ISSN:2348-2079

Volume-7 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Design and fabrication of magnet actuation technique to produce current

Ms.K.Sathyasree, L.Dharshini, S.Renugadevi, S.S.Thulasimani

Assistant Professor-EEE, Nandha Engineering College, Vaikkalmedu, Erode District, Tamil Nadu, India

Final year, Nandha Engineering College, Vaikkalmedu, Erode District, Tamil Nadu, India

ABSTRACT

Current is one of the serious and challenging problem faced by our country. The working principle of the project is the magnetic repulsion between the two same poles with producing the repulsive power. This phenomenon of repulsion is used in automotive vehicles to create a rotating force. Thus the magnetic fields producing the current which is needed to charge the battery. It does not create any kind of pollution, since no chemical element is not required to operate the engine. The possible impact of this project is that people can run the vehicles which are made by this kind of mechanism need not required any kind of pick up battery. It consumes free energy from the magnet. All the people can easily to operate the vehicle by using this method and need not to wait for service center. By using of this kind of energy the world pollution getting reduced.

Keywords: Aluminum profile, Battery Bearing, Dynamo, Neodymium magnet.

INTRODUCTION

Presently the demands for the cars, trucks and other automotive vehicles are initiate to produce the current without any external source to battery is very tedious. Because, most of the automatic vehicle is idling at few days, battery power will be lost.

In existing system, same pole of the magnet is placed in the wooden block (inner and outer side) and magnets will be repelled each other. At the same time, rotational force can be produced with the help of ball bearing. Existing system low power magnet (ferrite) is used, only the rotational force was produced. Wooden blocks are used to place the magnets but it is difficult to place in vehicles because of heavy weight and current could not be produced.

In proposed system repulsion is used to create a rotating force. Neodymium magnets are placed on outer and inner plate of Aluminum profile. Because of same poles (North - North), magnets are repelled each other and inner plate is rotated without any external source. Then magnetic fields produce current to charge the battery with the help of dynamo (rotational motion). Finally, dynamo wire connection fixed with battery for resolving the problem of self-starting in vehicles.

The repulsive power is used in battery operated vehicles such as car, trucks when battery is under low condition. During the time of starting trouble or low battery fault in cars, trucks and other automotive vehicles, this application can be used to overcome the self-start problem.

The main objective is to produce current without any external source by using magnetic repulsive force. The proposed system Aluminum is used for placing the magnets instead of wood and current will be induced by rotational force.

The paper is organized as follows; section 2 gives the comparison between ferrite magnet and Neodymium magnet, section 3 formula to find power of body in angular motion, section 4 describes about the proposed system, section 5 holds the conclusion of proposed system.

Author for correspondence:
EEE, Nandha Engineering College, Vaikkalmedu, Erode District, Tamil Nadu, India

COMPARISON BETWEEN MAGNETS

Ferrite magnet

A ferrite magnet is a ceramic material made by mixing and firing large proportions iron (III) oxide (Fe2O3, rust) blended with small proportions of one or more additional metallic elements, such as barium, manganese, nickel, and zinc. They are both electrically non-conductive, meaning that they are insulators, and ferromagnetic, meaning they can easily be magnetized or attracted to a magnet. Ferrites can be divided into two families based on their resistance to being demagnetized (magnetic coercivity). Hard ferrites have high coercivity, so are difficult to demagnetize. They are used to make permanent magnets for refrigerator magnets, loudspeakers and small electric motors.

Neodymium magnet

A neodymium magnet (also known as NdFeB, NIB or Neo magnet), the most widely used type of rare-earth magnet, is a permanent magnet made from an alloy of neodymium, iron and boron to form the $Nd_2Fe_{14}B$ tetragonal crystalline structure. Neodymium magnets are the strongest type of permanent magnet commercially available. They have replaced other types of magnets in many applications in modern products that require strong permanent magnets, such as motors in cordless tools, hard disk drives and magnetic fasteners.

Magnetic properties

Some important properties used to ^{compare} permanent magnets are:

Remanence (B_r)

Which measures the strength of the magnetic field.

Coercivity (H_{ci})

The material's resistance to becoming demagnetized.

Energy product (BH_{max})

The density of magnetic energy.

Curie temperature (T_C)

The temperature at which the material loses its magnetism. Neodymium magnets have higher Remanence, much higher coercivity and energy product, but often lower Curie temperature than other types. Special neodymium magnet alloys that include terbium and dysprosium have been developed that have higher Curie temperature, allowing them to tolerate higher temperatures. The table below compares the magnetic performance of neodymium magnets with other types of permanent magnets.

