



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ECT201 – ELECTRICAL ENGINEERING & INSTRUMENTATION
II YEAR III SEM

UNIT 3 – INDUCTION MACHINES

TOPIC 2- Three phase induction motor



Three Phase Induction Motor



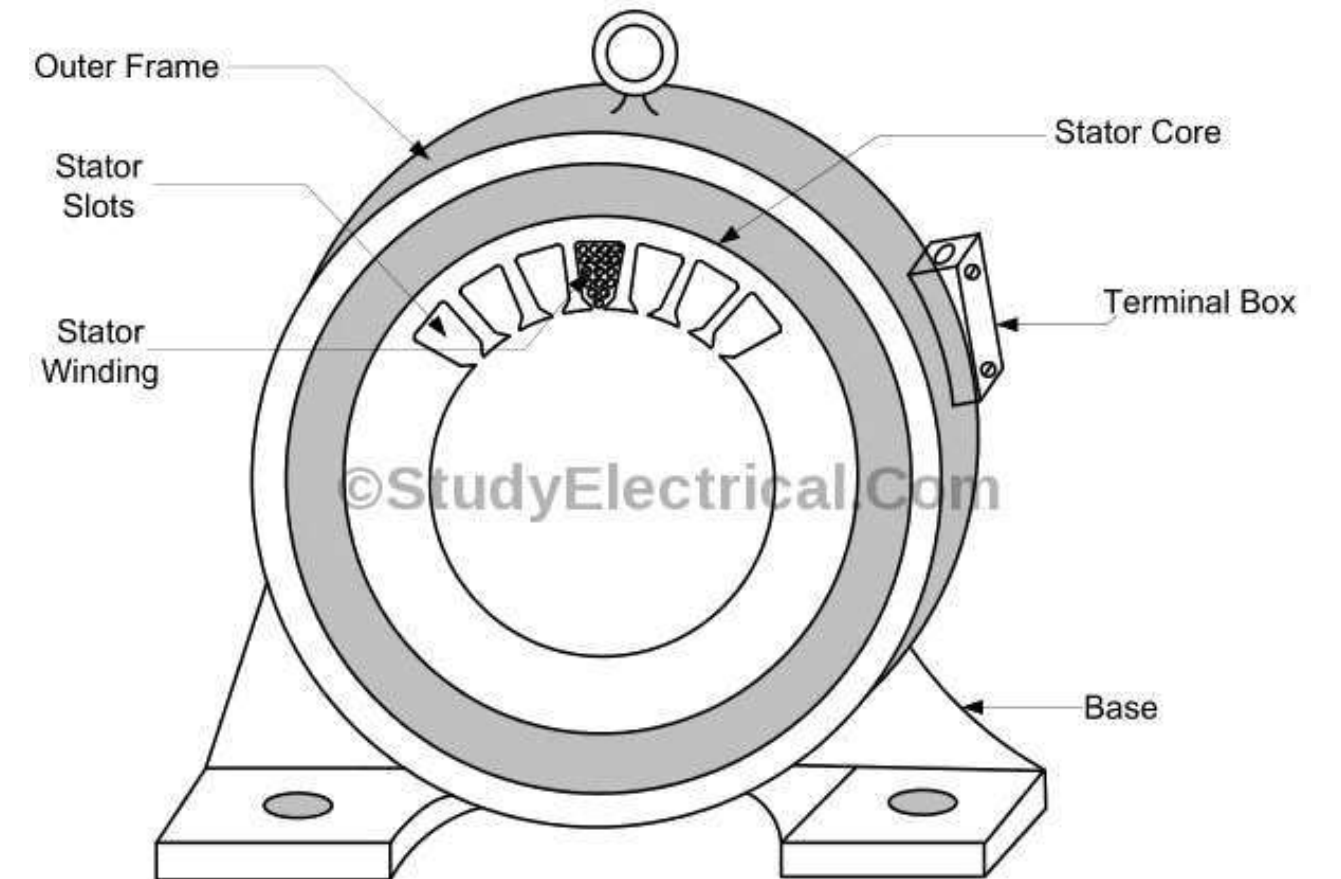
- The three-phase induction motors are the most widely used electric motors in the industry.
- They work on the principle of electromagnetic induction.
- Due to the similarity in the [working principle of the transformer](#), it is also known as the **rotating transformer**.
- They run at essentially constant speed from no load to full load.
- However, the speed is frequency-dependent and consequently, these motors are **easily adapted to speed control**.
- We usually prefer [DC motors](#) when large speed variations are required



Three phase Induction motor Construction

Stator:

- The stator consists of a steel frame that encloses a hollow, cylindrical core made up of thin laminations of silicon steel to reduce hysteresis and eddy current losses.
- A number of evenly spaced slots are provided on the inner periphery of the laminations.
- The insulated conductors are connected to form a balanced 3-phase star or delta connected circuit.





Three phase Induction motor Construction



Rotor:

The rotor, mounted on a shaft, is a hollow laminated core having slots on its outer periphery.

