**ADVANCED VEHICLE SUSPENSION USING ELECTROMAGNETIC DAMPER**

**Vehicle Primary Suspension:**

The components connecting the unsprung mass i.e. axle and wheel assemblies of a vehicle to the Sprung mass (frame) of the vehicle is called vehicle Primary Suspensions. There are two basic elements in conventional suspension systems. These elements are springs and dampers. The springs support the weight of the vehicle and absorb road shock. The role of the damper is to dissipate vibration energy and control the input from the road that is transmitted to the vehicle.

**Conventional Passive Suspensions:**

A passive suspension system is one in which the characteristics of the components (springs and dampers) are fixed. The performance of passive suspensions is the compromise between ride comfort and vehicle handling. If a passive suspension is designed to optimize the handling and stability of the vehicle, the operator often perceives the ride to be rough and uncomfortable. On the other hand, if the suspension is designed for ride comfort alone, the vehicle may not be stable during maneuvers.

**Fig.1-a Conventional passive suspension system**

**Fig.1-b Damping Compromise for Passive Dampers**
Electromagnetic Damper Suspension:-

As shown in fig. A Electromagnetic damper suspension system varies the damping force in real time depending on the dynamics of the controlled masses. This system utilizes a feedback loop to control the damping force at any time. The feedback is usually taken as the velocities of the bodies that the suspension controls. A processor can then use the feedback data to calculate the desired damper control force, which must be converted into a control signal that will adjust the damper. The signal that is sent to the damper changes the damper’s resistance to velocity and therefore changes the damper force. Finally, the feedback loop is completed as the changing damper force alters the acceleration of the controlled bodies and the feedback variables in ways that would not have occurred had a passive system been used.

**Fig.2-a** Electromagnetic Damper Suspension

**Fig.2-b** Difference between Passive Damping & Electromagnetic Damping Suspension
ELECTROMAGNETIC DAMPER - Constructional Details & Working

The construction of electromagnetic damper is same as conventional damper except electromagnetic coil and working fluid. It uses Magneto-Rheological fluid as a working fluid. The viscosity of MR fluid can be varied by applying a magnetic field across the fluid by means of Electromagnet. It contain micron-sized, magnetically polarized particles suspended in a carrier fluid such as silicon or a mineral oil. When exposed to a magnetic field, micron-size iron particles that are dispersed throughout the fluid align themselves along magnetic flux lines within milliseconds and create disturbances to flow of fluid which result in increasing the damper force. When inactivated, a MR fluid behaves as ordinary oil.
**Advantage of Electromagnetic Damper Suspension:**

1) **Increase Passenger comfort.**
   - Isolating the occupants from road disturbances like bumps or potholes.

2) **Increase Vehicle control.**
   - Reduce the effects of braking, which causes a vehicle to nose-dive, or acceleration, which causes a vehicle to squat.
   - Reduce the vehicle roll during cornering maneuvers.
   - Maintaining good contact between the tire and the road.

3) Powering from common low-voltage sources (DC 12–24 V), Less power consumption (max. 50 W).