

DC (Direct Current) motors are electromechanical devices that convert direct electrical energy into mechanical rotation. They are commonly used in various applications, from small toys to industrial machinery.

Definition:

A DC motor is a machine that transforms electrical energy from a direct current power source into mechanical energy, typically in the form of rotational motion.

Main Components :

Stator: The stationary part of the motor, which provides a magnetic field.

Rotor (Armature): The rotating part that interacts with the magnetic field to create torque.

Commutator: A mechanical switch that reverses current direction through the rotor windings.

Brushes: Carbon or metal pieces that maintain electrical contact with the rotating commutator.

Shaft: Transfers mechanical power to the external load.

Windings: Coiled wires inside the rotor that carry current.

How It Works:

When current flows through the rotor windings, it creates a magnetic field. This field interacts with the stator's field, generating a force (Lorentz force) that causes the rotor to turn. The commutator switches the current direction every half turn to maintain continuous rotation.

Types of DC Motors:

1. **Brushed DC Motor:** Uses brushes and commutator. Simple and inexpensive.
2. **Brushless DC Motor (BLDC):** Uses electronics instead of brushes. More efficient and longer-lasting.
3. **Shunt Wound Motor:** Field winding is connected in parallel with the armature.

4. Series Wound Motor: Field winding is connected in series with the armature. High torque at startup.

5. Compound Wound Motor: Combines series and shunt characteristics.

Applications:

- Electric vehicles (e.g., e-bikes, scooters)
- Fans and blowers
- Robotics and servos
- Conveyor belts
- Household appliances (vacuum cleaners, mixers)
- Industrial automation

DC motors are essential for systems requiring speed control, high torque, and flexible performance.