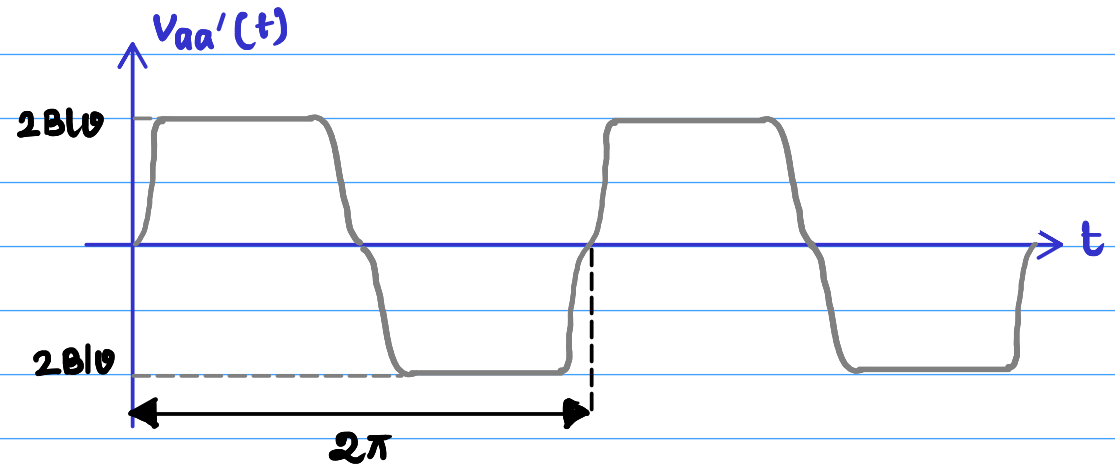
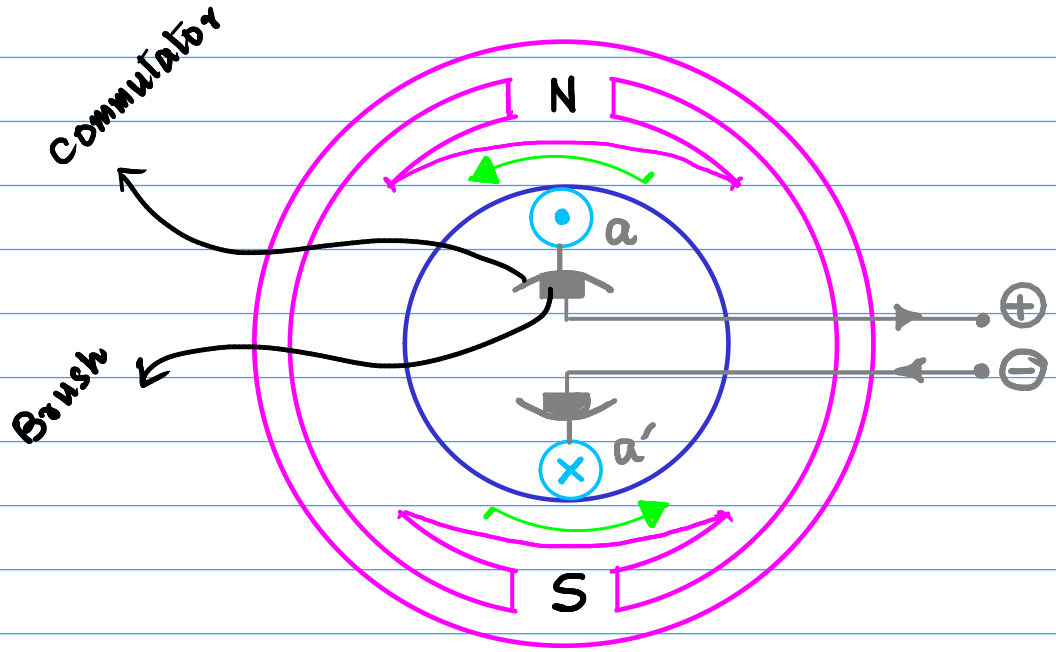
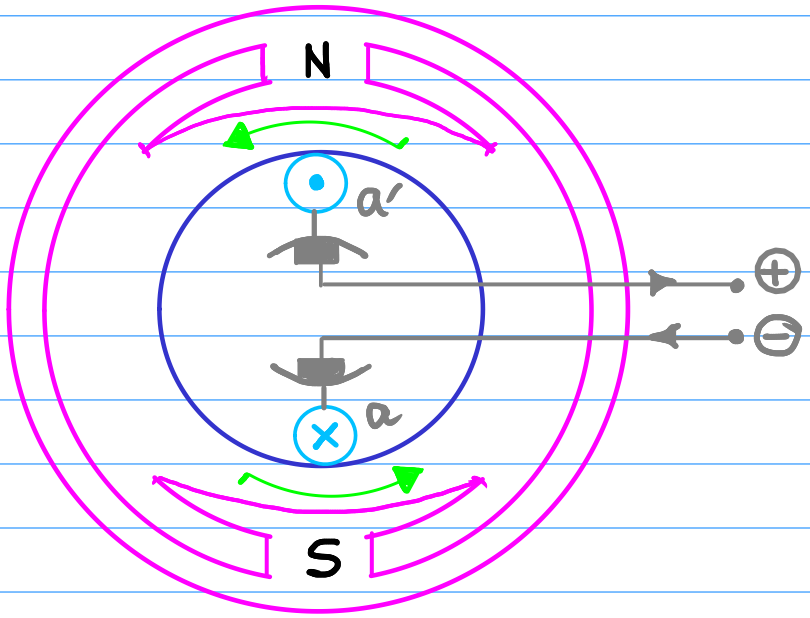


