RAMA UNIVERSITY

www.ramauniversity.ac.in

FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-ii

Amit Kumar Singh

A salient pole rotor with a shaft – mounted DC exciter

DC current from the exciter armature is supplied to the field windings by means of carbon brushes (not shown) riding on the commutator that connects to carbon brushes riding on the slip – rings.

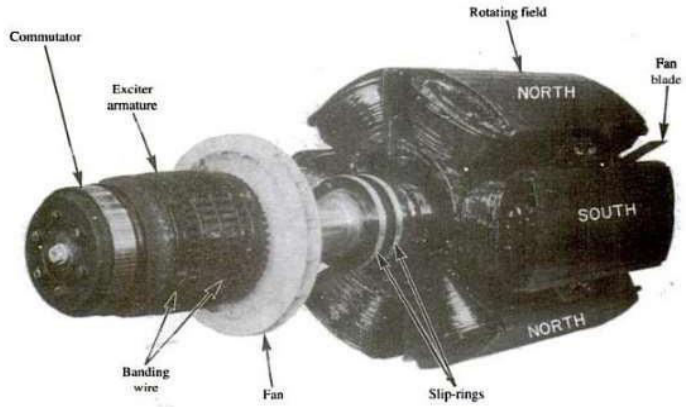


FIGURE 8.3
Salient-pole rotor with shaft-mounted DC exciter. (Courtesy GE Industrial Systems)

A salient pole rotor with a brushless excitation system

Brushless excitation is provided by a small 3 – phase exciter armature, a 3 – phase rectifier, and a control circuitry, all mounted on the same shaft.

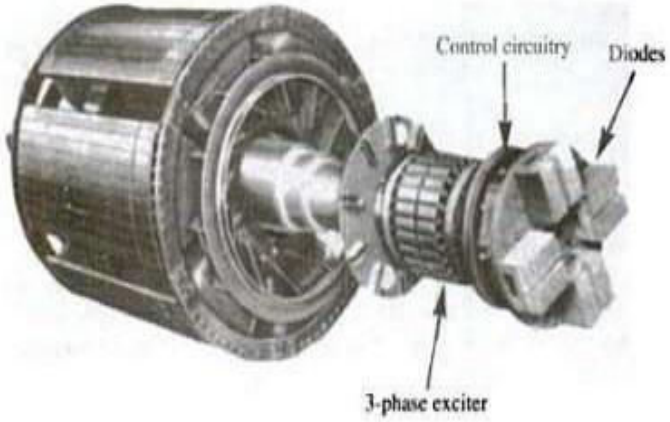
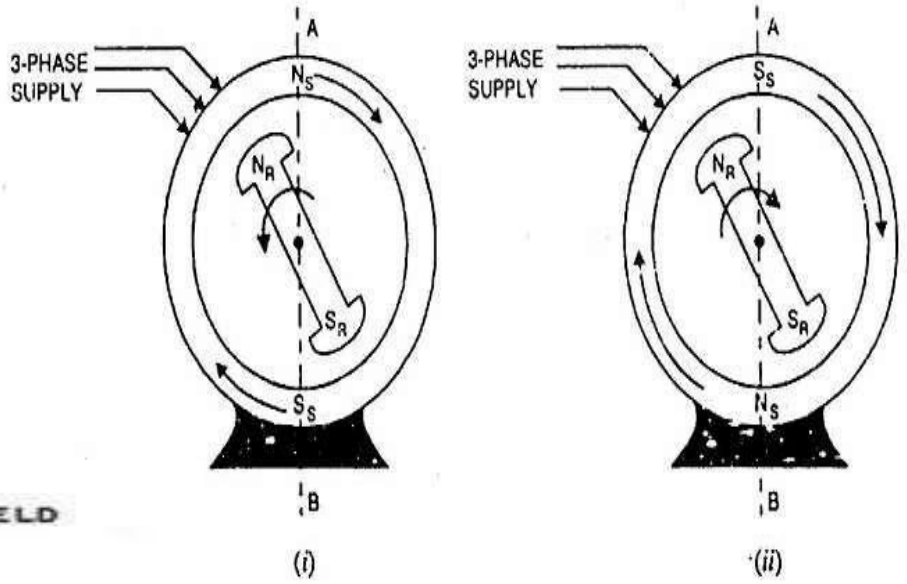


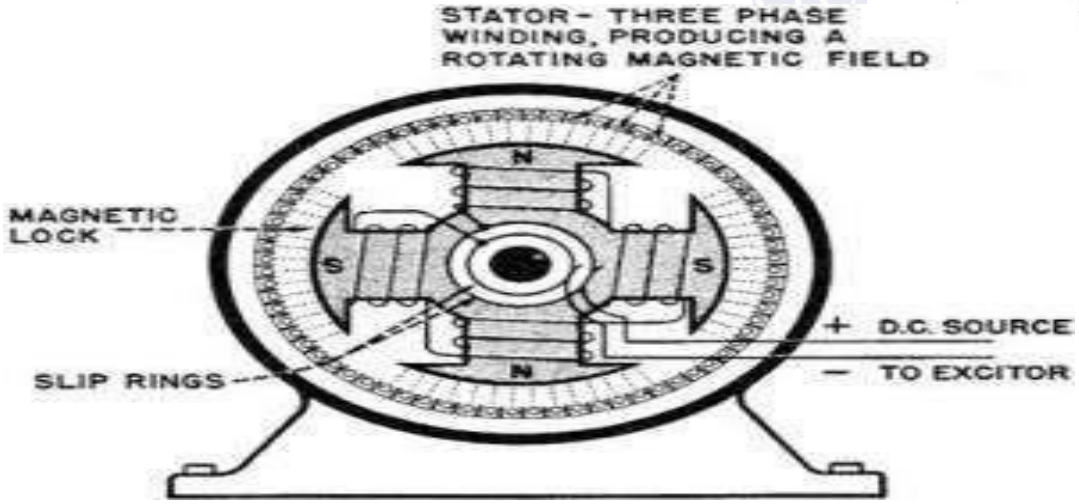
FIGURE 8.4
Salient-pole rotor with a brushless excitation system. (Courtesy Dresser Rand, Electric Machinery)

OPERATING PRINCIPLE

- If the rotor poles are rotated by some external means at such a speed that they interchange their positions along with the stator poles, then the rotor will experience a continuous unidirectional torque.

- If now the external prime mover driving the rotor is removed, the rotor will continue to rotate at synchronous speed in the clockwise direction because the rotor poles are magnetically locked up with the stator poles.
- This magnetic interlocking between stator and rotor poles that a synchronous motor runs at the speed of revolving flux i.e., synchronous speed





Making Synchronous Motor Self-Starting

- A synchronous motor cannot start by itself.
- In order to make the motor self-starting, a squirrel cage winding (also called damper winding) is provided on the rotor.
- The damper winding serves to start the motor.
- To start with, 3-phase supply is given to the stator winding while the rotor field winding is left unenergized.
- The rotating stator field induces currents in the damper or squirrel cage winding and the motor starts as an induction motor.
- As the motor approaches the synchronous speed, the rotor is excited with direct current.
- Because the bars of squirrel cage portion of the rotor now rotate at the same speed as the rotating stator field, these bars do not cut any flux and, therefore, have no induced currents in them.
- Hence squirrel cage portion of the rotor is, in effect, removed from the operation of the motor.
- It is important to excite the rotor with direct current at the right moment.