

Electromagnetic Suspension Navigated Vehicle

Deepak Saini, Ankit Vijay, Ajay Sharma, Ashutosh Sharma, Ajay Sahu, Akash Tiwari

Department of Electrical Engineering Swami keshvanand Institute of technology, management and gramothan
Jaipur, India

ABSTRACT

Electromagnetic suspension (EMS) of the object achieved by constantly altering the strength of a magnetic field produced by electromagnets using a feedback loop. Feedback loop continuously adjusts one or more electromagnets to correct the objects motion used to cancel instability. This technology is important because it reduces energy consumption and does not require fossil fuels so it will add a huge positive in the society. It also avoids wear and has very low maintenance requirements. The main application of this technology is most commonly known for maglev trains. Another application is in the active magnetic bearing. This type of technology provides very high speed to the vehicles. High speed trains promises to create dramatic improvements for travelling. This paper tries to study the most important uses based on electromagnetic suspension technology.

Keywords: Electromagnetism, suspension, Ferromagnetic, Maglev, levitation

I. INTRODUCTION

An electromagnet is a type of magnet in which magnetic field is produced by the help of electric current. When the current flowing through the wire generates a magnetic field around it, this is called as electromagnetism. When the current is turn off then the magnetic field disappears. Electromagnets consist of an insulated wire wound into a coil. Current flowing through the wire generates a magnetic field which is concentrated in the hole in the center of the coil. The main advantage of an electromagnet is such that the magnetic field can be altered quickly by changing the amount of electric current flowing through the winding. Electromagnets are widely used as the component of some other electrical devices such as motors, generators, relays, loud speakers, hard disks, etc. This type of technology is used in the Maglev (Magnetic Levitation) trains to propel the train with magnets rather than the wheels. High speed trains can provide tremendous changes for travelling if it is adopted widely.

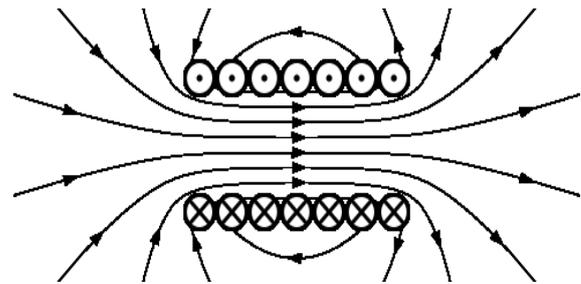


Figure 1. magnetic field produced by a coil of wire

Electric current flowing through the wire produces a magnetic field around the wire as in figure 1. To concentrate the magnetic field, in electromagnet the wire is wound into a coil having many turns of wire lying side by side. The direction of the magnetic field through a coil of wire can be found by using right hand thumb rule. Stronger magnetic fields can be produced if soft ferromagnetic material having strong magnetic core, such as iron, is placed inside the coil.

A. Principle of Electromagnetism

The generation of magnetic field around the wire is based on electromagnetic induction which defines the

production of the magnetic field by the flow of electric current. When the value of the electric current changes, Faraday's law of induction says that wire loop acquires an electromotive force, which also states that electromotive force in any circuit is equal to the rate of change of magnetic flux or current.

$$E = \frac{N\Delta\Phi}{\Delta t} \dots\dots(1)$$

Where E = Emf (V), N = Number of turns in the coil, Φ = Magnetic Flux (weber, Wb) and t = Time (s)

The direction of the electromotive force produced is found out by the Lenz's law which states that the induced current flows in the direction that opposes the change which produces it fig [2]. The induced magnetic field always keeps the magnetic flux constant.

