|| Volume 6 || Issue 4 || April 2021 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

MODELING AND STATIC ANALYSIS OF SHOCK ABSORBER USING DIFFERENT MATERIALS

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Abstract: - In vehicles problem happens while driving on bumping road condition. A shock absorber or suspension system is a mechanical assembly designed to smooth out or damp shock impulse, and dissipate kinetic energy. The objective of this project is to design and static ,dynamic analyze the performance of Shock absorber wire 8mm diameter of the coil spring. The Shock absorber which is one of the Suspension systems is designed mechanically to handle shock impulse and dissipate kinetic energy. It reduces the amplitude of disturbances leading to increase in comfort and improved ride quality. The spring is compressed quickly when the wheel strikes the bump. The compressed spring rebound to its normal dimension or normal loaded length which causes the body to be lifted. The spring goes down below its normal height when the weight of the vehicle pushes the spring down. This, in turn, causes the spring to rebound again. The spring bouncing process occurs over and over every less each time, until the up-and-down movement finally stops. The vehicle handling becomes very difficult and leads to uncomfortable ride when bouncing is allowed uncontrolled. Hence, the designing of spring in a suspension system is very crucial. The analysis is done by considering bike mass, loads, and no of persons seated on bike. Comparison is done by varying materials DIN 1722 SPRING STEEL(67SICR5), AISI 9255 SPRING STEEL, ASM A228 SPRING STEEL, AISI 1050 STEEL, 8mm diameter of the coil spring to verify the finally best material for the spring in shock absorber. Modeling and Analysis is done using catia and ANSYS respectively.

Keywords*: Shock Absorber, Coil Spring, Stress analysis.*

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I INTRODUCTION

A shock absorber (in reality, a shock "damper") is a mechanical or hydraulic device designed to absorb and damp shock impulses. It does this by converting the kinetic energy of the shock into another form of energy (typically heat) which is then dissipated. Most shock absorbers are a form of dashpot. Pneumatic and hydraulic shock absorbers commonly take the form of a cylinder with a sliding piston inside. The cylinder is filled with a fluid (such as hydraulic fluid) or air. This fluid-filled piston/cylinder combination is a dashpot. The shock absorbers duty is to absorb or dissipate energy. These are an important part of automobile suspensions, aircraft landing gear, and the supports for many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of structures to earthquake damage and resonance. A transverse mounted shock absorber, called a yaw damper, helps keep railcars from swaying excessively from side to side and are important in commuter railroads and rapid transit systems because they prevent railcars from damage station platforms. In a vehicle, it reduces the effect of travelling over rough ground, leading to improved ride quality, and increase comfort due to substantially reduced amplitude of disturbances. Without shock absorbers, the vehicle would have a bouncing ride, as energy is stored in the spring and then released to the vehicle, possibly exceeding the allowed range of suspension movement. Control of excessive suspension movement without shock absorption requires stiffer (higher rate) springs, which would in turn give a harsh ride. Shock absorbers allow the use of soft (lower rate) springs while controlling the rate of suspension movement in response to bumps. Damp the motion of the upspring weight up and down on the springiness of the tire. Since the tire is not as soft as the springs, effective wheel bounce damping may require stiffer shocks than would be ideal for the vehicle motion alone. Spring- based shock absorbers commonly use coil springs or leaf springs, though torsion bars can be used in tensional shocks as well. Ideal springs alone, however, are not shock absorbers as springs only store and do not dissipate or absorb energy. Vehicles typically employ springs and torsion bars as well as hydraulic shock absorbers. In this combination, "shock absorber" is reserved specifically for the hydraulic piston that absorbs and dissipates vibration. Pneumatic and hydraulic shock absorbers are used in conjunction with cushions and springs. An automobile shock absorber contains spring-loaded check valves and orifices to control the flow of oil through an internal piston.