However for DC M/c we need the o/p voltage as dc. Therefore to get the output voltage as dc we will use an arrangement here.

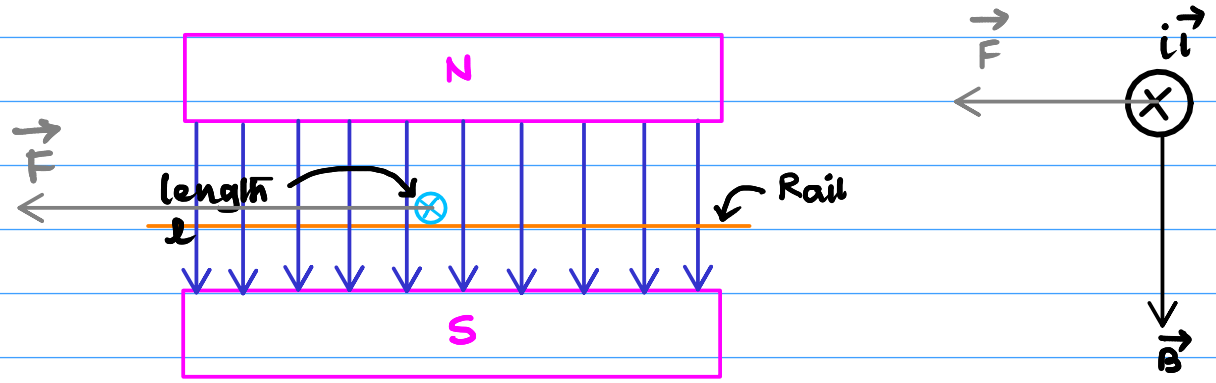
Semi circular arrangement
+
Brush arrangement



