An Overview on Electric Engines in Electric Vehicles

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ABSTRACT: This paper examines several electric motors as well as electric motors used in electric cars, with comparisons of various motors presented. The study of the advantages of various types of motors and their applications. Induction motors, rather than conventional motors, are now widely employed in a variety of applications. When an external prime mover as well as mechanical energy is applied to an induction motor, it can function as a synchronous motor. Special purpose motors are a type of motor that is designed to meet a certain application or task. DC, induction, permanent magnet synchronous, switching reluctance, and Brushless DC motors are the five primary electric motor types utilised in electric vehicles. These motors are also explored in this article. An electrical vehicle induction motor has been examined and found to be superior to other motors in terms of performance and accuracy. Motors that are powered by electricity It is also known for its non-polluting nature, which is due to the motors used in it, which are BLDC and permanent magnet motors. These two motors are better suited for electric cars, resulting in less pollution, lower fuel consumption, as well as a greater power-to-volume ratio. The cost of magnetic materials has decreased, resulting in higher permanent magnet or brushless DC motor efficiency. DC motors also add to the aesthetic appeal of the electric car.

KEYWORDS: Brushless DC motor, Current, Efficiency, Electrical vehicle, Induction motors.

1. INTRODUCTION

There are many different types of motors in the market; nevertheless, a famous scientist named Faraday developed two different types of electricity and termed them alternating current and direct current [1]. Many studies and tests have been conducted to determine the behaviour of AC or DC, their applications, their features, and how AC or DC differ from one another. A motor is a device that produces mechanical energy generally consists of a stator and rotor, with the stator being stationary and the rotor being rotational. Motors pole which is used in industry is salient pole and non-salient pole arrangement[1]. The stator, rotor, winding, air gap, and brushes are all part of the motor. These are all used in different ways to make different types of motors, such as brushless permanent magnet motors, which operate on direct current but do not require a brush for operation and energy conversion. Other motors are classified according to their position as well as production of back electromotive force, or according to the shape of back electromotive force. Electric motor classification shows in Figure 1.

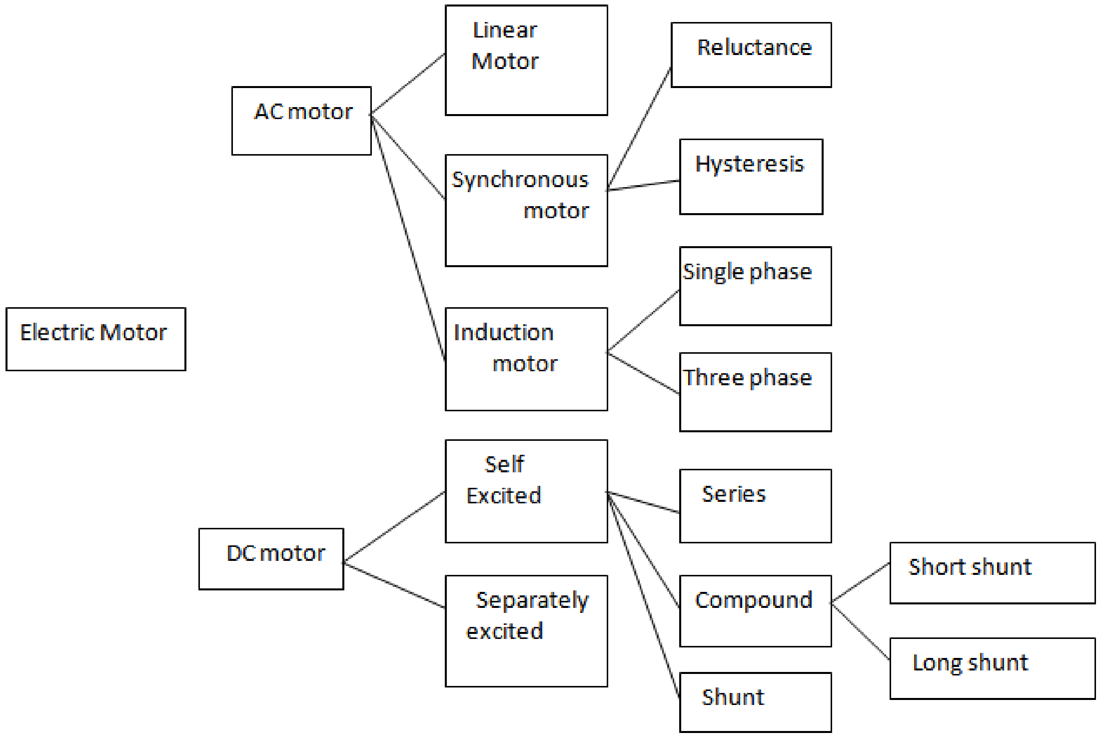

Figure 1: Illustrate diagram showing the classes of electric motor.