One design consideration, when designing or choosing a shock absorber, is where that energy will go. In most shock absorbers, energy is converted to heat inside the viscous fluid. In hydraulic cylinders, the hydraulic fluid heats up, while in air cylinders, the hot air is usually exhausted to the atmosphere. In other types of shock absorbers, such as electromagnetic types, the dissipated energy can be stored and used later. In general terms, shock absorbers help cushion vehicles on uneven roads.Vehicle body from road shocks and vibrations otherwise it is transferred to the passengers and load. It must keep the tires in contact with the road, regardless of road surface. A basic suspension system consists of the parts springs, axles, shock absorbers, arms rods and ball joints. The spring is the flexible component of the suspension. Modern passenger vehicles usually use light coil springs. Light commercial vehicles have heavier springs than passenger vehicles, and can have coil springs at the front and leaf springs at the rear. Each side of the vehicle wheels connected by solid or beam, axles. Then the movement of a wheel on one side of the vehicle is transferred to the other wheel with independent suspension, the wheel can move independently of each other, which reduce body movement. And it is also prevents the other wheel being affected by movement of the wheel on the opposite side and reduces body movement. Coil springs are used on the front suspension of most modern light vehicles. Then the spring act as an elastic object used to store mechanical energy. They can twist, pulled (or) stretched by some force and can return to their original shape when the force is released. A coil spring is made from a single length of special wire, which is heated and wound on a former, to produce the required shape. The load carrying ability of the spring depends on the diameter of the wire, the overall diameter of the spring, its shape, and the spacing of the coils.

Figure 1 SHOCK OBSERVER

II LITERATURE REVIEW

For providing the best design of spring coil to the suspension system of two wheeler vehicles. A lot of technical papers and reduction processes were studied before deciding upon the most feasible process for project. The following list presents a list of the main papers referred to, throughout the duration of the project.

N.Lavanya[1] The present work is optimum design and analysis of a suspension spring for motor vehicle subjected to static analysis of helical spring the work shows the strain and strain response of spring behaviour will be observed under prescribed or expected loads and the induced stress and strains values for low carbon structural steel is less compared to chrome vanadium material also it enhances the cyclic fatigue of helical spring.

Kommalapati.Rameshbabu [2] In this project they have designed a shock absorber used in a 150cc bike and modeled the shock absorber by using 3D parametric software Pro/Engineer. To validate the strength of design, structural analysis and modal analysis on the shock absorber was done. The analysis was done by varying spring material Spring Steel and Beryllium Copper. By observing the analysis results, the analyzed stress values are less than their respective yield stress values. The design is safe. By comparing the results for both materials, the stress value is less for Spring Steel than Beryllium Copper. Also the shock absorber design is modified by reducing the diameter of spring by 2mm and structural, modal analysis is done on the shock absorber. By reducing the diameter, the weight of the spring reduces. By comparing the results for both materials, the stress value is less for Spring Steel than Beryllium Copper. By comparing the results for present design and modified design, the stress and displacement values are less for modified design. So they c concluded that as per our analysis using material spring steel for spring is best and also their modified design is safe.

Rahul Tekade and ChinmayPatil (2015), designed a shock absorber to improve the comfort and safety of the passengers of the vehicle and also sustain the vibrations. They performed the structural and modal analysis of the shock absorber of the vehicle. They concluded that for the spring ASTM A228 (high carbon spring wire) will provide optimum results.P. Karunakar et al (2014), performed the comparative design analysis of the two wheeler shock absorber and designed the models of shock absorbers by varying material for spring using Creo. Also, they compared the models by analysing structural and modal analysis of the models of Structural Steel (ATM-A316), Inconel X750 and Nickel 2000 material on ANSYS. They conclude that Inconel X750 is best suited material for the spring of shock absorber.Sourabh G. Harale and M. Elango (2014) demonstration of composite material like a combination of conventional steel and a metal matrix composite of E-Glass fibre/Epoxy reinforced material in helical coil spring suspension. The results showed that there was decrease in the weight and increase in stiffness of the system but it also pointed out limitations like cost and manufacturing of E-Glass fibre, low stiffness of single composite spring.Achyut P. Banginwar et al (2014) investigated different models of shock absorbers by varying material for spring using Pro/Engineer. They also performed the structural analysis to validate the strength and modal analysis to determine the displacements for different frequencies for number of modes.SudarshanMartande et al (2013), have developed new correlated methodologies which will enable engineers in designing components of Shock Absorbers by using FEM based tools like ANSYS. They performed the experiment on a bike with 194kg weight, one person and then with two persons. They compared the FEA results with the analytical solutions and found out the errors to be 15%.

