

Indirect Design and Construction of Bumper (Vibration Absorber) System in Automobiles (cars) and Industrial Equipment

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Received: November 3 2013

Accepted: January 12 2014

ABSTRACT

Magnetic suspension systems widely used in various fields such supports without friction, high-speed passenger trains, wind tunnels, etc. It is important to construct a feedback controller with high-performance to controlling suspension body position, because the magnetic suspension system with is usually unstable on open-loop mode and their control problem is a major challenge for control engineers due to the nonlinear characteristics of the electromagnetic dynamics. The basis of this system is based on the same poles repulsion. Poles of the same magnet poles repel each other and the opposite poles absorb each other.

KEYWORDS: Bumper, suspension systems, magnet poles, automobiles

1. INTRODUCTION

Due to the tremendous advances in the automobile (car) industry over the last 100 years that has raised surprise everyone and weal ways saw several innovations. We also turn to a series of changes on disposal systems from last times and actually how this works in automobile that this work was practical after subsequent researches and different experiments.

2. A brief history of suspension systems

Generally, the suspension system of the automobiles is to reduce the impacts of the surface of move path to passenger cabin and greater flexibility of tires to the path surface. The methods on damping suspension systems have changed a lot over time. Therefore, in most cases, they were caused to bettering and easily of tire adhesion to the road surface. The major and common point between all these systems is having a direct connection to the vehicle's room. Consequently, the impacts of the path's surface with rubber, is transferred directly to the room. Remember the fact that the new systems absorb impacts significantly, but I think the passenger comfort would be greater than now.

3. Brief familiarity to old systems

As you can see in the Fig. (1), in the previous systems, a damper is used which the force applied to the piston axis was applied to the liquid oil and this oil also was pressured a tank of air. The tiny holes are provided on the piston for the passage of oil, through the hard passaging of the oil from these holes was getting a lot of force; the applied force on axis was either damped or simply depreciated. This system had the ability of force damping as for the amount of oil and inside air volume and the holes on the intermediate piston. Thus, for each type of use, such as driving ordinary or sports car should be used a particular type. This is why the Audi Company was decided to design a new system.

4. Magnetic Suspension Audi cars system

Magnetic suspension system of Audi cars company, while has supply unique ride to its own drivers, since the old model had to be installed an especial suspension system on cars for any type of driving, the Audi company thought that achieve to all these goals with the installation of one system.

So, the magnetic suspension system replaced to old model. This model is installed on this company's cars in a period time. First, the model was installed and tested on the Audi TT model of this company. But now this system to be installed almost on all models of the company, especially the company's popular design, Audi R8.

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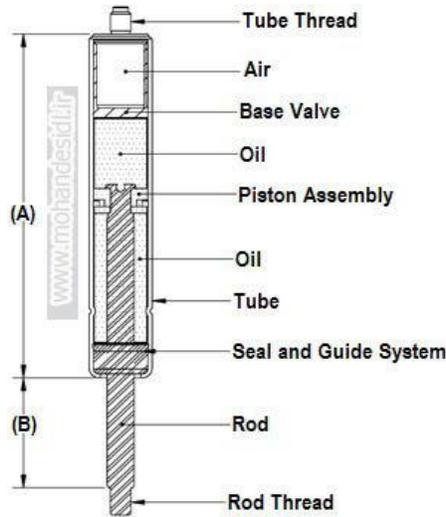


Fig. 1

In this system, the major thought was on oil changing in different ways, because the oil largely effect to dumping forces from impacts. However, we attempt to explain this system given the general information about it. You can see an overview of the system in below figure, but at a glance, the system is no typical different to ordinary systems. But don't make a mistake, as noted the character of this system lies within its specific dampers.

The above suspension system is related to Audi TT cars that are equipped with specific type of dampers.



Fig. 2

These dampers have a very simple structure. The only notable feature is the giving help of an electrical site that makes this type dampers intelligence instead of impacts in and it's a masterpiece! They are no different in structure to the previous models, except that the fluid injected into the oil reservoir (tank), which is a special fluid that its viscosity is controlled by a magnetic field. The suspension system of these cars is used this fluid characteristics to control and depreciate the forces applied to the cars .Note the following figure.