Magnet	Br (T)	Hci (kA/m)	BHmax (kJ/m3)	TC (°C)	TC (°F)
Nd2Fe14B (sintered)	1.0–1.4	750–2000	200–440	310–400	590–752
Nd2Fe14B (bonded)	0.6–0.7	600–1200	60–100	310–400	590–752
SmCo5 (sintered)	0.8–1.1	600–2000	120–200	720	1328
Sm(Co, Fe, Cu, Zr)7 (sintered)	0.9–1.15	450–1300	150–240	800	1472
Alnico (sintered)	0.6–1.4	275	10–88	700–860	1292–1580
Sr-ferrite (sintered)	0.2–0.78	100–300	10–40	450	842

Physical and mechanical properties

Comparison of physical properties of sintered neodymium and Sm-Co magnets.

Property	Neodymium	Sm-Co
Remanence (Teslas)	1–1.3	0.82–1.16
Coercivity (MA/m)	0.875–1.99	0.493–1.59

Relative permeability	1.05	1.05
Temperature coefficient of Remanence (%/K)	−0.12	−0.03
Temperature coefficient of coercivity (%/K)	−0.55 – −0.65	−0.15 – −0.30
Curie temperature (°C)	320	800
Density (g/cm^3)	7.3–7.5	8.2–8.4
CTE, magnetizing direction (1/K)	5.2×10^{-6}	5.2×10^{-6}
CTE, normal to magnetizing direction (1/K)	-0.8×10^{-6}	11×10^{-6}
Flexural strength (N/mm^2)	250	150
Compressive strength (N/mm^2)	1100	800
Tensile strength (N/mm^2)	75	35
Vickers hardness (HV)	550–650	500–650
Electrical resistivity ($\Omega\cdot$cm)	$(110–170)\times10^{-6}$	86×10^{-6}

FORMULA

Power of body in angular motion

The power of a rotating body can be expressed as

$P = T\ \omega$

$= T\ 2\ \pi\ n_{rps}$

$= T\ \pi\ n_{rpm} / 30$

Where

P = power (W)

T = torque or moment (Nm)

ω = angular velocity (rad/s)

π = 3.14...

n_{rps} = rotations per second (rps, 1/s)

n_{rpm} = rotations per minute (rpm, 1/min)

1 rad = $360^o / 2\ \pi = \sim 57.29578^o$

Torque of a Body in Angular Motion

$T = I\ \alpha$

Where

I = moment of inertia (kg m^2, lb_m ft^2)

α = angular acceleration (rad/s^2).

Magnetic flux density

The magnetic flux density of a magnet is also called "B field" or "magnetic induction". It is measured in tesla (SI unit) or gauss (10 000 gauss = 1 tesla).

A permanent magnet produces a B field in its core and in its external surroundings. A B field strength with a direction can be attributed to each point within and outside of the magnet. If you position a small compass needle in the B field of a magnet, it orients itself toward the field direction. The justifying force is proportional to the strength of the B field.

Formula for block magnet flux density

Formula for the B field on the symmetry axis of an axially magnetized block magnet (block or cube):

$B=Br/\pi[\arctan(LW/2z\sqrt{(4z^2+L^2+W^2)}-\arctan(LW/2(D+z)\sqrt{4(D+z)^2+L^2+W^2}]$.

B_r=Remanence field, independent of the magnet's geometry

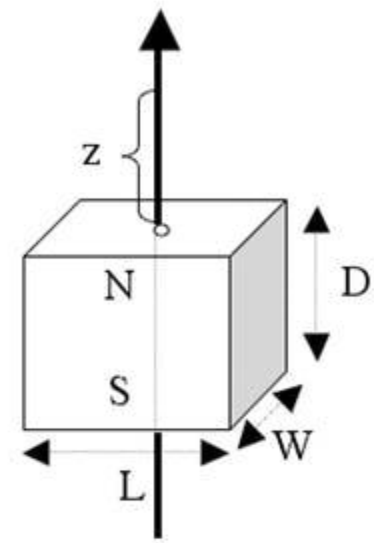
Z=Distance from a pole face on the symmetry axis

L=Length of the block

W= Width of the block

D=Thickness (or height) of the block

The unit of length can be selected arbitrarily, as long as it is the same for all lengths.



PROPOSED SYSTEM

Figure.1 shows the complete block diagram of the proposed system. In this magnetic repulsive power without any external source is used for the application of charging car battery to resolving the self-start problem. The attraction as well as the repulsion of magnets decrease significantly with increasing distance.

