International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Types of Electric Motors

Samir A. Borkar[1], Saurabh S. Thakare[2], Assist. Prof. Chaitanya. G. Deshmukh[3]

[1]*Student, Dept. of Mechanical Engineering, DES'S COET, Dhamangaon Rly, 444709, India*
[2]*Student, Dept. of Mechanical Engineering, DES'S COET, Dhamangaon Rly 444709, India*
[3]*Professor, Dept. of Mechanical Engineering, DES'S COET, Dhamangaon Rly 444709, India*

A B S T R A C T

There are many different types of electric motors on the market. These motors can be selected based on their functioning, voltage, and applications. The field winding's primary role is to generate a fixed magnetic field, whereas the armature winding resembles a conductor organized within the magnetic field. Electric motors are used in almost every industry and in a wide range of applications. The field winding and the armature winding are two key components of every motor. DC, induction, permanent magnet synchronous, switching reluctance, and brushless DC motors are the five primary types of electric motors explored. Different electric motors are investigated and compared in order to determine the advantages of each motor and which one is best suited for usage in electric vehicle (EV) applications. The conclusion is that, while induction motor technology is more advanced than others, brushless DC and permanent magnet motors are better suited for EV applications. These motors will produce less pollution, consume less fuel, and have a higher power-to-volume ratio

Keywords: Electric Motors, Types, DC Motors, Electric Motors.

1. INTRODUCTION

Around 91 percent of the world's population lives in a region where air quality exceeds the WHO's recommended level. In India, air pollution accounts for around a quarter of the overall pollution. According to Wikipedia, India has nine of the top ten most polluted cities in the world, all of which have extremely dangerous levels of air pollution. This is a serious problem that must be handled right away, or it will have far-reaching consequences. According to the World Health Organization (WHO), over 4.2 million people die each year as a result of diseases caused by air pollution. Electric vehicles, which may be used to replace internal combustion engines, are an effective way to reduce this.

When we turn on an electric drill, for example, we expect it to quickly accelerate to the correct speed, and we don't wonder how it knows what speed to run at, or how the power drawn from the source drops to a very low level once enough energy has been drawn to bring it up to speed. When we turn on the drill, it draws more power from the mains, and when we turn it off, the power drawn from the mains diminishes automatically, without our participation.

The simple motor, which is made up of nothing more than copper coils and steel laminations, is definitely a sophisticated energy converter that deserves serious examination. We will be able to appreciate the motor's potential and limitations by obtaining a rudimentary understanding of how it works, and we will learn (in subsequent chapters) how its already exceptional performance can be further increased by the addition of external electrical controllers. Electric motors are so common in our daily lives that we hardly think about them. The focus of this tutorial will be on energy efficiency considerations in the selection and deployment of three-phase squirrel cage induction motors. They are extremely dependable and tough, and they cover over 90% of the installed capacity of electric motors in the industrial sector. Electric motors are by their very nature incredibly efficient. Their efficiencies range from 85% to 95% for motors with capacities ranging from 10 HP to 500 HP. Because there is such a vast installed base of electric motors, even a slight increase in efficiency can result in significant savings on a national scale.

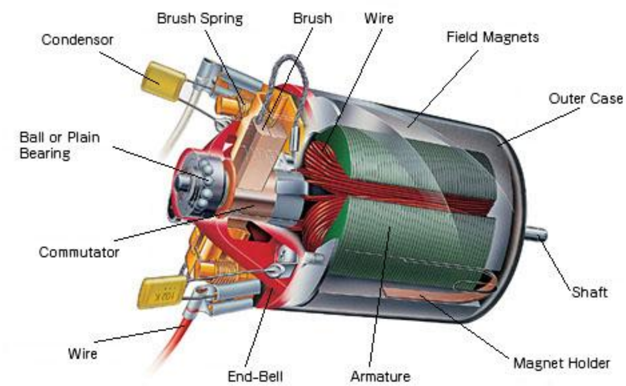

Fig 1.1 Model of Electric Motor

Better efficiency, higher power density, effective regenerative braking, durability, reliability, and lower maintenance requirements distinguish AC motor drives from their DC equivalents. Switched reluctance motors are the "black horse in the race" as DC motors lose their appeal. A survey and comparison of the properties of electric vehicle motor drives are offered. In terms of research, the other three types of synchronous motors, such as induction, brushless DC, and permanent magnet synchronous motors, are far more prevalent. As a result, in this paper, these motors are used in EV applications, and vehicles with similar characteristics are simulated using Advisor software in several driving cycles to assess pollution, fuel consumption, and power to volume ratio.