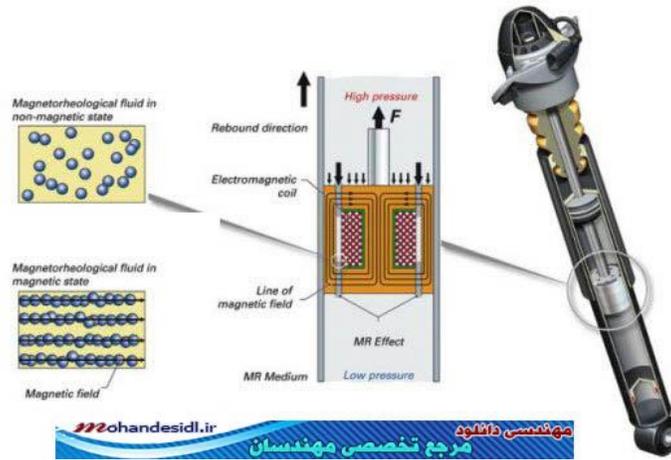


Fig. 3

As can be seen in the figure, the piston which is attached to the end of the transmission shaft has holes that allow fluid to pass through it. But this piston is not simply as the before piston systems. But also it is equipped with electro- magnet that creates a magnetic field in the fluid path of the piston. The fields is sensitive to the fluid that is created on magnetic field, and influence it and control its viscosity .In the left side of above picture, the impact on the fluid fields are clearly observed. (It is note that the magnetic field scan be changed the viscosity and damper force 1000 times per second!!!).The viscosity has been changed the passing rate of fluid through the pores. The hardness and softness that is created by a magnetic field cause to damp the different forces. And more general, soft or dry the shock absorber. These dampers have an extra ordinary energy that is a vast advantage to the company , each damper normally uses up 5 watts and at maximum 25 watts of power.

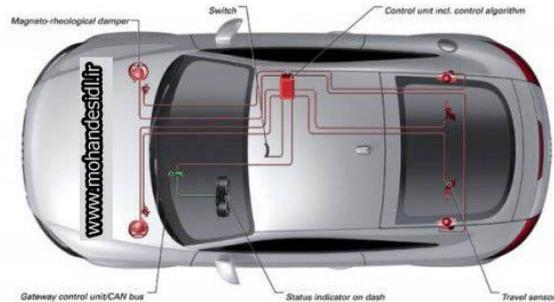


Fig. 4

In the above picture you can see the overall system of the shock absorber electronic control (on the Audi TT car). First four travel sensors were used to input the road or driving way quality information for data entry into the system. (two on front and two on the rear axle). These sensors will be sent status information received from the road to the control unit. The system has an existence status display on car's dashboard. Shift switches on the side panel (Switch) are placed as a default to change the status of the road that driver can be in an alert status by these dampers. Usually two type of normal and sport driving to have embedded to this status (mood). Four outputs were also sent for each damper from control unit that is order to what the magnetic field intensity will is placed and continues.

5. Maglev trains (magnetic trains)

Maglev system utilizes a magnetic field which is created between the train and therailline, pended at a small from the line and a driving force that can be generated by a jet engine or the magnetic field comes off along the line. At magnetic train because of the absence of physical contact between the train and line, there is no frictional contact, only air resistance and a small amount of magnetic elasticity at high speed is presented.

Maglev, or magnetic levitation transportation, which is named a new technology according to its major features, will revolutionize the transportation industry. " Maglev ", is a form of transportation that pushing train

levitation and completely distinct from the Earth by electromagnetic force to forward .The new method is faster, more comfortable and sure method of transport current is associated with the common wheels .

Due to the main propulsion, this system in its tracks, instead the train itself, these trains are very light and very easy to control downhill. Tracks used in this system are made from light materials .The maglev technology is allowed to train that easily achieving the aircrafts speed (500 to 580 kilometers per hour).



Fig. 5

6. Technology

In general, there are two types of maglev, an electromagnetic suspension (EMS) and the Electro- Dynamic Suspension (EDS)

In the electromagnet suspension system, the train with powerful electromagnetic is pressured on the rail that this action is caused its suspending. The magnets set towards track and by feedback control; they are calculated and maintained its suspension.

Electrodynamics suspension system is acted in a different way, as both rail and train have magnets that the train by same poles repulsive force is kept its distance and height from rail.

My system is modeled from the same mechanism of Maglev trains. These trains are suspended on its rails and have no direct contact with the guide rail you see a sample of these trains that is a schematic of a type of trains.