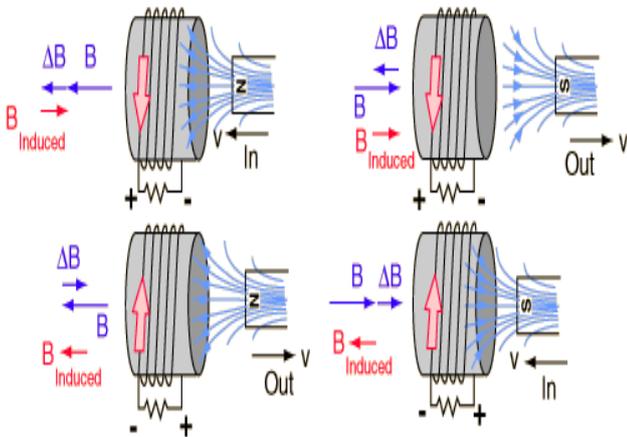


Figure 2. Magnetic flux changes

B. Applications of Electromagnetism

• Magnetic Levitation Trains:

This is the modern transportation technology that is based on the concept of electromagnetism. These are high speed trains that use electromagnets to develop the speed. The train in fig [4] will move over a guide way using the basic principles of magnet such as electromagnetic suspension. A guide way is an arrangement of specially designed magnetic coils and tracks that are arranged at regular intervals. Along this guide way the train is suspended by the phenomenon of the magnetic levitation without any support other than magnetic fields.

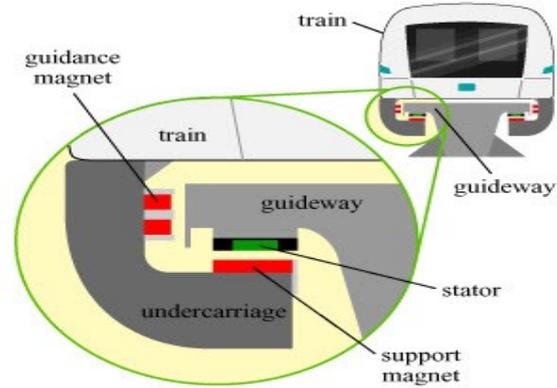


Figure 4. Magnetic levitation trains

The figure 4 shows the EMS magnetic levitation system in which electromagnets are attached to the body of the train and are provided power by the help of batteries in the train. The guide way consists of electromagnetic coils made on the surface of the track. These coils are constructed with core material and coil windings. When the electromagnets are energized, the train will be levitated by the attractive force between the electromagnets and coil.

• Medical System

Electromagnetic fields play an important role in advanced medical equipments such as hyperthermia treatments for cancer, implants and magnetic resonance imaging. In MRI scans sophisticated equipment works based on the electromagnetism can scan minute details of the human body. The electromagnetic therapy is an alternate form of medicine which claims to treat disease by applying pulsed electromagnetic radiation to the body. Many of the medical equipment are such as scanners, x-ray equipment and other equipment uses electromagnetism principle for their functioning.

• Security System

Security systems use locking systems for doors which are generally magnetic locking systems. These systems are unlocked either by a magnetic card swiping or having a security code.

• Card Reader

Magnetic card reader on the doors reads the number of keys stored in the magnetic tape of the card. When key stored in memory matches with data on the card, then the door opens.

II. MODEL HARDWARE DESCRIPTION

Electromagnetism application are economical and ecofriendly thus we proposed a vehicle , which is completely base on electromagnetism, which will move by induction and reduce pollution rate.

A. Component description

A copper wire of required diameter with 300 turns are used to prepare a electromagnetic coil. A step down transformer is used to obtain the 12V supply for the model. A Gear motor is designed to generate high torque by maintaining low speed motor output which is used to drive the wheels of the vehicle.

III. INTEGRATED CIRCUITS

In this model, IC CD 4017, 7805, 7812 and 555 are used for low range counting, to maintain the constant output voltage of 5V, to restrict the output voltage to 12v and draws regulated respectively.-

