Everything About Switched Reluctance Motor

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Switched reluctance motor (SRM), also called variable-reluctance motor is gaining much interest in industrial applications such as wind energy systems and electric vehicles due to its simple and rugged construction, high-speed operation ability, insensitivity to high temperature, and its features of fault tolerance. SRM motors have been used extensively in clocks and phonograph turntables before, but nowadays, with the rising emphasis on energy efficiency, SR motors are taking more prominent roles in appliances, industrial uses, and commercial and vehicular applications. In this article, we are giving an overview of switched reluctance motors, their operation, applications, and differences from other motors. Read this new blog in Linquip to find out more about this motor.

Our purpose at Linquip is to provide as many details as possible on the website about motors so that you can make informed decisions. If you have any questions about switch reluctance motors and the equipment associated with them, Linquip is the best platform to contact. In order to answer any queries you might have regarding motors, Linquip's experts are available to help at any time. Take a look at Linquip's article entitled, "**What is Industrial Motor?**" which provides an overview of the concept.

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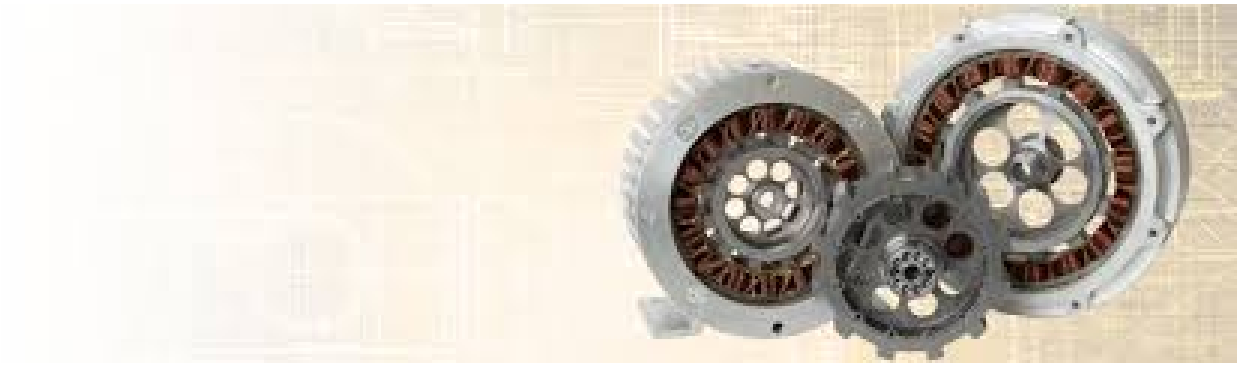
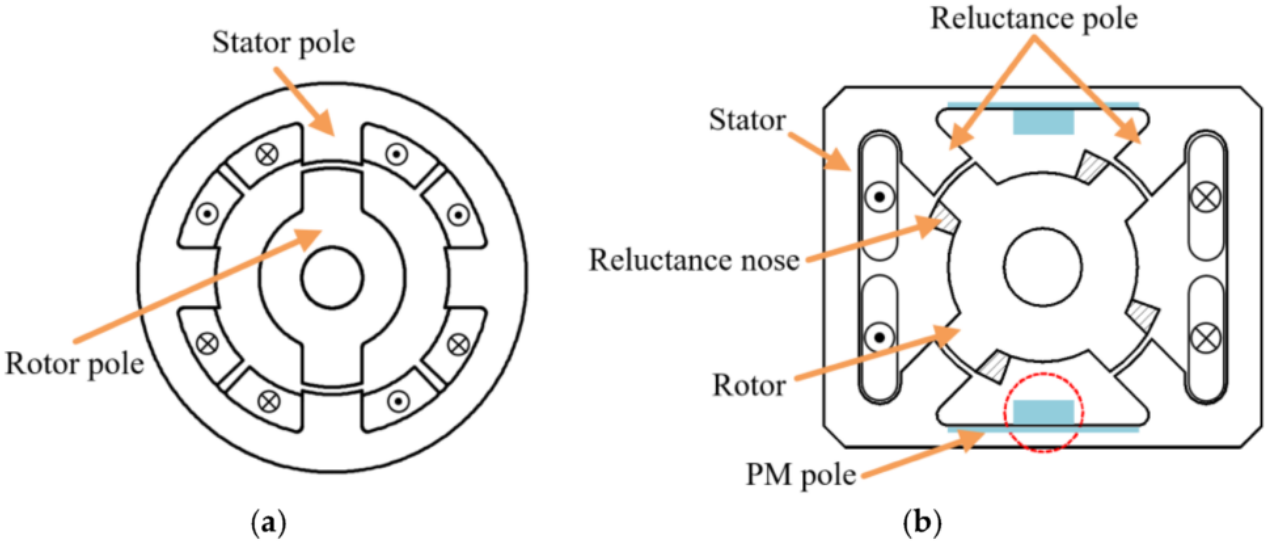


About Switched Reluctance Motor

To understand this motor better, let's have a review of the definition of each word one by one.

