



SNS COLLEGE OF ENGINEERING

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An Autonomous Institution

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT 5 - OTHER MOTORS

Hysteresis Motor





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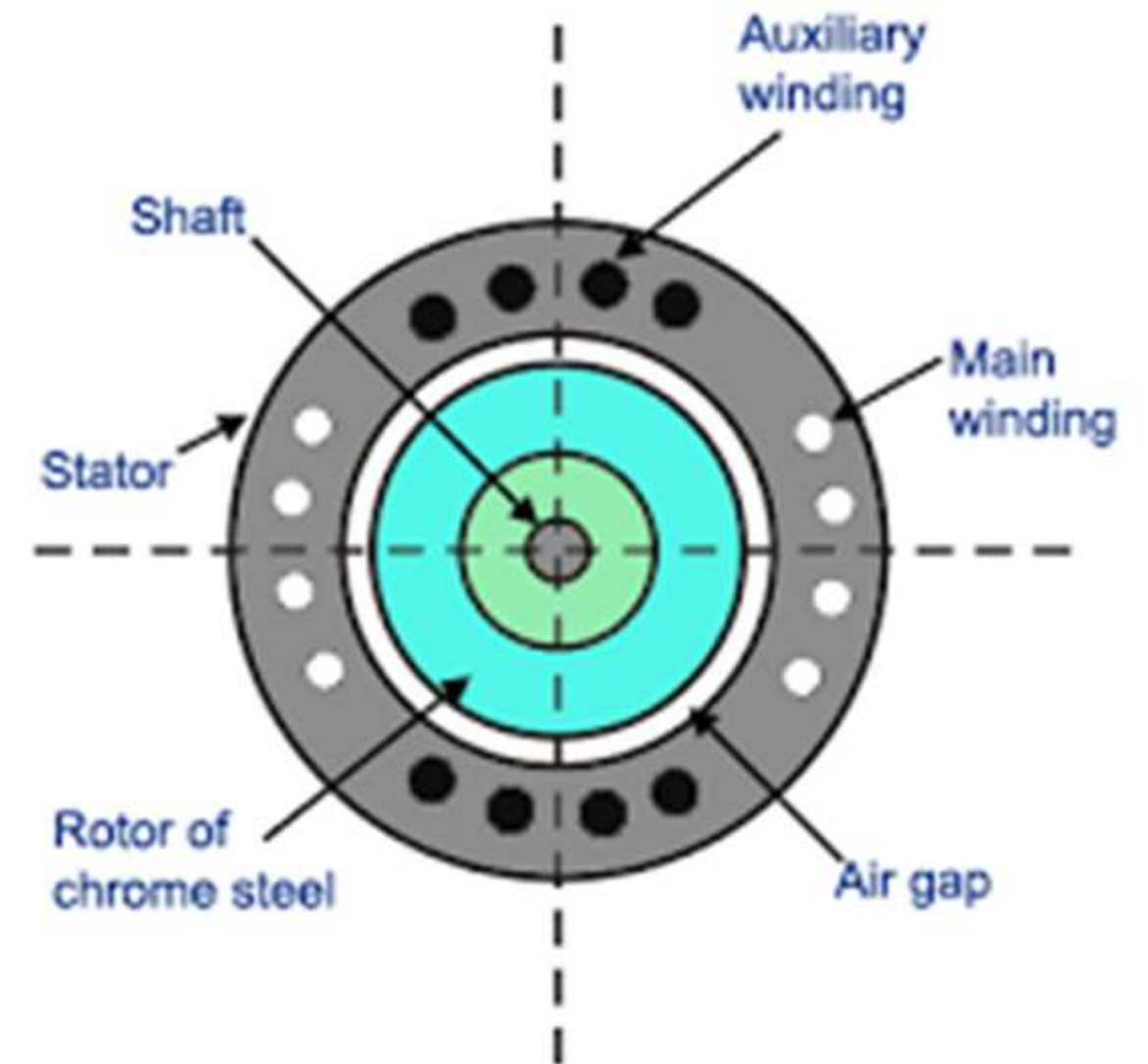


