Unit-III -
Switched reluctance motor

1. What is srm?

It is a doubly salient , single excited motor.this means that it has salient poles on both rotor and the stator.but only one member carries winding.the rotor has no windings,magnets or case windings.

2. What are the advantages od SRM?

- Construction is very simple
- Rotor carries no winding
- No brushes and requires less maintenance

3. What are the disadvantages of SRM?

- It requires a position sensor
- Stator phase winding shold be capable of carrying magnetizing currents
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4. Why rotor position sensor is essential for the operation of switched reluctance motor?

It is necessary to use a rotor position sensor for commutation and speed feedback. The turning on and off operation of the various devices of power semiconductor switching circuit are influenced by signals obtained from rotor position sensor.

5. What are the different power controllers used for the control of SRM?

- Using two power semi conductors and two diodes per phase
- Phase windings and bifilar wires
- Dump – C converter
- Split power supply converter

6. What are the applications of SRM?

- Washing machines
- Fans
- Robotic control applications
- Vacuum cleaner
- Future auto mobile applications

7. What are the two types of current control techniques?

- Hysteresis type control
- PWM type control

8. What is meant by energy ratio?

Energy ratio = Wm/(Wm+R)=0.45

Wm=mechanical energy transformed

This energy cannot be called as efficiency. As the stored energy R is not wasted as a loss but it is feedback to the source through feedback diodes.

9. Write the torque equation of SRM?

$T=1/2(i^2\ dL/d\theta)$

10. What is phae winding?

Ststor poles carrying field coils.the field coils of opposite poles are connected in series such that mmf „s are additive and they are called „"phase winding"" of SRM.

11. Write the characteristics of SRM.

- Lowest construction complexity, many stamped metal elements
- Like a BLDC or stepper without the magnets
- High reliability (no brush wear), failsafe for Inverter but...acoustically noisy
- High efficiency

12. Write the voltage,power range of SRM.

Industrial

Voltage	Motor Power	Speed Range
100 - 240 Vac	50W - 10'sKW	0 - 60,000 RPM

Automotive

Voltage	Motor Power	Speed Range
12 - 42Vdc	50W -1kW	0 - 20,000 RPM

13. Define the control system of SRM.

The control system is responsible for giving the required sequential pulses to the power circuitry in order to activate the phases as required. There are two options for producing the sequence including a microcontroller to produce the signal or a timer circuit which could also produce the desired signal

14. Define the timer circuit of SRM.

The use of a timer circuit would be very effective in producing the necessary signal in which to control the circuit. As the required signal is very simple it could easily be implemented by digital timer, such as the 555 timer. A digital timer is more precise than any other form of timer, such as a mechanical timer. With the widespread use of digital logic within integrated circuits the cost of these timers has reduced considerably. The latest controllers in use incorporate programmable logic controllers (PLC"s) rather than electromechanical components in its implementation. Within PLC"s, the timers are normally simulated by the software incorporated in the controller; the timer is therefore controlled by the software. There are obvious advantages to this system, although the control of a soft start could be hard to implement in this way.

15. What are the major advantages of frequency control of SRM?

This has a major advantage of being easily controlled and changed at any point by simply altering the programming. By using this method the development time is reduced and the number of modules to implement is also reduced.

16. Define the power circuitry of SRM.

- The most common approach to the powering of a switched reluctance motor is to use an asymmetric bridge converter.
- There are 3 phases in this in an asymmetric bridge converter corresponding to the phases of the switched reluctance motor. If both of the power switches 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.
- N+1 Switch And Diode
- 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 shall not cause fluctuations in the supply voltage.

17. What are the current control schemes?

- Hysteresis type current regulator
- PWM type current regulator

UNIT-3

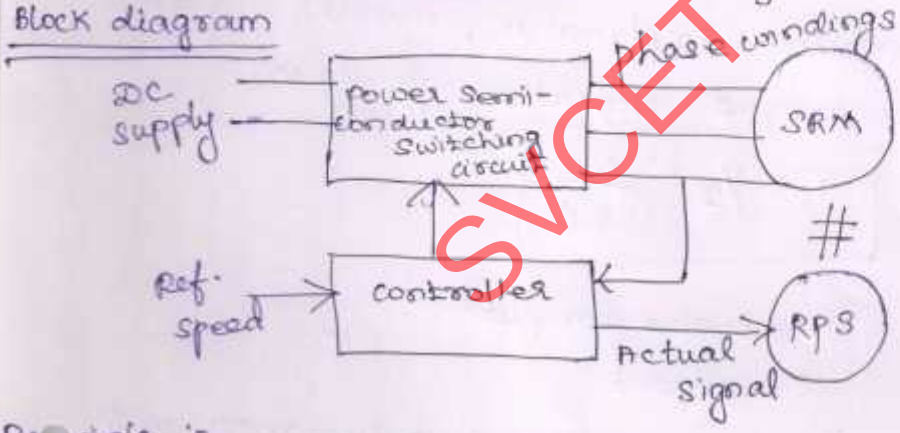
Switched Reluctance motor

1) Explain the construction & working principle of SRM.

The switched Reluctance motor is double salient, singly excited motor. This means that it has salient pole on both the rotor & the stator, but only one member carries windings. The rotor has no windings, magnets (or) cage winding. It works on Variable Reluctance principle.

Construction - diagram, Explanation, principle of operation Advantages &

Block diagram



Principle :-

Based on information obtained from rps. If phase winding A is energized the motor will produce the torque which is equal to $\frac{1}{2} i_a^2 \frac{dL_a}{d\theta}$

This torque rotates the rotor & rotor aligned with Stator.

once rotor aligned then the torque becomes zero. During unaligned position the torque is max.

2) Describe the various power controller circuits applicable to SRM & explain the operation of any one scheme with suitable circuit diagram.

→ Using two power semiconductors & two diodes per phase

→ (n+1) power switching devices & (n+1) diodes per phase

→ phase windings using Bifilar wires

→ Dump c converter

→ Split power supply converter

Diagram, explanation, waveforms merits & demerits.

3) Derive the torque equation of SRM.

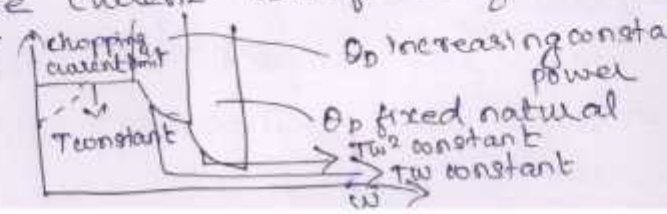
$$T = \frac{1}{2} i^2 \frac{\partial L}{\partial \theta}$$

T - motor torque

i - current

$\frac{\partial L}{\partial \theta}$ = change of inductance with respect to rotor angle

4) Draw & Explain the General Torque - speed characteristics of SRM & discuss the type of control strategy used for different regions of the curve. Sketch the typical phase current waveforms of slow speed operation.



The curve BC → max. permissible torque

point C → max. permissible power

CD → Tw^2 constant

D → corresponds to max. 'w' permissible

5) Describe the hysteresis type & pwm type current regulator for one phase of a SRM.

At low speeds, the self emf of the phase winding is small & the current must be limited by following methods:

1. Hysteresis type current controller
2. Voltage pulse width modulation control or duty cycle control method

Hysteresis Type current controller / pwm control method

Diagram

Explanation

waveform

In this type of current controller maintains a more or less constant current throughout the conduction period in each phase. This controller is called Hysteresis type current controller.