SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-35

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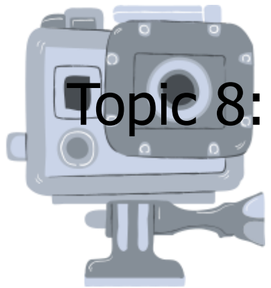
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EET207/ SYNCHRONOUS AND INDUCTION MACHINES

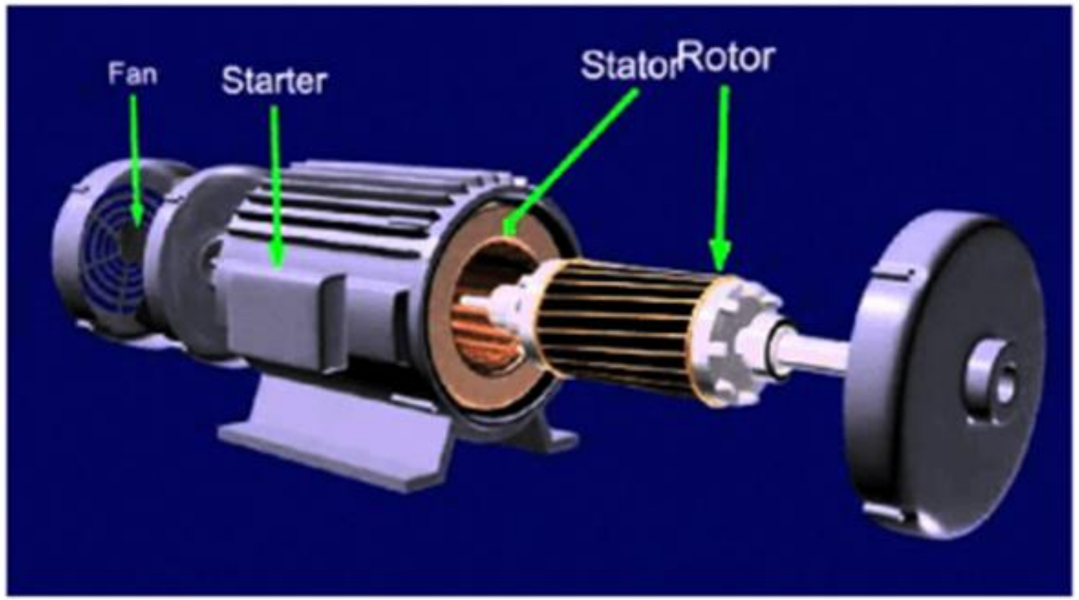
II YEAR / IV SEMESTER

Unit 4 – CONCEPT OF STARTING, BRAKING AND SINGLE PHASE INDUCTION MOTOR



Topic 8: Starting methods – All Capacitor Induction motors

GUESS THE TOPIC NAME…



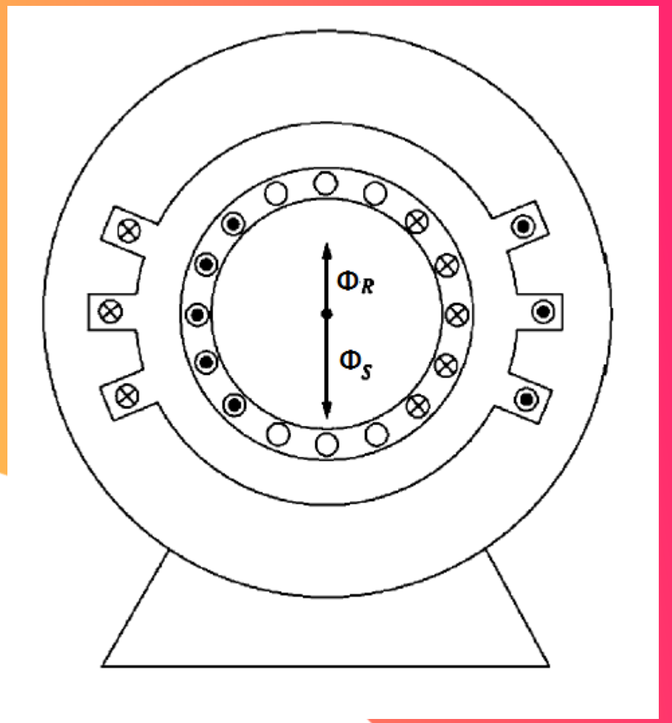
Types of single phase motor

- The single phase induction motors are not self starting due to absence of rotating magnetic field. Depending upon the methods of providing rotating magnetic field at start
- The 1-phase induction motors are of the following types:

  (a)Split phase induction motor

  (b)Capacitor type single phase induction motor

  (c)Shaded pole motor



Split phase induction motor

- A split phase induction motor consists of two main parts:
  (1)Stator (2)Rotor
- The stator is provided with two 1-phase windings
  (a)Main or running winding (b)Auxiliary or starting winding

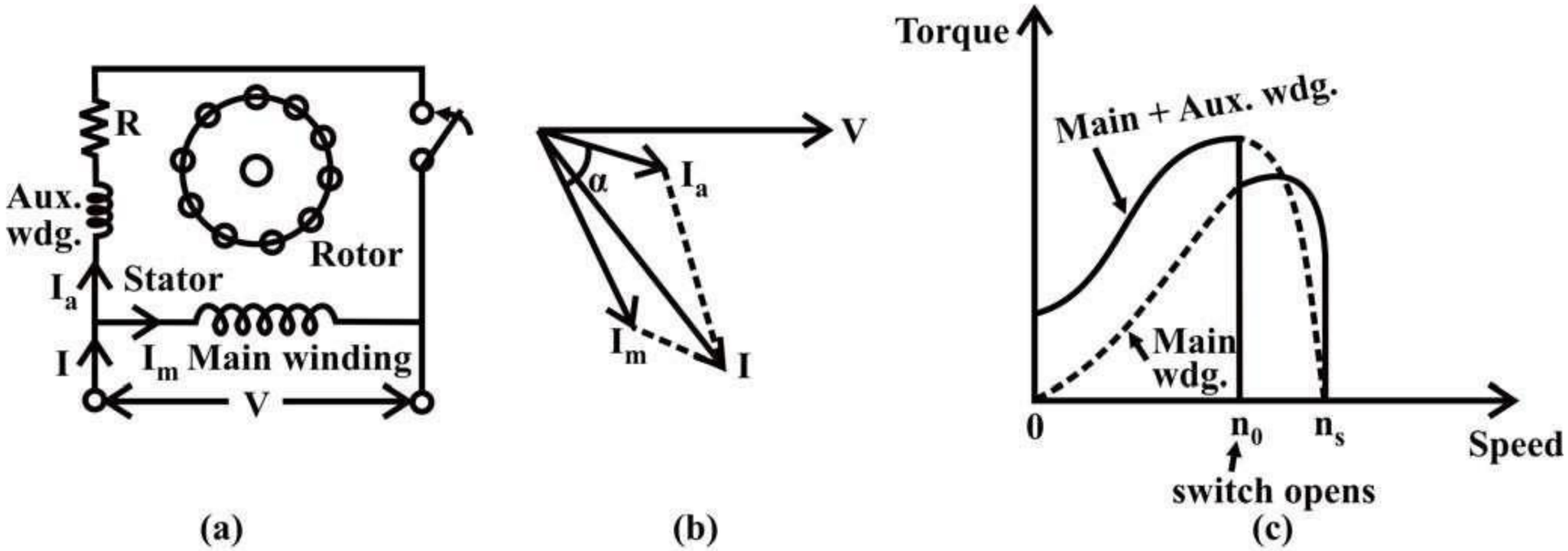


Fig. 34.4: Resistance Split-phase Induction Motor
(a) Schematic Diagram
(b) Phasor Diagram
(c) Torque-Speed characteristic

Split phase induction motor

- The schematic (circuit) diagram of this motor is given. As detailed earlier, another (auxiliary) winding with a high resistance in series is to be added along with the main winding in the stator.
- This winding has higher resistance to reactance (Ra / Xa) ratio as compared to that in the main winding, and is placed at a space angle of 90 degree from the main winding as given earlier.
- The phasor diagram of the currents in two windings and the input voltage is shown. The current (I a) in the auxiliary winding lags the voltage (V) by an angle, Φa , which is small, whereas the current (Im) in the main winding lags the voltage (V) by an angle, Φm , which is nearly 90° . The phase angle between the two currents is ($90-\Phi a$), which should be at least 30°
- This results in a small amount of starting torque. The switch, S (centrifugal switch) is in series with the auxiliary winding. It automatically cuts out the auxiliary or starting winding, when the motor attains a speed close to full load speed.

