ANALYSIS ON SHOCK ABSORBER WITH DIFFERENT MATERIALS

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Abstract

The purpose of a shock absorber is to minimize the impact of shock impulses and dissipate kinetic energy, resulting in a smoother ride quality and increased comfort while traveling over rough terrain. This project involved designing a suspension system and creating a 3D model of it using CATIA V5 R21. The model was modified by adjusting the thickness of the spring, and various spring materials (Spring Steel, Phosphor bronze, Beryllium Copper, and Titanium alloy) were used to conduct structural and modal analyses on the shock absorber. Structural analysis was carried out on the helical spring to validate the model's strength. The analysis considered factors such as loads, bike weight, and single and double riding. Modal analysis was also performed to determine the displacements for different frequencies and modes. Finally, the different spring materials were compared to identify the best material for the shock` absorber. The modeling was done using CATIA, while ANSYS was used for the analysis.

***Keywords**:*
Cylinder,Tortionbar,Titanium,Vibration,Magnet,,Spring.

I. INTRODUCTION

A shock absorber, also known as a damper, is a mechanical device used to smooth out or dampen the impact of shocks and dissipate kinetic energy. They are commonly found in automobiles, aircraft landing gear, and industrial machines. Shock absorbers consist of a cylinder filled with fluid or air and a piston that moves inside the cylinder. They are important for providing a comfortable ride by reducing the effect of traveling over rough terrain and preventing excessive suspension movement. Without shock absorbers, the vehicle would bounce excessively and have a harsh ride. Spring-based shock absorbers commonly use coil springs or leaf springs, but these alone are not sufficient for shock absorption. Instead, hydraulic shock absorbers are used to absorb and dissipate vibration. Spring-based shock absorbers often use coil springs, leaf springs, or torsion bars, but springs alone do not absorb or dissipate energy. That's why hydraulic shock absorbers are used in combination with springs to control suspension movement. The hydraulic piston absorbs and dissipates vibration, reducing the amplitude of disturbances. Shock absorbers play an essential role in preventing railcars from swaying excessively, preventing damage to railcar structures and station platforms. They can also be used in structural engineering to reduce the susceptibility of buildings to earthquake damage and resonance. Overall, shock absorbers are crucial components in ensuring a smoother, safer, and more comfortable ride in a variety of applications. When it comes to converting an impact or collision into a smooth and cushioned contact, there are various methods available. One method is to use metal springs, which are designed to absorb and dissipate kinetic energy by deforming when a force is applied to them. Another method is to use rubber buffers, which work by absorbing the energy of impact through the deformation of the rubber. Hydraulic dashpots are another option, and they work by using a piston to push fluid through a small orifice, creating a resistance that slows down the movement of the piston. Finally, collapsing safety shock absorbers are designed to absorb the energy of an impact by collapsing or compressing in a controlled manner, thereby reducing the force that is transmitted to the object being protected. Each of these methods has its own advantages and disadvantages, and the choice of which method to use will depend on the specific application and the requirements of the system being protected.

II. TYPES OF SCHOCK ABSORBERS

There are several common ways to receive shock:

Constraints of structural materials, such as compression of rubber sheets, tension of rubber bands and ropes, bending of steel springs or torsional hysteresis of rods in flexible materials with less force than required. A normal car without shock absorbers is completely vulnerable to spring and tire damage.

on the lever axle (traditionally made of leather), friction created by springs and dry friction used in wheel brakes were used on some British cars from the 1940s onwards. Although now considered obsolete, this is one of the advantages of the system. Its technical simplicity. The level of damping can be easily and simply adjusted by tightening or loosening the screws holding the plate.

A simple weapon. The disadvantage is that the damping force does not increase with the speed of vertical movement.

Solid-state short-circuit coils often use an axial arrangement of one or more spherical cones in a metallic housing such as Nitinol [1].