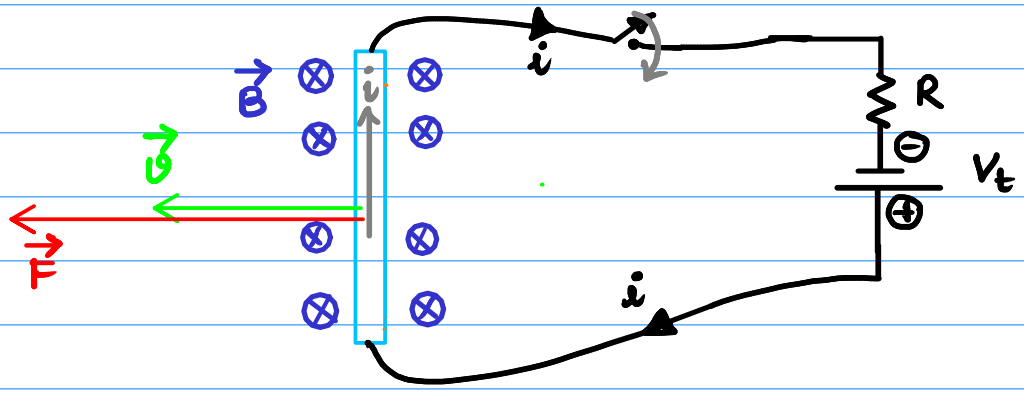


Therefore by using the brush and commutator segment the ac voltage can be converted to the dc voltage.

DC Motors —



Initially the coil is stationary.



At $t = 0$, let the switch is closed.

The force $\vec{F}$ starts to accelerate the conductor in the left dir^n.

Therefore with the velocity of the conductor increasing and back emf e_b increasing the conductor current i is decreasing.

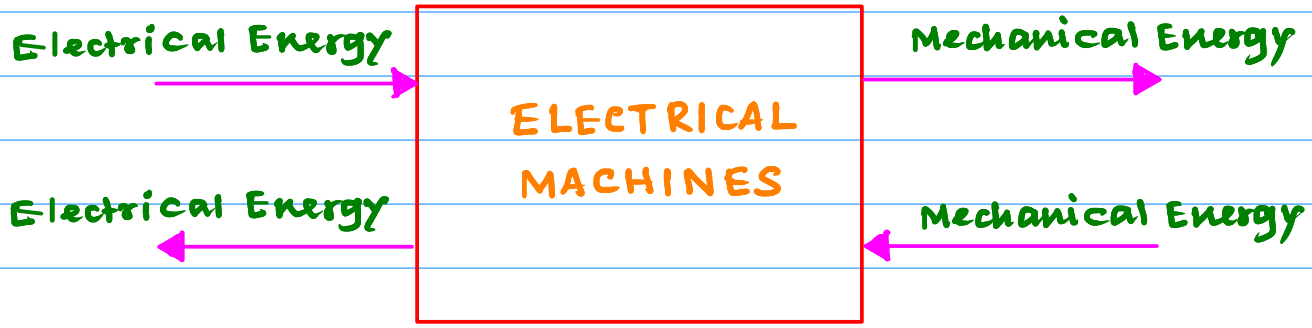
When i becomes zero, accelerating force vanishes and the conductor moves with constant velocity.

However the track friction & also the air friction cannot be neglected.

Generator Mode ⇒ Electromagnetic force acts in the opposite direction of motion.

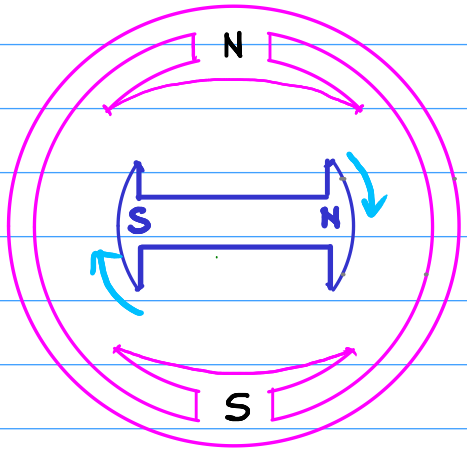
Motoring Mode ⇒ Electromagnetic force acts along the direction of motion

Rotating Electrical m/cs are basically electromech-anical conversion device.