The winding placed in these slots (called rotor winding) may be one of the following two types:

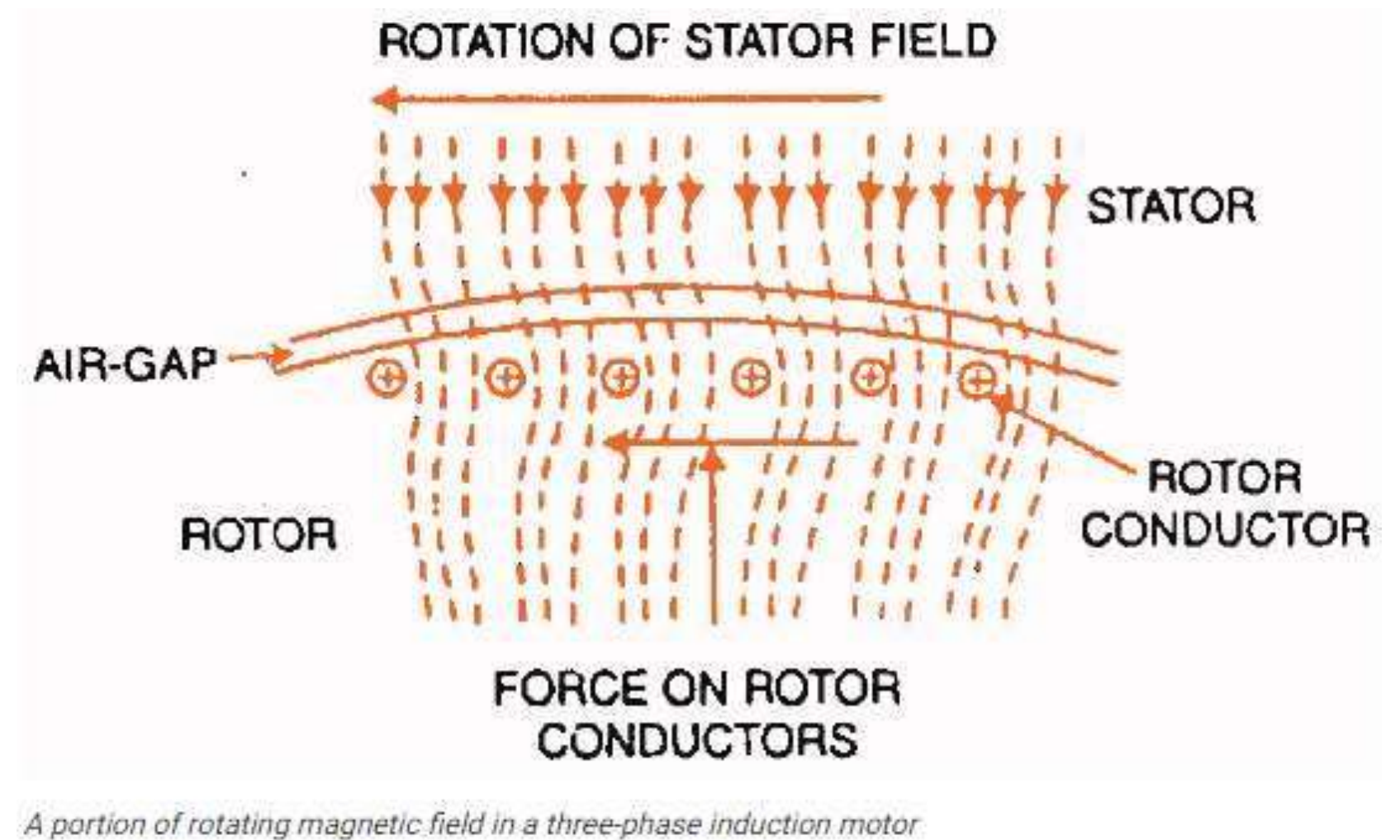
- Squirrel Cage Type
- Wound Rotor Type



Working Principle of 3 phase Induction motor



➤ The working of the three-phase induction motor is based on the Electromagnetic induction. When three-phase stator winding of an induction motor is energized from a 3 phase supply, a rotating magnetic field is set up which rotates around the stator at synchronous speed (N_s).





Working- Three phase Induction motor



- The rotating field passes through the air gap and cuts the rotor conductors, which are stationary.
- An EMF gets induced in every rotor conductor due to the relative speed between the rotating magnetic flux and the stationary rotor
- The current-carrying rotor conductors are placed in the magnetic field produced by the stator.
- Consequently, a **mechanical force** acts on the rotor conductors. The sum of the mechanical forces on all the rotor conductors produces a **torque** which tends to move the rotor in the same direction as the rotating field.



Applications of Three Phase Induction motor



- They are used for loads that requires speed control.
- Typical applications of wound rotor or slip ring induction motors are **crushers, plunger pumps, cranes & hoists, elevators, compressors and conveyors**



Slip in Induction motor



- In practice, the rotor can never reach the speed of stator flux.
- The friction and windage would immediately cause the rotor to slow down.
- Hence, the rotor speed (N) is always less than the stator field speed (N_s). This difference in speed depends upon load on the motor.
- The difference between the synchronous speed N_s of the rotating stator field and the actual rotor speed N is called **slip in a three-phase induction motor**.
- Slip is usually expressed as a percentage of synchronous speed i.e.,
- **Slip, $s = (N_s - N)/N_s \times 100 \%$**
- The quantity $N_s - N$ is sometimes called **slip speed**.
- When the rotor is stationary (i.e., $N = 0$), slip, $s = 1$ or 100 %.



TYPES OF THREE PHASE INDUCTION MOTOR



SQUIRREL CAGE INDUCTION MOTOR

- ▶ Most of the application of industrial as well as domestic are this type of induction motor.
- ▶ Its construction is simple and rugged.
- ▶ Cheap compare to slipring IM
- ▶ Maintenance is easy
- ▶ Cost is less compare to slipring IM
- ▶ Can use at explosive area
- ▶ Starting torque is low compare to slip ring IM
- ▶ **Application:-**
- ▶ Leath machine, Compressors, centrifugal pump, in agriculture etc. where cost is most important factor



SLIP RING INDUCTION MOTOR

- It has high starting torque compare to squirrel cage IM
- Construction is complicated
- Maintanance cost is high compare to squirrel cage IM
- Starter requires compulsory
- Can not use at explosive area
- **Application:-**
- Crane, hoist, lift and where high starting torque is required



Thank You