

Electrical Technology

(EE-101F)

Contents

- Basics of Electrical Machines
- Operating Principle of DC Machine
- Armature & Its windings
- Voltage & Torque in DC Machine
- Test yourself
- NPTEL Link

Basics of a Electric Motor

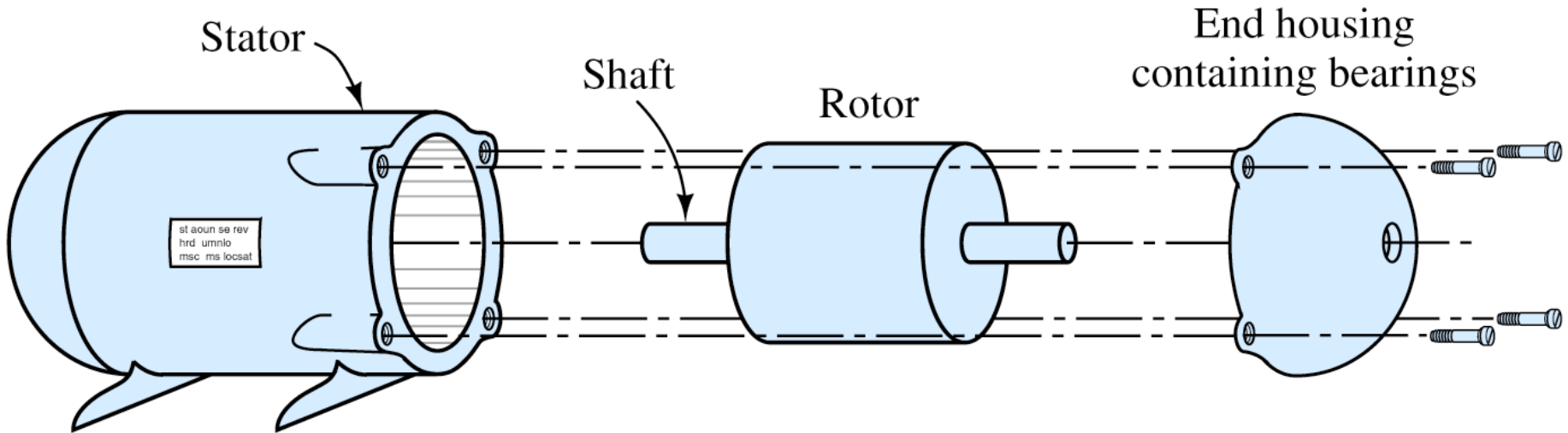


Figure 16.1 An electrical motor consists of a cylindrical rotor that spins inside a stator.