Saurabh Singh (2012), has demonstrated the feasibility of composite material for helical coil spring suspension system design. The author has replaced conventional steel with a mixture of steel and Glass Fibre/Epoxy which results in increased stiffness of the spring. The reason of implementing combination of steel and composite material was the low stiffness of single composite spring, which limits its application to light weight vehicle only.Priyanka Ghate et al (2012), attempted to analyse the failure of Freight Locomotive Suspension spring of primary suspension and redesigning of the spring to improve the durability and also the ride index. The results revealed to use a single nonlinear spring.Pinjarla.Poormohan and Lakshmana Kishore T. (2012), designed different models of shock absorbers by varying material for spring. They then compare the models by analysing structural and modal analysis of the models of Spring Steel and Beryllium Copper material. They used the ProEngineer for the modelling and ANSYS for the analysis of the shock absorber.Prince Jerome Christopher J. and Pavendhan R. (2010), designed and performed analysis of Shock Absorber performance by varying diameter of the coil spring. By considering bike mass, loads, and number of persons seated on a bike, comparison is done to verify best dimension of spring in the shock absorber. They used ProE and ANSYS for the modelling and analysis respectively.Budan, D. Abdul, T. S. Manjunathan (2010), demonstrated the feasibility of composite coil spring like glass fibre, carbon fibre and their mixture over the conventional metal coil spring. The experimental results show that spring rate of carbon fibre spring is much more than the other materials and its weight is also lower as compared to the other composite materials tested.Results revealed that the spring rate of the carbon fiber spring is 34% more than the glass fiber spring and 45% more than the glass fiber/carbon fiber spring. The weight of the carbon fiber spring is 18% less than the glass fiber spring, 15% less than the Glass fiber/carbon fiber spring and 80% less than the steel spring. Thus, we can see that a lot of research has been done on this topic. The ultimate goal of this study as discussed earlier is material selection based on different conditions and to lay a groundwork which can be used as a standard for the selection of material for the shock absorber used in the race car.

C.Madan Mohan Reddy [3] The comparative study has been carried out in between the theoretical values to the experimental values and the analytical values. The maximum shear stress of chrome vanadium steel spring has 13- 17% less with compare to hard drawn steel spring. The deflection pattern of the chrome vanadium steel spring 10%less at specified weight with compare to the hard drawn steel spring. It is observed that 95% of the similarity in deflection pattern and 97% similarity in shear stress pattern between experimental values to the analytical values. It is observed that 60%similarity in between theoretical values of deflection to the experimental values and 85% similarity in maximum shear stress of spring.

Among the many types of springs, wave springs have attracted considerable attention this kind of long and reliable source of long lasting durability and considerable effectiveness than rest of the springs (David Clarke, 2002). An analytical model for stamped ring wave springs is proposed, Because of the particular shape of the spring in the un deformed configuration, the load—deflection curve is found to be appreciably bilinear in character. A similar but less pronounced behavior is displayed also by the relationship between load and internal stresses. The analytical results are compared to earlier theoretical findings and are shown to correlate well with experimental measurements [1]. Wave springs are used to reduce the height of the spring and to produce the same end effect end that of a coil spring .these were first developed by SMALLEY Industries U.S.A in 1990’s. These also obey the principles of Hooke’s law discovered by Robert Hooke (Ulf Kletzin, 2007). So on taking the above basis wave spring application on suspension system is made. Suspension is the term given to the system of springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two (J.Mayor,1965). In general coil springs were used as a suspension system in the form shock absorber in 1901 by Mors automobile factory, France. A suspension system or a shock absorber is the mechanical device designed to smooth out or damp shock impulse and dissipate kinetic energy, in a vehicle it reduces effect of travelling over a rough road leading to improved ride quality (P.P.Mohan, 2005).A sustainable development of dynamic finite element program must develop on helical springs and structural analysis should also be done in precise (Doojong Kim 1999). Besides the great deal of experimental works on spring’s failure analysis of automotive suspension coil springs are also to be done to get the sustainable output (Prawoto Y., Ikeda M., Manville S. K. and Nishikawa A, 2008). Poornamohan & Lakshmana Kishore analyzed the strength of the shock absorber under various conditions by performing structural analysis and modal analysis[2,3].When the vehicle moves in the high speeds there must also be a requirement to make analysis fatigue and dynamic loading are to be done result of very high cycle fatigue tests on helical compression springs However, due to their huge computational tasks, practical experiments are also to be conducted on wave spring but due to high complexity, the analysis is done is only confined to studies of finite element analysis, so as to provide relatively sustainable outcome.