BLOCK DIAGRAM

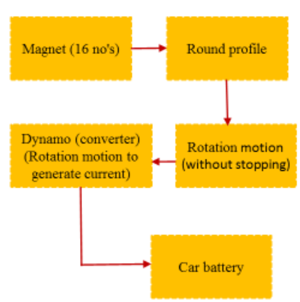


Figure 1. Complete block diagram of the proposed system

When two equal magnets touch each other, the attraction between two unequal poles is 5-10% stronger than the repulsion of equal poles. That is due to the alignment of the molecular magnets in a magnet. In a single magnet, the molecular magnets are aligned sort of parallel to each other. The more regular the molecular magnets are aligned, the higher is the "strength" of the magnet.

Figure 2.Normal alignment of molecular magnets

Sathyasree K et al., Inter. J. Int. Adv. & Res. In Engg. Comp., Vol.–07(02) 2019 [2039-2047]

Attraction

When two unequal magnetic poles attract each other, the one magnet supports the parallel alignment of the molecular magnets in the other magnet. This renders both magnets a little stronger.

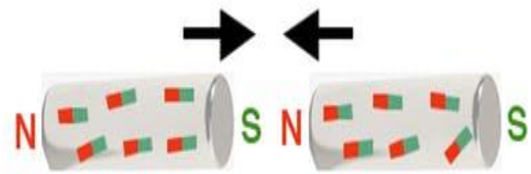


Figure 3.Better alignment of the molecular magnets at attraction

Repulsion

When two equal magnetic poles repel each other, however, the one magnet disturbs the parallel alignment of the molecular magnets in the other magnet. This renders both magnets a little weaker. If you pull them far enough apart, however, they regain their original order and therefore their original strength.

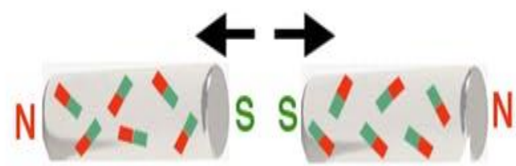
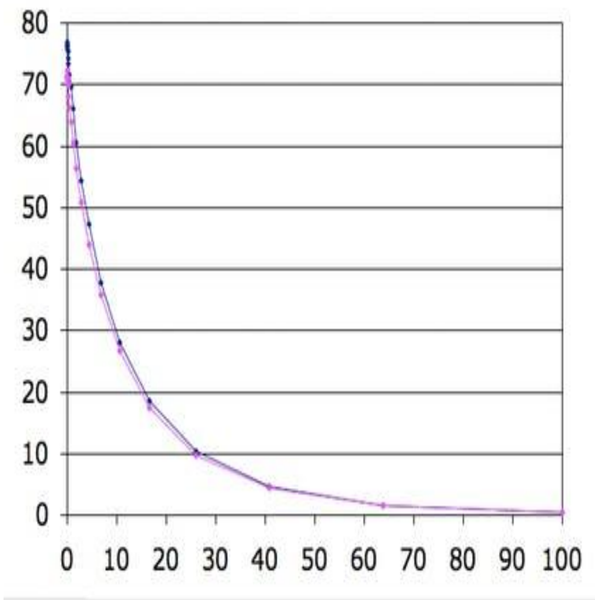


Figure 4.Bad alignment of the molecular magnets at repulsion

With increasing distance between two magnets, the molecular magnets are hardly impacted by the other magnet anymore. The attraction is then almost equal to the repulsion.

Concrete example



X axis= distance [mm]
Y axis= force [kg]
Blue curve = attraction
Pink curve = repulsion

A numeric example with our large disc magnet S-45-30-N confirms: The attraction (blue) of a magnet is slightly stronger than the repulsion (pink). At a distance of 4 cm, the attractive, as well as the repulsive force, are at approximately 5 kg.

Distance	Attraction	Repulsion
0 cm	78 kg	72 kg
1 cm	30 kg	28 kg
2 cm	15 kg	14 kg
4 cm	5 kg	5 kg

Aluminum rod

Aluminum is a relatively soft, durable, lightweight, ductile, and malleable with appearance ranging from silvery to dull gray, depending on the surface roughness. It is nonmagnetic and does not easily ignite.

Figure 5. Aluminum Rod

Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

Figure 6. Battery

Bearings

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis or it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts.

Figure 7. Bearing

Dynamo

A dynamo is an electrical generator that creates direct current using a commutator. The electric dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law of induction. Due to Faraday's law of induction the motion of the wire within the magnetic field creates an electromotive force which pushes on the electrons in the metal, creating an electric current in the wire.