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DEFINITION OF HYSTERESIS MOTOR

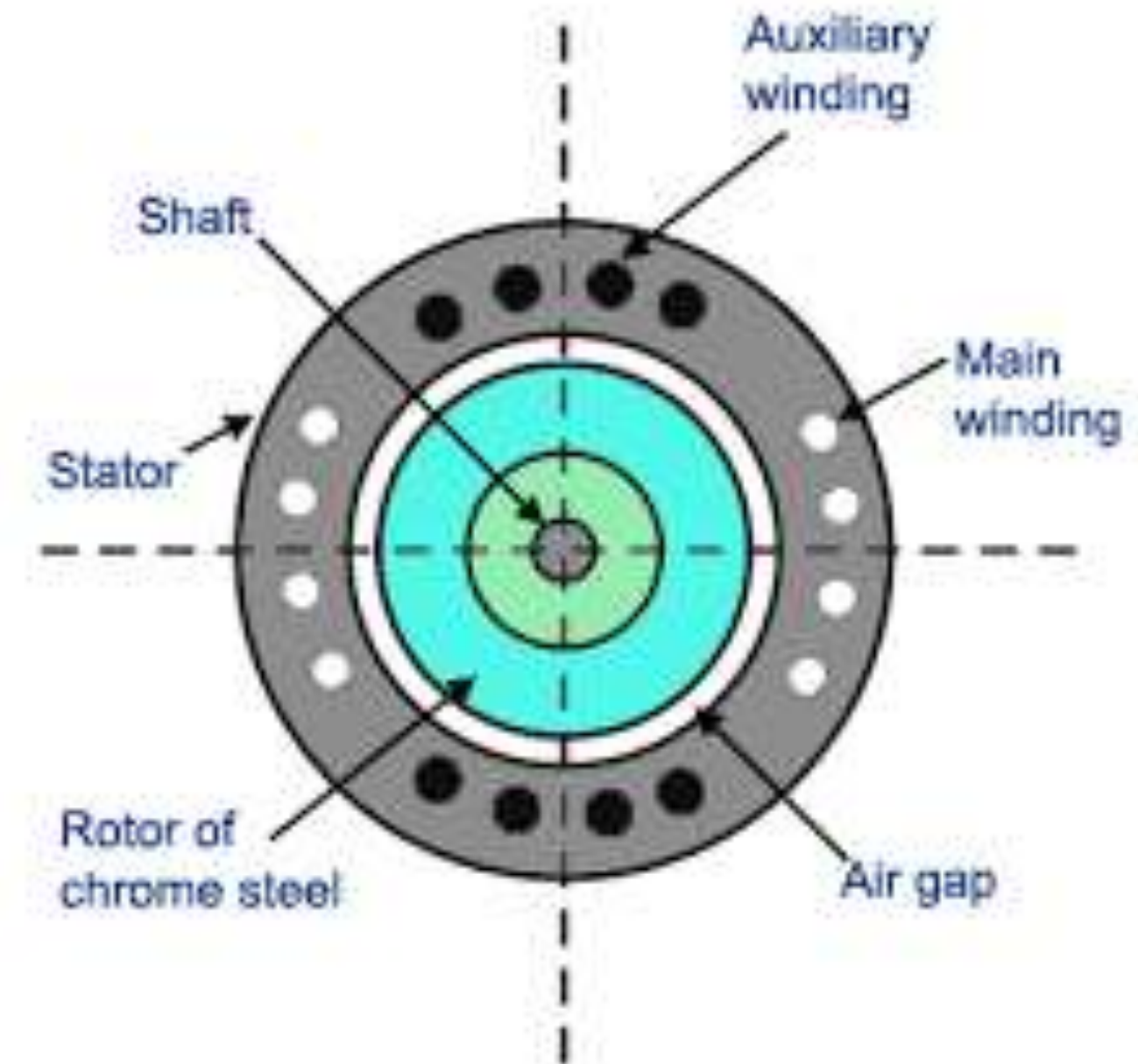
- A hysteresis motor is defined as a synchronous motor with a cylindrical rotor that operates using hysteresis losses in the rotor
- It is a single-phase motor.



