Introduction to Electrical Circuits

Final Term
Lecture – 12

Reference Book:

[1] A Textbook of Electrical Technology , Volume- II, - B.L. Theraja, A.K. Theraja

[2] Principles of Electrical Machines -V.K. Mehta, Rohit Mehta

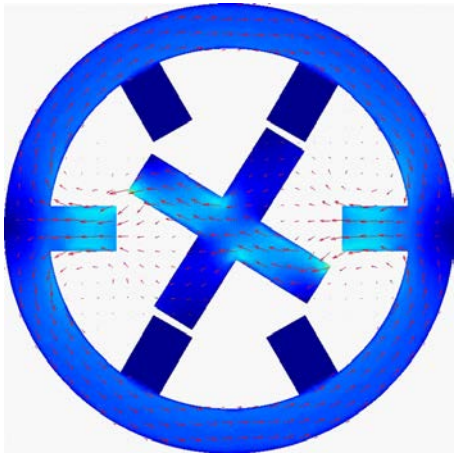
CONTENT

Week No.	Class No.	Chapter No.	Article No., Name and Contents
W13	FC12		**Hysteresis motor, Reluctance motor, Linear motor:** Hysteresis technique and about copper ring, and reluctance operation with respect to Saliency phenomenon.

Reluctance Motor

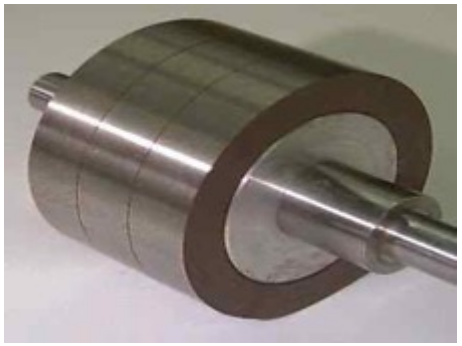
- When a piece of magnetic material is in a magnetic field, a force acts on the material, tending to bring it into the densest portion of the field.
- The force tends to align the specimen of material in such a way that the reluctance of the magnetic path that lies through the material will be minimum.
- If the reluctance torque is sufficient to start the motor and its load, the rotor will pull into step with the revolving field and continue to run at the speed of the revolving field.

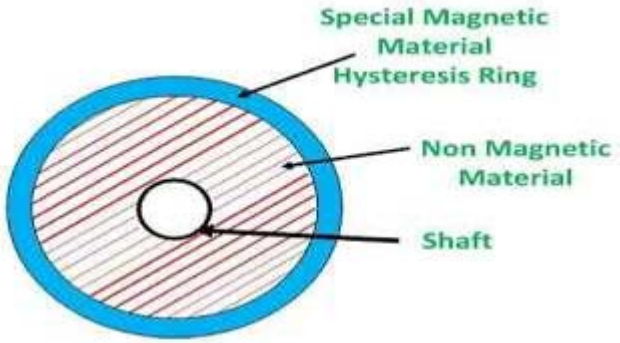
Reluctance brushless motor



Hysteresis Motor

- Hysteresis motor is defined as a synchronous motor that is having cylindrical rotor and works on hysteresis losses induced in the rotor of hardened steel with high retentivity.
- It is a single-phase motor and its rotor is made of ferromagnetic material with nonmagnetic support over the shaft.





Characteristics of Hysteresis Motor:

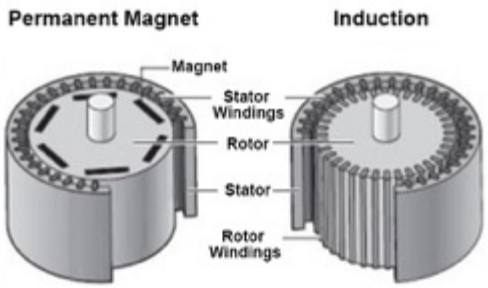
- A hysteresis motor can synchronize any load which it can accelerate, no matter how great the inertia.
- It is because the torque is uniform from standstill to synchronous speed.
- Hysteresis motor produces very smooth and soundless rotation.
- The rotor takes on the same number of poles as the stator field.
- Thus by changing the number of stator poles through pole-changing connection, we can get a set of synchronous speeds for the motor.

