ELEC 344
4th Tutorial

DC Machine, Fleming's rule & Assignments #2

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3.5 An electromagnet lift system is shown in Fig. P3.5. The coil has 2500 turns. The flux density in the air gap is 1.25 T. Assume that the core material is ideal.

(a) For an air gap, $g = 10$ mm:

(i) Determine the coil current.

(ii) Determine the energy stored in the magnetic system.

(iii) Determine the force on the load (sheet of steel).

(iv) Determine the mass of the load (acceleration due to gravity = 9.81 m/sec^2).

(b) If the air gap is 5 mm, determine the coil current required to lift the load.

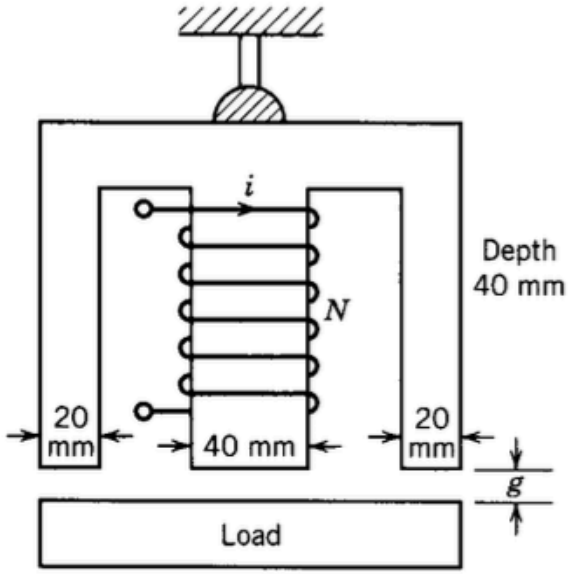


FIGURE P3.5

3.6 The cross section of a cylindrical magnetic actuator is shown in Fig. P3.6. The plunger has a cross-sectional area 0.0016 m^2. The coil has 2500 turns and a resistance of 10 Ω. A voltage of 15 V (dc) is applied to the coil terminals. Assume that the magnetic material is ideal.

(a) Determine the air gap g in mm for which the flux density in the air gap is 1.5 T. Determine the stored energy for this condition.

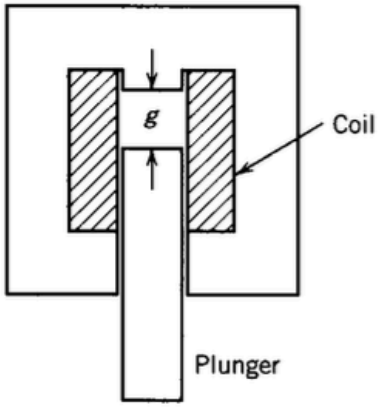


FIGURE P3.6

(b) Obtain an expression for the force on the plunger as a function of the air gap length g.

(c) Determine the force on the plunger for the condition of part (a).