Figure 2 shows the classification of motors in which it is visible that electric motor is of two types AC motor and DC motor. The working principle as well as arrangement of the winding, stator, rotor, and air gap are all determined by the working principle and arrangement of the winding, stator, rotor, and air gap. According to the supply voltage, ac motors are divided into three categories: linear motors, synchronous motors, and induction motors; dc motors are divided into two categories: self-excited and separately excited DC motors. Induction motors are divided into single phase induction motors or three phase induction motors, while self-excited DC motors are divided into series self-excited DC motors, compound self-excited DC motors, and shunt self-excited DC motors. Short shunt compound self-excited DC motors and long shunt compound self-excited DC motors are two types of compound motors. Because the electric motor is such a crucial component in the operation of an electric vehicle, its rating and winding should be capable of handling large loads[2].

Induction motors are highly efficient motors that operate on the mutual induction principle. There are two types of induction motors single phase as well as three phase induction motors. Single phase induction motors are not self-excited, whereas three phase induction motors are. Because it does not function at synchronous speed (synchronous speed is the speed at which the magnetic field spins, while slip speed is the difference between the speed of the magnetic field as well as the speed of the rotor or induction motor), an induction motor is also known as an asynchronous motor)

Speed of magnetic field or synchronous speed can be found by formula in which the number of poles and frequency should be known[3].

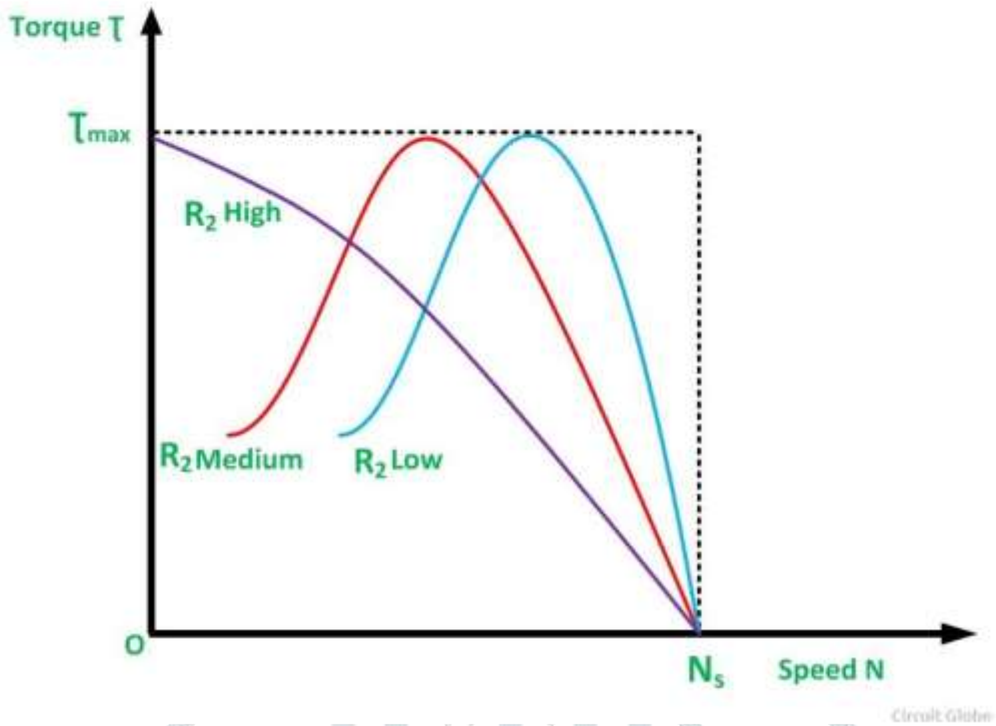

Figure 2: Illustrate graph showing torque Speed Characteristic of an Induction Motor.

