

# AIRBAG SUSPENSION FOR MOTORCYCLES

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## ABSTRACT

Motorcycle market has spiked significantly in recent past. This is primarily due to the affordability, compact size, agile, consume less fuel, pass easily through congested areas, require less maintenance compared to cars and can glide through traffic smoothly. Many people use motorcycle for their daily commute, to go on adventures on weekend or to travel to nearby town or cities.

Despite these advantages, motorcycle riding is a relatively complex and risky process. Motor cycle and Motorcyclists are exposed and are vulnerable to a variety of hazards in their surroundings. Significant amount of damage is done when suspension is damaged or exposed to fatigues. Secondly, due to prolonged riding severe back pain is caused to the motorcyclist. To reduce the damage this project aims to design an airbag, which can be inserted in the suspension of motorcycle for hassle free and comfortable riding experience.

This paper presents the design of a product, which has potential to reduce damage on vehicle and provide relaxing riding experience to the user. The product is designed in such way that that it can fitted in motorcycle easily by a technician or nonprofessional. Product design is lightweight, portable, and reliable.

**Keywords** – Airbag, Motorcycles, Suspension, Airbag suspension.

**Subject to be Publish under** – Engineering.

## I. INTRODUCTION

The inventions for new machinery and vehicles has increased the need for mechanical elements that are able to eliminate undesired vibrations. All the vehicle suspensions are designed with the same end, i.e., to filter out the vibrations coming from the tyres which is in touch with roads. One such suspension system is the air suspension having certain advantages over the classical mechanical suspension systems is to reduce road wear and increasing passenger comfort. It is well known that air suspensions can provide both a soft ride at lesser speed on good roads and Stability and control on rough roads at high speed. Moreover, the vehicle's chassis height is adjusted to suit the particular conditions of any given trip [1]

Air suspension is used in place of conventional steel springs in passenger cars, and in heavy vehicle applications such as buses and trucks. It is broadly used on semi-trailers. The purpose of air suspension is to provide a smooth, constant ride quality. The vehicle has constant

height i.e. the vehicle is not lowered when the load is kept in it. By using these suspensions the vehicle can be used on both streets and off the tarmac. Increasing the height of the vehicle, it becomes easy to manoeuvre over obstacles. One of the main reasons to use this is the body height of the vehicle can be controlled and it can actively regulate and control the height of the vehicle body according to actual driving conditions and operation requirements and it has important significance to improve the ride comfort, passing quality, the control stability and the fuel economy of the vehicle.

## II. AIM AND OBJECTIVE

Aim-

- Safe and effective way to reduce motorcycle damping.
- Safe and effective way to reduce fatigue and stress on suspension.

Objective –

- Design a product that can be easily installed in suspension of any motorcycle.
- Design a product, which is portable and effective.

## III. LITERATURE REVIEW

1. A suspension system is an often more stressed area. From a comfort and safety standpoint, a suspension is integral to how the vehicle drives. Shock absorbers and coil springs help absorb and direct road force, maintaining the wheel's oscillations, bounces and rebounds. However, every time weight to a vehicle is added or taken away, speed up or slowed down, or turned left or right, the problems what the shock absorbers and springs are facing is very large. In air suspension, the spring are replaced by air bags. Each air bag is filled with compressed

air, which supports the weight of the vehicle. The air is further compressed and absorbs the shock when the wheel encounters a bump on the road. An air compressor supplies air to the system and its driven with the help of a belt from the engine.

### *Functions of a Suspension System*

- To prevent the road shocks from being transmitted to the vehicle frame.
- To preserve the stability of the vehicle in pitching or rolling, while in motion.
- To safeguard the occupants from road shocks.
- To provide good road holding while driving, cornering and braking.

### *Requirements of a Suspension System*

- Minimum deflection consistent with required stability.
- Compatibility with other vehicle components such as tyre, frame, wheelbase, etc.
- Minimum wheel hop.
- Low maintenance and operating costs.
- Low initial cost.
- Minimum weight. [2]

2. Air suspension is generally used in heavy vehicles:-

Problem heavy vehicle exhibit :

- Excessive whole body vibration at the driver's seat.
- Excessive maintenance due to vibration related damage in the broad sense.
- Constant steering input to control wandering.
- The occurrence of significant divergence from the intended vehicle path without driver input.

