

A Review on Switched Reluctance Motor with a Detailed Implementation of Electric Vehicles

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ABSTRACT: The Development of today's world has a tremendous influence over many fields just from agriculture to space technology there are so much technological development across the industries in such a way that the transportation has developed so long from traditional IC(internal combustion) Engines till date there is a significant improvement on the revolution of electrical vehicles. EV has so much of influence over the society and it is sustainable to our environment. Major purpose of using electric vehicles is to overcome the utilization of resources. When using switched reluctance motor in electrical vehicle the rise in efficiency and the o.

Keywords: Switched Reluctance Motor, Electric Vehicles, Hybrid Electric Vehicles, Torque speed characteristics.

1. Introduction

The one that is expanding and becoming increasingly important in the globe is the technology. Electric vehicle which is belong to the larger trend for environmentally friendly transportation. There are currently over 40 million electric vehicles in use worldwide, and it is rising quickly. The four primary categories of electric vehicles are Fuel Cell Electric Vehicles (FCEVs), Plug-in Hybrid Electric Vehicles (PHEVs), Hybrid Electric Vehicles (HEVs), and Battery Electric Vehicles (BEVs). HEVs, which combine an internal combustion engine with an electric motor. HEVs can help the gasoline engine, particularly while accelerating, or it can even operate the car for brief distances using only electricity. Both the gasoline engine and regenerative braking are used by HEVs to

replenish their batteries. In this study uses a non-linear controller to operate a switching reluctance motor in a hybrid electrical car with low torque and speed ripple. HEVs employed in Switched Reluctance Motor for further advantages like high efficiency, high power and torque densities. A Switched Reluctance Motor (SRM) in a Hybrid Electric Vehicle (HEV) acts as a generator during regenerative braking to recharge the battery and produces torque and power to the wheels by sequentially switching the stator windings. This makes it possible to manage energy more effectively and depend less on internal combustion engines (ICEs).

2. Evolution of Electric vehicles

The hybrid vehicle technology was introduced not to save the fuel but to assist IC engines in performance. The very first hybrid vehicle was

reported in 1899 at the Paris Salon. The Vehicle were driven by Electrical Energy is known as E-vehicle. It was invented by Frenchman Gustave Trouve in 1881. That vehicle using of DC motor were the power supplied by lead acid battery to operate the three wheel vehicle (tricycle). The weight of the Vehicle was 160KG (with driver). It was commercially failure because the DC motor produces only 0.01hp. After two years in 1883 the French professor were decided to start the development of E-vehicle though the development of E-vehicle were successful in commercial areas. It was created by Mooris Salaman, named as electro-bot is called Electric vehicle. This E-vehicle were achieved the top speed of 33kmph that engine was produce 1.25hp through Electrical Motor.

In 1896 Scientist M Deraac invented the regenerative braking. Regenerative braking is a system that capture kinetic energy while applying braking converted in to electrical energy to recharge a battery. In 1905 the production of Electrical vehicles were completely stopped due to the large number of load were failed to carry, failure of pickup. Comparative to petrol diesel engines it was inefficient so the production of the E-vehicle were totally stopped after the years. The BELL company was first introduced a semiconducting devices in 1945 it will create a huge impact in the electrical and electronic field. with the help of thyristor creates the huge impact in electrical motors because using the thyristor in electrical motor it produce the high voltage and constant current supply after 11year the General Motor company was invented a new model of E-vehicle in 1956. In that E-vehicle The Induction Motor were used for run a vehicle and giving a power supply by the electronic equipment's it was a main advantage to the E-vehicle

The production of the E-vehicle again started in 1990 but in this time also met up to failure because of the inefficient in speed, range and batteries. After the year of the 1990 E-vehicle

industry gets more attention in Hybrid vehicle field.

3. Development in Hybrid Vehicles

Hybrid vehicle technology is the combination of IC with electric motor. The first hybrid vehicle was introduced in 1899 at Paris salon. It was parallel hybrid vehicle with gas engine and electric motor with lead acid batteries. In 1902 H.Kriegar, a Frenchman introduces series hybrid vehicle accompanied with two DC motor that drive the front wheels, DC motors are energised by 44 lead acid batteries and were charged by 4.5hp alcohol spark engine coupled with DC generator. It was not commercially success because of the high cost and usage of more motors can cause various hazards.

Controlling the electric motor is another difficulty and initially it was controlled by mechanical switches and resistors. Due to the evolution of power electronic make the controlling of motor makes better and easier. Later it was developed by Dr.Victor Wouk in 1975. Dr. Victor Wouk and team built parallel hybrid vehicle. Again 1990 hybrid vehicle got more attention. US government encouraged the development of parallel hybrid electric vehicle like ford prodigy (car) and GM percept were pair with small turbo charge diesel engine.