Figure 8. Dynamo

Circuit diagram

Figure 9. Shows the circuit diagram of the proposed system.

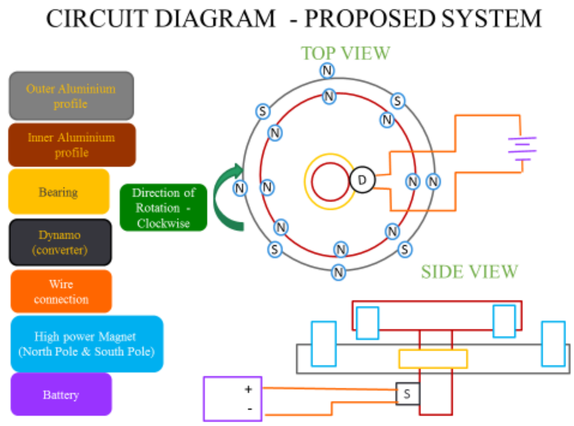


Figure 9. Circuit diagram

In this system Aluminum rod is fixed at the center of the inner plate. Different poles of magnets (North -South) are placed in outer Aluminum plate and same poles are in inner Aluminum plate. Holding key is placed at the end of Aluminum rod to stop the rod become rotating with the help of wood or stainless steel. That is mounted between same poles of magnet.

Because of same poles (North - North), magnets are repelled each other and inner plate is rotated without any external source. By that rotational force produced. It can be done with the help of ball bearings. Then electric current will be induced by using dynamo. Finally from dynamo wire connection is given to car battery for charging.

CONCLUSION

In this project minimum 5V, 1.3Amps current will be produced by using magnets which is given to a battery for igniting process of a car or any other devices. Use this electric current without any external source to overcome the increasing cost of fuel and to reduce pollution. In this, Aluminum rod is used for reducing the weight of hardware. Proposed system uses Neodymium magnet which is high power to induce the required mechanical force. In existing system rotational force only can obtained but in this current will be produced and applied to some application such as battery of a car.

REFERENCES

[1]. Saeid Haghbin, Torbjorn Thiringer, Ola Carlson, “An integrated split-phase dual-inverter permanent magnet motor drive and battery charger for grid-connected electric or hybrid vehicles”, 2012 XXth International Conference on Electrical Machines –2012.

[2]. Bermudez S, .Bottura L, Todesco E, “Persistent-Current Magnetization Effects in High-Field Superconducting Accelerator Magnets”, IEEE Transactions on Applied Superconductivity-2016.

[3]. Chunyan Lai-K, Iyer-Kaushik Mukherjee, Narayan Kar, “Analysis of Electromagnetic Torque and Effective Winding Inductance in a Surface-Mounted PMSM during Integrated Battery Charging Operation”, IEEE Transactions on Magnetics – 2015.

[4]. Ohshima S,Takeishi K, Saito A, Mukaida M, Takano Y,Nakamura T, Suzuki T, Yokoo M, “A Simple Measurement Technique for Critical Current Density by Using a Permanent Magnet”, IEEE Transactions on Appiled Superconductivity – 2005.

[5]. Liwei Shi, Xueyi Zhang, "Permanent Magnet Generators with Three-Phase Half-Wave Voltage Regulator in Hybrid Vehicles", 2009 Asia-Pacific Power and Energy Engineering Conference – 2009.

[6]. Shi Liwei, Zhang Xueyi, "Permanent Magnet Generators with Three-phase Half-wave Voltage Regulator in Hybrid Vehicles", 978-1-4244-2487-0/09 ©2009 IEEE.

[7]. Ren Tsunata, Masatsugu Takemoto, Satoshi Ogasawara, Asako Watanabe, Tomoyuki Ueno, Koji Yamada, "Development and Evaluation of an Axial Gap Motor using Neodymium Bonded Magnet", 2016 IEEE.

[8]. Yachida T, Yoshikawa M, Shirai Y, Member IEEE, Matsuda T, and Yokoyama S, "Magnetic Field Stability Control of HTS-MRI Magnet by Use of Highly Stabilized Power Supply", 2016 IEEE.

[9]. Min Cheol Ahn, Jeongwoo Jang, Woo Seung Lee, Seungyong Hahn, and Haigun Lee, "Experimental Study on Hysteresis of Screening-Current-Induced Field in an HTS Magnet for NMR Applications", 2013 IEEE.

[10]. Geng J, Matsuda K, Shen B, Zhang H, Zhang X, Fu L, Huang Z, and Coombs T.A, "HTS Persistent Current Switch Controlled by AC Magnetic Field", 2015 IEEE.