III OBJECTIVE OF THE PROJECT

3.1PROJECT OVER VIEW

When a vehicle is travelling on a level road, the spring is compressed quickly when the wheel strikes the bump. The compressed spring rebound to its normal dimensions or normal loaded length which causes the body to be lifted. The spring goes down below its normal height when the weight of the vehicle pushes the spring down. This, in turn, causes the spring to rebound again. The spring bouncing process occurs over and over every less each time, until the up-and-down movement finally stops. The vehicle handling becomes very difficult and leads to uncomfortable ride when bouncing is allowed uncontrolled. The designing of spring in a suspension system is very crucial. analysis of the spring by using different materials.

PROBLEM DEFINITON

The important problem that is faced by the automotive industry is that the vehicle handling becomes difficult and leads to uncomfortable ride when spring bouncing is uncontrolled. This is based on a number of parameters such as load applied and the duration of it.Therefore the existing material is steel, the main problem is developed more stresses, strain, deformations, finally change the material find out the stress, strain deformation, and which material is suitable for shock absorber spring selected based on Ansys results.

DESIGN CALCULATIONS : Mean diameter of a coil D=72mm Diameter of wire d = 8mm

Total no of coils n= 15 Pitch=14mm

Weight of bike = 150kgs

Let weight of 1 person = 75Kgs Weight of 2 persons = 75×2=150Kgs Weight of bike + persons = 300Kgs Considering Factor of Safety(FOS)=1.5Weight of Bike=200 kg(including FOS)

Wt of Bike+2 persons= 200+150 =350Kg (including FOS) Consider dynamic loads (w) = 450kg = 4414 .5N

Single shock absorber weight (W) = w/2 = 225.5kg = 2207.25N

3.2 MATERIAL PROPERTIES:

3.2.1 AISI 1050 STEEL:

Carbon steels contain carbon as the main alloying element. They are designated by AISI four- digit numbers, and contain 0.4% of silicon and 1.2% of manganese. Molybdenum, chromium, nickel, copper, and aluminium are present in small quantities. Impurities such as sulfur and phosphorous are also found in these steels.

Carbon steels are steels with carbon content up to 2.1% by weight. American Iron and Steel Institute (AISI) definition of Carbon Steel states:

Steel is considered to be carbon steel when: No minimum content is specified or required or chromium, cobalt, molybdenum, nickel, niobium, titanium, tungsten, vanadium or zirconium, or any other element to be added to obtain a desired alloying effect;

•The specified minimum for copper does not exceed 0.40 percent;or the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicon 0.60, copper 0.60.

The term "carbon steel" may also be used in reference to steel which is not stainless steel; in this use carbon steel may include alloy steels. as the carbon percentage content rises, steel has the ability to become harder and stronger through heat treating; however, it becomes less ductile. regardless of the heat treatment, a higher carbon content reduces weldability. in carbon steels, the higher carbon content lowers the melting point.

Table 1MATERIAL PROPERTIES AISI 1050 STEEL SPRING

MATERIAL PROPERTIES AISI 1050 STEEL SPRING	
Density	**7960kg/m^3**
Tensile strength	**636Mpa**
Young's modulus	**210Gpa**
Possion's Ratio	**0.28**

3.2.2 ASM A228 SPRING STEEL:

ASM A228 Spring steel is a name given to a wide range of steels used widely in the manufacture of springs, prominently in automotive and industrial suspension applications. These steels are generally low-alloy, medium-carbon steel or high-carbon steel with a very high yield strength. This allows objects made of spring steel to return to their original shape despite significant deflection or twisting.

- Applications include piano wire (also known as music wire) such as ASTM A228 (0.80– 0.95% carbon), spring clamps, antennas, springs, and vehicle coil springs, leaf springs, and s-tines.
- Spring steel is also commonly used in the manufacture of metal swords both historically and for stage combat due to its resistance to bending, snapping or shattering.

- Spring steel is one of the most popular materials used in the fabrication of lockpicks due to its pliability and resilience.