Applications

This motor is used in applications, such as fan, saw, small lathe, centrifugal pump, blower, office equipment, washing machine, etc.

Capacitor type single phase induction motors

In these motors, a capacitor is connected in series with the starting or auxiliary winding, which takes leading current and hence produces high starting torque.

Depending upon whether the capacitor remains in the circuit permanently or it is disconnected from the circuit using centrifugal switch,

the capacitor motors can be further classified as:

(1)Capacitor start motor

(2)Capacitor start and capacitor run induction motor(Permanent capacitor motor)

(3)Two-value capacitor motor

Capacitor Start Motor

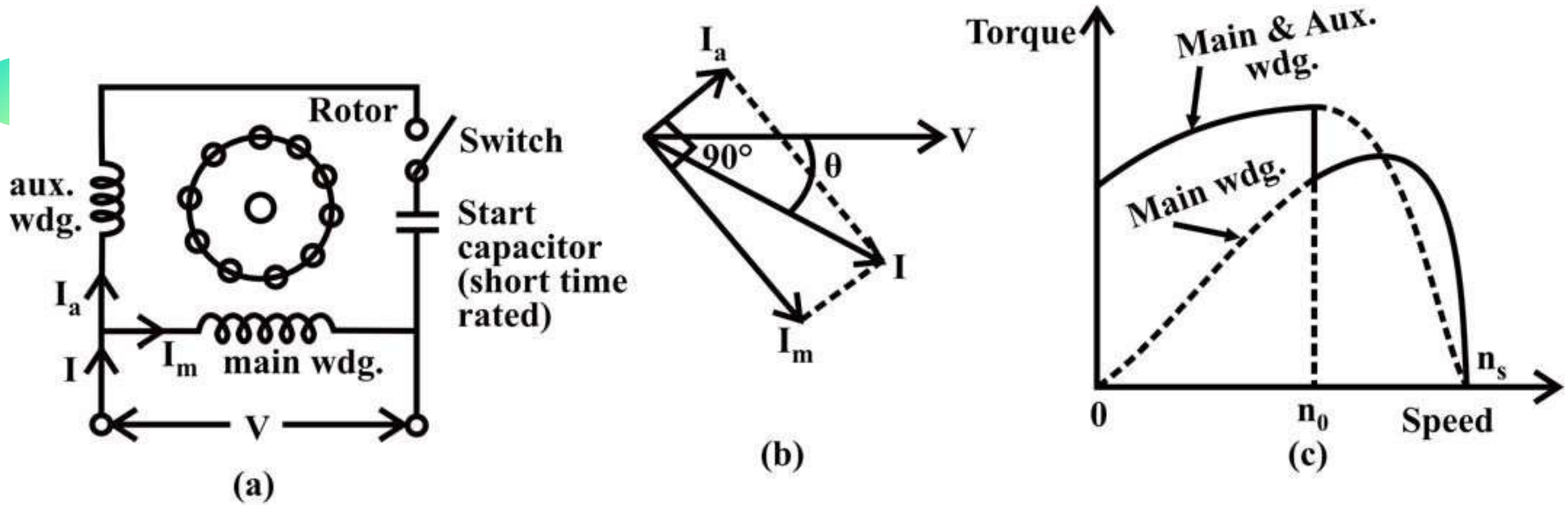


Fig. 34.5: Capacitor-Start Induction Motor
(a) Schematic Diagram
(b) Phasor Diagram
(c) Torque-Speed characteristic

It may be observed that a capacitor along with a centrifugal switch is connected in series with the auxiliary winding, which is being used here as a starting winding.

Capacitor Start Motor

The capacitor may be rated only for intermittent duty, the cost of which decreases, as it is used only at the time of starting. The function of the centrifugal switch has been described earlier.