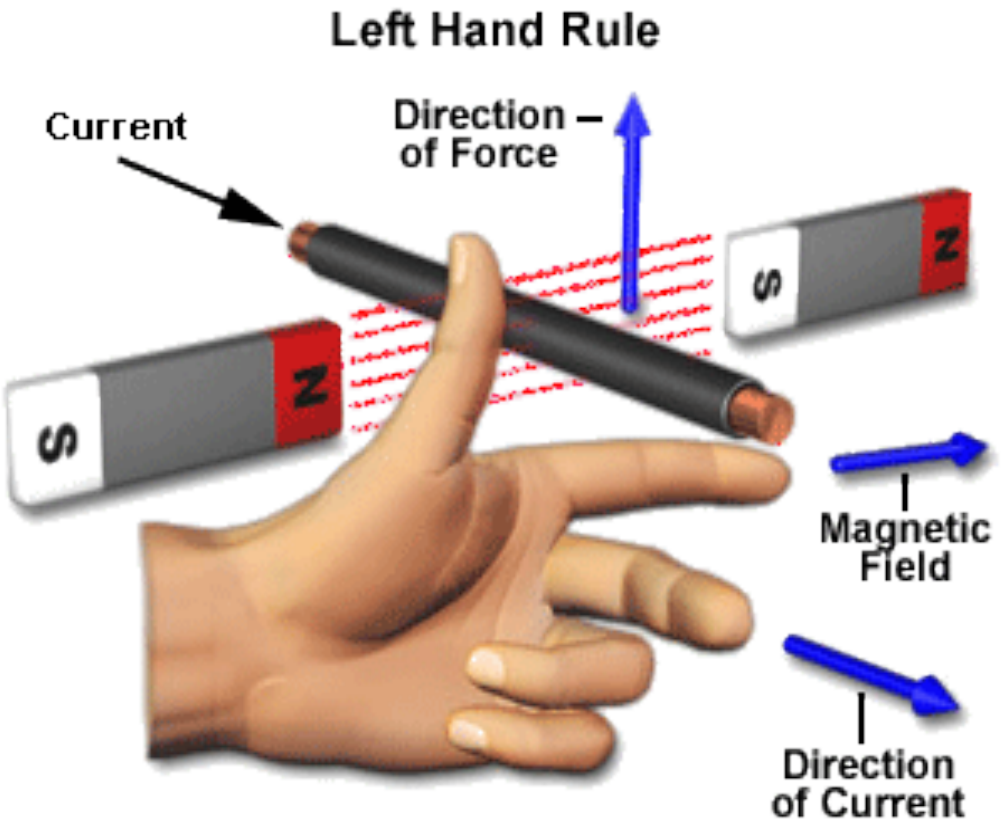
(d) Suppose the plunger moves quickly from an initial gap of 5 mm to the fully closed position. The plunger moves so quickly that the flux linkage of the coil (and hence the flux density in the air gap) hardly changes during the motion.

(i) Determine the force during the motion.

(ii) Determine the amount of mechanical energy produced during the motion.

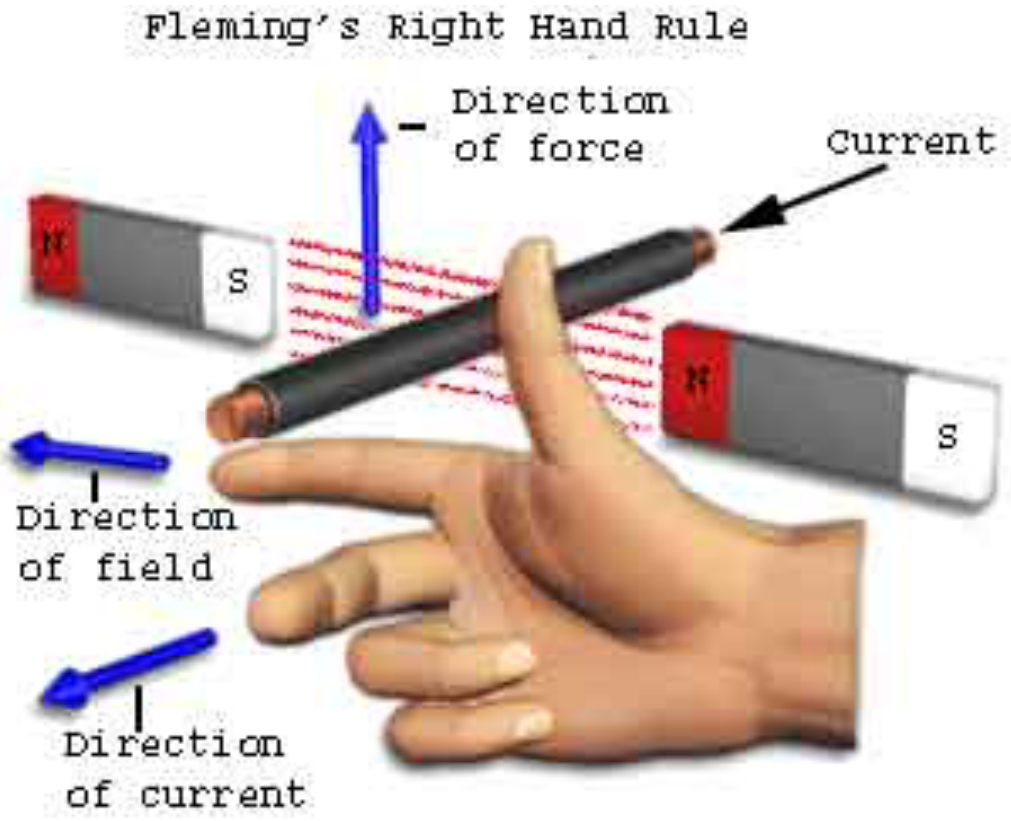
Fleming's Left Hand Rule (MOTOR!!!)

