

# Magnetic Suspension in Automobiles

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**Abstract:** Suspension is a mechanical arrangement contributing to vehicle's road handling behaviour. If roads were perfectly flat with no irregularities, suspensions wouldn't be necessary. It's these imperfections that apply force to the wheels. There are many types of suspensions such as double wishbone, trailing arm and air shocks. But these suspensions possess some disadvantages such as vibration, mechanical failure and stiffness variation. So in this paper we have introduced the idea of "MAGNETIC SUSPENSION" which will enhance the driving pleasure and control over road. Magnetic suspension will allow us to get variable stiffness and much higher comfort just by playing with magnetic field. It will also allow us to reduce wear and tear along with less maintenance. The magnetic suspension has two cylindrical tubular structure having electromagnets on both ends. The magnetic field will be induced using battery power which is produced by electromagnets using a feedback loop. Also when current passes through a wire, a magnetic field around that wire is generated. When the current through the wire stops, so does the previously generated magnetic field. The strength of the generated magnetic field is proportional to the rate of current through the wire. When a wire is coiled, this generated magnetic field is concentrated to the centre of the coil. The strength of this field can be increased by placing a ferromagnetic material in the centre of the coil. The arrangement will be in such a way that same poles will be facing each other resulting in repulsion of the magnets. That is either (+) positive - (+) positive or vice versa. Reducing vehicle's vibrations while travelling on irregular roads, the magnets will act as dampers and damping effect will be produced due to repulsion between them. Moreover stiffness can also be controlled by varying magnetic field according to the requirement.

## 1. INTRODUCTION

A vehicle is a mechanical arrangement which is used to transfer people or goods from one location to other with ease. There have been a lot of developments in the field of automobile from its initial days to make the ride comfortable and easy. There are remarkable developments in engine, steering, brakes, tyres, chassis and suspension and have evolved more or less completely from its initial days of invention. One of the greatest developments has taken place in the field of suspension. It has evolved a lot. The first ever mass production car is used in suspension employed transversely mounted semi-elliptical spring for both the front and rear beam axle, to the latest adaptive air suspension, using

air as damping agent and now the most advanced one is the MAGNETIC SUSPENSION.

The basic role of suspension is to isolate the vehicle from the road shocks and vibration so that it could be a comfortable ride for these passenger and goods are in their proper condition too. The suspensions act as a link between vehicle tires and chassis. The vibrations from the wheels are reduced by suspension only. The suspension gives the cushioning effect.

The basic role of suspension can be understood by this example:- let's say a car is moving on any surface, the surface may have so many deformities. At that time the suspension only helps to reduce the vibrations and ease the passengers. One more example can be quoted:-when the vehicle is moving on a straight road and then if a turn is there the vehicle will accordingly turn then due to centrifugal forces, the vehicle ride height may change thus resulting in discomfort, hence suspension plays the most crucial role by give a good ride.

There are lot of types of suspension. Such Leaf spring(mostly used in heavy duty trucks and SUVs), coil spring, double wishbone, trailing arm suspension, mc pherson, spring-hydraulic suspension, hydraulic suspension, air suspension etc. all these are or have been in use for quite a long time. But the entire above still lag in providing comfort to the passenger and lots of failures have been faced by the industry related to suspension. There are many types of failures occurring in day to day operations of suspension.

There are mechanical failure, changes in stiffness of springs, change of ride height due to uneven distribution of loads during non-flat tapered road resulting in change in spring stiffness and its arrangement. Some other problems are that the spring cannot be adjusted by the person himself who is driving the car, even though high end car have adjustable ride height but it is not in access to all categories of people of the society

## 2. BACKGROUND

Hence we came up with an idea of using magnetic suspension in an automobile. The magnetic suspension will make the ride

comfortable and will give more flexibility as compared to that of mechanical suspension and reduce mechanical failures too. The magnetic suspension is based on working of the magnetic attraction and repulsion phenomenon. Magnetic suspension will enhance and improve the driving experience.

### 3. WORKING

The magnetic suspension will be a set of electromagnets acting as dampers. The magnetic suspension will consist of two ends (the normal hydraulic suspension arrangement) like two cylindrical arrangements which will be having two electromagnets on either ends. One end will be connected to the vehicle frame and the other end will be connected to the wheels. Now the ends will be having same charge (Polarity of magnets) while travelling on the highway, city or on any surface. Now we will be using electromagnets which will be connected to the power supply. Then let's say the vehicle is travelling on the road and a bump comes the polarity of the electromagnets will be in such a manner that both the ends are same i.e. either (+) positive-(+) positive or vice versa. When the vehicle hits a bump then the charge being produced due to same polarity will result in repulsion and this will indirectly affect the vehicle. The magnetic field for electromagnetic suspension can be generated by using feedback loop for electromagnet. The basic reason is that, when current passes through any closed wire magnetic field is generated. The strength or power of magnetic field can be increased or decreased accordingly as per requirement.

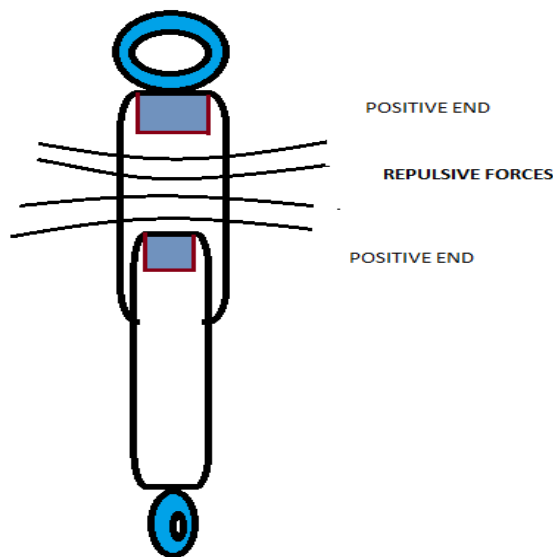


Fig. 1.: A Schematic Diagram Showing Magnetic Repulsion

The magnetic suspension gives more flexibility compared to the current or conventional types of suspension. Magnetic suspension allows us to change the stiffness also according to the requirement of the driver.

Since there are less mechanical parts hence the amount of wear and tear in magnetic suspension is less. The magnetic suspension will provide a high end comfort since there is no limitation of spring compressing capacity or air/fluid compressibility. The magnets will repel as they possess same polarity and this will result in nullifying the vibrations which will ease the driving by increasing comfort level.

### 4. PROBLEMS AND SOLUTIONS RELATED TO MAGNETIC SUSPENSION

Even though the stability is a concern but it can be controlled by using servomechanism, use of diamagnetic material or system involving eddy current through which stability can be achieved.

### 5. CONCLUSION

As we have seen the magnetic suspension is a revolutionary idea which will provide a comfortable ride by minimising the vibrations and other factors. It would also allow to set the suspension stiffness as per requirement. Thereby magnetic suspension will be a best substitute for current problems and providing ultimate vehicle dynamics.

### REFERENCES

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