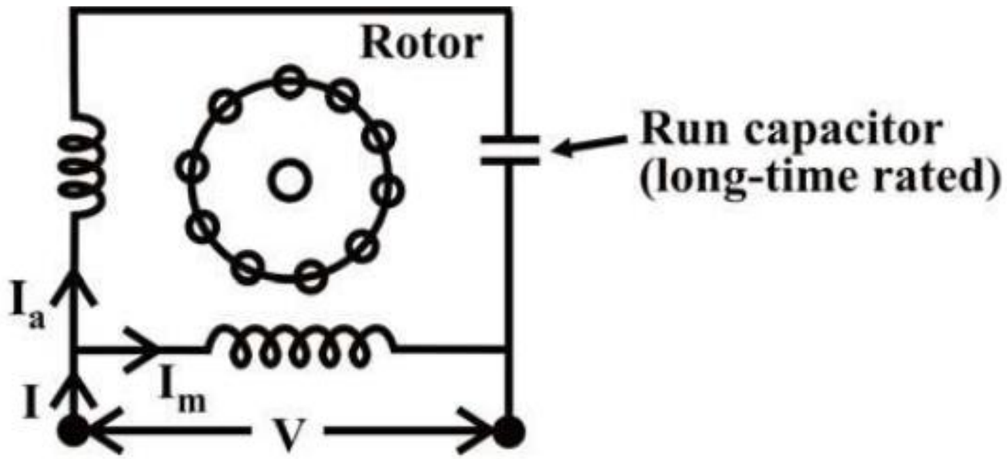
The phasor diagram of two currents as described earlier, and the torque speed characteristics of the motor with/without auxiliary winding, are shown

Applications

This motor is used in application such as, compressors, fans, blowers, pumps, air conditioners, refrigerators, conveyors, washing machines, machine tool drive etc

Capacitor start and capacitor run induction

Beside the above two types of motors, a Permanent Capacitor Motor with the same capacitor being utilised for both starting and running, is also used. The power factor of this motor, when it is operating (running), is high.

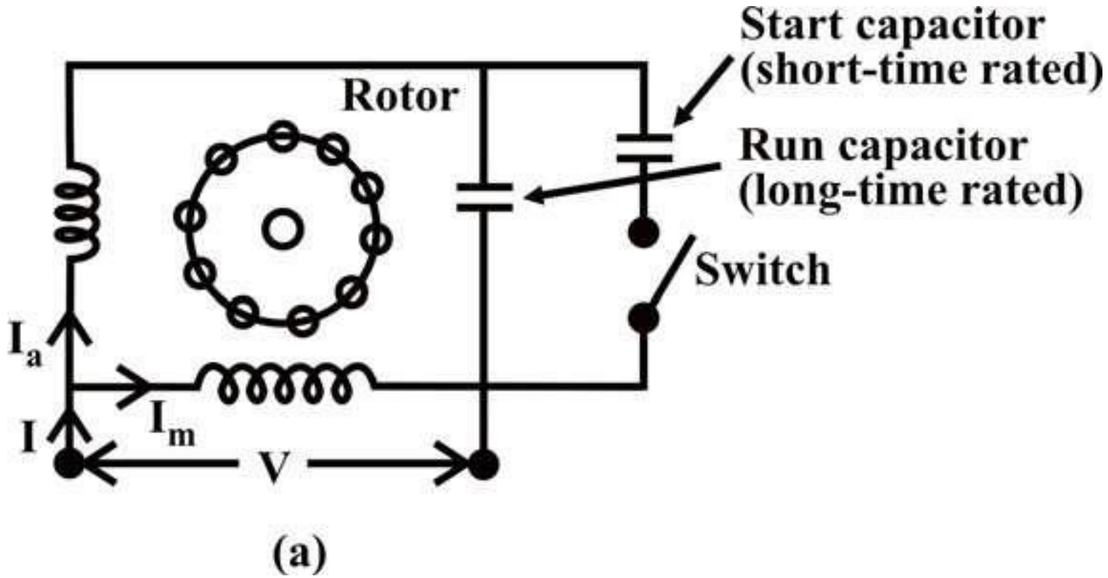


The operation is also quiet and smooth.