CONSTRUCTION

A hysteresis motor is constructed of five main components:

- Stator
- Single phase stator winding
- Rotor
- Shaft
- Shading coil





STATOR



- The stator of a hysteresis motor is designed to produce a synchronous revolving field from a single-phase supply.
- It carries two windings: the main winding and the auxiliary winding. In some designs, the stator also includes shaded poles.



Now, let's
look at the
stator..



ROTOR



- Rotor of hysteresis motor is made of magnetic material that has high hysteresis loss property. The type of materials can be chrome, cobalt steel or alnico or alloy. Hysteresis loss becomes high due to large area of hysteresis loop.
- Rotor does not carry any winding or teeth. The magnetic cylindrical portion of the rotor is assembled over shaft through arbor of non-magnetic material like brass. Rotor is provided with high resistance to reduce eddy current loss.



Construction (Further)



- TyStator and Motor is the main part of this motor.
- It is almost like a (construction) single phase induction motor.
- There are 2 types of windings namely main and auxiliary winding.
- Capacitor start induction run is used, to split the phase.
- Rotor's core is made up of non-magnetic material like aluminium.
- The upper part of the rotor is made up of (ssm)special magnetic material like hard chrome or cobalt steel.
- The ssm has high retentivity and hysteresis loss.
- Here rotor is without any slots.
- Rotor is plane cylindrical type.



WHAT IS HYSTERESIS LOSS?



- Hysteresis loss is a type of energy loss that occurs in a hysteresis motor when ferromagnetic materials are exposed to an alternating magnetic field
- In simple words, Hysteresis loss is the energy dissipated as heat in a magnetic material when the material is subjected to an alternating magnetic field.