Table 2 MATERIAL PROPERTIES ASTM A228 SPRING STEEL

MATERIAL PROPERTIES ASTM A228 SPRING STEEL	
Density	7850kg/m^3
Tensile strength	1760Mpa
Young's modulus	208Gpa
Possion's Ratio	0.313

3.2.3 AISI 9255 SPRING STEEL:

AISI 9255 is a Standard grade ***Alloy Steel***. It is commonly called AISI 9255 Silicon- manganese steel. It is composed of (in weight percentage) 0.51-0.59% Carbon (C), 0.70- 0.95% Manganese (Mn), 0.035%(max) Phosphorus (P), 0.04%(max) Sulfur (S), 1.80-2.20% Silicon (Si), and the base metal Iron (Fe). Other designations of AISI 9255 alloy steel include UNS G92550 and AISI 9255.

Steel is the common name for a large family of iron alloys. Steels can either be cast directly to shape, or into ingots which are reheated and hot worked into a wrought shape by forging, extrusion, rolling, or other processes. Wrought steels are the most common engineering material used, and come in a variety of forms with different finishes and properties. Alloy steels are steels that exceed the element limits for Carbon steels. However, steels containing more than 3.99% chromium are classified differently as stainless and tool steels. Alloy steels also includes steels that contain elements not found in carbon steels such as nickel, chromium (up to 3.99%), cobalt, etc.

The typical elastic modulus of alloy steels at room temperature (25°C) ranges from 190 to 210 GPa. The typical density of alloy steels is about 7.85 g/cm^3. The typical tensile strength varies between 758 and 1882 MPa. The wide range of ultimate tensile strength is largely due to different heat treatment conditions.

Table 3 MATERIAL PROPERTIES AISI 9255 SPRING STEEL

MATERIAL PROPERTIES AISI 9255 SPRING STEEL	
Density	7850kg/m^3
Tensile strength	1035Mpa
Young's modulus	200Gpa
Possion's Ratio	0.29

3.2.4 DIN 17221 SPRING STEEL(67sicr5):

These steels have a high Carbon concentration to have a high yield strength. Furthermore these steels are supplied in a cold rolled state to improve their elastic limit even further. Mechanical properties increase with increasing Carbon concentration. These steels are non- weldable. Manufacturing of products is by cold forming of wire or punching articles from sheet. The steels included in Idemat have limited corrosion resistance and are only suitable for indoor applications. Chemical Composition: Composition of 67SiCr5 (DIN 17221 spring steel grade) in weight %: Ferro (Fe) rest, Carbon (C) 0.62-0.72, Silicon (Si) 1.20-1.40, Chromium (Cr) 0.40-0.60.

Table 4 MATERIAL PROPERTIES DIN 17221 SPRING STEEL(67SiCr5)

MATERIAL PROPERTIES DIN 17221 SPRING STEEL(67SiCr5)	
Density	7850kg/m^3
Tensile strength	1700Mpa
Young's modulus	210Gpa
Possion's Ratio	0.27

IV DESIGN PROCEDURE IN CATIA:

In sketcher specify a point 36mm distance form origin point now go to the wire frame and surface design work bench select helix specify the pitch=14,height=225,angle=0, and select vertical direction. Now go to the sketcher workbench create profile 8mm diameter go to part design work bench select rib option.