A Two Pole DC Motor

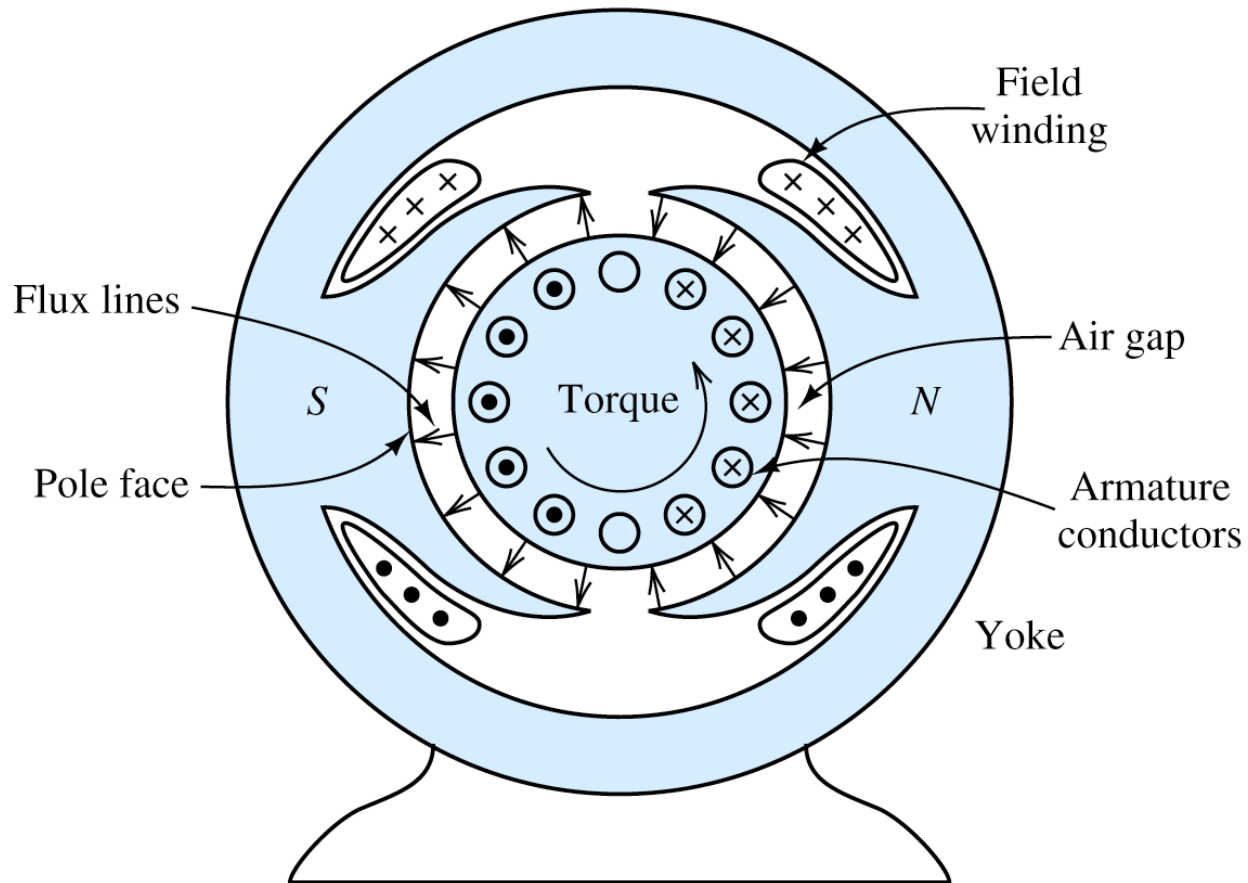


Figure 16.10 Cross section of a two-pole dc machine.

A Four Pole DC Motor

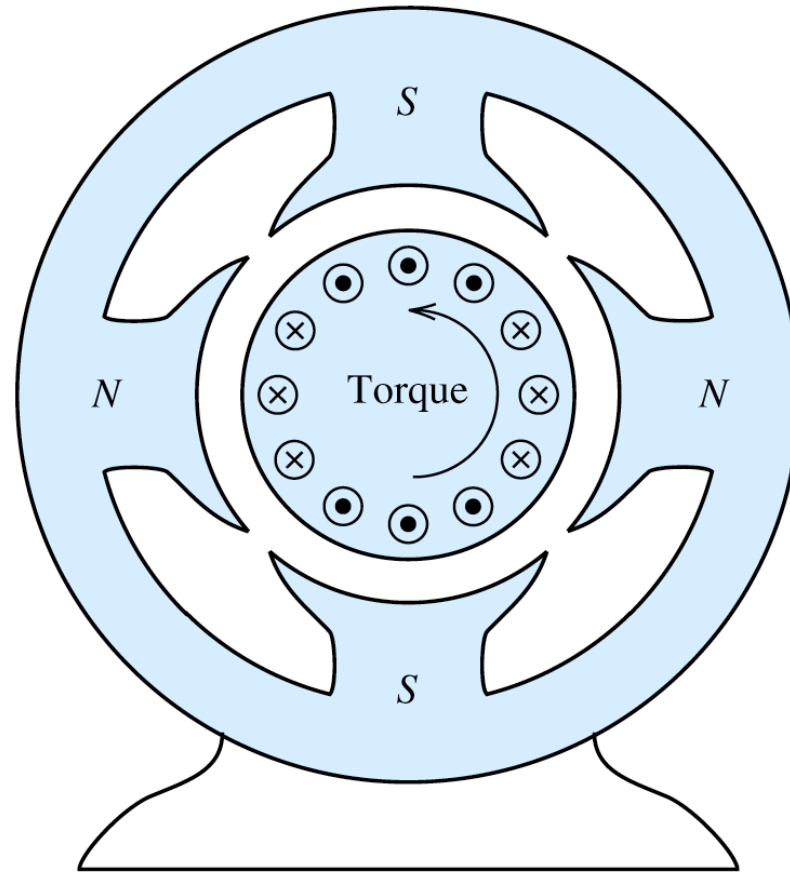


Figure 16.11 Cross section of a four-pole dc machine.