Hysteresis Motor Applications:

- While audio recording, noise less operation of recording equipment is very essential.
- Due to quiet operation and ability to derive high-inertia loads, hysteresis motors are used for timing devices and precision audio-equipment.

Permanent Magnet Synchronous Motor

- Such motors have a cage rotor having rare-earth permanent magnets instead of a wound field.
- Such a motor starts like an induction motor when fed from a fixed-frequency supply.
- A typical 2-pole and 4-pole surface-mounted versions of the rotor are shown in Fig. 5.
- Since no d.c. supply is needed for exciting the rotor, it can be made more robust and reliable.
- These motors have outputs ranging from about **100W up to 100 kW**.
- The maximum synchronous torque is designed to be around **150 per cent of the rated torque**.
- If loaded beyond this point, the motor loses synchronism and will run either as an induction motor or stall.
- These motors are usually designed for direct-on-line (DOL) starting. The efficiency and power factor of the permanent-magnet excited synchronous motors are each 5 to 10 points better than their reluctance motor counterparts.



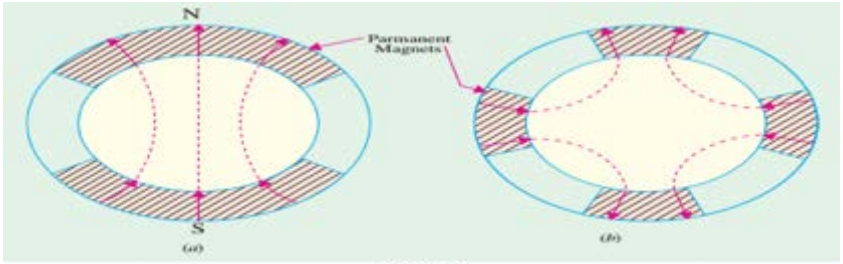
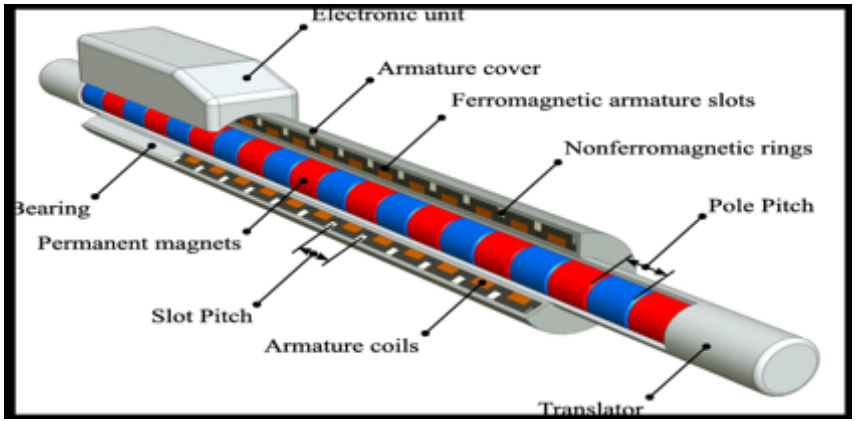
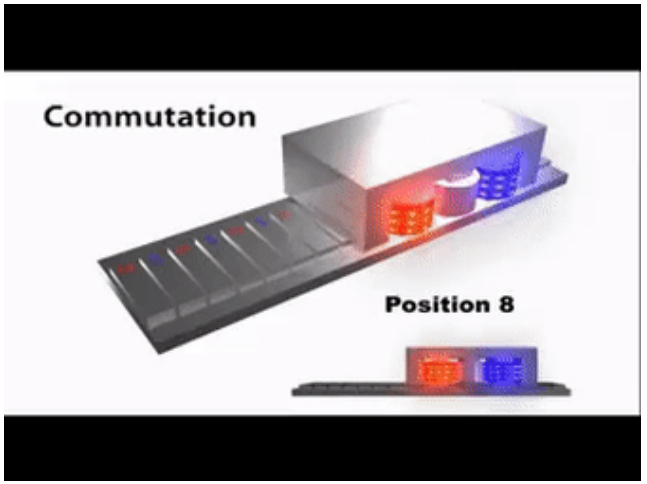