- Reluctance is an engineering term that means that when you create an electromagnetic field, any steel part that is located near that field is reluctant to remain un-aligned with the field that is provided. The electromagnetic field will exert a strong force onto any steel part near it to align with the invisible magnetic field.
- The switched part means that the location for the magnetic field that is performing the work is switched from one location to the next adjacent location so that the rotor will continuously spin.

A Switched Reluctance (SR) motor is an electromagnetic, rotary machine in which torque is produced by the tendency of its movable part to move to a position where the inductance of the exciting winding is maximized. Switched reluctance motor manufacturers claim they offer better performance and reliability, higher efficiency, and lower price than standard induction or other adjustable speed motors.



Switched Reluctance Motor Construction

An SR motor is simple and rugged. This motor has both salient pole stator and rotor like a variable reluctance stepper motor. A one-phase winding of a 4-phase switched reluctance motor has 8 poles on the stator and 6 poles on the rotor. While the rotor has no windings, each stator pole has a concentrated winding around it and each pair of diametrically opposite coils comprise one phase of the motor. These motors are designed for applications different from those for which stepper motors are designed.

According to the switched reluctance motor for sale list and among various possible combinations of stator and rotor pole numbers in SRMs, the commonly used are 8/6 and 6/4. The stator has concentrated coils and diametrically opposite coils are connected in series or parallel to provide one phase. Thus, motors with pole numbers 6/4 and 8/6 will have three and four phases respectively.

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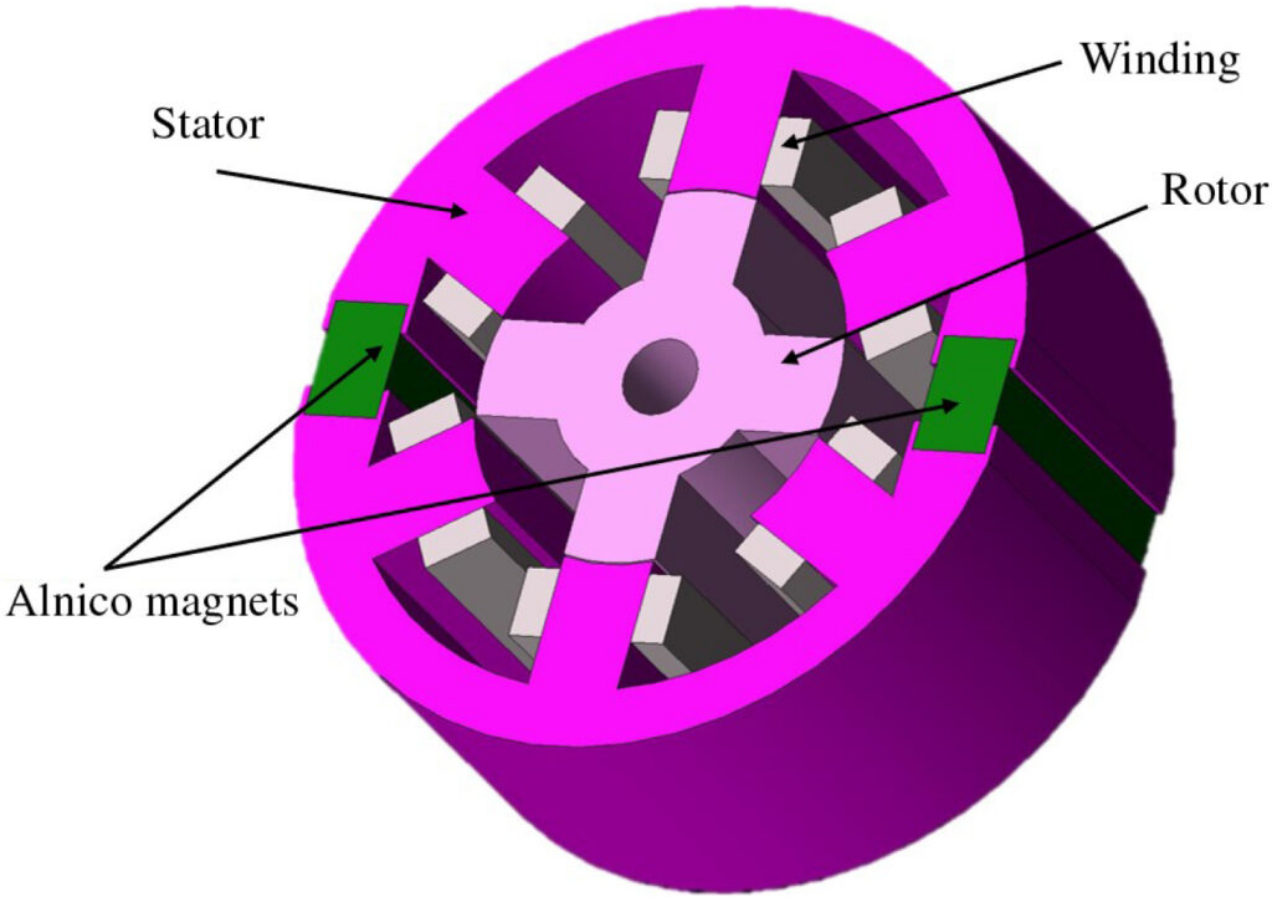
Switched Reluctance Motor Operations