Used to determine the ***direction of force*** acting on a ***current carrying conductor*** placed in a ***magnetic field***.

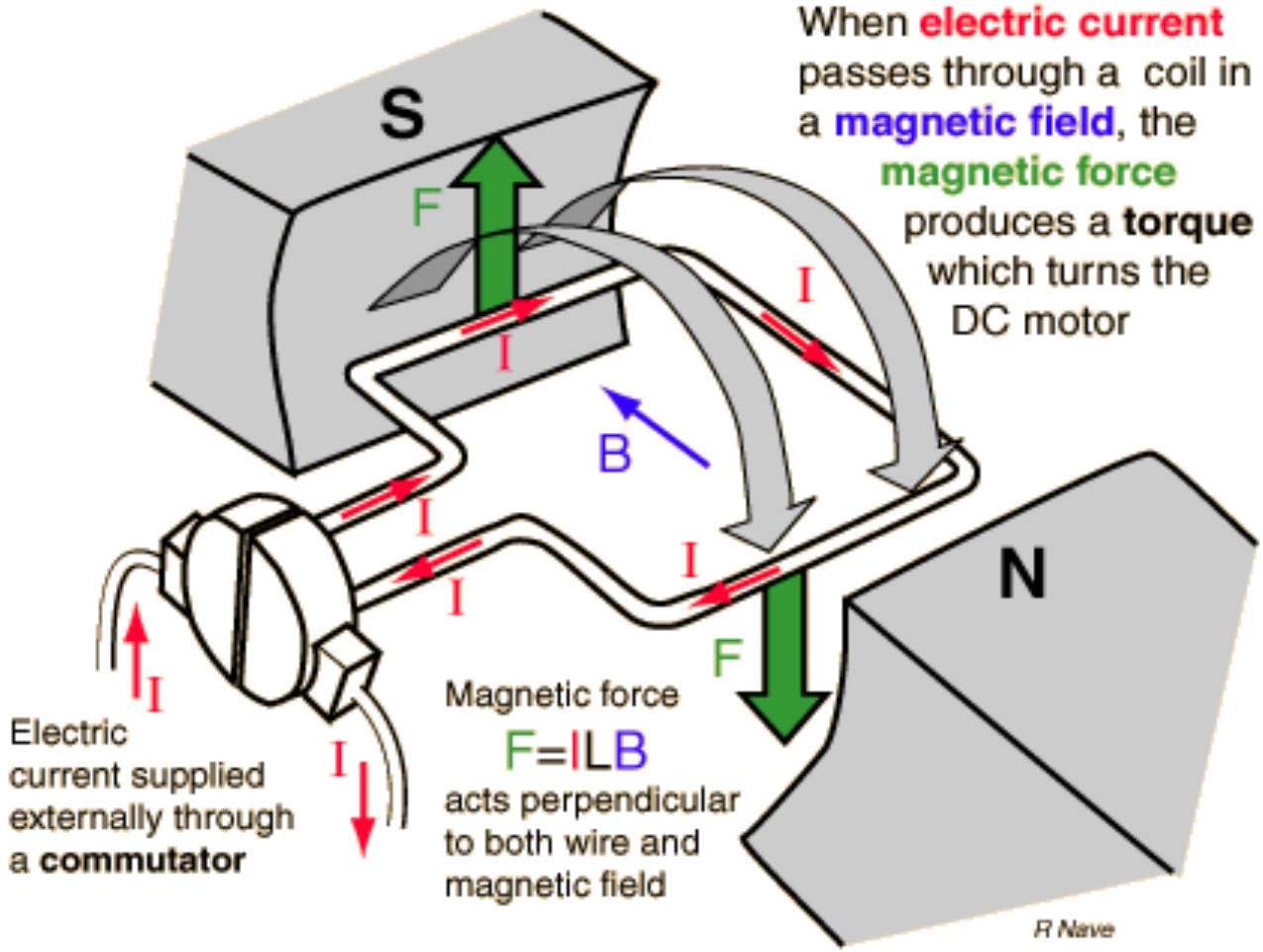


Fleming's Right Hand Rule (GENERATOR!!!)