Fig.5

Linear Motor

- A linear motor is an electric motor that has had its stator and rotor "unrolled" thus instead of producing a torque (rotation) it produces a linear force along its length.
- However, linear motors are not necessarily straight.
- Characteristically, a linear motor's active section has ends, whereas more conventional motors are arranged as a continuous loop.





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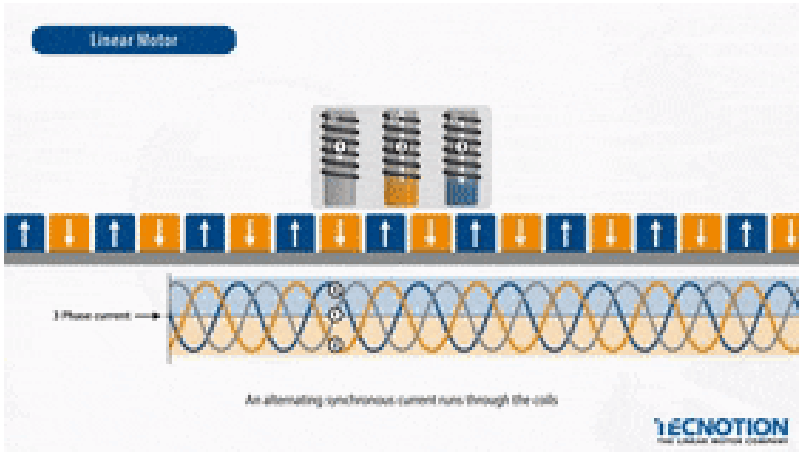
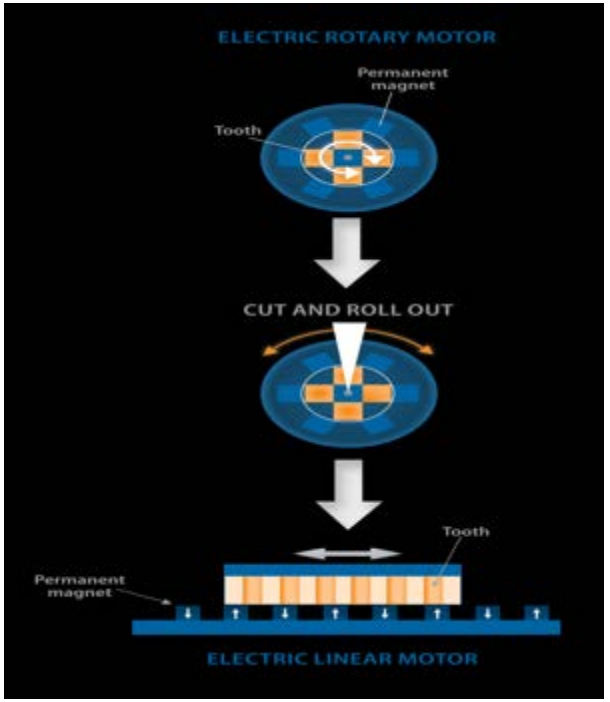
- Linear motors operate with an AC power supply and servo controller, which are often the same as those used for rotary servo motors.
- The linear motor primary part is connected to the power supply to produce a magnet field.
- By changing the current phase in the coils, the polarity of each coil is changed.
- The attractive and repelling forces between the coils in the primary part and the magnets in the secondary part cause the primary to move and generate a linear force.
- The rate of change of the current controls the velocity of the movement, and the amperage of the current determines the force generated.



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