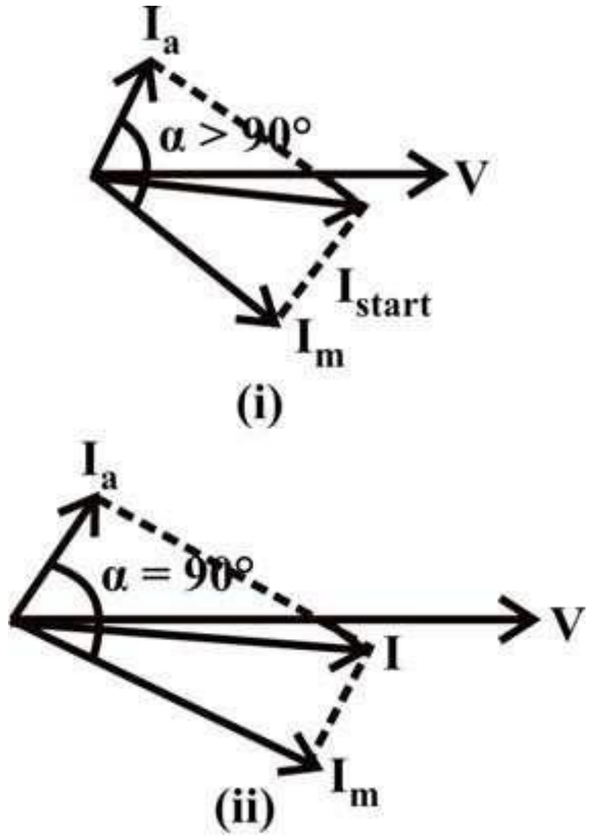
Applications

This motor is used in applications, such as ceiling fans, air circulator, blower, etc.

Two-value capacitor motor

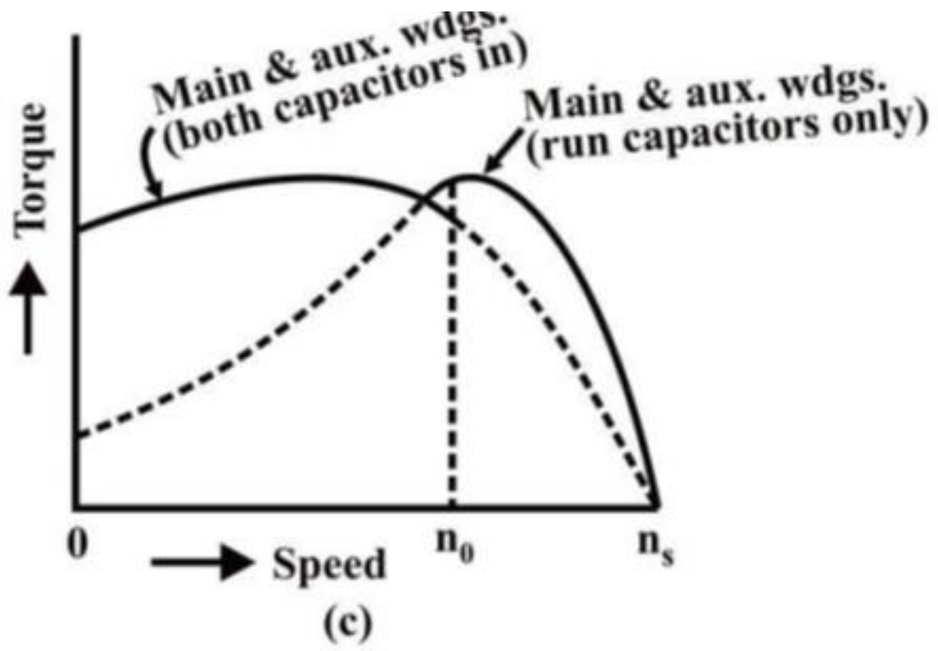


(a)



(b)

Two-value capacitor motor



Capacitor-Start and Capacitor-run Induction Motor
(a) Schematic Diagram
(b) Phasor Diagrams
(c) Torque-Speed characteristics

two capacitors − Cs for starting, and Cr for running, are used. The first capacitor is rated for intermittent duty, as described earlier, being used only for starting.

A centrifugal switch is also needed here. The second one is to be rated for continuous duty, as it is used for running.

The phasor diagram of two currents in both cases, and the torque-speed characteristics with two windings having different values of capacitors, are shown

Two-value capacitor motor

The phase difference between the two currents is ($\Phi m+\Phi a \geq 90$) in the first case (starting), while it is 90 for second case (running). In the second case, the motor is a balanced two phase one, the two windings having same number of turns and other conditions as given earlier, are also satisfied.