Later it was developed by French Renault, toyoto, Honda were made significant effort in commercializing in hybrid vehicles.

4. Principle and Modelling Equations of Switched Reluctance Motor

There are different configurations for the switched reluctance motor depending on the number of rotor and stator poles, such as 6-4, 8-6, 12-8 etc. The cross sectional view of an 8-6 SRM, for which there are 8 stator poles and 6 rotor poles, is shown in Fig.1. The eight stator coils are connected to give four phases. In SRM, generally, any one phase will be energized at a particular instant of time. Consider that phase 1-1' is energized for a considerable time. The rotor

will occupy the stable position as shown in the figure where the inductance of phase 1-1' is maximum. The rotor is in a stable equilibrium since any slight displacement of the rotor from this position is followed by an electromagnetic torque trying to pull back the rotor to the original position.

5. Working Principle of Switched Reluctance Motor

SRM (Switched Reluctance Motor) is an electromagnetic and electrodynamics equipment which converts the electrical energy into mechanical energy. It's a DC Motor and also known as self-starting motor. In SRM the electromagnetic torque is developed just based on variable reluctance principle, such as power semiconductor switching circuit and positioning of rotor sensor

In SRM the inductor is inversely proportional to reluctance, air gap is directly proportional to the reluctance of the conductor and the minimum of reluctance creates the inductor winding maximum and the phase of next winding is energized due to the A phase alignment of stator is same.

The switched reluctance motor (SRM) drives for industrial applications are of recent origin. Since 1969, a variable reluctance motor has been proposed for variable speed applications. The origin of this motor can be traced back to 1842, but the "reinvention" has been possible due to the advent of inexpensive, high-power switching devices. Even though this machine is a type of synchronous machine, it has certain novel features