Operating Principle of a DC Machine

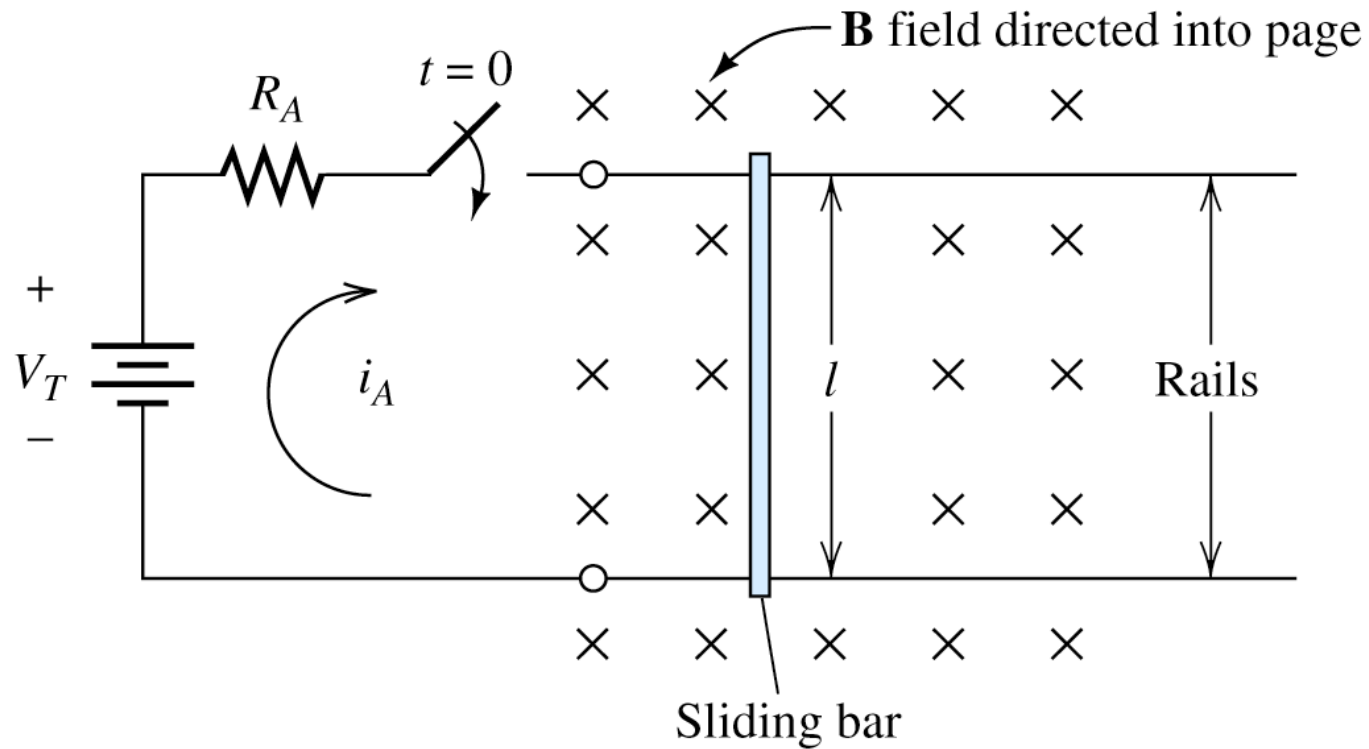
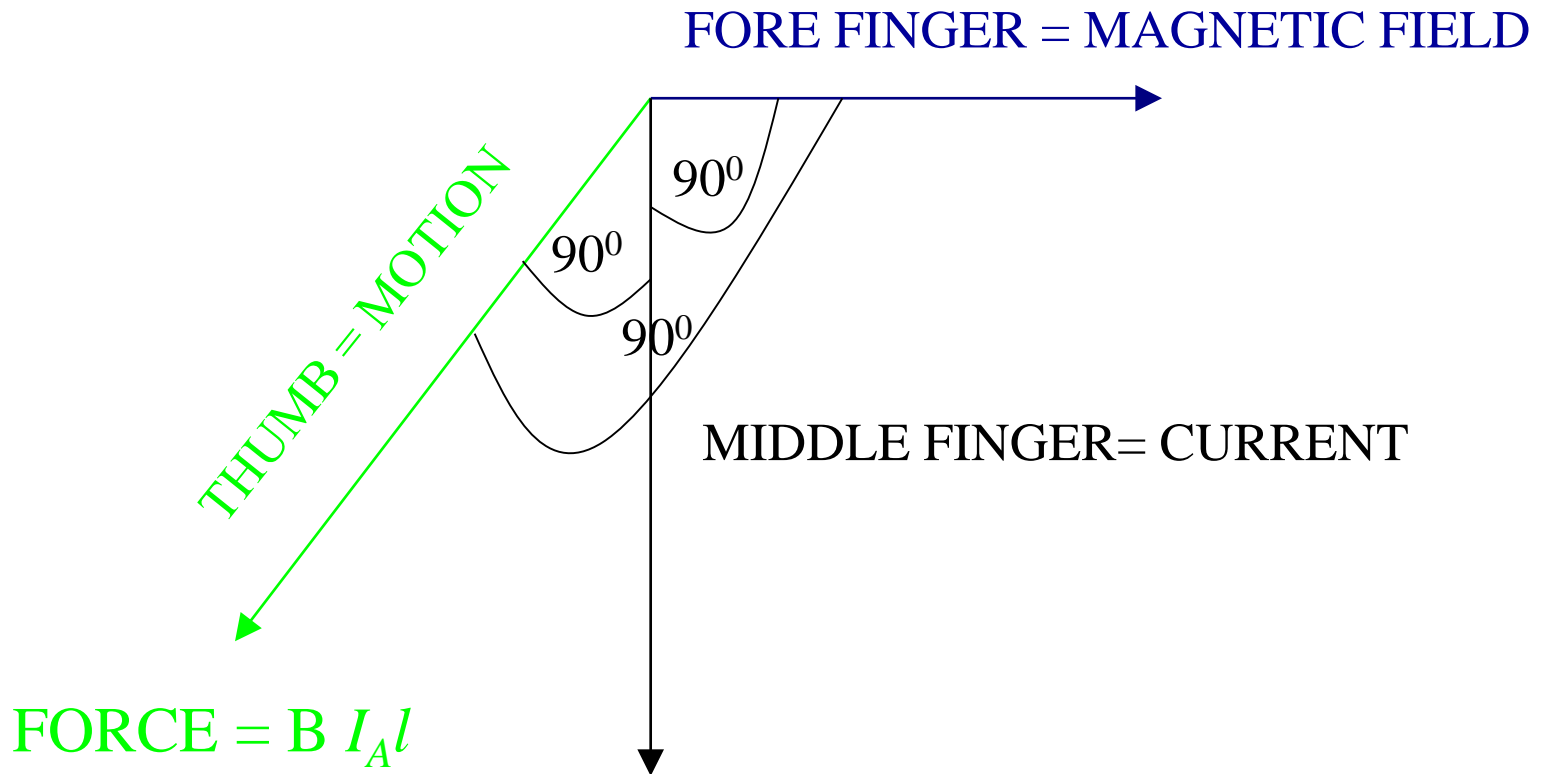