Synchronous speed of motor = 120f/p

f= frequency of motor

P = number of poles of motor

A motor's speed is a fundamental property that can be measured in rotations per minute; it is simply the pace at which a motor spins in a minute, as well as torque refers to the amount of force that a motor can produce in its output to drive a load[4].

When a current carrying conductor is put in a magnetic field, a flux is produced, and that flux is responsible for the creation of current in the rotor, and that spinning current will create emf (electromagnetic force), and that emf is responsible for the production of torque. Flux cutting is crucial in induction motors so that magnetic locking cannot occur, which is why the rotor or induction motor speed is lower than the magnetic field speed. Figure 3 depicts a graph of the induction motor's speed and torque. The speed of the induction motor varies as the resistance value changes[5].

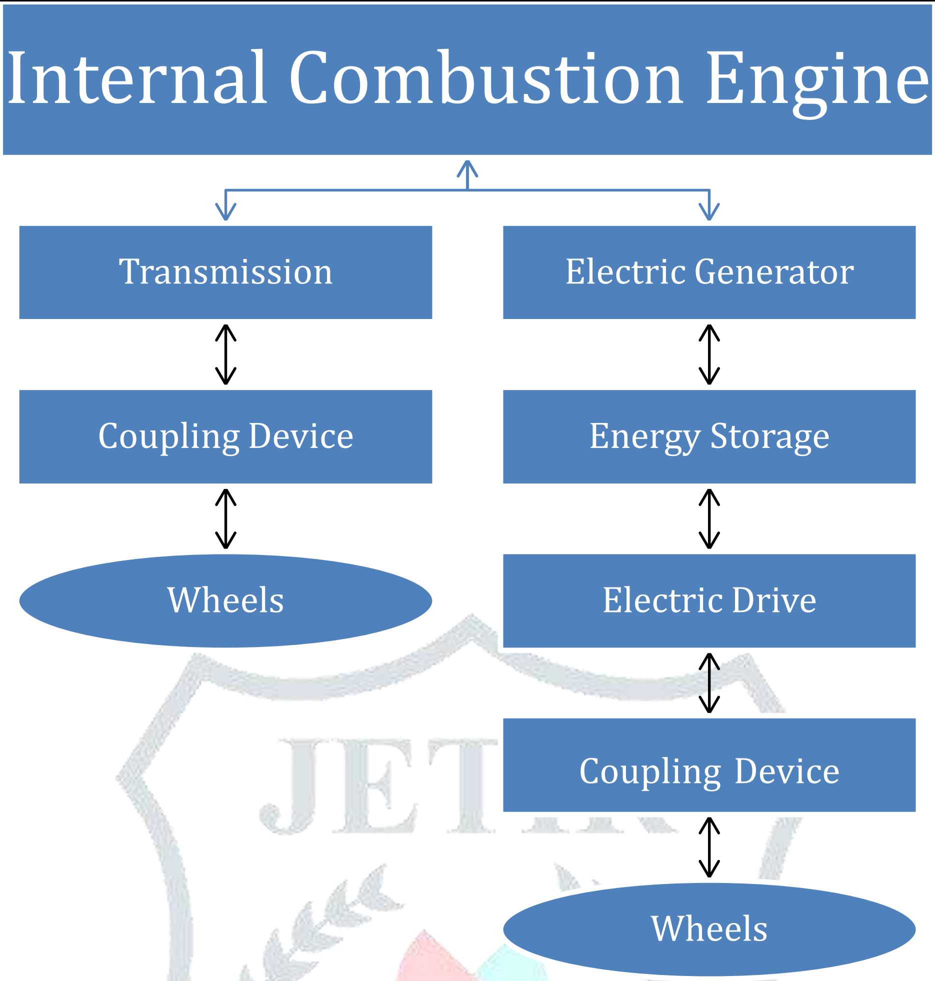

Figure 3: Illustrate Diagram Shows a Hybrid Electric Vehicle Train.

In a hybrid electric car, there is a combination of more than one motor or operation. There is also an internal combustion engine, which is separated into two sections. The transmission is the first part of the internal combustion engine, and the coupling device is used to couple the wheels but instead transmission blocks in a two-way process. The second part of the internal combustion engine is the electric generator, which is used to generate electricity using mechanical power as input). an energy storing block (the energy produced by the electric generator is then stored in this block), an electric drive that uses the produced electric energy, and a coupling device to couple the wheels that drive that drive rotates the wheels of a car, train, or other drive by using mechanical power[6].