Fluid friction, such as water flowing through a narrow channel (hydraulics), causes most vehicle shock absorbers. The advantage of this type is that a special internal valve can be used to soften the blow. Relatively stiff for compression (smooth response to finish) and recovery. Thus, "hop" controls the vehicle's response to energy stored in the pavement. Similarly, the control valve spring varies in stiffness depending on the degree of impact or return speed. Race-specific shocks increase drag with minimal drag during acceleration, then provide strong landing resistance while maintaining the rear weight distribution required for optimal traction. Some shocks allow travel to be adjusted by valve control with manual adjustment provided in the shock. In expensive cars, the valve can be adjusted remotely, which allows the driver to control the desired throttle while driving. Basic handling is provided by computerized variable valve control in response to sensors, a smooth ride when needed and firm suspension. Most shock absorbers contain pressurized nitrogen, which reduces the tendency to foam due to excess oil. Temporarily reduce the power of

the foam. Heavy-duty units used for racing and/or off-road use may have a second cylinder mounted on the shock that serves as a reservoir for water and compressed gas. Another type is geomagnetic hardening, which uses electromagnetic fields to change the properties of water.

Air pressure, such as a pneumatic spring, can act as a spring and resist when air pressure increases. When the air pressure reaches the desired maximum level, the air spring acts like a hydraulic spring. The air springs on the landing gear of the aircraft can be operated by water jets, reducing drag. These devices are called oleo (oil-air) supports [3].

Magnetic effect. Eddy shock absorbers are now shock absorbers consisting of large magnets and non-electrical tubes.

Poor acceleration resistance, e.g. pre-1966 Citroen 2CV [4] 3.5 kg (7.75 lb) compact springs, shock absorbers and wheel arches with no external moving parts.

The integrated hydraulic system has a spring function, like some Citroën models. including water per unit and vehicle height

Conventional shock absorbers are combined with coil springs for unequal length and height adjustment. It is also available in larger and luxury trucks such as Lincoln and Land Rover.

The performance of high frequency (noise) shock absorbers is limited when compressed gas is used as the working medium or used on rubber pads.

The heavier and faster the object, the more energy the object has. Energy absorption technologies include rubber cushions, metal springs, air sources, and waterproofing. Shock evacuation methods usually involve a spring evacuation method If the system continues to operate under shock, the dampers should be lowered to reduce accidental effects. especially the sticky damper. which releases energy in heating water Common examples of shock absorbers in everyday life are safety helmets, steel toes in industrial shoes. collapsible car bumper and road block see below.

III.TYPES OF SHOCK ABSORBER

There are several different ways to turn a bump into a relatively smooth connection.

- Metal spring
- Rubber buffer
- Hydrometer
- Simultaneous safety dampers
- Pneumatic cylinder
- Self leveling irrigation system

1. Metal source

Finding a mechanical spring that absorbs shock loads is a cost-effective way to reduce falls and minimize vibration. They can work in extreme temperatures. These devices provide great stopping power at the end of the journey. A metal spring stores energy, but does not lose it. When using shock shells, measures must be taken to prevent vibrations. Metal springs are often used with adhesive shock absorbers.

There are many types of mechanical springs such as coil springs, cone springs, leaf springs, ring springs and mesh springs. Each type of bathroom has its own characteristics.

2.Elastomatic Shock absorbers.

This is a useful option for reducing wear and tear, reducing load and improving fluidity. Easy to adjust. These engines have stopped power and water inside at the end of the car. Elastomer shock absorbers are widely used because of their efficiency. In addition to affordable prices and benefits. The natural viscosity of the elastomer prevents excessive vibration during pulling. It is cheaper than metal springs. However, elastomer-based shocks cannot withstand heat and cold. and drug it. Silicone rubber can provide excellent properties from -500°C to +1800°C - most elastomers can withstand this temperature.

3.Hydraulic Dashpot

Such emergencies rely on ordinary electric batteries. As the stem moves, it exerts a force on the pore fluid, stopping the flow and losing control over the stem. The action is so fast that the stroke is started with a single injection. The braking force peaks at the beginning of the impact and then decreases rapidly. After shaking, the system is stable. The energy is dissipated as heat in an electric fluid. Such shock absorbers have enough springs to return the movement to its original position after the shock load is removed.