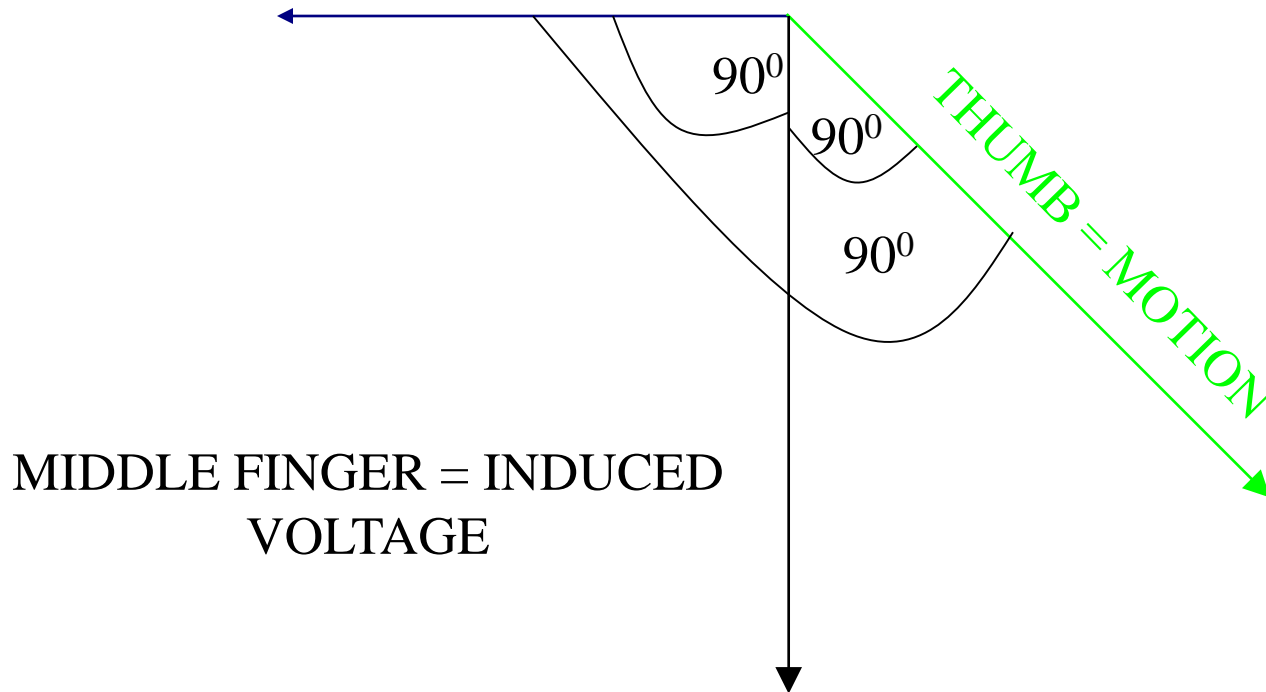
Figure 16.6 A simple dc machine consisting of a conducting bar sliding on conducting rails.

