IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, September 2023

# Switched Reluctance Motor

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**Abstract:** *There has been a growing interest in switched reluctance motor (SRM) ever since the development of thyristor in 1956. The most appealing feature of SRM which attracts researchers over these years is its simple structure that incorporates concentrated windings on the stator poles and plain laminations of ferromagnetic material as a rotor. Due to this attributes, advances are being made rapidly with the consideration that SRM can be used as an alternative to DC motors and permanent magnet motors. The objective of this paper is to present an overview of the recent developments and a prediction of possible future advancements in SR Drives. Brief history, importance, innovations in structure and control, along with practical application examples are all discussed here to give a more in-depth comprehension of the motor.*

**Keywords:** Switched Reluctance Motor

## I. INTRODUCTION

SWITCHED reluctance motor (SRM) is a doubly salient electric machine that relies on reluctance torque to rotate rather than electromagnetic torque, as indicated on the name. The term switched comes from the fact that the motor depends heavily on power switching transistors for its operation. This, however, was the factor that slowed the development of SRM since power electronics were not so advanced. Robert Davidson invented the world's first electric locomotive for the Edinburgh-Glasgow railway line on 22nd September 1842 which was driven by a motor that he created in 1839 . The structure of Davidson's motor was simple: there was a pair of horseshoe-shaped electromagnets each connected to either a rotary switch or commutator and a wooden cylinder with an odd number of iron bars on it. By alternately turning the switches on and off, the iron bars will be pulled towards the corresponding electromagnets, thus creating a rotation. As primitive as it might be, this later became the fundamental principle of modern SRMs, which will be explained in detail in the next section. Although there were some problems such as a significantly large radial force when an iron bar gets aligned with an electromagnet that would detach it from its wooden frame and high eddy loss on the iron bars, Davidson's motor was functional and became one of the remarkable inventions throughout history. There were a few variations of the early SRMs which rooted from the electromagnetic motor by Davidson, but the name itself did not arise to the public until 1969 when S. A. Nasar published his paper titled "D.C.-Switched Reluctance Motor" . The rotor consisted of a single iron blade and there were six electromagnets which current us switched on and off according to the rotor position. This model slightly resembled the modern SRM and it was introduced as a commutator-less DC motor emphasizing on the replacement of commutators with solid-state switching devices.


DOI: 10.48175/568

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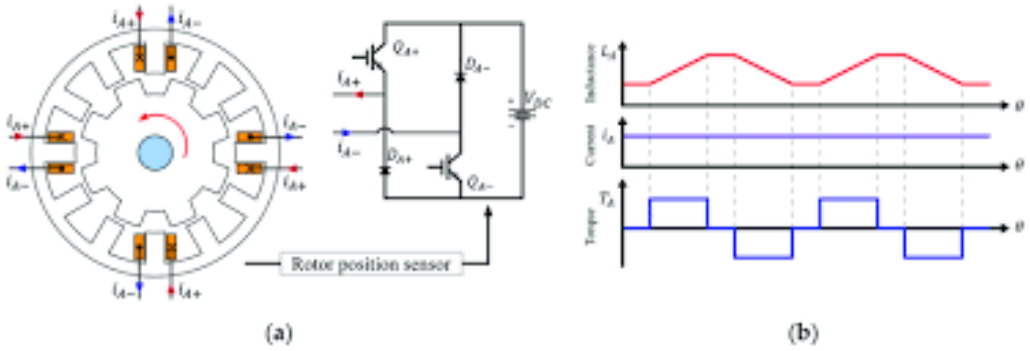


**Advantages of Switched Reluctance Motor :**

- High precision torque feedback compared to conventional control strategies such as chopping current control. This opens possibilities for high-performance speed and position controller.
- Directly controlled torque which is simple to implement by using hysteresis controllers with no predetermined current information needed. This is if compared to other instantaneous torque control strategies, such as current control-based torque sharing function and current profiling method, where torque-current transformation is required.
- Commutation strategy is also not needed and the same principle can be applied in any rotor position. Meanwhile.

**Disadvantages of Switched Reluctance Motor :**

- SRM is generally singly excited and the excitation of additional phase together may generate negative phase torque and reduce total output. Therefore, a constant amplitude of flux vector does not have to be kept constant in SRM, unlike in induction motors .
- High phase current is required to generate constant flux which increases copper losses and reduces efficiency. This is achieved by longer phase conduction time. Moreover, the absence of current controller allows possibility for the current to exceed maximum allowed value.

## II. CONCLUSION

A brief review on SRM research trends is presented in this paper. SRM is simple in structure which is its main attracting point. The rotor is merely a stack of core laminations and the stator winding is that of the distributed type that can just be easily inserted to stator pole. Over the years, there are inventions made to improve SRM performance such as adding rib to the rotor to reduce windage loss, non-uniform air-gap for wider positive torque region, short-flux path to reduce core loss, bearingless structure to increase efficiency by lowering friction, and adding permanent magnets to

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single-phase SRM to give definite starting position. The reason why SRM research is only growing in the last couple of decades is because of its dependency on power converter. The motor control also become variant and much more improved. For example, direct torque control which was primarily used in AC motors only can now also be implemented in SRM and also sensorless control where rotor position is estimated and mechanical position sensors can be eliminated. Some notable applications are also shortly explained. In conclusion, SRM is a viable alternative to permanent magnet motors and is a good candidate for low-cost and/or high-speed drive. It is the duty of future researchers to investigate solutions to the motor's drawbacks and explore its potential either for research purposes or commercial products.

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