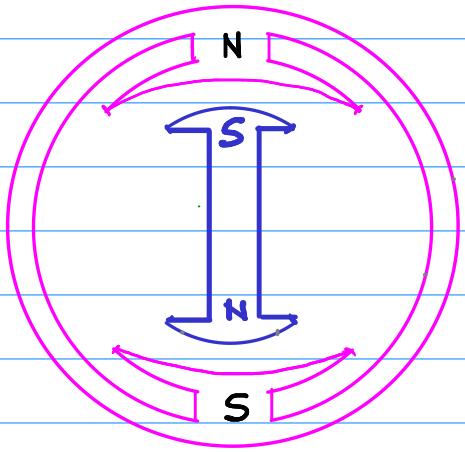


Operation of DC Motor :-

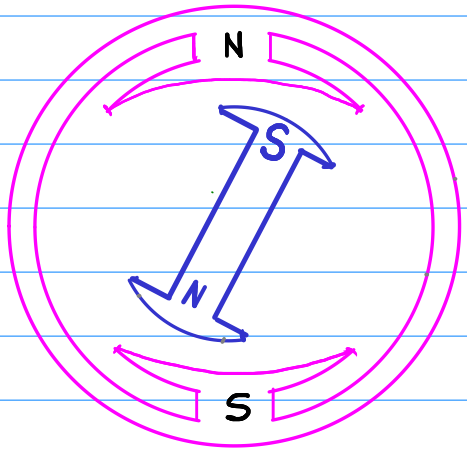
The principle idea of motoring action is magnetic attraction or repulsion.



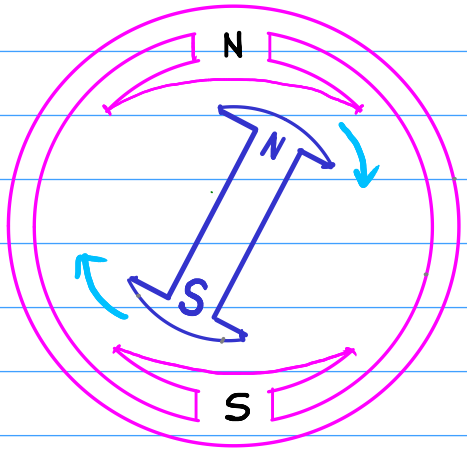
i) Let us assume that somehow we are able to create magnetic poles in the rotor



ii) Rotor magnet will try to allign itself to the stator magnet.



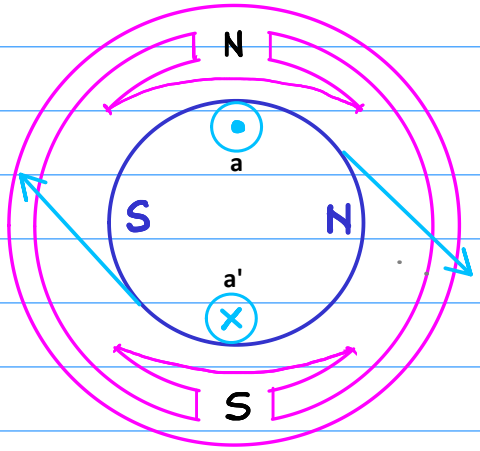
iii) After allignment the rotor part will not stop due to its inertia and overshoots a bit, and the stator poles will again try to allign the rotor poles.

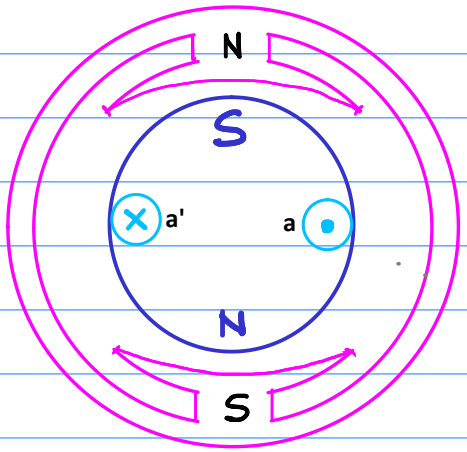


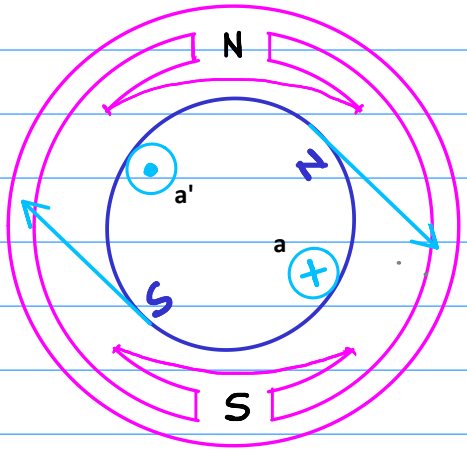
iv) Now consider a situation at which just during the alignment the rotor magnet poles are changed by some arrangement.