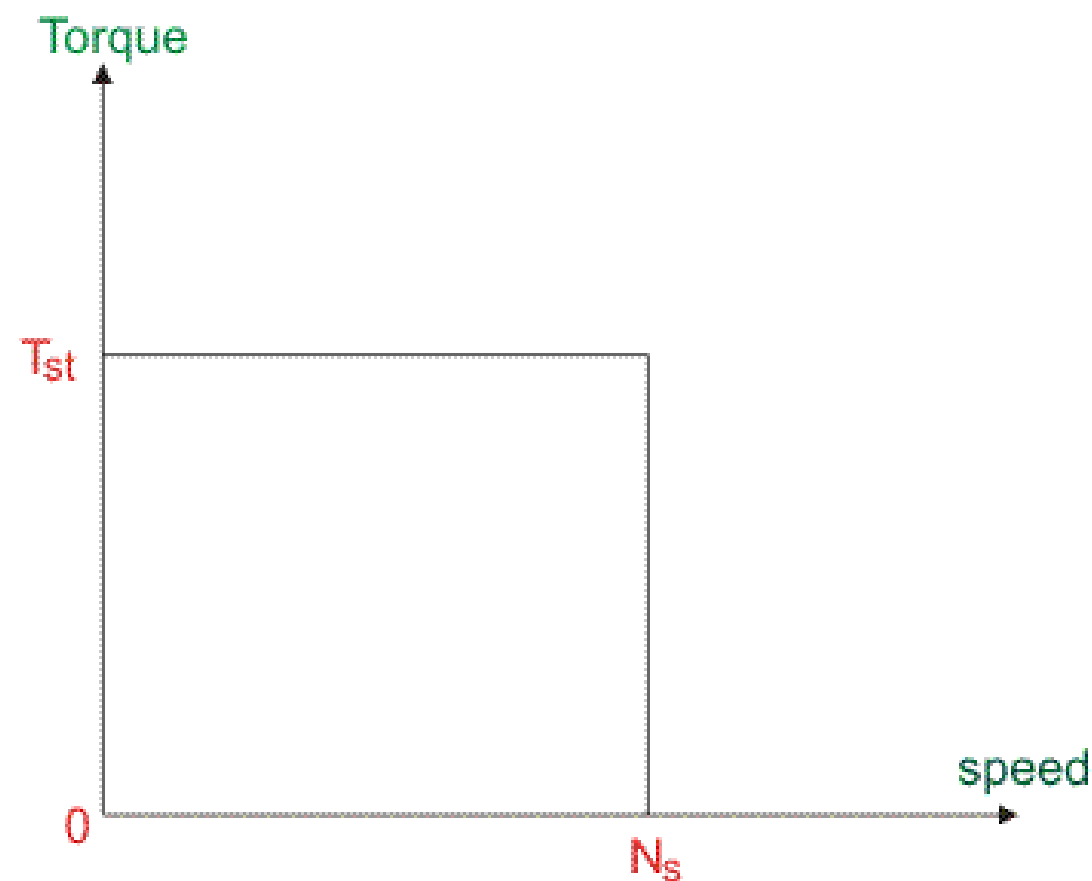
WORKING

- The Hysteresis motor is connected to single phase AC supply.
- Then the current flows through the main and auxiliary windings, here the capacitor is connected in series with the auxiliary windings, which creates the phase difference, we can also use shaded pole method for splitting.
- Here phase difference is produced between the main and the auxiliary windings, which on turn produce the rotating magnetic field (rmf) in synchronous speed, here the stator field polarity will also rotate with magnetic field.
- When the rotating magnetic field link with the rotor, the emf is induced in the rotor. Due to this emf a current flows in the circuit that is known as Eddy Current.
- Due to the Eddy Current the rotor gets magnetized.
- At some point, the stator polarity attracts the opposite rotor polarity and when the stator field polarity rotates, the rotor also rotates.
- After some time, the stator and rotor poles interlocks, so the rotor starts to rotate at synchronous speed with rmf.



TORQUE SPEED CHARACTERISTICS

- The torque is almost constant from starting to running condition. At starting condition, the starting torque is the eddy current torque along with the hysteresis torque. But in the running condition net running torque means only the hysteresis torque. This constant valued torque allows the motor to synchronize any load it can accelerate.