Whenever a conductor moves inside a magnetic field, there will be an induced current in it. If this conductor gets forcefully moved inside the magnetic field, there will be a relation between the direction of applied force, magnetic field and the current.



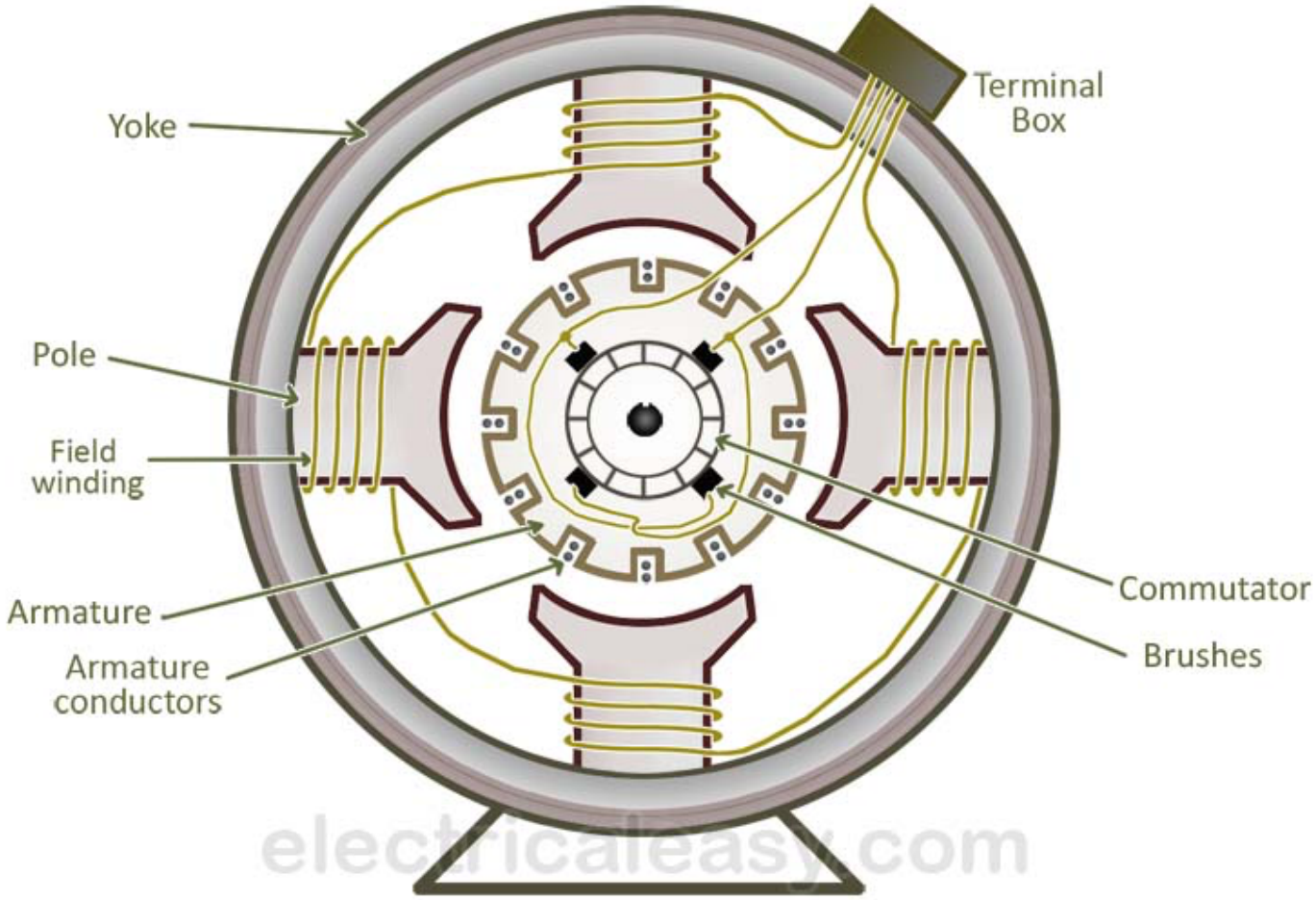
Working Principles of DC Machine