3. Air suspensions preferred over spring/coil suspension:-

- Reduced noise, vibration and harshness

It is much more comfortable for the driver – noise, vibration and harshness causes driver fatigue and discomfort, so if you can reduce this, it is safer.

It is easier on components – reduced vibration and harshness means better wear on other components in the vehicle. Vehicles tend to last longer when on air suspension, as the components do not suffer as much vibration. It reduces the tendency to bounce over rough terrain when the truck is empty.

- Improved fuel consumption.

Some air suspension systems can optimise the ride height based on the speed of the vehicles and whether it is loaded or unloaded. Unloaded vehicles usually sit higher because there is less weight pushing the suspension down, but this is bad for wind resistance. A lower ride height means better aerodynamics because it reduces the wind resistance.

Because the suspension is better suited to the road surface, higher corner speeds can be achieved leading to time saving on routes with many turns.

There is some trade-off in the fuel benefits in the form of a small amount of extra fuel used to run the air suspension compressor when needed.

- More versatile on all types of terrain.

It is sometimes height adjustable – adjustability can help with different types of loads, and air suspension sometimes comes with a ‘kneel’ mode to help with loading, and a ‘raise’ mode to help clear bumps and rough terrain.

It is sometimes adjustable for feel, enabling better drivability; a driver can choose a softer ride for motorway cruising, or a harder ride with better handling on roads, which are more demanding.

Air suspension is more consistent. Systems can ensure the vehicle is level side-to-side in the case of loads, which are difficult to load evenly, and it

can reduce body roll in corners. You can effectively eliminate suspension sag.

Because the suspension can be levelled with any load (using a height control valve), it allows a trailer to be built to a higher top and lower floor while maintaining consistency and ensuring that a trailer is never over-height.

- Better, load carrying capacity.

Fragile loads such as large panes of glass benefit from being carried on vehicle with air suspension, as there is less risk of breakages. Other loads benefit from air suspension, too, meaning that a vehicle becomes more versatile and therefore is less likely to be running empty.

Air suspension can increase the ability to transport some loads by creating better grip through levelling the suspension

- Improved tyre life.

Suspension that is more effective means less vibration that has to be accommodated by the tyre and this leads to better tyre wear.

- Less damage to road surfaces.

There are actual benefits to the road network as it causes less damage to the road and bridges. Less vibration is transmitted into neighbouring buildings and structures.

- Less load shifting and damage.

When there is less vibration through the suspension, it is better for the load. While improvements in packaging and load restraint have reduced the amount of damage caused to loads on bumpy roads, the smoother ride of air suspension adds that extra level of cushioning. [3]