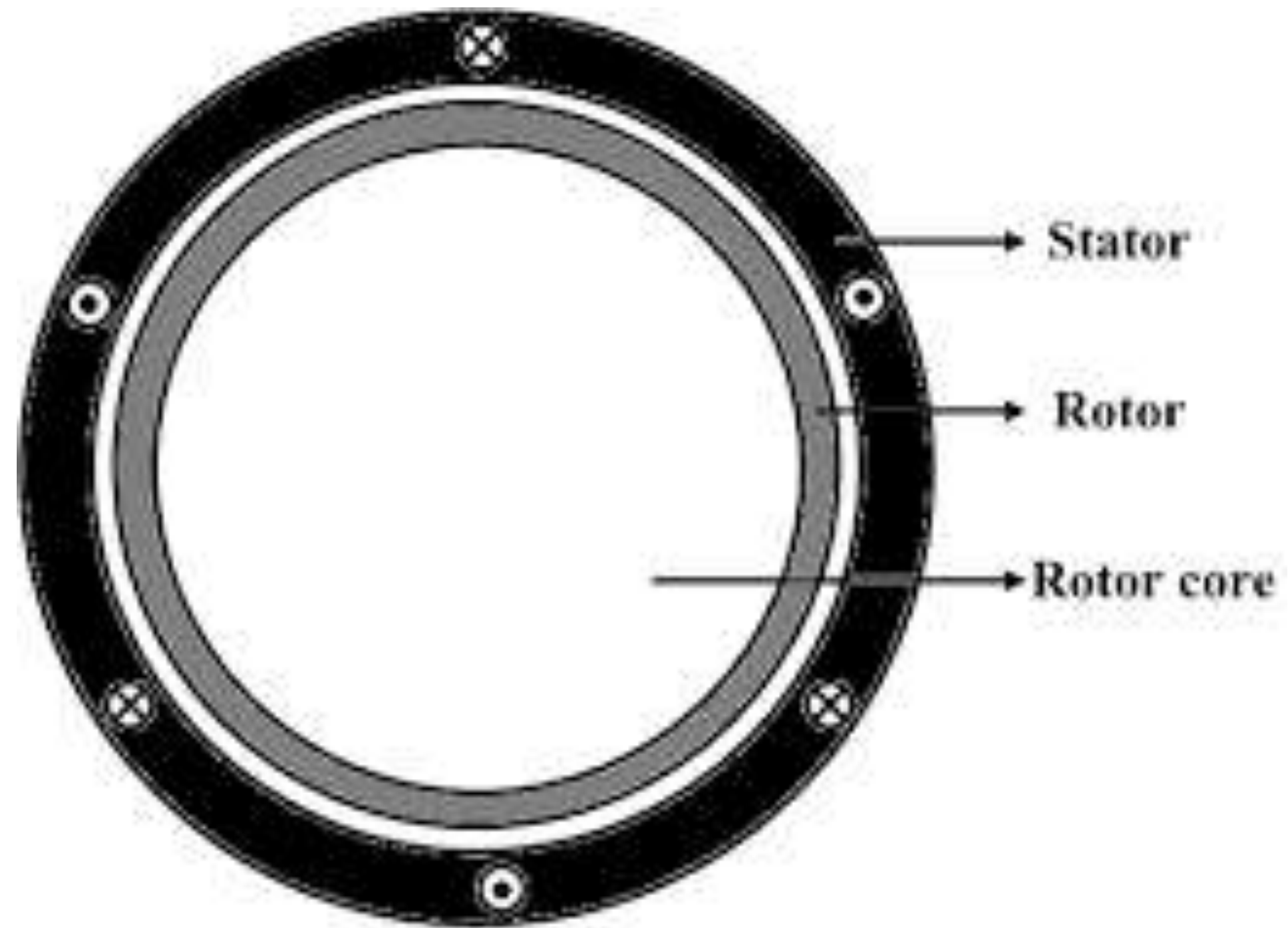
TYPES OF HYSTERESIS MOTORS



There are various types of hysteresis motor by construction. They are:

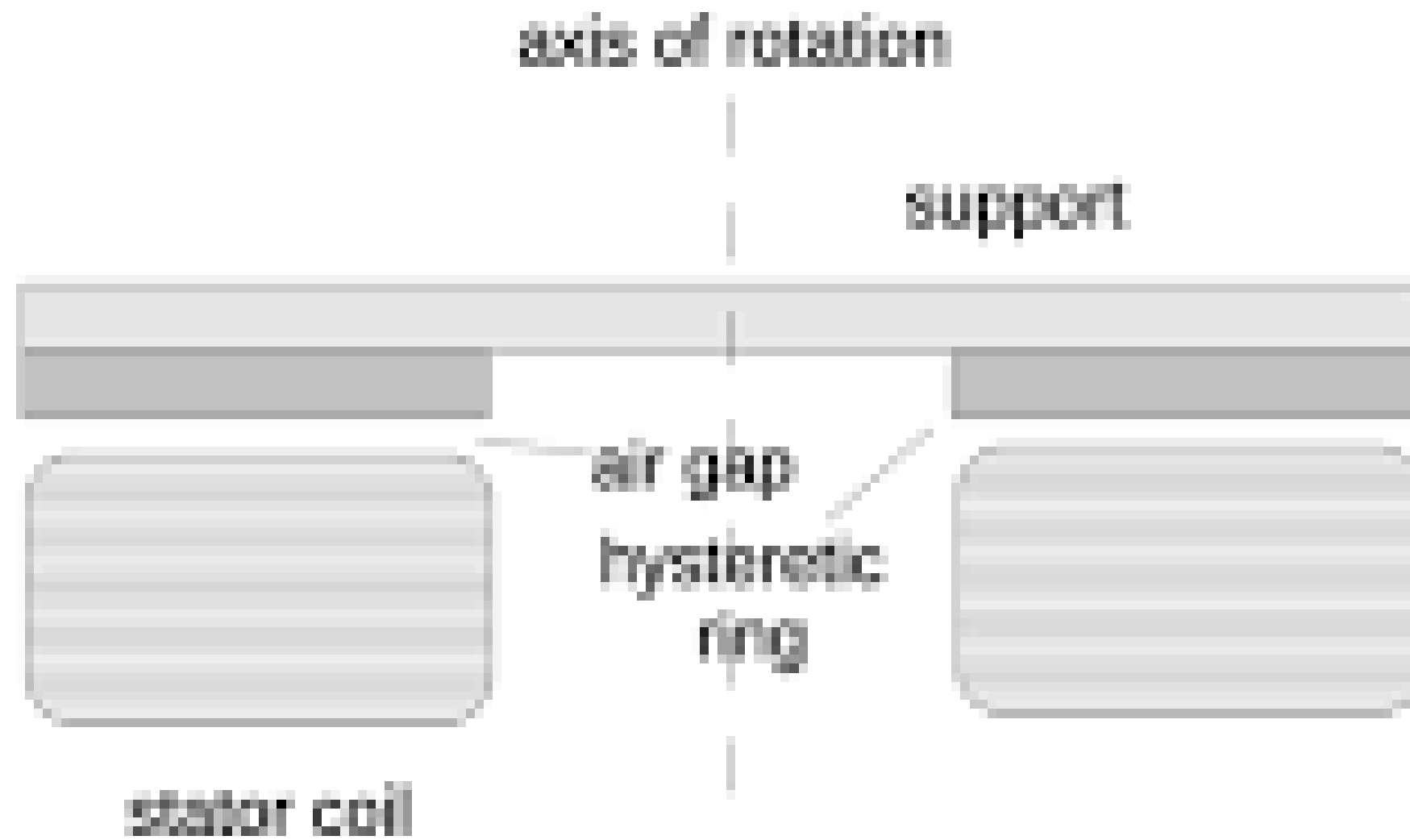
- Cylindrical hysteresis motors: It has cylindrical rotor.
- Disk hysteresis motors: It has annular ring-shaped rotor.
- Circumferential-Field hysteresis motor: It has rotor supported by a ring of non-magnetic material with zero magnetic permeability.
- Axial-Field hysteresis motor: It has rotor supported by a ring of magnetic material with infinite magnetic permeability.