2. ROLLER CHAIN

Because resistance losses in wiring upstream of the motor are proportional to the square of the current, running with a PF less than one has a significant effect. For efficient overall plant functioning, both a high value for and a PF close to unity are desirable. Induction motors have high efficiency and power factor, which is defined as the ratio of mechanical energy delivered at the rotating shaft to electrical energy input at the terminals (PF). As a result, the total current draw required to deliver the same actual power is greater than that required by a load with a higher PF. Power factors less than one characterize motors, as well as other inductive loads. There are two essential characteristics linked to the efficiency of A.C.'s electricity use. Cost, performance, efficiency, power density, technology maturity, and how easy it is to regulate the motor are all key factors to consider when choosing a motor. We have a wide range of motors to choose from. As a result, choosing a motor is quite important and should be done carefully so that the vehicle can function brilliantly. DC and AC motors are the two types of motors. It is critical that we learn more about these motors in depth and learn more about the properties of each type of motor, as well as whether or not they are acceptable for use in an electric car. Simply explained, DC motors use DC voltage while AC motors use AC voltage. The electric vehicle's most significant component is the motor. The effectiveness with which a motor converts electrical energy input to mechanical energy output to drive a load is measured by motor efficiency. Larger efficiency ratings are usually associated with higher horsepower ratings. Electrical and mechanical losses make up the difference between the power input and the power output. It's defined as the ratio of motor output to source input power. Small fractional horsepower motors have a low operating efficiency, whereas large integral horsepower motors have a high operating efficiency. The motor efficiency is fixed by design at a given operating voltage and shaft load; it cannot be modified externally, whereas power factor can be corrected outside.

3. TYPES OF ELECTRI MOTOR

- AC Motor
- DC Motor
- DC geared Motor
- Stepper Motor
- Servo Motor

1. AC Motor:

An alternating current (AC) motor is an electric motor that runs on alternating current (AC). The AC motor is made up of two basic components: an outer stator with alternating current coils that produce a rotating magnetic field, and an interior rotor coupled to the output shaft that produces a second revolving magnetic field. Permanent magnets, reluctance saliency, or DC or AC electrical windings can all produce a magnetic field in the rotor. An AC motor's structure includes coils that generate a spinning magnetic field inside a rotor connected to an output shaft, which generates a second magnetic field. An alternating current motor (AC motor) is an electric motor that produces mechanical energy by using magnetism and alternating current. Rotating magnetic fields are created by the stator and rotor. The stator, or fixed outer drum, and the rotor, or revolving inner section coupled to the motor shaft, are the two primary components of an AC motor. Alternating current is used to wind the stator, which provides the rotating field. The winding in an AC motor functions as both the armature and the field winding. When an AC supply flux is connected to the stator, an air gap is generated, which rotates the flux at a fixed synchronous speed, producing voltages in the stator and rotor winding.

Fig 3.1 AC motor

2. DC Motor:

A DC motor is an electric motor that runs on DC (direct current) (unlike an induction motor that operates via an alternating current). That is how a DC motor, often known as a direct current motor, works. This is referred to as "motoring activity." Fleming's left hand rule states that if the index finger, middle finger, and thumb of your left hand are extended mutually perpendicular to each other and the index finger represents the direction of the magnetic field, the middle finger represents the direction of the current, and the thumb represents the direction in which force is experienced by the shaft of the DC motor, then the thumb represents the direction in which force is experienced by the shaft of the DC motor. DC electrical energy is converted into mechanical energy by a DC motor. When a current-carrying conductor is put in a magnetic field, it is subjected to torque and tends to move. In other words, a mechanical force is created when a magnetic field and an electric field interact.

Fig 3.2 DC motor

4. DC Geared motor:

By using a gear motor, the user can get a lower speed and higher torque. DC Gear motors are also referred to as DC Geared Motors, Geared Dc Motors, gearhead motors, and gearbox motors. It is made up of an electric DC motor and a gearbox or gearhead that is used to reduce the DC motor's speed while increasing the torque. A gear motor combines a motor and a gearbox into one unit. When a gear head is added to a motor, the speed is reduced but the torque output is increased. In terms of gear motors, the most significant criteria are speed (rpm), torque (lb-in), and efficiency (percent). To choose the best gear motor for your application, you must first calculate the load, speed, and torque requirements for your application. ISL Products has a wide range of Spur Gear Motors, Planetary Gear Motors, and Worm Gear Motors to satisfy your needs. Most of our DC motors can be combined with one of our one-of-a-kind gearheads to create a highly efficient gear motor solution..

