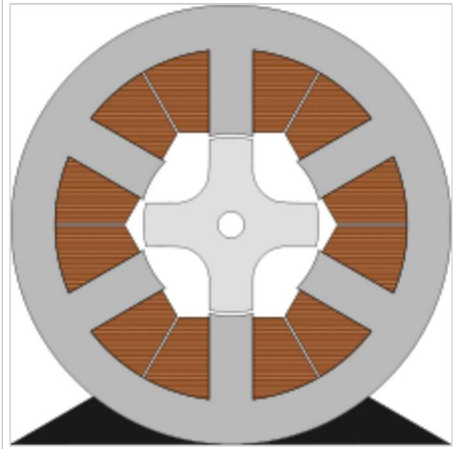
Switched reluctance motor

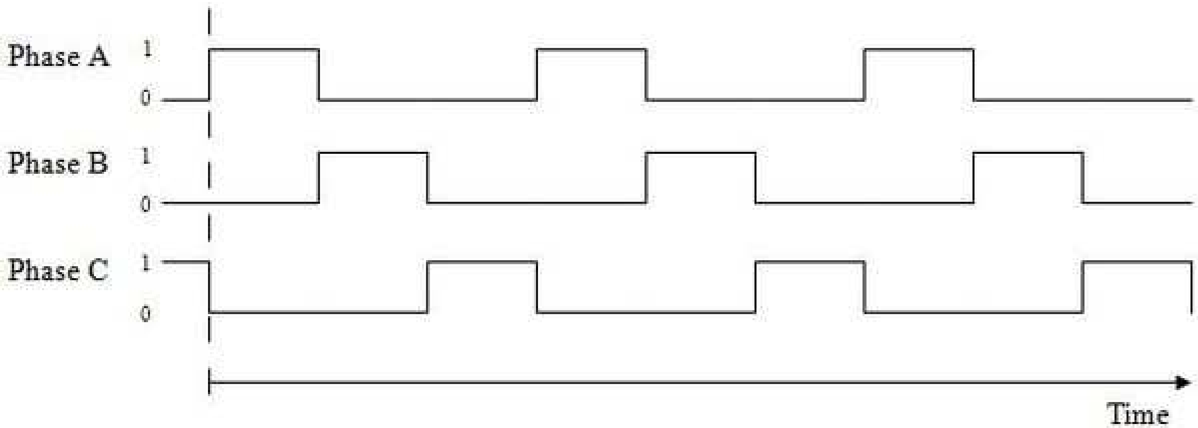
The **switched reluctance motor** (**SRM**) is a type of reluctance motor, an electric motor that runs by reluctance torque.



6/4 Pole SRM

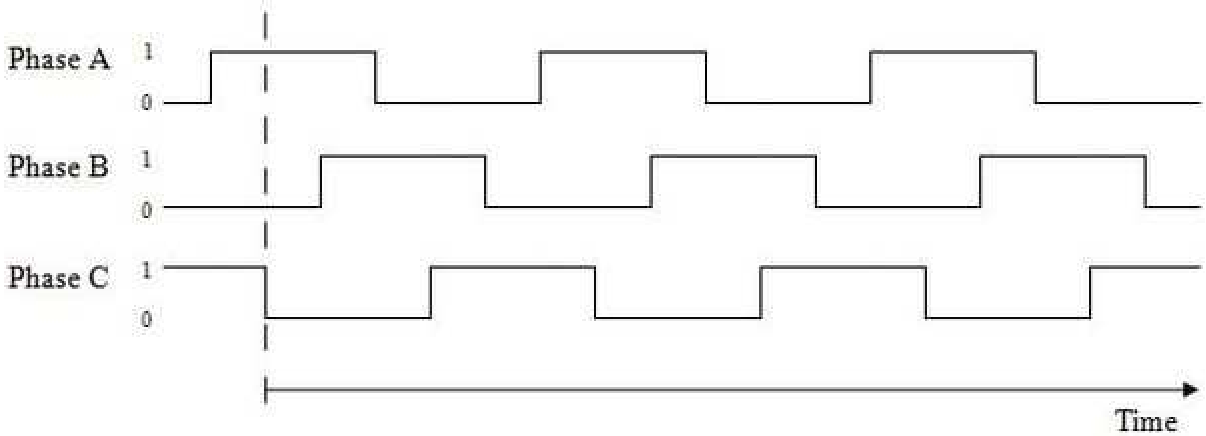
Operating principle

The SRM has wound field coils as in a DC motor for the stator windings. The rotor however has no magnets or coils attached. The rotor of the motor becomes aligned as soon as the opposite poles of the stator become energised. In order to achieve a full rotation of the motor, the windings must be energised in the correct sequence. For example, if the poles a1 and a2 are energised then the rotor will align itself with these poles. Once this has occurred it is possible for the stator poles to be de-energised before the stator poles of b1 and b2 are energised. The rotor is now positioned at the stator poles b. This sequence continues through c before arriving back at the start. This sequence can also be reversed to achieve motion in the opposite direction. This sequence can be found to be unstable while in operation.



Improved sequence

A much more stable system can be found by using the following sequence, firstly the stator poles a1 and a2 are energised. The stator poles of b1 and b2 are then energised which pulls the rotor so that it is positioned between the stator poles of a and b. Following this the stator poles of a are de-energised and the rotor continues on to be aligned with the stator poles of b, this sequence continues through bc, c and ca before a full rotation has occurred. This sequence can also be reversed to achieve motion in the opposite direction.



In addition to more stable operation, this sequence provides a well-timed sequence as the timings of the phase being both on and off are equal, rather than being at a 1:2 ratio as in the simpler sequence.

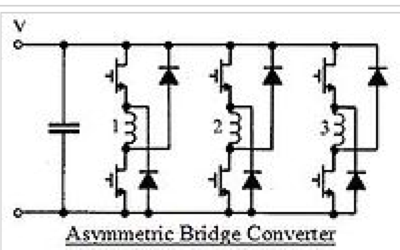
Control

The control system is responsible for giving the required sequential pulses to the power circuitry in order to activate the phases as required. While it is possible to do this using electro-mechanical means such as commutators or simple analog or digital timing circuits, more control is possible with more advanced methods.

Many controllers in use incorporate programmable logic controllers (PLCs) rather than electromechanical components in their implementation.

A microcontroller is also ideal for this kind of application since it enables a very precise control of the phase activation timings. It also gives the possibility of implementing a soft start function in software form, in order to reduce the amount of hardware required.

Power circuitry



Asymmetric Bridge Converter

The most common approach to the powering of a switched reluctance motor is to use an asymmetric bridge converter.

There are 3 phases in an asymmetric bridge converter corresponding to the phases of the switched reluctance motor. If both of the power switches on either side of the phase are turned on, then that corresponding phase shall be actuated. Once the current has risen above the set value, the switch shall turn off. The energy now stored within the motor winding shall now maintain the current in the same direction until that energy is depleted.

This basic circuitry may be altered so that fewer components are required although the circuit shall perform the same action. This efficient circuit is known as the (n+1) switch and diode configuration.

A capacitor can be added to either configuration, and is used to address noise issues by ensuring that the switching of the power switches does not cause fluctuations in the supply voltage.