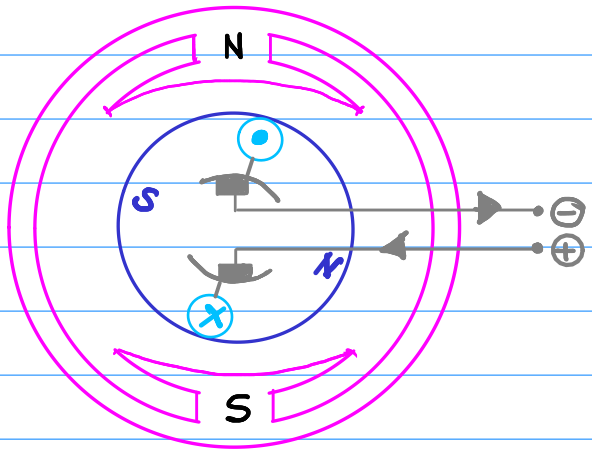
Then the rotor will experience the force in the same dir?

Practicle Arrangement :-









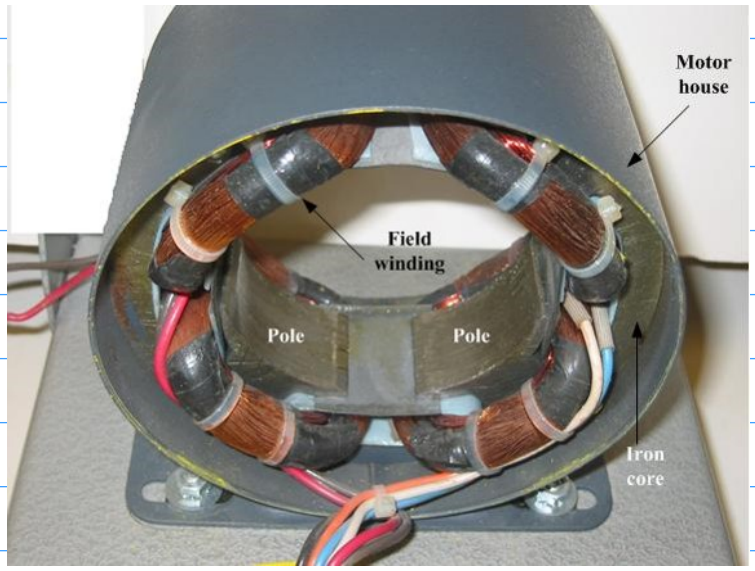
- For the half cycle, one brush should connect to one commulator segment and for rest of the half cycle, the brush should be connected to the other commulator segment.

- Position of the brushes should be such that at aligned position it will be able to change the dirⁿ of the current through the coil.

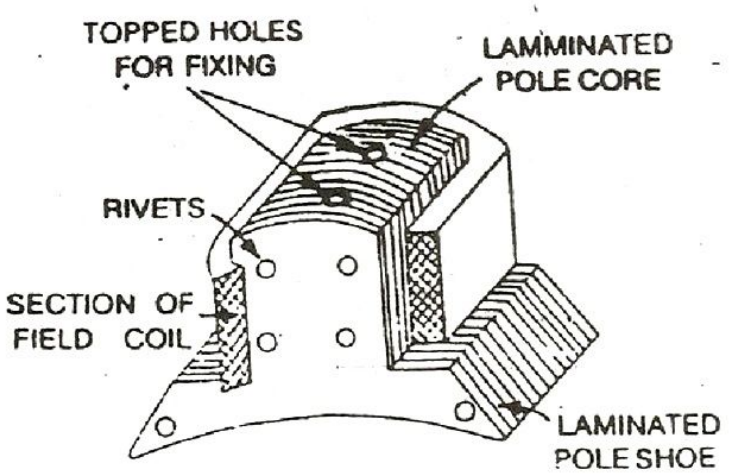
- Dc supply is given through the brushes.