Fleming's Left Hand Rule Or Motor Rule



Fleming's Right Hand Rule Or Generator Rule

FORE FINGER = MAGNETIC FIELD



MIDDLE FINGER = INDUCED
VOLTAGE

$$\text{VOLTAGE} = B l u$$

Action of a Commutator

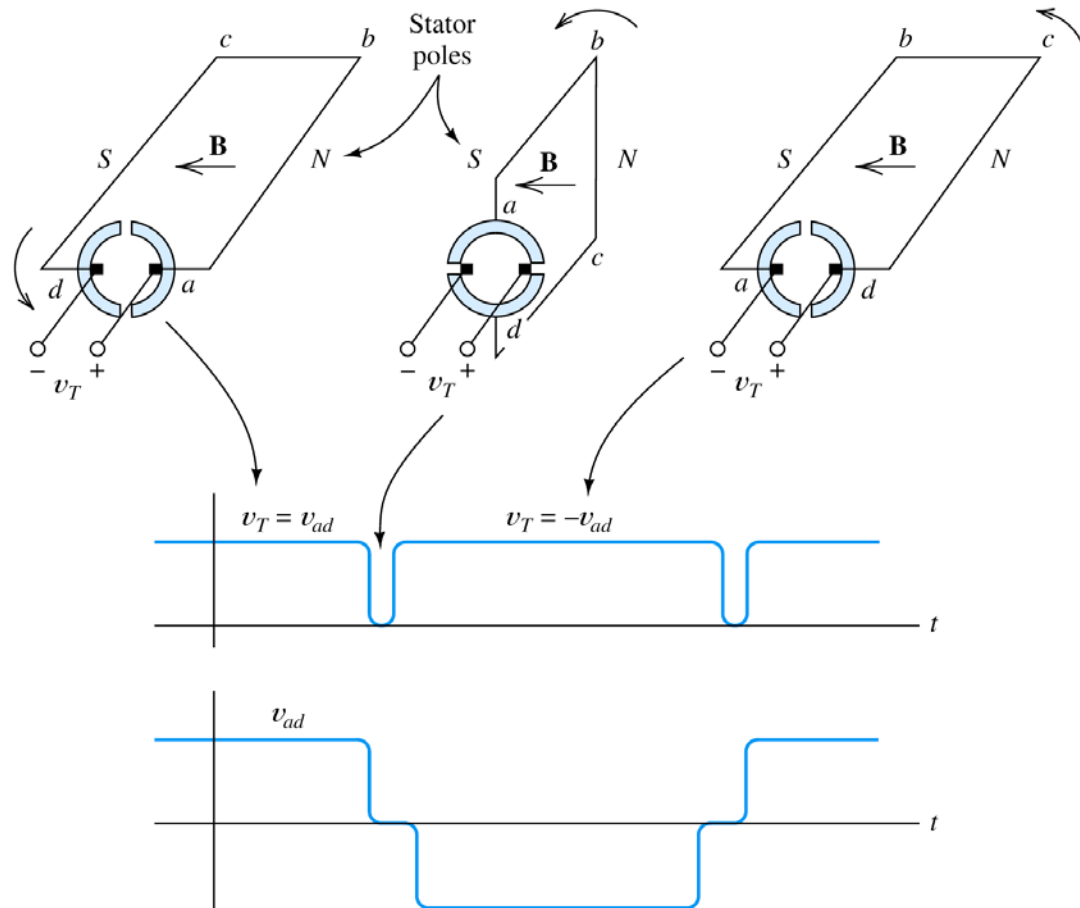


Figure 16.12 Commutation for a single armature winding.

Armature of a DC Motor

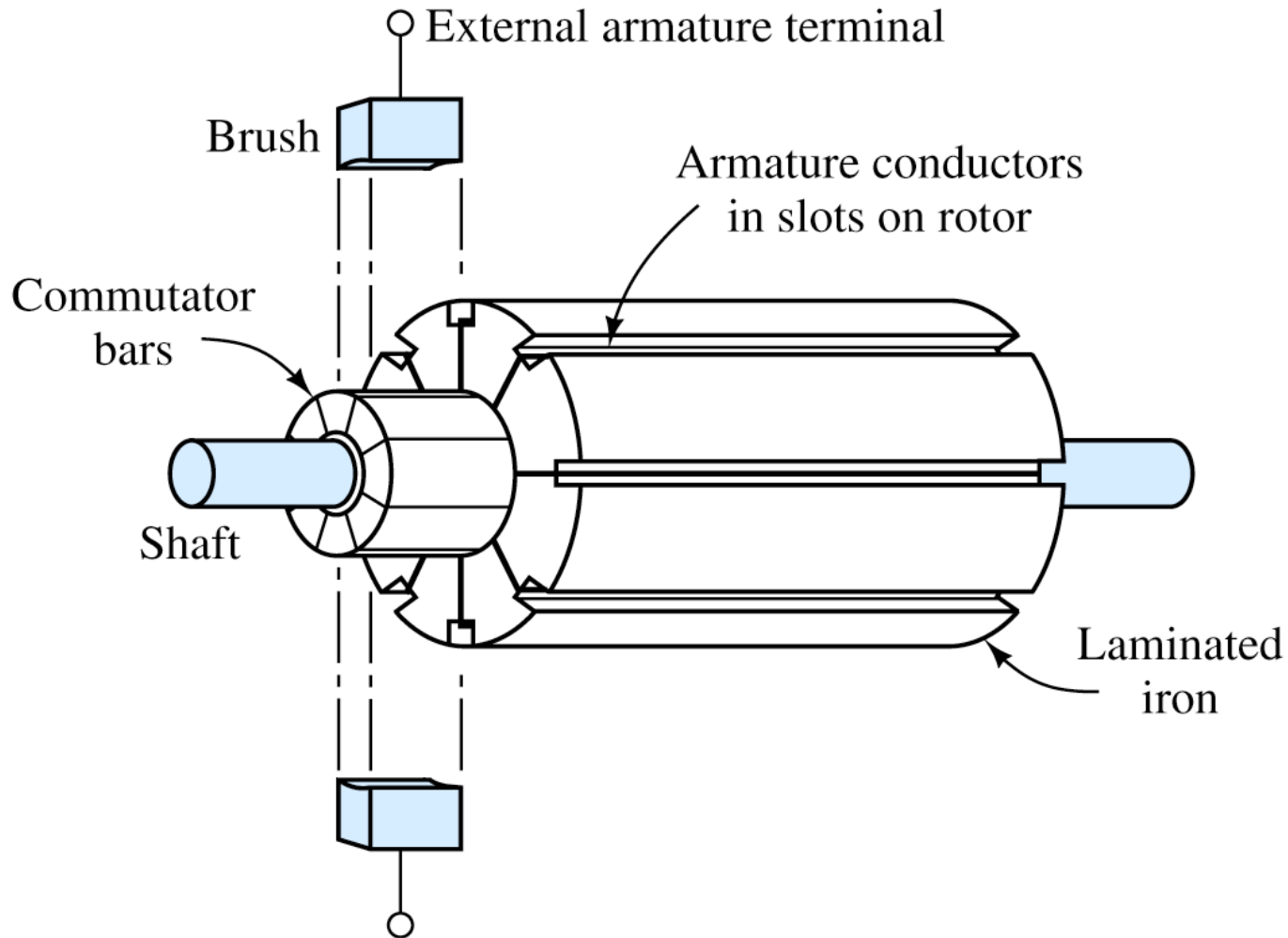


Figure 16.9 Rotor assembly of a dc machine.

