



## A Study of Magnetic Suspension in Automobile

<sup>1</sup>Mr.P Srinivas, <sup>2</sup>Ms.Swetha.T,

<sup>1</sup>Associate Professor, <sup>2</sup> Assistant Professor, Dept. of CSE,  
Malla Reddy Engineering College (Autonomous), Secunderabad, Telangana State

**Abstract:** Suspension is the system of tires, tire air, springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two. Suspension systems must support both road holding/handling and ride quality, which are at odds with each other. The tuning of suspensions involves finding the right compromise. It is important for the suspension to keep the road wheel in contact with the road surface as much as possible, because all the road or ground forces acting on the vehicle do so through the contact patches of the tires. Suspension wouldn't have been necessary if the roads were flat. Today's generation suspension possesses disadvantages in vibration, mechanical and stiffness. So to have control over the road, I introduced you the MAGNETIC SUSPENSION that will enhance the pleasure of driving. Here I will represent the construction and working of magnetic suspension. Using of magnetic suspension will take out the problem of leakage of oil and less maintenance.

### Introduction

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. There are lots 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 cars have adjustable ride height but it is not in access to all categories of people of the society.

So I came up with the idea of MAGNETIC SUSPENSION which will make the ride comfort and will be flexible than mechanical suspension.

**Electromagnetic suspension (EMS)** is the magnetic levitation of an object achieved by constantly altering the strength of a magnetic field produced by electromagnets using a feedback loop. In most cases the levitation effect is mostly due to permanent magnets as they don't have any power dissipation, with electromagnets only used to stabilize the effect. According to Earnshaw's Theorem a paramagnetic or magnetized body cannot rest in stable equilibrium when placed in any combination of gravitational and magneto static fields. In these kinds of

fields an unstable equilibrium condition exists. Although static fields cannot give stability, EMS works by continually altering the current sent to electromagnets to change the strength of the magnetic field and allows a stable levitation to occur.

Many systems use magnetic attraction pulling upwards against gravity for these kinds of systems as this gives some inherent lateral stability, but some use a combination of magnetic attraction and magnetic repulsion to push upwards.

Magnetic levitation technology is important because it reduces energy consumption, largely obviating friction. It also avoids wear and has very low maintenance requirements. The application of magnetic levitation is most commonly known for its role in Maglev trains.

### Objective

- To minimize the road shocks that is being transmitted to the vehicle components.
- To minimize the maintenance cost.
- Having cushioning effect.

- To minimize the weight and cost of the vehicle.
- To save the vehicle frame and body from road shocks.

### What is an electromagnet?

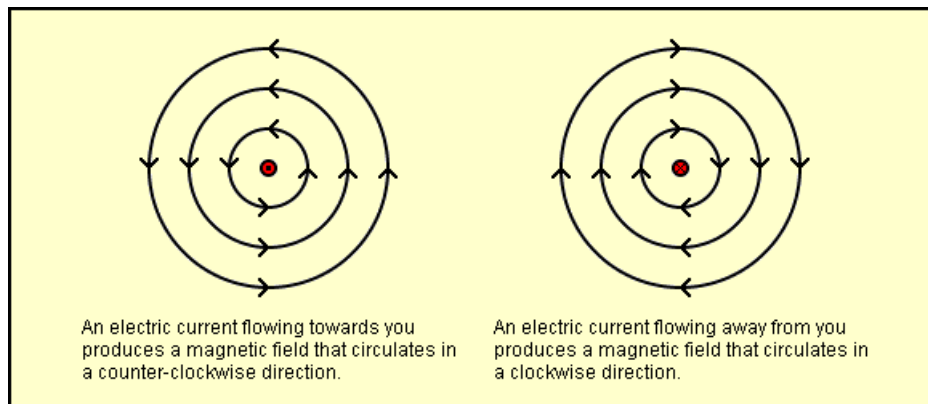
An electromagnet is a magnet which runs on electricity. Unlike a permanent magnet, the power of an electromagnet can be easily changed shown in the diagram below: Flowing of electric current in counter-clockwise and clockwise

### Working

The magnetic suspension is a set of electromagnets which is acting as dampers. The magnetic suspension

by changing the amount of electric current that flows through it. The poles of an electromagnet can be reversed by reversing the flow of electricity.

An electromagnet works because an electric current produces a magnetic field. The magnetic field produced by an electric current forms circle around the electric current, as consists of two ends (normal hydraulic suspension) like two cylindrical arrangements which will be having two electromagnets on either ends. One end is connected to the vehicle body and the other end is connected to the wheels. The ends will have same charge



(Polarity of magnets) while travelling on highway, city. So now electromagnets is being used which will be connected to the power supply. Suppose the vehicle is travelling on a road and a bump comes

then the polarity of the electromagnets will be in such a manner that both the ends are same which is either (+) positive. So when the vehicle hits a bump then the charge that is produced due



to same polarity will result in repulsion and this will indirectly affect the vehicle. By using feedback loop for electromagnet the magnetic field for electromagnetic suspension can be generated. The reason is that, when the current passes through any closed wire magnetic field is generated. The power of the magnetic field can be increased or decreased accordingly as per requirement.

So the magnetic suspension gives more comfort on comparing to the conventional types of suspension. The driver can change the stiffness of magnetic suspension according to his or her requirements. Having less mechanical parts the amount of wear and tear in magnetic suspension will be less. The magnetic suspension will provide a high comfort with zero limitation of spring compressing capacity or air/fluid compressibility. The magnets are going to repel as they possess same polarity which will result in minimizing the vibrations and will ease the driving by increasing comfort level.

### Conclusion

So we have seen the magnetic suspension

which is a revolutionary idea that will provide a comfortable ride by minimizing the vibrations and other factors. It would also allow us to set the suspension stiffness as per requirement. Therefore magnetic suspension will be a best substitute for today's problems and provides ultimate vehicle dynamics.

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