Structure of DC Machine

https://youtu.be/LAtPHANEfQo

Cross-sectional view of DC machine

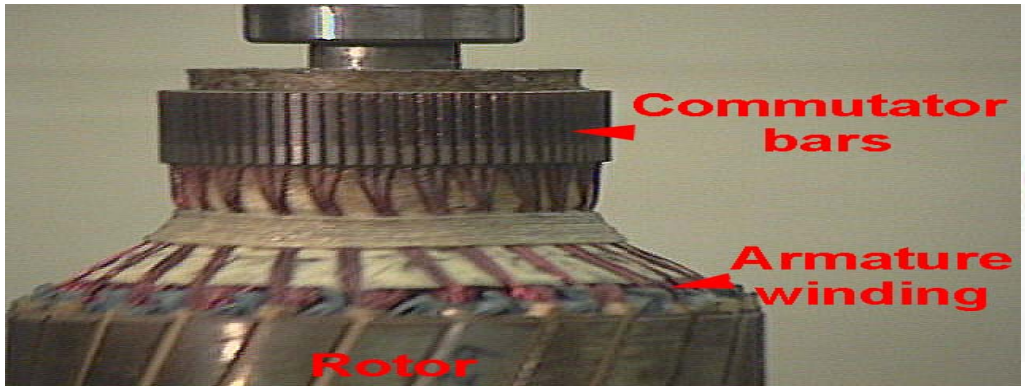


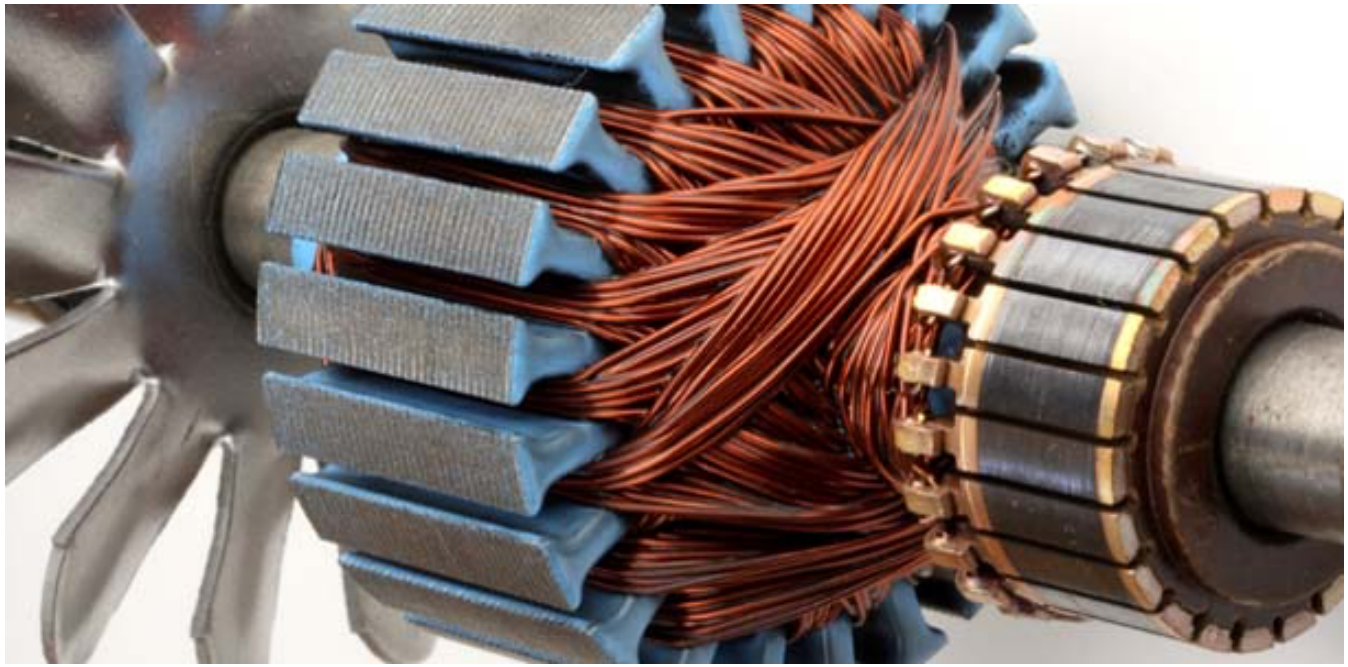
Structure of DC Machine

Stator & Field Winding

Structure of DC Machine

Rotor & Commutator Bars





Structure of DC Machine

Brush Holder