An electrical vehicle is made up of many key components, including a source of energy or power, an auxiliary power system, and an ion propulsion subsystem. An electric vehicle's electric propulsion system consists of a controller (a device that can be digital or analogue and is used to control the electric process), a power converter (a device that converts energy into an electrical circuit from one form to another depending on the load, and this is an electrical circuit), and a battery). Mechanical transmission (mechanical transmission is the act of transferring mechanical power from one location to another; it is mostly employed in laboratories to ensure that viruses do not infect the host body) and various electric motors [6]. The properties of several motors used to power electric cars were investigated in this article. In this work, the application of devices such as motors and controllers is also examined. Electric cars run on electricity, drawing power from the grid for operation. The energy spent by the automobile from the power station is then stored in the battery, which may be recharged. According to common understanding, a motor is a mechanical power device that accepts electrical energy and outputs mechanical energy. The motor also spins or rotates the wheel. The speed of an electric automobile is higher than that of a car powered by oil or petrol[7].

2. LITERATURE REVIEW

Mohammad Kebriaei studied about the Internal combustion engines, electric machinery, and power electronic devices are all part of a HEV. An overview of HEVs is provided in this publication. In reality, our goal is to provide an overview of HEVs, including their history, benefits, drawbacks, categorization, vehicle types, energy management techniques, and other relevant information. Because of the need to find alternate means to produce energy for cars owing to limited fuel-based energy, global warming, and exhaust pollution limitations in the previous century, research for hybrid electrical vehicles (HEV) have gotten a lot of attention[8].

Nasser Hashernnia and Behzad Asaei wrote a research paper on Comparative study of using different electric motors in electric vehicles, which discussed the differences between an electric vehicle and a normal engine car, the characteristics of DC motors, the characteristics of induction motors, the study of DC motors, permanent magnet synchronous (PMS) motors (or brushless AC), the conventional characteristics of SRM, and more[9].

Willett Kempton discussed about the electric-drive vehicles. Whether powered by batteries or liquid or gaseous fuels, these vehicles will be valuable power supplies to electric utilities. The present internal combustion passenger car fleet's power potential is vast and underutilized. For example, in the United States, the vehicle fleet has almost IO times the mechanical power of all existing U.S. military vehicles. This study compares three electric vehicle designs over a range of driving requirements and electric utility demand circumstances to examine car battery storage in greater depth. Even if negative assumptions about battery cost and duration are made, the usefulness of tapping vehicle electrical storage outweighs the expense of the two-way hook-up and lower car battery life across a wide variety of situations. For example, in a utility with a medium value of peak power, even a currently available electric car might supply electricity at a net present cost to the vehicle owner of $955 and a net present value to the utility of $2370. Increased storage would bring system benefits like as dependability and cheaper costs for a utility tapping vehicle power, and would subsequently allow large-scale integration of intermittent-renewable energy supplies[10].

3. DISCUSSION

Electric motors are the most important component of an electrical vehicle, as they are responsible for the rotation of the wheels. Based on previous knowledge, different types of motors such as DC motors, induction motors, permanent magnet motors, brushless AC or brushless DC motors, and special type of motors were designed for specific operations, one of which is the switched reluctance motor. A power grid is used to charge an electric car's battery; there are three levels of charging in an electric vehicle; level 3 is also known as rapid DC charging. The EV charges its battery, which really is rechargeable, and then gives electric power to the motor, which the motor converts into mechanical power, which is used to move the car's wheels. The future potential of electric vehicles is quite bright, and in the following year, Tesla will debut their latest type of electric car in India.

4. CONCLUSION

Different motors and their properties have been reviewed and studied in this work. The motor utilised in an electric drive train and automobile was also discussed. The working principle, speed torque, including current torque of a motor have been demonstrated, as well as the operation of motors, requirements during operation, features or quality, or demerits or disadvantages of all accessible motors. In the case of electric vehicles or electric drives, it has been determined that brushless DC motors are more efficient than any other motors. Because of its great efficiency, cheap cost, and high-power density, the BLDC motor is the most efficient of all motors. This motor is used in drives, trains, or automobiles.

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