Cylindrical Hysteresis Motor

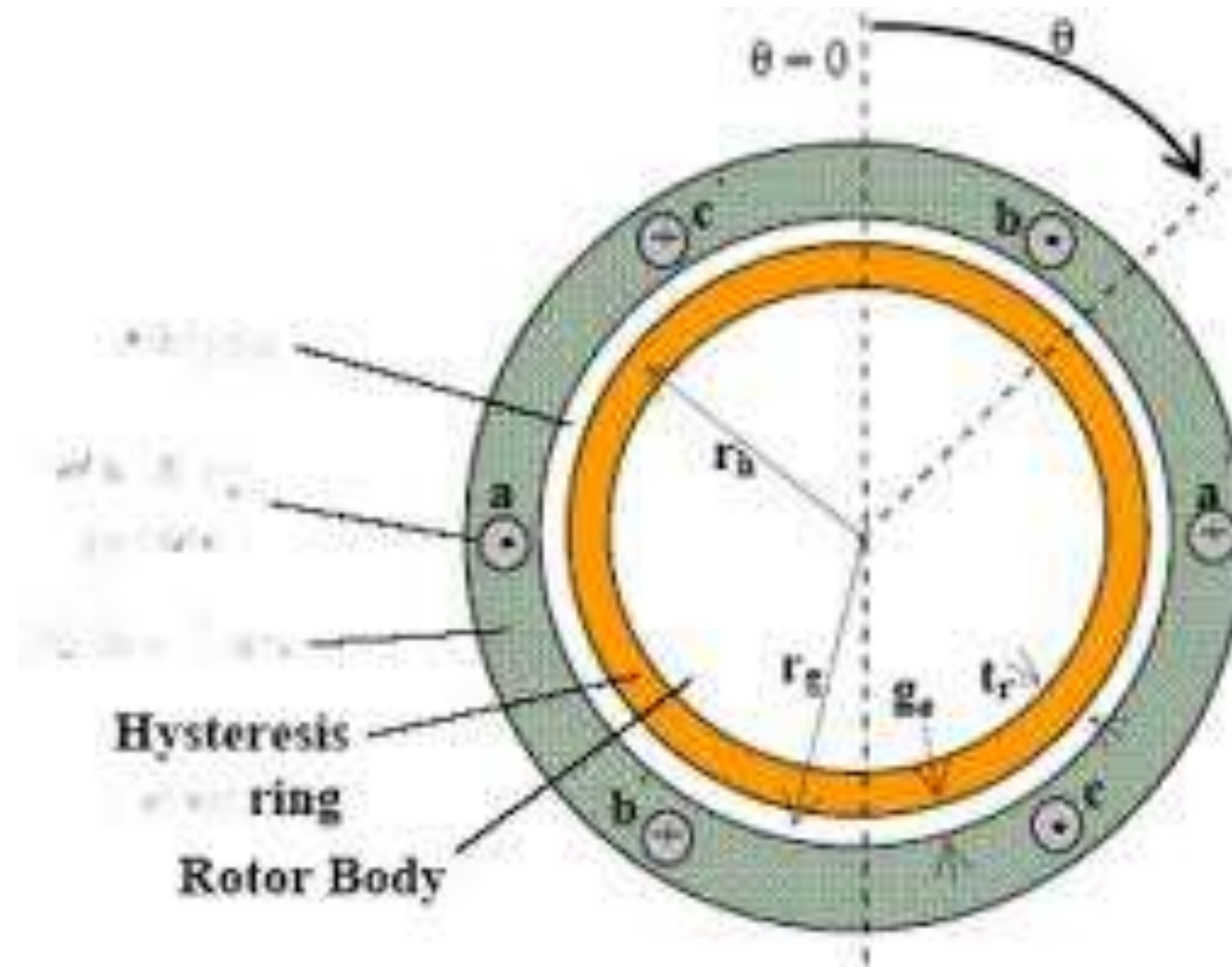




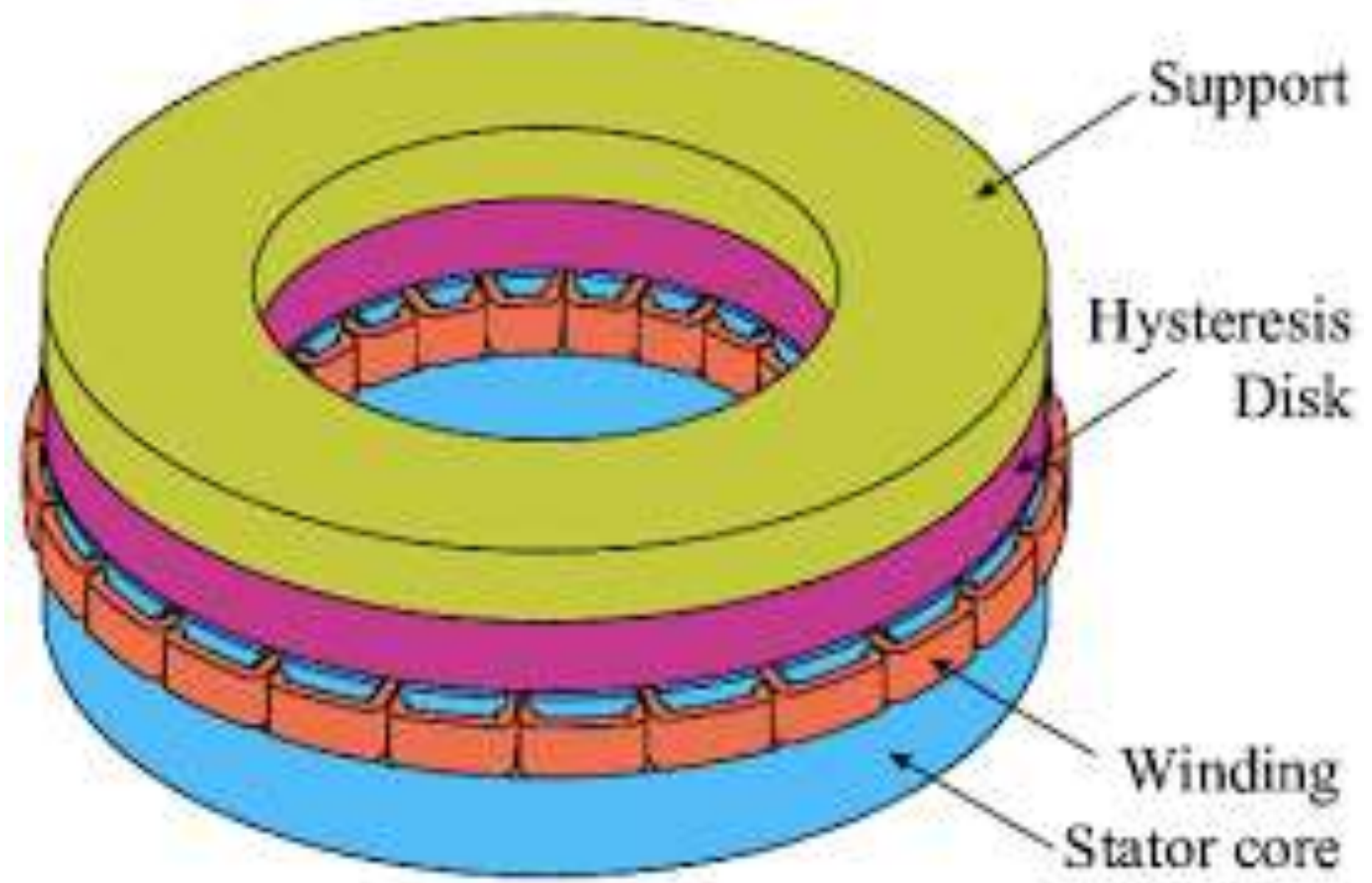
Disk Hysteresis Motors



Circumferential-field Hysteresis Motor



Axial-field Hysteresis Motor





ADVANTAGES



- As no teeth and no winding in rotor, no mechanical vibrations take place during its operation.
- Hysteresis motors are the quietest single-phase motors and are often used in sound recording equipment like tape recorders and record players.
- Hysteresis motors operate at a constant speed.
- Hysteresis motors have a smooth rotor periphery and are free from mechanical and magnetic vibrations.
- Hysteresis motors are self-starting and have a constant torque.
- Hysteresis motors are used in instruments that require accurate and precise motion control, such as robotics and medical devices.
- Hysteresis motors are low cost.





DISADVANTAGES



- Hysteresis motor has poor output that is one-quarter of output of an induction motor with same dimension.
- Low efficiency
- Low torque.
- Low power factor
- This type of motor is available in very small size only.

They have some disadvantages too..





Applications



- Sound producing equipment's
- Sound recording instruments
- High quality record players
- Timing devices
- Electric clocks
- Teleprinters



