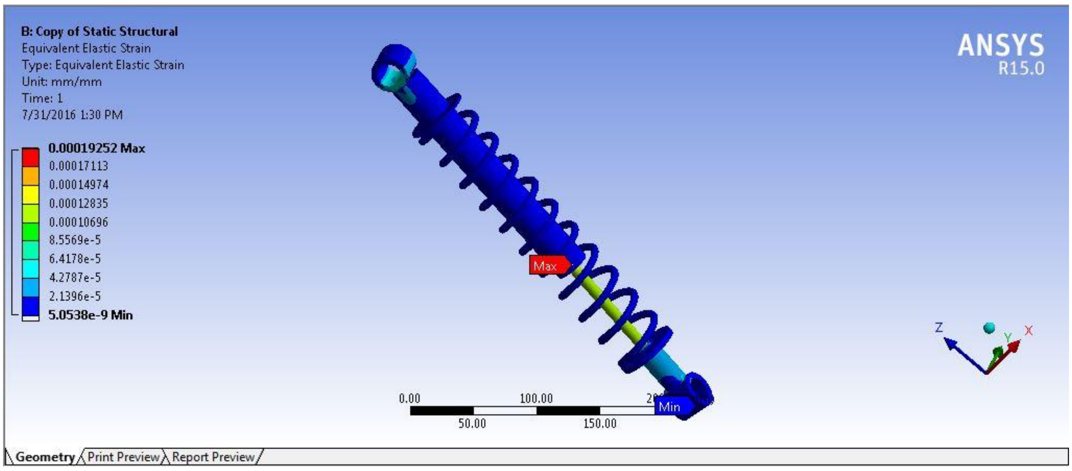


(b)

Fig.7. (a) Equivalent Stress at 3237.3N and (b)Equivalent Stress at 1618.5N



(a)



(b)

Fig.8. (a) Equivalent Strain at 3237.3N and (b) Equivalent Strain at 1618.5N

IV. CONCLUSION

In this paper Shock Absorber is designed and prepared 3D model by using CATIA V5 software and Structural Analysis is done by using ANSYS R15 software. To check the strength of the design and structural analysis is done by applying different types of loads. The following are the conclusions made by this paper and comparing the analytical results,

a. By observing the results, the total deformation is 0.038139mm for 3237.3N and 0.019068mm for 1618.5N loads.
b. By comparing results for both loads, the equivalent stress is 76.101MPa for 3237.3N and 38.047MPa for 1618.5N.
c. By comparing results for both loads, the equivalent strain is 0.00038508 for 3237.3N and 0.00019252 for 1618.5N.
d. The analyzed stress value is less than the ultimate stress. This ensures safe design of the shock absorber.

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