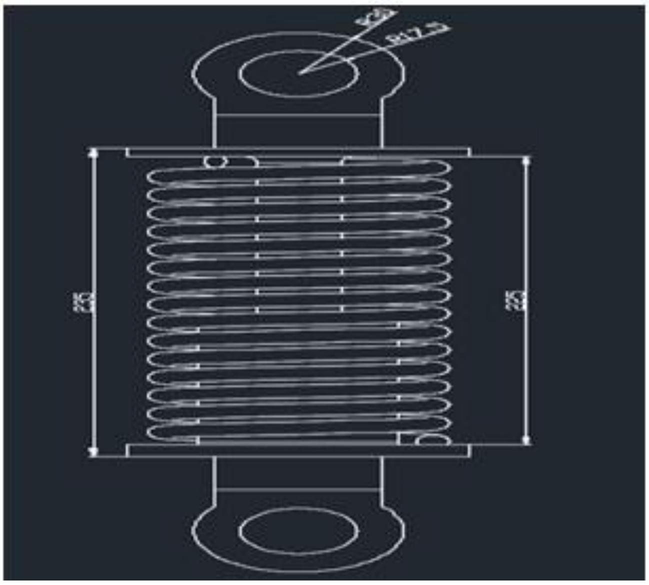

Figure 2 DIMENSIONS OF SHOCK ABSORBER

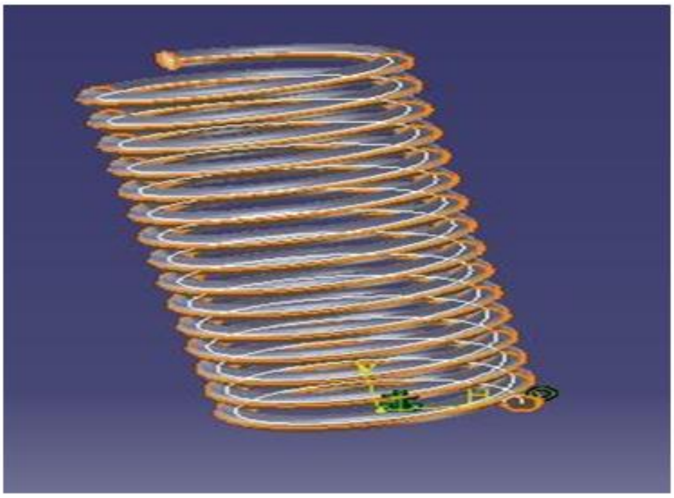

Figure 3 HELICAL SPRING

Again go to the sketcher workbench create upper mount,shaft,oil piston and valves go to part design workbench apply shaft 360 degrees.again to to sketcher create the lower mount and upper mount now select part design apply padding finally as shown below figure

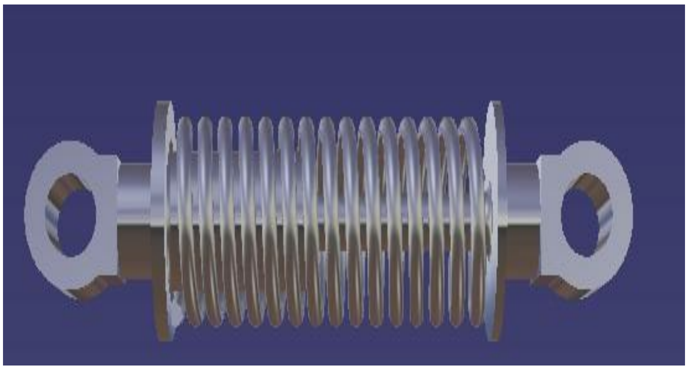

Figure 4 FINAL SHOCK ABSORBER

V INTRODUCTION TO ANSYS

5.1 INTRODUCTION TO ANSYS:

ANSYS is a large-scale multipurpose finite element program developed and maintained by ANSYS Inc. to analyze a wide spectrum of problems encountered in engineering mechanics**.**

PROGRAM ORGANIZATION:

The ANSYS program is organized into two basic levels:

- Begin level
- Processor (or Routine) level

The Begin level acts as a gateway into and out of the ANSYS program. It is also used for certain global program controls such as changing the job name, clearing (zeroing out) the database, and copying binary files. When you first enter the program, you are at the Begin level. At the Processor level, several processors are available.

Each processor is a set of functions that perform a specific analysis task. For example, the general pre-processor (PREP7) is where you build the model, the solution processor (SOLUTION) is where you apply loads and obtain the solution, and the general postprocessor (POST1) is where you evaluate the results of a solution.

An additional postprocessor, POST26, enables you to evaluate solution results at specific points in the model as a function of time.

5.2 ANALYSIS PROCEDURE IN ANSYS:

Designed component in CATIA V5 workbench after imported into ANSYS workbench now select the steady state thermal ANALYSIS.

1. ENGINEEERING MATERIALS (MATERIAL PROPERTIES).
2. CREATE OR IMPORT GEOMENTRY.
3. MODEL (APPLY MESHING).
4. SET UP (BOUNDARY CONDITIONS).
5. SOLUTION.
6. RESULT.

STATIC ANALYSIS:

Used to determine displacements, Stresses, Strain, Deformation etc. under static loading conditions in both linear and nonlinear static analysis. Nonlinearities include plasticity, stress stiffening, large deflection, large strain, hyper elasticity, contact surfaces, and creep. Apply Material for crankshaft (grey cast iron, mmc material, steel).