4.Collapsing Safety Shock Absorbers

Disposable tools are often designed specifically for a specific task. They are designed to fall and break when the energy is absorbed by the material deformation in the impact zone. Therefore, a material based on bending in the elastic region is better.

5.Air (Pneumatic) spring

This machine uses air as a propellant. Air is stronger than steel or elastomeric materials. High-pressure air and fluid springs are often more compact than comparable steel or elastomer devices. At the end of the ride, the power characteristics increase due to air compression. Most of the energy is absorbed near the end of the coil Air springs require more maintenance than powder or elastomer springs and have limited heat capacity compared to metal springs.

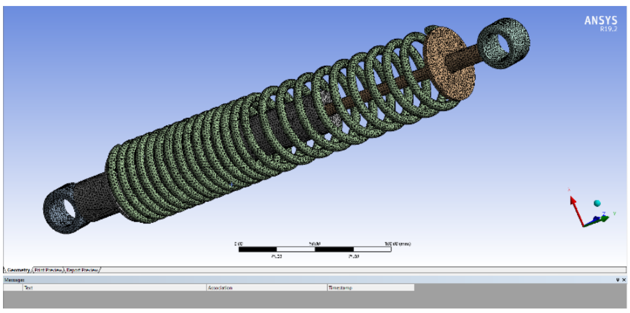
6.Self compensating Hydraulic

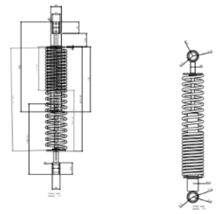
This device is similar to the hydraulic car type, except that the boat has more space for various restrictions. It is designed so that the shock moves easily and smoothly with constant force throughout the shock stroke. Lighten the load with lower power in minimum time to eliminate unnecessary loss of power and damage to machinery and equipment. This type of shock absorber is flexible enough to allow the vehicle to return to its original position after the impact load is removed.

IV.DESIGN CALCULATIONS FOR HELICAL SPRINGS FOR SHOCK ABSORBERS

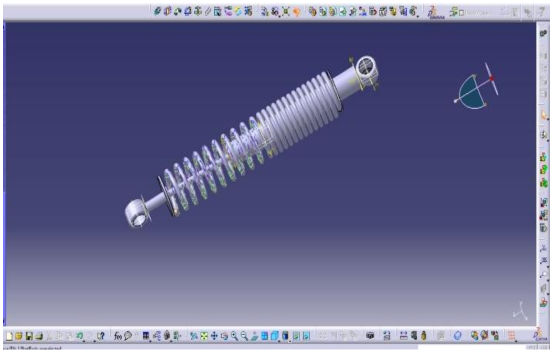
Material: Steel (modulus of rigidity) (G) = 41000 N/mm2
Mean diameter of a coil (D) = 62mm
Diameter of wire (d) = 8mm
Total no of coils (n1) = 18
Height (h) = 220mm
Outer diameter of spring coil (D0) = D +d =70mm
No of active turns (n) = 14
Weight of bike (w) = 125kgs
Let weight of 1 person = 75Kgs
Weight of 2 persons = 75×2=150Kgs
Weight of bike + person = 275Kgs
Rear suspension = 65%
65% of 275 = 165Kgs
Considering dynamic loads, it will be double (W) = 330Kgs = 3234N