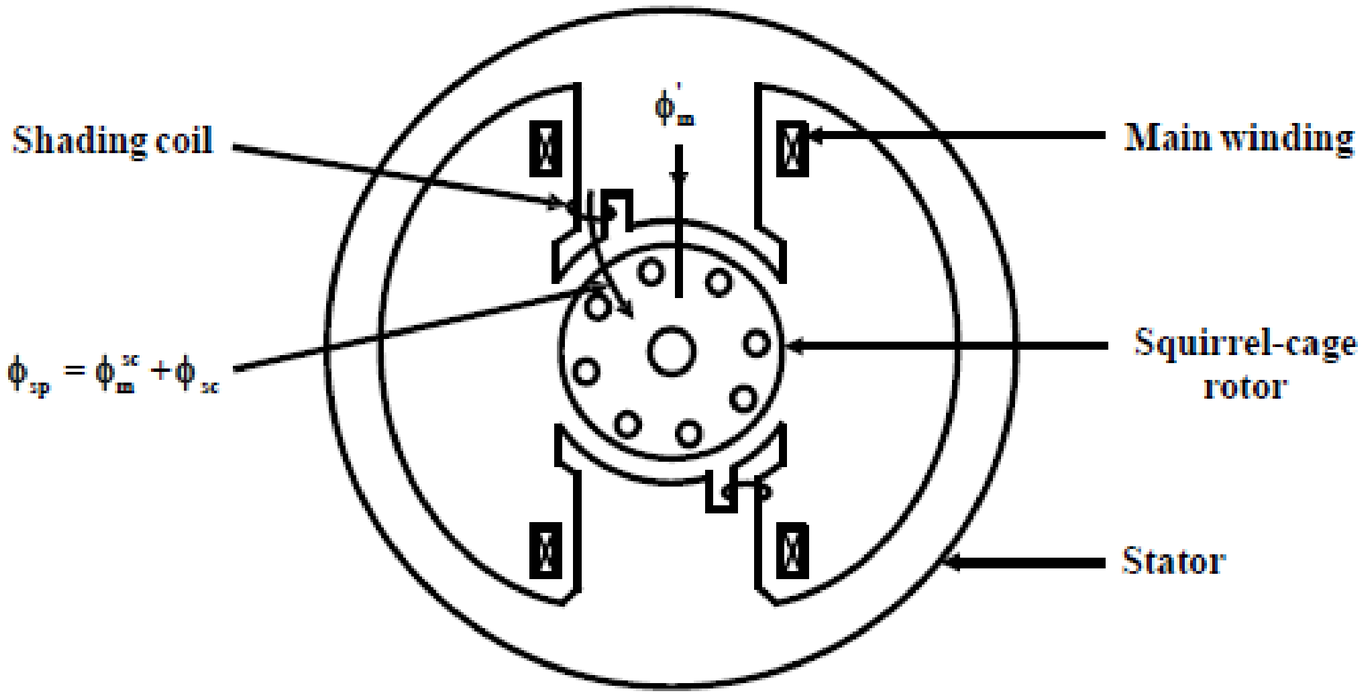
So, only the forward rotating field is present, and the no backward rotating field exists. The efficiency of the motor under this condition is higher.

Hence, using two capacitors, the performance of the motor improves both at the time of starting and then running.

Applications

This motor is used in applications, such as compressor, refrigerator, etc.

Shaded pole motor



Shaded pole motor

- A typical shaded-pole motor with a cage rotor is shown in Fig. 34.8a. This is a single- phase induction motor, with main winding in the stator.
- A small portion of each pole is covered with a short-circuited, single-turn copper coil called the shading coil.
- The sinusoidally varying flux created by ac (single-phase) excitation of the main winding induces emf in the shading coil.
- As a result, induced currents flow in the shading coil producing their own flux in the shaded portion of the pole.
- When 1-phase AC supply is given to the main winding of stator, an alternating flux is produced in the pole. A portion of this flux links with the shading coil.

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Shaded pole motor

- The phase difference between these two fluxes produce resultant rotating magnetic field. Hence the motor produce a starting torque.

- In short, when 1-phase AC supply is given to the stator windings of shaded pole motor, due to shading provided on the salient poles, a rotating magnetic field is produced.

Applications

- Due to above limitations, these motors are used in small fans, hair dryers, toy motors, advertising displays, film projectors, electric clocks, record players etc.

SUMMARY

KEEP
LEARNING..

Thank u

SEE YOU IN NEXT CLASS