RAMA UNIVERSITY

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FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-1

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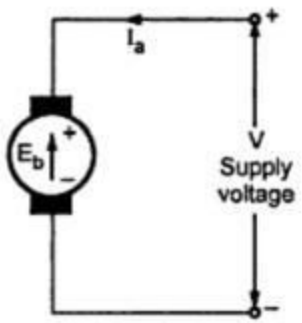
Significance of back e.m.f., the relation between back emf and Terminal voltage

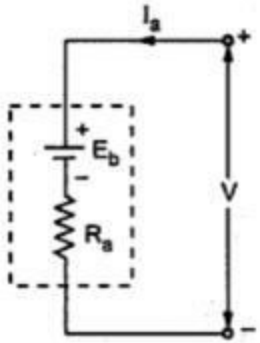
After a motoring action, there exists a generating action. There is an induced e.m.f. in the rotating armature conductors according to Faraday's law of electromagnetic induction. This induced e.m.f. in the armature always acts in the opposite direction of the supply voltage. This is according to the Lenz's law which states that the direction of the induced e.m.f. is always so as to oppose the cause producing it. In a d.c. motor, electrical input i.e. the supply voltage is the cause and hence this induced e.m.f. opposes the supply voltage. This e.m.f. tries to set up a current through the armature which is in the opposite direction to that, which supply voltage is forcing through the conductor.

So as this e.m.f. always opposes the supply voltage, it is called back e.m.f. and denoted as E_b. Though it is obtained as E_b, basically it gets generated by the generation action which we have seen earlier in case of generation. So its magnitude can be determined by the e.m.f. equation which is derived earlier. So,

$$E_b = \frac{\phi P N Z}{60 A} \text{ volts}$$



(a) Back e.m.f. in a d.c. motor



(b) Equivalent circuit

$$V = E_b + I_a R_a + \text{brush drop}$$

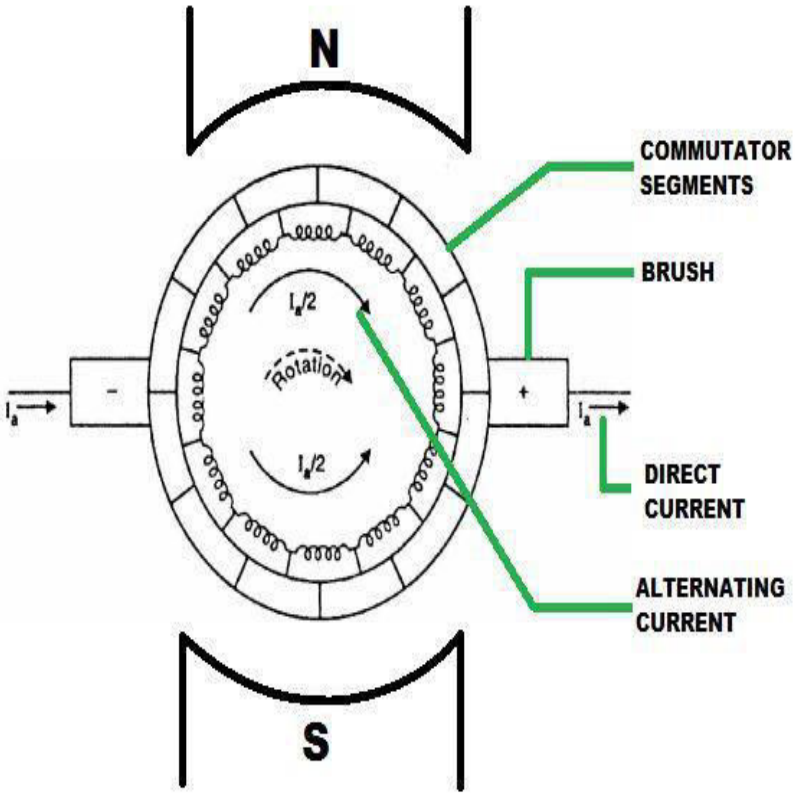
Commutation

- Reversal of current in the armature coil by means of brushes and commutator segments.

Methods of Improving Commutation

There are three methods of sparkles commutation:

- Resistance Commutation
- Voltage Commutation
- Compensating Windings



Armature reaction

Armature flux superimposes with the main field flux and, hence, disturbs the main field flux.

This effect is called as armature reaction in DC machines. perpendicular to the lines of force.

Effects of Armature Reaction

- It decreases the efficiency of the machine.
- It produces sparking at the brushes.
- It produces a demagnetizing effect on the
- main poles.
- It reduces the emf induced.
- Self excited generators some times fail to build up emf.

Armature reaction remedies

- Extra turns in the field winding
- Slots are made on the tips to increase the reluctance
- The laminated cores of the shoe are staggered
- In big machines the compensating winding at pole shoes produces a flux which just opposes the armature mmf flux automatically