A.Tetra Meshed Model



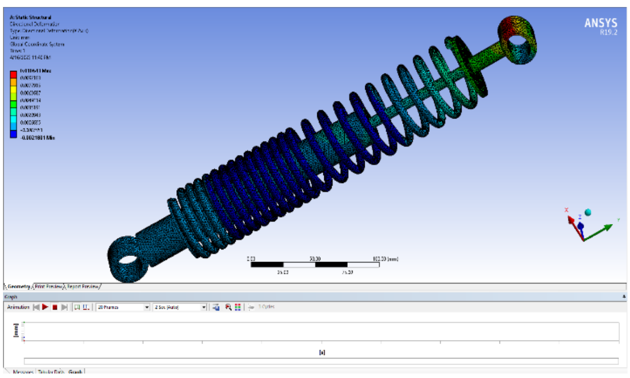


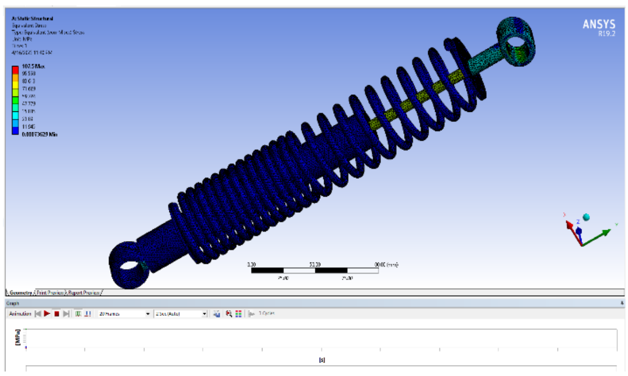
B)Assembly



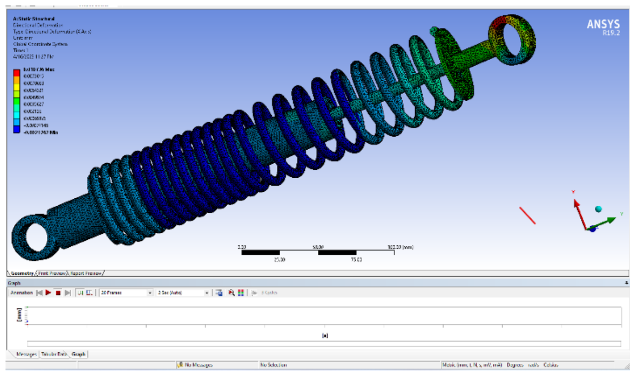
C)CATIADrawing

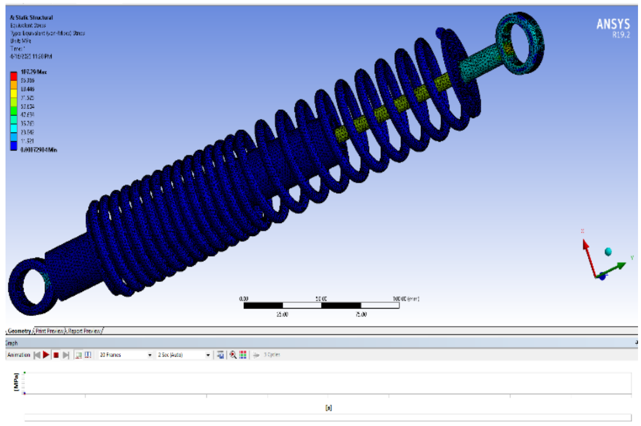
1.Structural Analysis for bike weight (3234 N) using Spring Steel as spring material