Armature Winding in a DC Machine

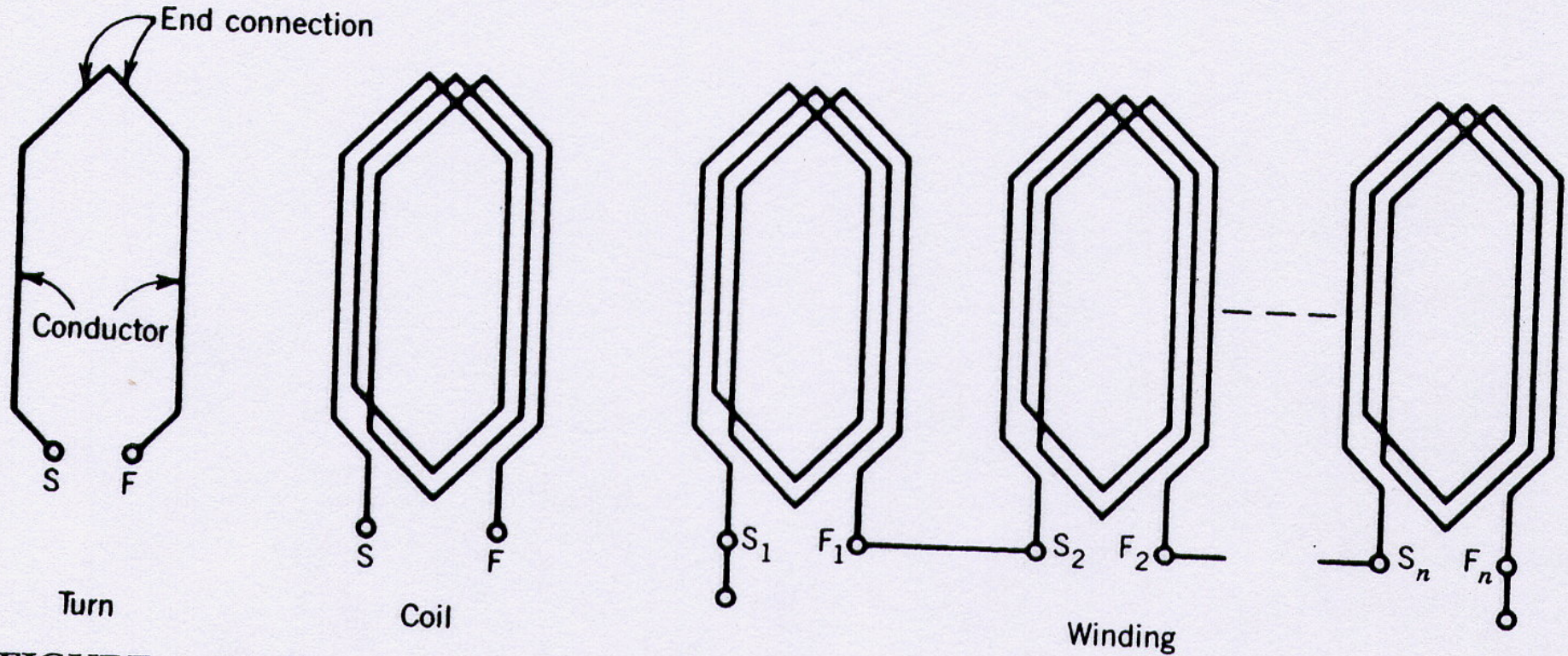


FIGURE 4.15 Turn, coil, and winding.

Summary of a DC Machine

- Basically consists of
 1. An electromagnetic or permanent magnetic structure called **field** which is static
 2. An Armature which rotates -
- The Field produces a magnetic medium
- The Armature produces voltage and torque under the action of the magnetic field

Voltage and Torque developed in a DC Machine

- Induced EMF, $E_a = K_a \Phi \omega_m$ (volts)
- Developed Torque, $T_{dev} = K_a \Phi I_a$ (Newton-meter or Nm)

where ω_m is the speed of the armature in rad/sec., Φ is the flux per pole in weber (Wb)

I_a is the Armature current

K_a is the machine constant