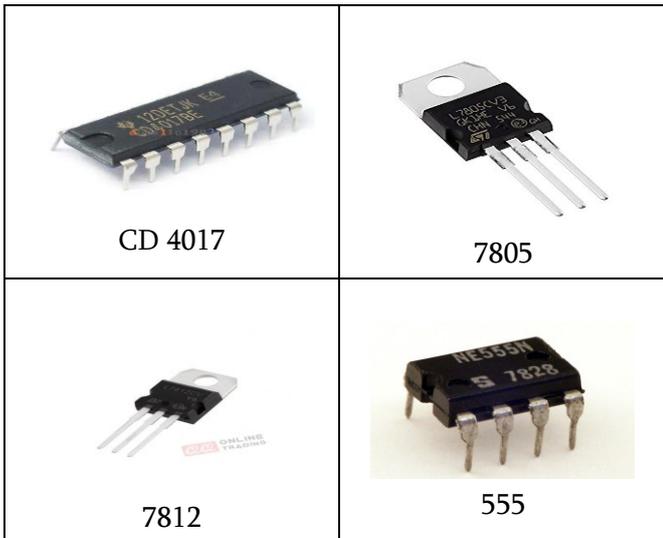


Figure 5. Various ICs

IV. VARIOUS CIRCUITS

A rectifier circuit, trip circuit and booster circuit are used to converts the AC (Alternating current) to DC (Direct current), to provide supply to the electromagnetic coils through the relays which trip one by one by the help of the timer IC and to increase the voltage to a level respectively.

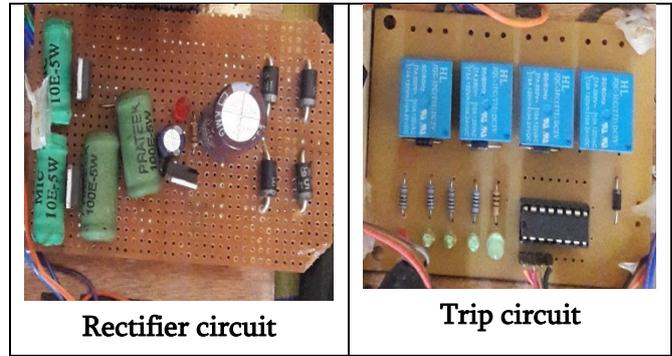


Figure 6. Various circuit

V. WORKING OF MODEL

The 230v ac supply from the source is step down to 12v by the help of step down transformer. Then the 12v ac is provided to the rectifier circuit in order to convert the 12v ac voltage to the DC voltage and then this pulsed DC voltage is provided to the electromagnetic coils. From IC 7805, the 5v voltage is provided to the circuit where the 4017 IC is connected. From here the output of the IC is provided to the timer IC which is used to trip the relays connected and provide the supply to the electromagnetic coils one by one. The vehicle is made by arranging an electromagnetic coil with an electric gear motor along with tires that is used to drive the vehicle. The magnetic field produced on the lower side is passed on to the upper coil which drives the gear motor. The booster circuit is used to provide the boosted supply to the electromagnetic coils. The supply to the booster circuit is provided by using external DC battery.

Hence the motor rotates which moves the vehicle.

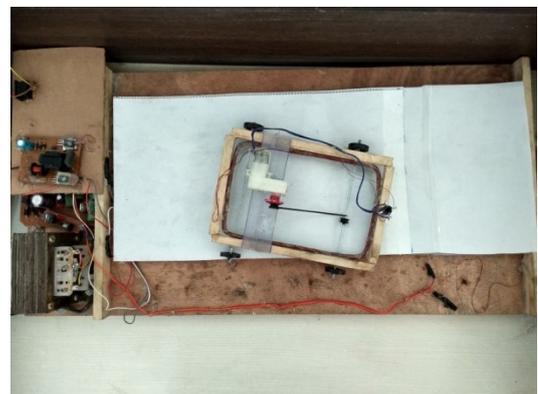


Figure 7. Complete working model

VI. ADVANTAGE

Magnetic field produce by electromagnet is strong as compared to permanent magnet. It can be easily turned on and off by cutting the supply of electrical current. The switching and speed of motor can be controlled by this method. It runs without the use of fossil fuels so it is eco-friendly. The vehicles based on this technology can run faster than the conventional vehicles because of the less friction. Life span of electromagnetic vehicle is more than the conventional as magnetic property diminishes slowly with time.

VII. CONCLUSION & FUTURE SCOPE

The world has to gain the benefits from the various electromagnetic suspension vehicle .This type of vehicle can run without the use of fossil fuels so it will add a huge positive in the society, as we are facing lot of problems due to pollution. Electromagnetic vehicle is faster so it will help people to travel quickly and save time out of their busy life. The balance vehicle can be made by electromagnet which will not lose its balance in any condition .The goal of the electromagnetic vehicle is to create a economical, safer and reliable source of transportation. Electromagnetic vehicle is the future of conveyance and it need further improvisation to become a successful in daily usage.

VIII. REFERENCES

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