The train propulsion is made by the change of positive and negative poles and yet it is caused the balance between the two sides of the pole. The difference between a train and a car is that we don't need to move our car and suspension is important to us only.

Some of these systems are seen as below.

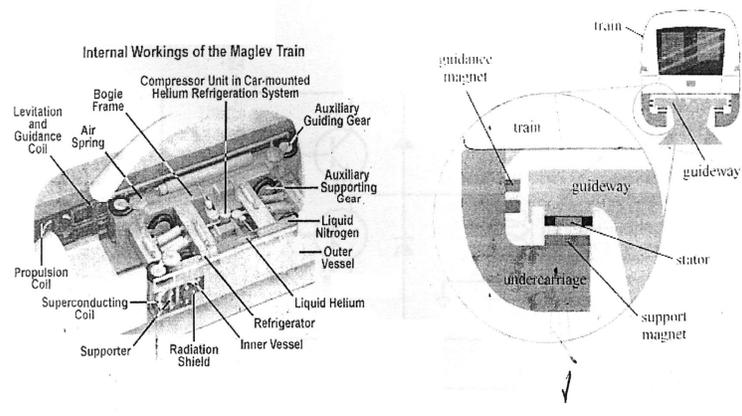


Fig. 6

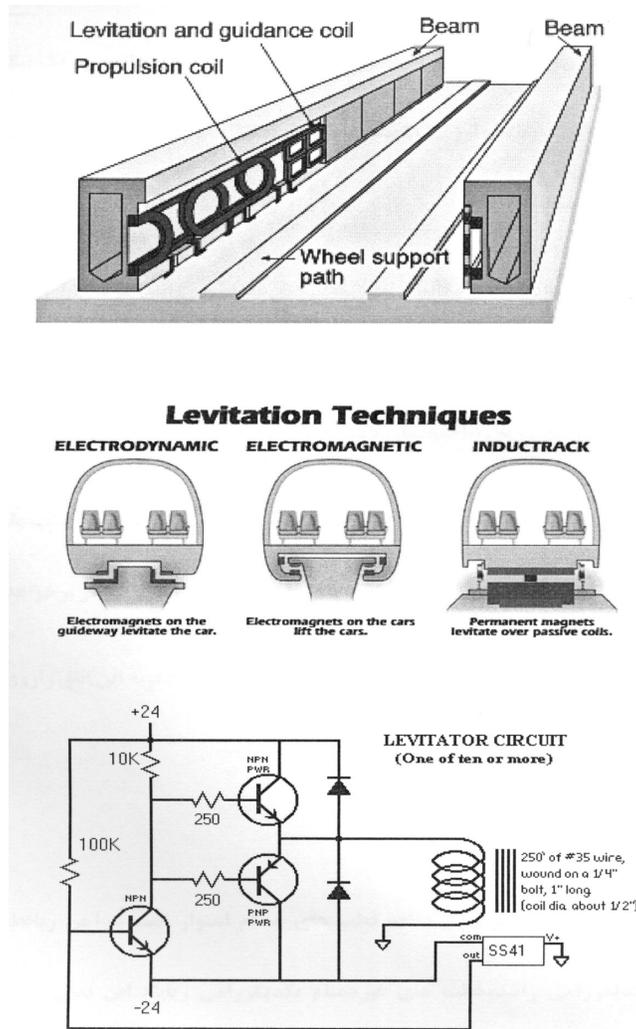


Fig. 7

We follow up further descriptions to this that today's most rooms and chassis are made of one piece. Therefore, impacts and vibrations are transferred directly to the room. In one system is high and in another is low.

7. Magnetic suspension system

Magnetic suspension systems widely used in various fields such supports without friction, high-speed passenger trains, wind tunnels, etc. It is important to construct a feedback controller with high-performance to controlling suspension body position, because the magnetic suspension system with is usually unstable on open-loop mode and their control problem is a major challenge for control engineers due to the nonlinear characteristics of the electromagnetic dynamics .However ,if we can maintained the suspension of the passengers' room on the chassis is using the suspension mechanisms of magnetic trains, designing an independent suspension system(or we can rely on just the first part)and the impact greatly be impels and maybe a little transmitted.

Why we use the word “may be “because it is we don’t so far obtain an opportunity of the exact tests. But what is certain, is that the control will yield great results. With this interpretation, a question that arises is how to keep the room suspension on the chassis, and how we can control it in different situations.