#### IV. DESIGN STRUCTURE AND WORKING

##### 1. CAD model

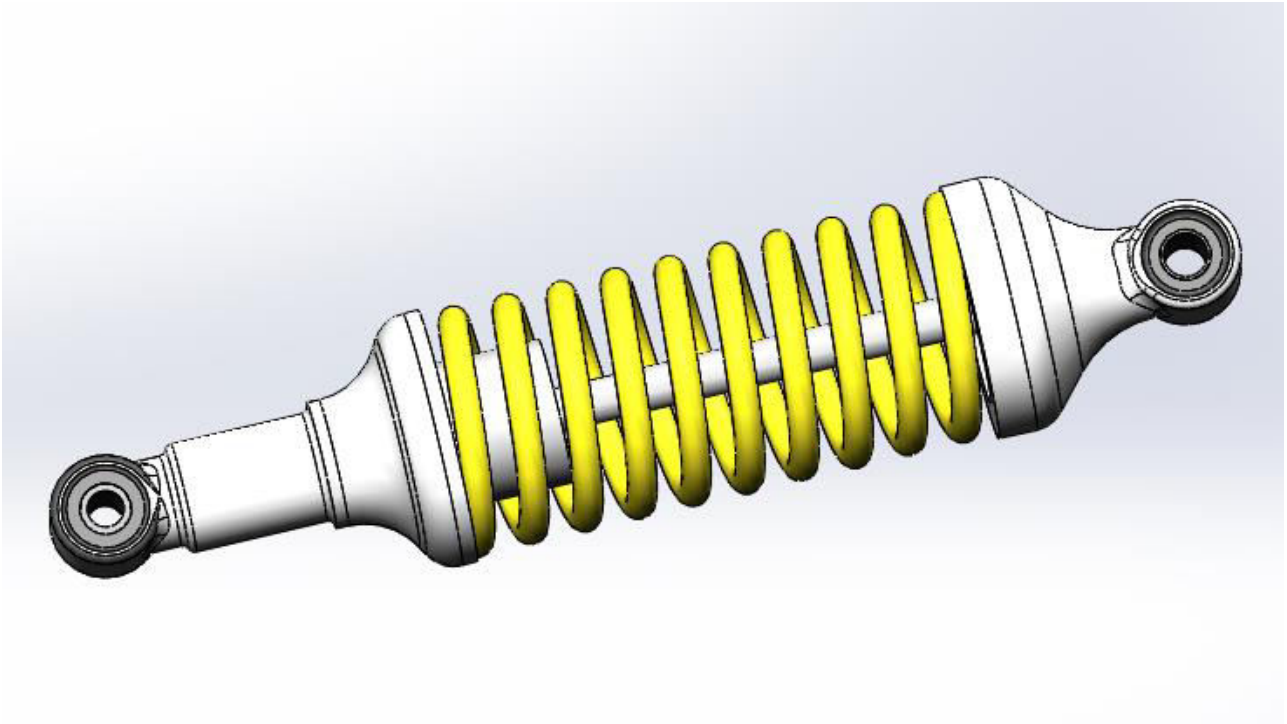


Figure 1. Motorcycle suspension without Airbag.

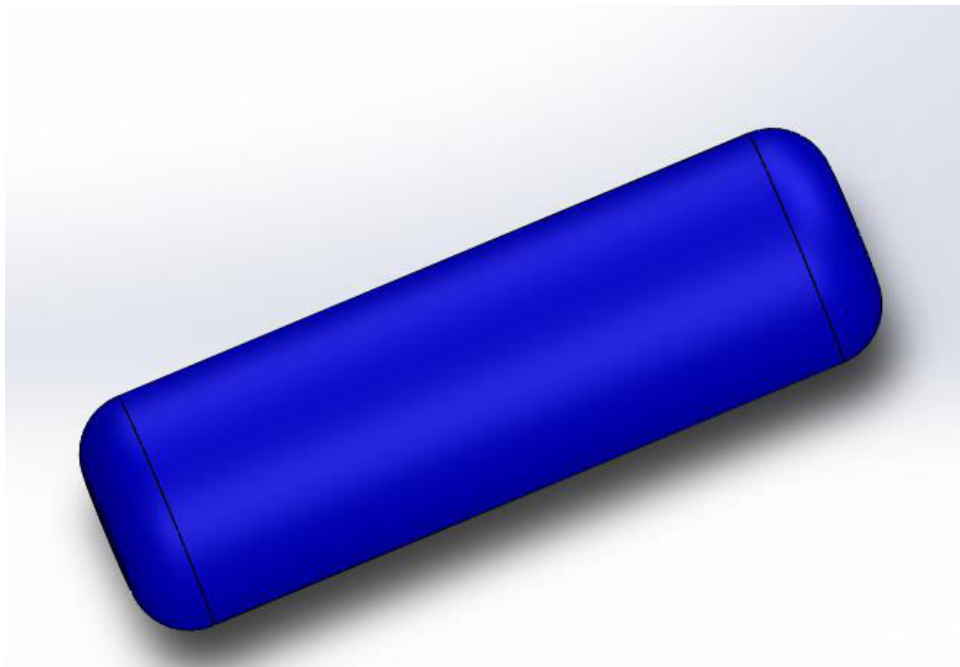


Figure 2. Airbag for Motorcycle suspension.

