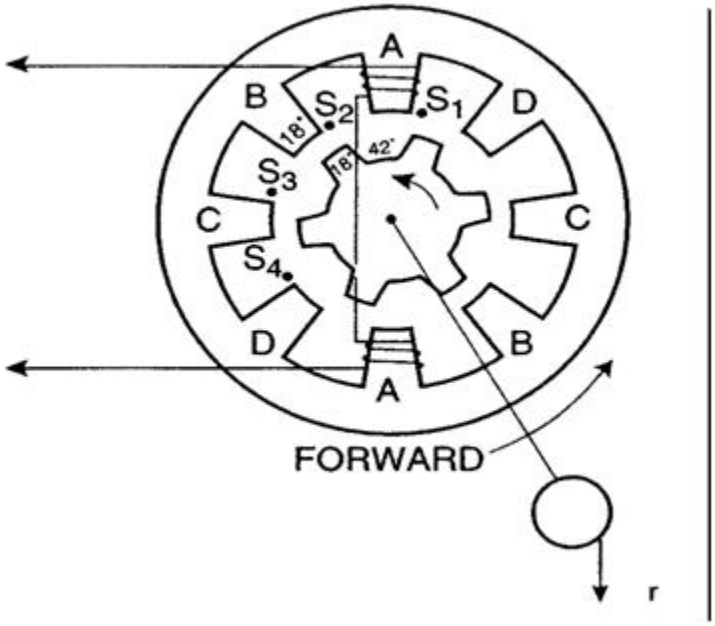
SWITCHED RELUCTANCE MOTORS

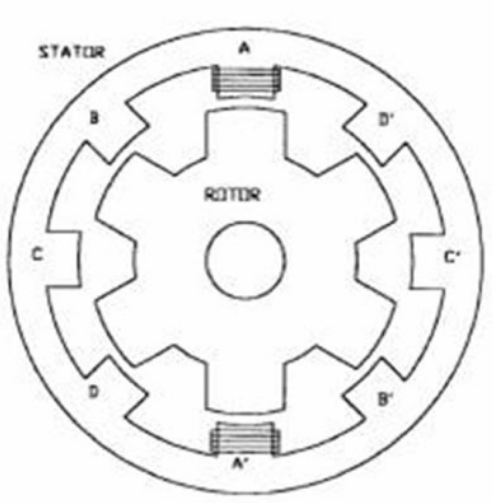
The structure of a switched reluctance motor is shown below. This is a 4-phase machine with 4 stator-pole pairs and 3 rotor-pole pairs (8/6 motor). The rotor has neither windings nor permanent magnets.



The stator poles have concentrated winding rather than sinusoidal winding. Each stator-pole pair winding is excited by a converter phase, until the corresponding rotor pole-pair is aligned and is then de-energized. The stator-pole pairs are sequentially excited using a rotor position encoder for timing.

CONSTRUCTION

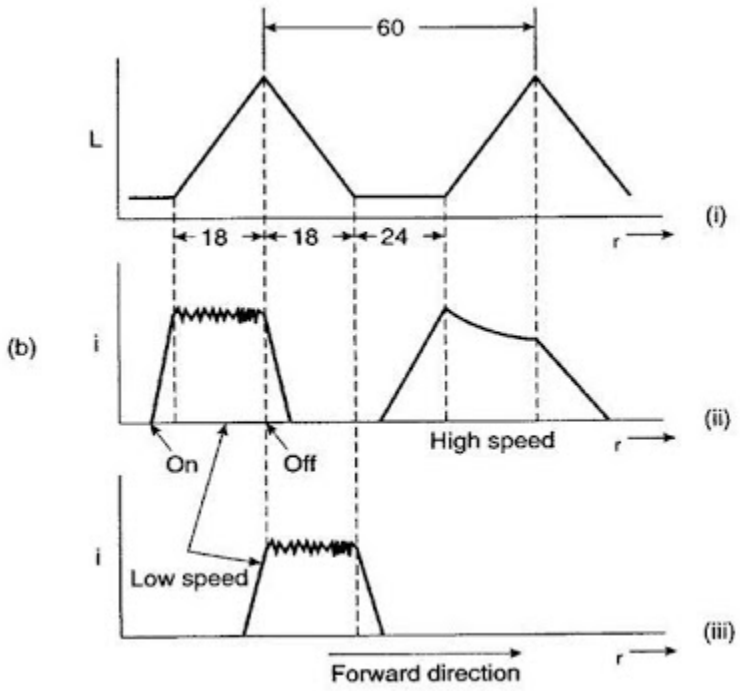
- STATOR AND ROTOR ARE SALIENT IN STRUCTURE
- STATOR WINDINGS ARE INDEPENDENT CONCENTRATED WINDINGS WHICH ARE EXCITED WITH SWITCHES FROM SOURCE
- NO FIELD WINDINGS HENCE SINGLY EXCITED
- DIAMETRICALLY OPPOSITE ARMATURE WINDINGS ARE CONNECTED TO FORM A PHASE
- FOR BIDERCTIONAL CONTROL AND SELF STARTING,NUM OF ROTOR POLES ARE LESS THAN NUM OF STATOR POLES
- M15,M17,M19 FOR HIGH SPEED AND HYPERCO AND VANADIUM PERMENDUR FOR HIGH PERFORMANCE
- SINGLE STACK AND MULTI STACK CONSTRUCTION POSSIBLE