The switched reluctance motor working principle is simple, let us take an iron piece. If we keep it in a magnetic field, the iron piece will align with the minimum reluctance position and get locked magnetically. The same principle is followed in the switched reluctance motor. As the name suggests, a switching inverter is required for the operation of a switched reluctance motor. It works on the principle of variable reluctance, meaning the rotor always tries to align along the lowest reluctance path. The minimum reluctance portion of the rotor tries to align itself with the stator magnetic field. Hence the reluctance torque is developed in the rotor. This motor exploits the fact that the forces from a magnetic field on the iron in the rotor can be up to ten times greater than the magnetic forces on the current-carrying conductors.



How do Switched Reluctance Motors Differ from Other Motors?

SRM designs have come into research and development in recent years with renewed structures. SRMs have the simplest structure among all rotating electrical machines since their manufacturing cost is the lowest compared to that of mainstream brushless poly-phase machines, such as induction, permanent magnet synchronous, and brushless DC. Let's take a look at the differences between switched reluctance and other motors.

Switched Reluctance Motor vs Stepper Motor

A switched reluctance motor can be considered a stepping motor in type. However, important differences in their configuration and methods used to control them have placed switched reluctance motors into a separate category. The most important differences between SRMs and stepper motors are as follows:

- SRMs have much bigger steps but much fewer poles than steppers.
- SRMs find use in applications where power density is a primary concern while stepper motors are typically chosen for positioning applications, where step integrity and high resolution are important.
- SRMs have a closed-loop control system while steppers have specific steps and operate without the use of feedback and in an open loop.
- SRMs produce more audible noise than stepper motors.
- Unlike stepper motors, there is no overlap of coils between successive phases in switched reluctance motors.

- SRMs have rotors that have lower inertia and can therefore achieve higher accelerations and speeds than stepper motors.
- SRMs can withstand higher temperatures (less cooling required) and simple, lower-cost construction than stepper motors.

Switched Reluctance Motor vs BLDC

A switched reluctance motor operates by switching currents in the stator windings in response to changes in the magnetic circuit formed by the rotor and stator. The stator of a switched reluctance motor contains windings, similar to a brushless DC motor, but the rotor is simply made of steel that is shaped into salient poles, with no windings or magnets. The followings are some differences between SRMs and brushless DC motors:

- **BLDC motors** inverter would be significantly more expensive than the SRMs inverter by considering the currents that must be supported by the switches.
- **BLDC motors** have six switches that must support 325A while the SRMs have eight switches that must support 140A.
- **SRMs** use a smaller air gap than the **BLDC motors.**

Switched Reluctance Motor vs Induction Motor

In a switched reluctance motor, both stator and rotor have salient poles, the stator winding consists of a set of coils, each wound on a pole, the rotor is only made with steel lamination stacked onto the shaft. This is the main difference with induction motors which have rotor windings or permanent magnets. Unlike induction motors, there are no rotor bars and consequently no torque-producing current flow in the rotor in SRMs. Switched Reluctance Motors can provide an effective alternative to induction motors in many situations where the operating conditions do not suit them. Disadvantages of induction motor based systems include:

- **Induction Motors** with direct-on-line starting, draw very high starting currents, especially where the initial torque is high.
- **Induction Motors** with soft starting have limited torque available to start loads.
- **Induction Motors** with variable frequency drives (VFD) are less efficient where there is regular acceleration, deceleration, stopping, and reversal.

Switched Reluctance Motor Applications

In switched reluctance motor applications both energy and cost, efficiency plays an integral role. The switched reluctance motor is being considered, nowadays, for applications ranging from low power servo motors to high power traction drives. Motors of power ratings varying from 4 to 22 kW are commercially available at present for many applications. Typical applications include:

- **Domestic appliances such as washing machines, vacuum cleaners, fans, etc.**
- **Machine tools: Planers, vertical lathes, drilling machines**
- **General machinery: fans, pumps, compressors**

- **Food mixing machinery**
- **Lifting machines: lifts, winches, conveyors**
- **Power generation equipment: wind turbine rotor blade load control**
- **Plastic manufacturing: extrusion machinery, injection molding machines**
- **Papermill machinery**
- **Metal rolling mill**
- **Coil winding and unwinding machinery**
- **Oilfield machinery including vertical pumps, beam pumps, well testing machinery**
- **Mechanical presses such as screw presses**
- **Mining machinery including shearers, conveyors, winches, boring machines, ball mills, coal crushers**
- **Electric vehicles**

So, there you have a detailed description of the SRMs. If you enjoyed this article in Linquip, let us know by leaving a reply in the comment section. Is there any question we can help you through? Feel free to sign up on our website to get the most professional advice from our experts.