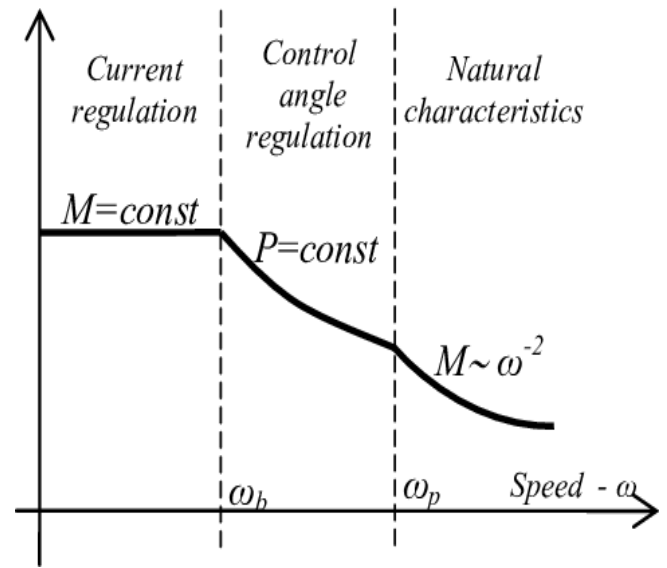


Figure 1: Torque speed characteristics

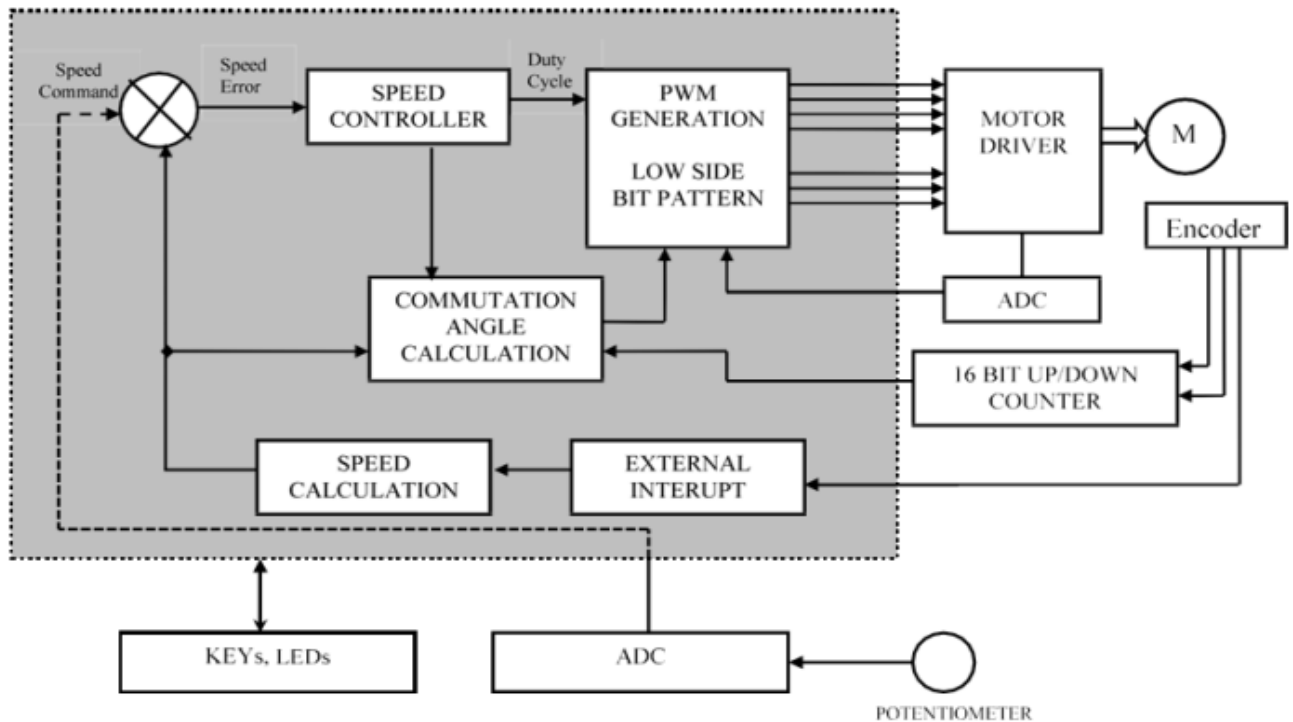


Figure 2: Microprocessor based control SRM motor

6. Converter Configuration

The mutual coupling between phases is negligible in SRMs. This gives complete independence to each phase winding for control and torque generation. While this feature is advantageous, a lack of mutual coupling requires a careful handling of the stored magnetic field

energy. The magnetic field energy has to be provided with a path during commutation of a phase: otherwise. It will result in excessive voltage across the windings and hence on the power semiconductor switches leading to their failure.

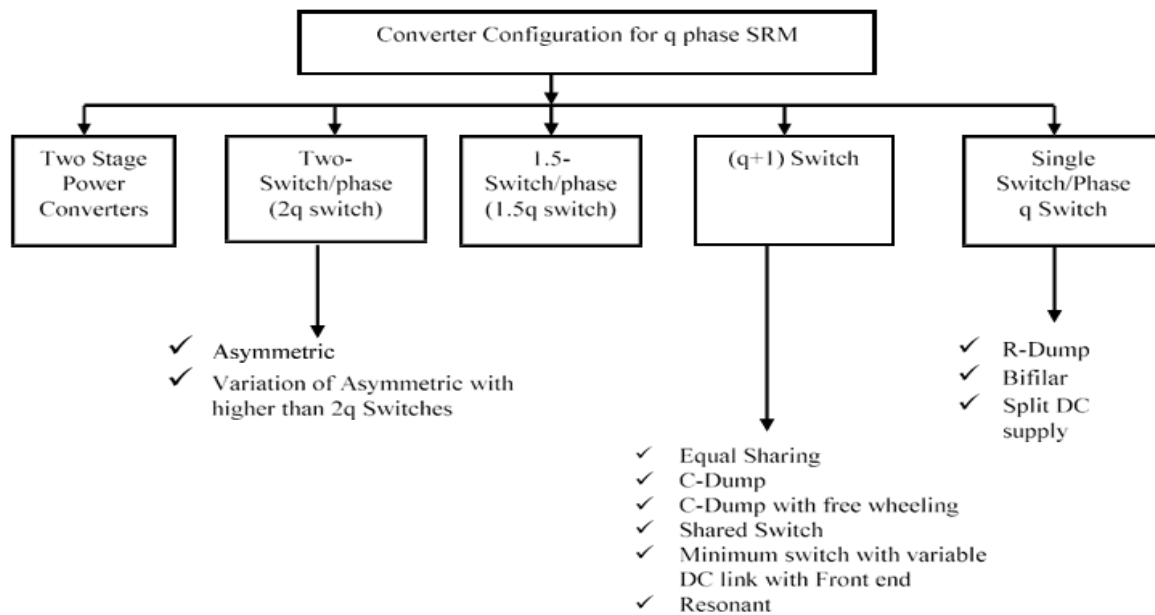


Figure 3: Converter Configuration

7. Conclusion

The modernization of the time has a special emphasize on a green and clean environment, a concern on preserving the nature for the generations to come. There are many who think over the reduction by replacing the IC engine used for transportation with an electric vehicle. Further studies on Switched Reluctance Motor along with the development in power electronics and digital controllers open up new set of solutions which can even replace all the conventional electric motors that are used for different applications especially in the field of electric or hybrid vehicle technologies. In near future the researches will find its fruits.

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