STEP 1: First the domain is represented as finite elements. This is called descritization of domain. Mesh generation programs called processors, help in dividing the structure.

STEP 2: Formulate the properties of each element in stress analysis. It means determining the nodal loads associated with all element deformation stress that is allowed

STEP 3: Assemble elements to obtain the finite element model of the structure.

STEP 4: Apply the known loads, nodal forces in stress analysis. In stress analysis the support of the structure has to be specified.

STEP 5: Solve simultaneous line algebraic equations to determine nodal displacements in the stress analysis.

STEP 6: Postprocessors help the user to sort the output and display in the graphical output form.

A typical finite element model is comprised of nodes, degrees of freedom, elements material properties, externally applied loads and analysis type. The finite element method is a numerical analysis technique for obtaining approximate solutions to a wide range of engineering problems.

5.3 STRUCTURAL ANALYSIS OF COIL SPRING

Structural analysis is the study of the static response of the structures under the loads. In structural mechanics is to determine the deflections of a object or structure under load conditions. Static analysis used to determine displacements, stresses, etc. under static loading conditions. ANSYS can compute both linear and nonlinear static analyses. Nonlinearities can include plasticity, stress stiffening, large deflection, large strain, hyper elasticity, contact surfaces, and creep.To study the effect of deflection for various materials, a load is applied on coil spring for different materials by keeping the length constant. The load is considered as 2207.25N for single shock absorber weight. On these Materials DIN 1722 SPRING STEEL(67sicr5), AISI 9255 SPRING STEEL, ASM A228 SPRING STEEL, AISI 1050

STEEL,as shown below figure.

BOUNDARY CONDITIONS:

The shock absorber is modeled in catia using helical sweep command and the bottom and top cover of the spring are modelled using pad option. The modeled spring is imported into Finite Element Analysis software by converting it into IGS file. The imported file is opened in FEM software and meshed using face sizing mesh nodes=12601 and elements =5280 as shown below figure

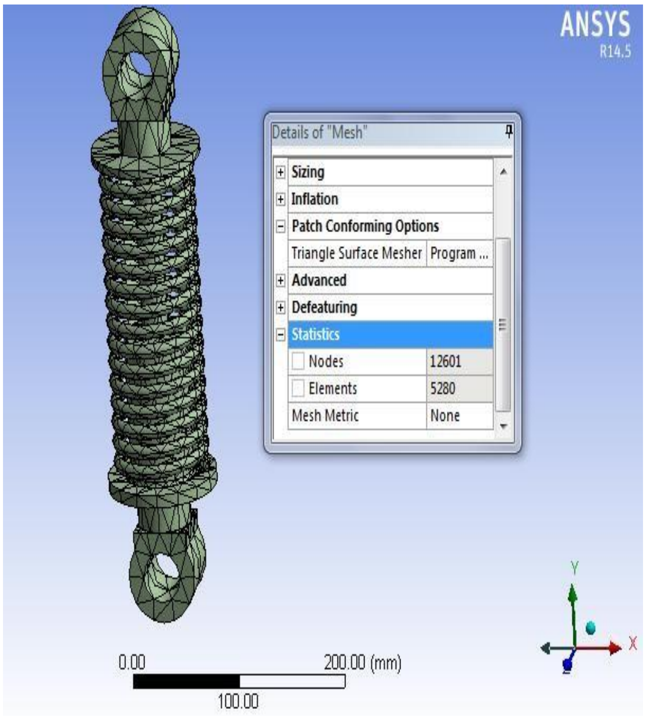

Figure 5 Meshing

As shown below figure fixed at one end and apply load at another end 2207N taking the boundary conditions.

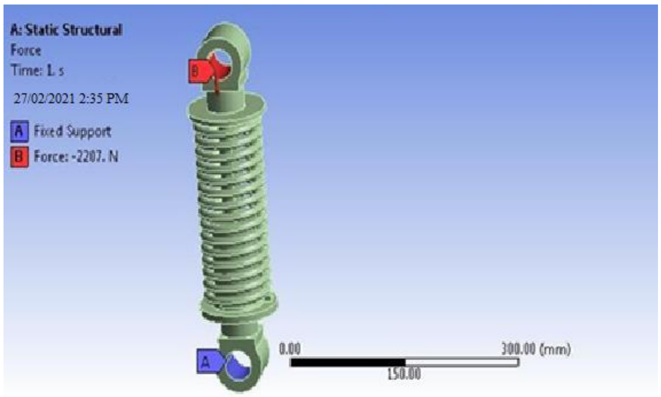

Figure 6 Boundary conditions

VI RESULTS AND DISCUSSIONS

The constructed shock absorber in catia is analyzed using ANSYS V14.5.0 and the results are depicted below. The different stress, strain and deflection values in shock absorber components have been obtained using FEA tools finally concluded suitable material for shock absorber.