WORKING

- FIG SHOWS AN 8/6 SINGLE STACK WHICH HAS 4 PHASES A,B,C,D
- WHEN PHASE A IS EXCITED RELUCTANCE TORQUE CAUSES ROTOR TO TURN UNTIL IT ALIGNS WITH AXIS OF PHASE A.
- EXCITATION IS CHANGED TO B AND A IS DEEXCITED BEFORE ALIGNMENT
- ROTATION IS IN DIRECTION OF ENERGISATION
- DIRECTION OF ROTATION REVERSED BY REVERSING SEQUENCE OF EXCITATION
- SPEED DEPENDS ON MAGNITUDE OF INPUT MICROSTEPPING CAN BE DONE FOR SINGLE STACK ONLY 1 ROTOR AND STATOR
- FOR MULTI STACK OPERATION,NUM OF ROTOR AND STATOR DEPENDS ON NUM OF PHASES
- POSITION OF MIN RELUCTANCE CHANGED WITH HELP OF POSITION SENSORS
- WHEN PHASE IS EXCITED AFTER THE ROTOR PASSES POINT OF MIN RELUCTANCE, REVERSE TORQUE ACTS[REGENERATIVE BRAKING]

The inductance of a stator-pole pair and corresponding phase currents as a function of angular position is shown below.



Applying the stator pulse when the inductance profile has positive slope induces forward motoring torque.

Applying the stator pulse during the time that the inductance profile has negative slope induces regenerative braking torque.

A single phase is excited every 60degree with four consecutive phases excited at 15degree intervals.

The torque is given by:

$$T_e = \frac{1}{2} m i^2$$

where m = inductance slope and
i = instantaneous current.

Switched reluctance motors are growing in popularity because of their simple design and robustness of construction. They also offer the advantages of only having to provide positive currents, simplifying the

inverter design. Also, shoot-through faults are not an issue because each of the main switching devices is connected in series with a motor winding. However, the drawbacks of this type of motor are the pulsating nature of their torque and they can be acoustically noisy (although improved mechanical design has mitigated this problem.)

ADVANTAGES

- ROTOR HAS NO WINDINGS COMMUTATOR OR BRUSH
- TORQUE –INERTIA RATIO IS HIGH
- HIGH RELIABILITY,WIDE SPEED RANGE,LOW COST
- FAST RESPONSE,RUGGEDNESS,FAULT TOLERANCE
- NO SHOOT THROUGH AND CROSS OVERS IN CONVERTER
- NO PERMANENT MAGNET
- OC VOLTAGE AND SHORT CIRCUIT CURRENT AT FAULTS IS ZERO

DISADVANTAGES

- ROTOR POSITION SENSORS REQUIRED
- TORQUE RIPPLES ARE HIGH
- ACOUSTIC NOISE IS PRESENT

APPLICATIONS

- FLUID PUMPS,VACUUM BLOWERS
- PROCESS CONTROL INDUSTRIES
- HYBRID/ELECTRIC VEHICLES
- ELECTROMECHANICAL BRAKE SYSTEM
- ELECTRIC POWER STEERING
- STARTER GENERATOR SYSTEM
- FUEL PUMP OPERATION

Source : http://mediatoget.blogspot.in/2011/11/switched-reluctance-motors.html