Fig 3.3 DC Geared Motor

4. Stepper Motor:

As long as the motor is suitably scaled for the application in terms of torque and speed, the position of the motor can be ordered to move and hold at one of these stages without any position sensor for feedback (an open-loop controller). A stepper motor, sometimes referred to as a step motor or stepping motor, is a brushless DC electric motor that divides a whole rotation into a series of equal steps. A stepper motor is a mechanical device that converts electrical energy into mechanical energy. It's also a brushless, synchronous electric motor with the ability to partition a full rotation into a large number of stages. As long as the motor is properly sized for the application, the position of the motor can be precisely regulated without the use of any feedback device. Switched reluctance motors are comparable to stepper motors. When a pulse of electricity is applied to the stepper motor, the theory of operation for magnets is used to cause the motor shaft to turn a specific distance.

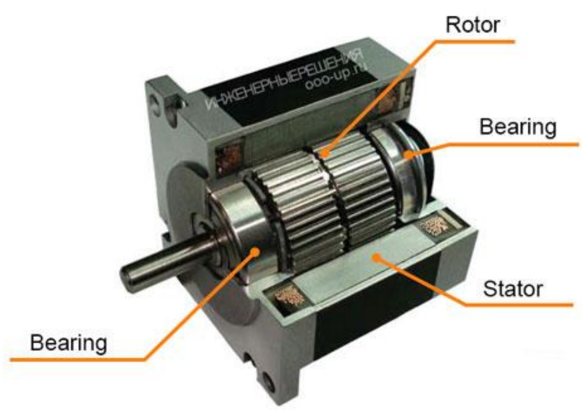

Fig 3.4 Stepper Motor

5. Servo Motor:

A servomotor (or servo motor) is a simple electric motor that is controlled by servomechanism. When a motor is used as a controlled device and is connected to a servomechanism, it is referred to as a DC Servo Motor. A controlled motor that is powered by AC is known as an AC Servo Motor.

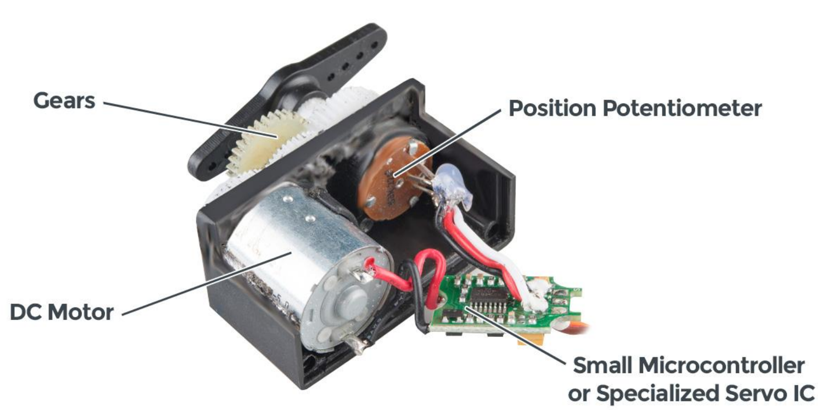

Fig 3.5 servo motor

International Journal of Research Publication and Reviews, Vol 2, no 12, pp 292-296, December 2021

5. Conclusion

It demonstrates how a magnet and coil wire may spin an armature. The electric motor is a device that has resulted in one of the most significant achievements in engineering and technology. Electric motors are classified according to their function and application. The DC and achi motors are used to describe how electrical current is passed through and out of the motor. However, in industries that support ac source voltage, ac motors are commonly employed. How an electric motor operates and how the power of electric magnetic forces aids in the generation of energy

.

References

Bearing Failure: Causes and Cures." Barden Precision Bearings Gray, Will, and Don Macdonald. "A practical guide to understanding bearing damage related to PWM drives." IEEE, 1998.

"Inverter-Driven induction Motors Shaft and Bearing Current Solutions." Baldor Electric Company "Motor Shaft Voltages and Bearing Currents Under PWM Inverter Operation." GAMBICA and REMA Technical Guide, 2006.

Motors: "AC Motor Selection and Application Guide." GE Industrial Systems. "Advanced Vacuum Pressure Impregnation (VPI) System." Solidstate Controls, Inc. "Application Guide For AC Adjustable Speed Drive Systems." NEMA Standards Publication, 2001.

"Determining Electric Motor Load Efficiency." U.S. Department of Energy "Efficiency Improvement for AC Electric Motors." PG&E Energy Efficiency Information, 1997.

"Variable Speed Driven Pumps-Best Practice Guide." GAMBICA Cowern, Edward H. " Bolder Motors and Drives." Baldor Electric Company, 1999.