8. Design Basis

The basis of this system is based on the same pole repulsion.

The same poles of magnets are pulled together and opposite poles are absorbed each other. This means that if we have two magnets with the same poles, we can keep them suspended by control of our hands. If we add two

magnets on two hands of this collection and fixing three magnets (the below magnet and two laterals) we can keep to suspending the upper magnet on them.

Finally, if we added another same magnet to the upper of suspended magnet and keep it, we could fix the suspended magnetic on the same point.

This description was based on the design basis, with the exception that controlling tools and accurate and reliable suspension must be used to implement stage on cars, so that car can be maintained passengers room on chassis or frame.

Magnets that are used in this system must have the ability to become polarized and decrease or increase of repulsive or attractive forces. Because we need different magnetic conditions under different car move situations.

For example, we need a type of situation to control the suspension in turns of the road and another type of situation on braking.

Now if we define a frame that is placed on its chassis and passenger cabin is suspended on it, by placing the magnetic and using targeted electrical current, same magnets are caused to suspend of room on the chassis.

Given this description, first we need a series of magnets with ability to convert to two poles, and sensors that are measured different car situations and reporting this to an ECU program that analyzes information from sensors and sent required commands to Functions.

For example, more forces are on one side of car on turn of road, sensors of that point reported force information to that part to ECU and ECU command the stronger repulsion force in that part (or other programmed commands) to prevent the collision of plane and frame or the chassis.

Now with more descriptions, we started the detail of design.

a - Required electrical sources

Electricity (electric flow) requirements in this plan due to the weight of the car can be provided from different batteries with different capacities. We can use such a dynamo and coil or equipment such these to supply voltage and conveying the current to the magnets by suitable interface wires.

b – Magnets

Magnets that we use in this system are installed to around, up and down of the plane. A series of magnets are also installed on three internal frames.

We can be performing the suspension using this mechanism.

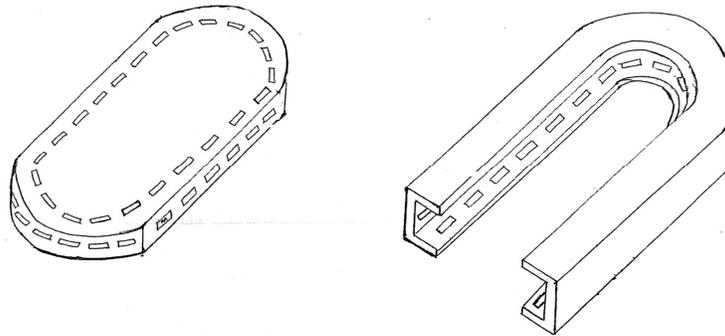


Fig. 8

c - Sensors and central computer

We need to have an accurate control tools. This requires that a set of sensors based on the path and the car situations including suddenly brakes, turns and ... that are entered the different forces into various parts of car, and send data to a central computer that this computer present required commands to maintain stability and sustention of car . This computer is already programmed and will be sent the appropriate commands according to the information received from the sensors.

A very important point here is that this process must be done carefully and in a very short time. Moreover, it is necessary to devise other mechanical control tools. These tools can be a valid guarantee in emergency situations such as accidents to maintain the balance and integration.

d – Plate and Palit

Palit and plate can have different designs according to car type and its usage and their kind also can be changed according to its characteristics.

Here we need to point out once again that I designed a suspension system in the chassis. This system can theoretically absorb impacts and somewhat transmit them to the frame.

Of course, it is possible without it but doing tests related to this part and to achieve the desired results can be also installed and designed the system.

9. Advantages of Magnetic Suspension

According to car situations on different modes is never out of its frame.

Absence of directly relation to car room and vibration chassis and eliminates more noises.

This provides possible curvature and turns angle to the room.

This system does not dependence on weather conditions.

The lack of mechanical contact.

No need for lubrication

Not require much maintenance and repairs.

Resistant to heat, cold and vacuum.

Low losses.

10. Applications

The usage of this system is very high and almost can carry out the plan in all kinds of cars.

It means that most vehicles are used this system.

When the car is off can be designed plastics under plate so with cutout the current plate places on frame that do not need to electricity.

Finally, I must emphasize once again that the problem of design may different according to car type and its usage (applications) and the important point of these descriptions and figures is the clear vision of the project by the audience.

Acknowledgment:

The authors declare that they have no conflicts of interest in this research.

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