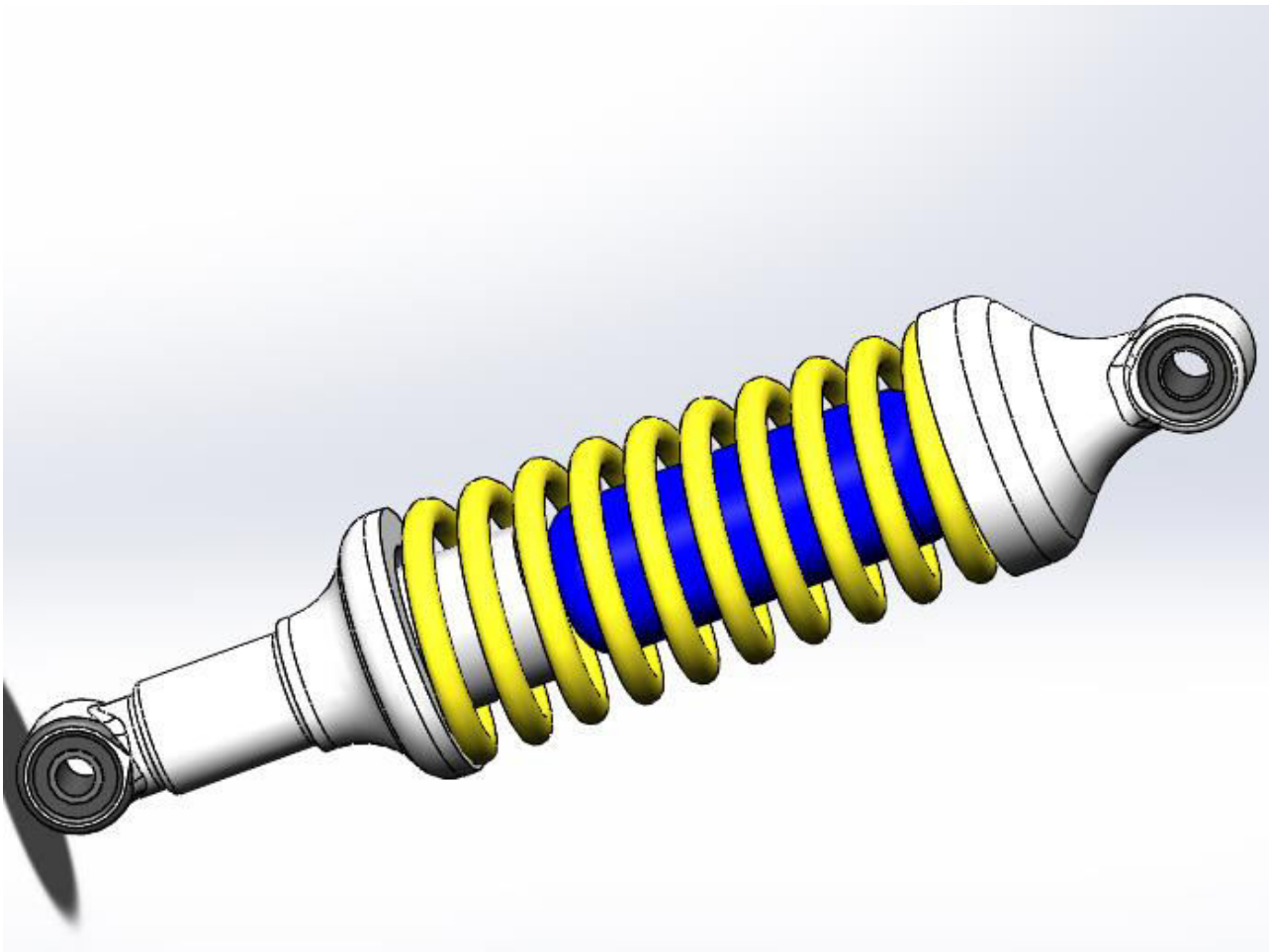


Figure 3. Motorcycle suspension with Product (Airbag) fitted.

## 2. WORKING

Airbag can be fitted in the suspension of motorcycle between the coils. Installation process is easy user needs to remove the coil from suspension fit the airbag in it and put back in same position. Airbag can be adjusted for varying loads and road conditions by inflating or deflating, just like inflating or deflating a car tyre, to give you levelling control of your vehicle. Airbags will give your vehicle the extra support needed in the suspension for more comfortable, economical and safer driving.

You can add air via a service stations tyre inflation facilities or if you have a portable compressor that will work perfectly as well. If you wanted to inflate or deflate your airbags from the comfort of your vehicle,

## 3. MATERIAL OF AIRBAG

The bag can be made from a composite of rubber and polyurethane, which provides toughness against light abrasion from road debris and sand, structural integrity, air-tight construction, and resistance to salt and chemical corrosion.

## V. CONCLUSION

This product is designed based on literature and research on different journal and papers relevantly available and designed in accordance so it provides flexibility in operation. This product is designed to provide comfort. It can be used to adjust the height of the vehicle according to the need. It reduces damping, vibrations and stress on the spring. Assembly is easy and can be used in any model of motorcycle. This product

can be further improved by attaching a portable air compressor and integrating it with ECU.

## **VI. REFERENCES**

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- [3] Darren Cottingham, “Institute of Advanced Motorists and the NZ Motoring”