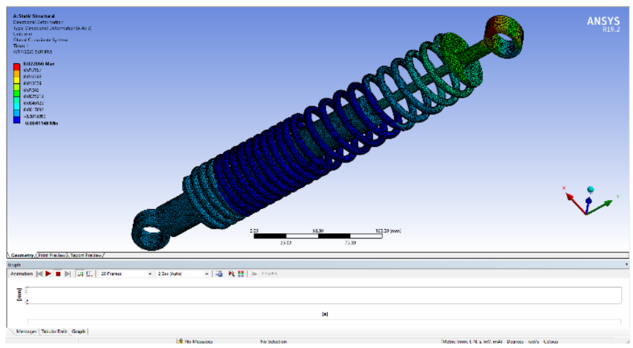


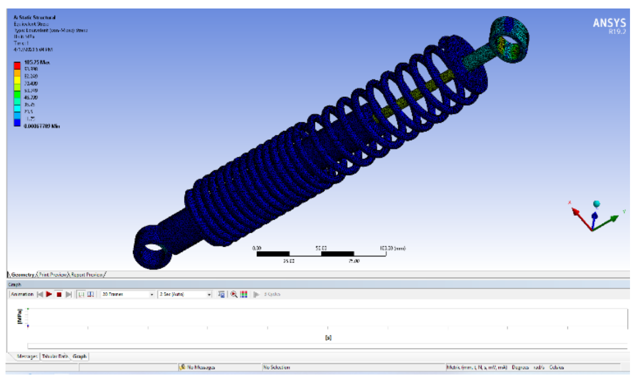
2.Structural Analysis for bike weight (3234 N) using Structural Steel as spring material



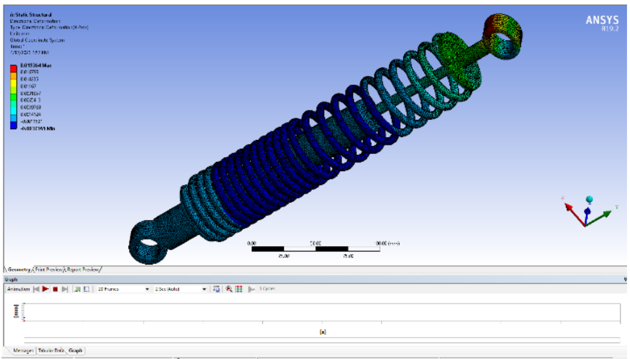


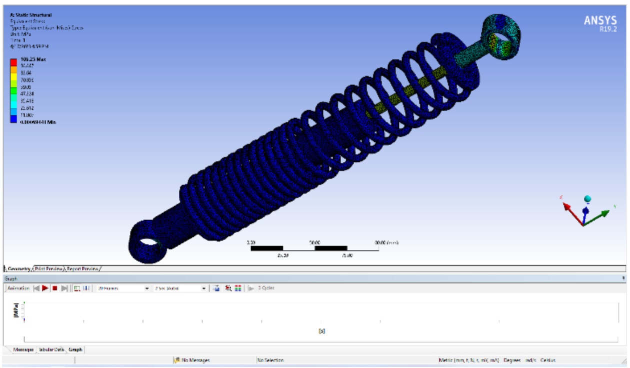
3.Structural Analysis for bike weight (3234 N) using Structural Steel as spring material





4. Structural Analysis for bike weight (3234 N) using Copper Alloy as spring material





V.Material Properties:

Sr no.	Material	Young's Modulus(N/ mm^2)	Density (Kg/mm3)	Poisson's ratio
1)	Spring Steel	202000	7820	0.292
2)	Structural Steel	210000	7750	0.28
3)	Titanium Alloy	102000	4850	0.3
4)	Copper Alloy	130000	8100	0.285

VI.Result :

Sr. no	Parameters	Spring Steel	Structural Steel	Titanium Alloy	Copper Alloy
1)	Maximum displacement(in mm)	0.010643	0.010736	0.022066	0.019364
2)	Maximum stress intensity	107.5	107.29	105.75	106.25

VII.CONCLUSION

In this scheme, the spiral bow wins the shot. Using the CATIA 3D parametric software,Analyzes were performed using ANSYS as the general model. finite element analysis (FEA) software. To ensure the integrity of the packaging design. The coil spring was structurally analyzed Steel, titanium and other various spring materials copper and structural steel and alloys. are analyzed to determine speed Different frequencies for the number of modes maximum displacement and stress intensity Relevant materials for review purposes are listed below. Our Design Ability We build structures analysis.

VIII.REFERENCE.

1)"Design and Analysis of a Pneumatic Shock Absorber for a Bike" by R. Ravi and K. Suresh Babu.

2)"Design and Analysis of a Twin Tube Shock Absorber for a Bike" by G. Lakshmi Narayana and K. Vinod Kumar.

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4) "Design and Analysis of a Composite Shock Absorber for a Bike" by M. Ravi Shankar and B. Vijaya Ramnath".
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