6.1 1050 STEEL SPRING:

The stress, deflections , strain obtained by in the simulation analysis.

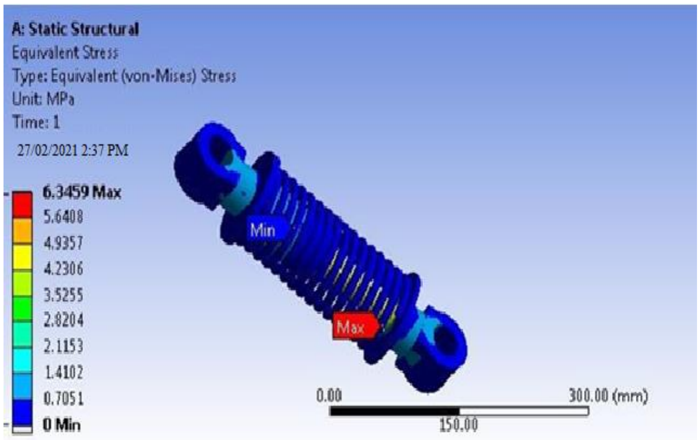

Figure 7 Equivalent stress (von-mises stress)

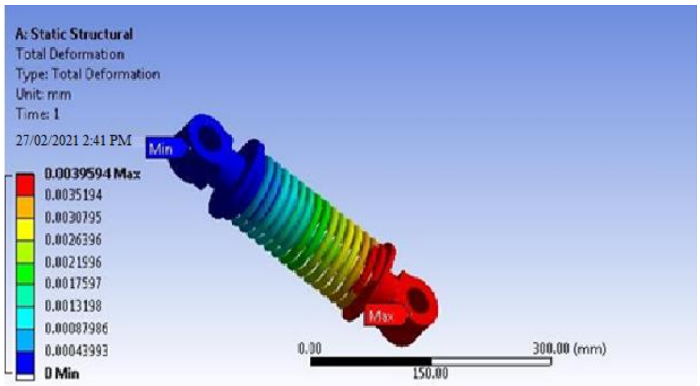

Figure 8 Total deformation.

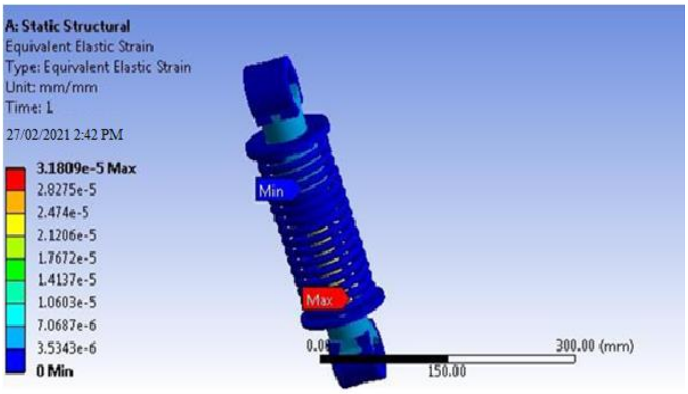

Figure 9 Equivalent Elastic strain

VIICONCLUSION:

Conclusion Designed and Modelled a bike shock absorber by using 3D parametric catia and analysed the shock absorber by using Ansys software. Analysis result [deformation, stress, strain] Shows for four different materials 1050,steel,ASM A228 SPRING STEEL,AISI 9255 SPRING STEEL,DIN 1722 SPRING STEEL (67SICR5) From this results conclude DIN 1722 SPRING STEEL (67SICR5)is better than the remaining materials. Because of less stress, deformation, strains, So future work is to analysis the DIN 1722 SPRING STEEL (67SICR5) is suitable material for load conditions as well as various factors.

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