

STEPPER MOTOR.



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Stepper motors:- A stepper motor is an electro-mechanical device that converts electrical power into mechanical power. Also it is a brushless synchronous electric motor that can divide a full rotation into an expensive number of steps.

The size of the step is measured in degree and can vary depending upon the application. Due to precise control stepper motors are commonly used in medical, satellite, robotics and control applications. The major features of stepper motor are

- i) **High accuracy:-** operate under open loop.
 - ii) **Reliability:-** Stepper motors are brushless.
 - iii) **Load independent:-** Stepper motor rotates at a set speed under different load.
 - iv) **Holding torque.** For each and every step the motor holds its position without brake.
- Stepper motor requires sequence and driver to operate. Sequence generator generates sequence for switching which determines the direction of rotation and mode of operation. Driver is required to change the flux direction in the windings. The below figure shows the block diagram of stepper motor system.

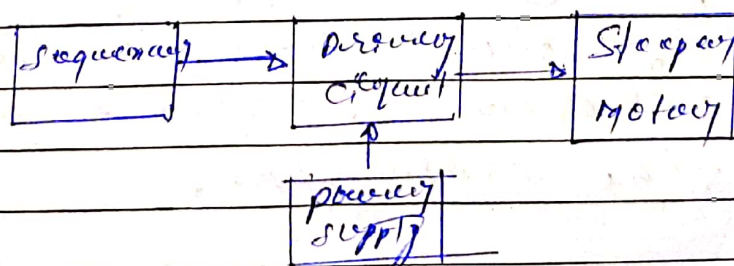
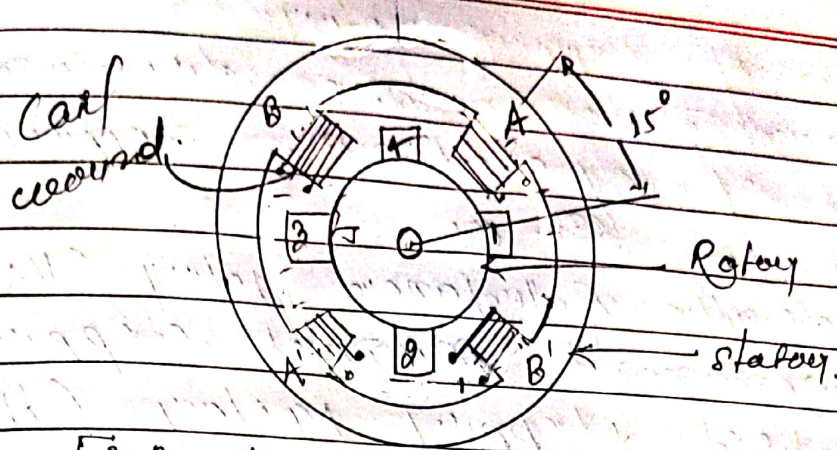


Fig: Block diagram of stepper motor

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Fig's Stepper motor.

Construction- A stepper motor consists of stator and a rotor. The stator consists of individual sets of coils. The number of coils is different based on the type of stepper motor. The rotor consists of metal poles and each pole is attracted by a set of coils in stator. The coils on the stator are arranged in pairs of poles like A and A' B and B' and so on. So each of this coil pair forms an electromagnet and they can be energised individually using a driver circuitry.

When a coil gets energised it acts as a magnet and the rotor pole gets aligned to it, when the rotor starts to adjust itself to align with the and it is called as one step.

Similarly by energising the coils in a sequence we can rotate the motor in small steps to make a complete rotation.



Types of Stepper motors:

According to machine structure and principle of operation, stepper motors are classified as:

- i) Variable Reluctance Motor (VRM)
- ii) permanent Magnet stepper motor (PM)
- iii) Hybrid stepper motor (HSM).

A) Variable Reluctance motor (VRM).

It consists of iron-toothed rotor and a wound stator. When the stator windings are energized with DC current the poles become magnetized. Rotation occurs when the rotor teeth are attracted to the energized stator poles. Both the stator and rotor materials must have high permeability and be capable of allowing high magnetic flux to pass through even if a low magnetomotive force is applied. When the rotor teeth are directly lined up with the stator poles, the rotor is in a position of minimum reluctance to the magnetic flux.

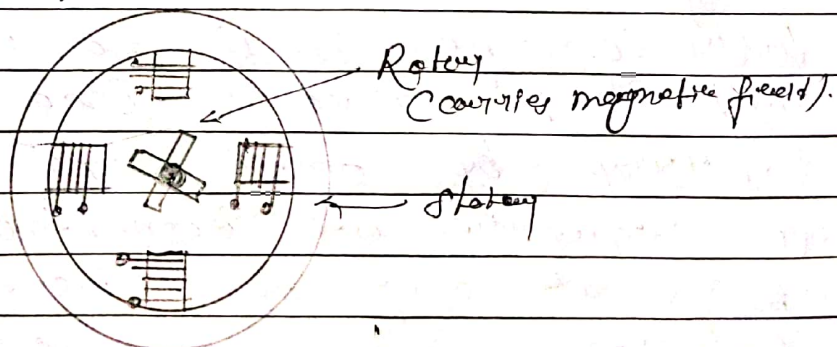


Fig 8 Cross-sectional view of Variable reluctance motor