- Brush + commulator segment act as AC–DC converter for generator and DC–AC converter for motor.

Construction of DC M/c :-

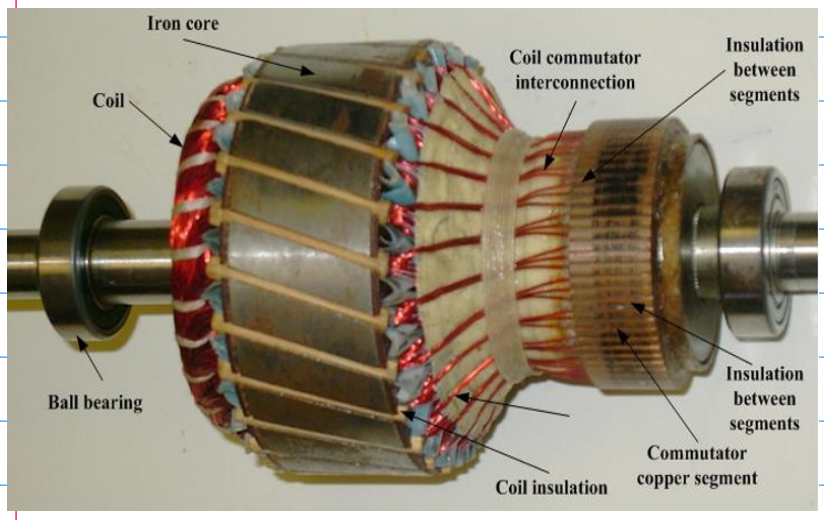


1. Magnetic Frame or yoke



2. Pole cores & pole shoes

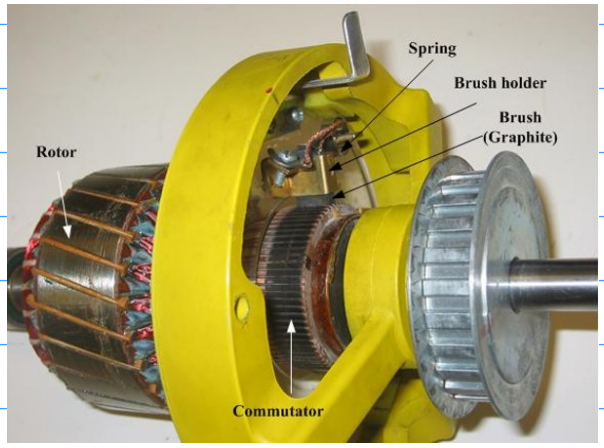
3. Pole coils or field coils



4. Armature Core

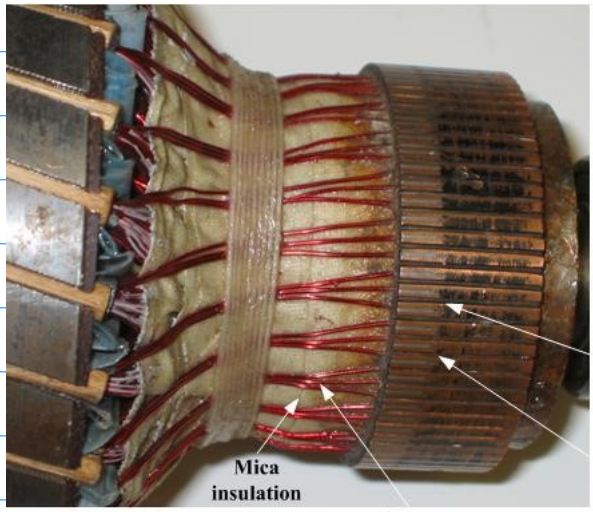
5. Armature winding.

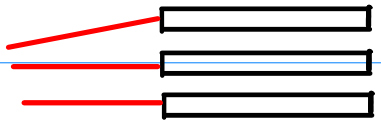
6. Bearings



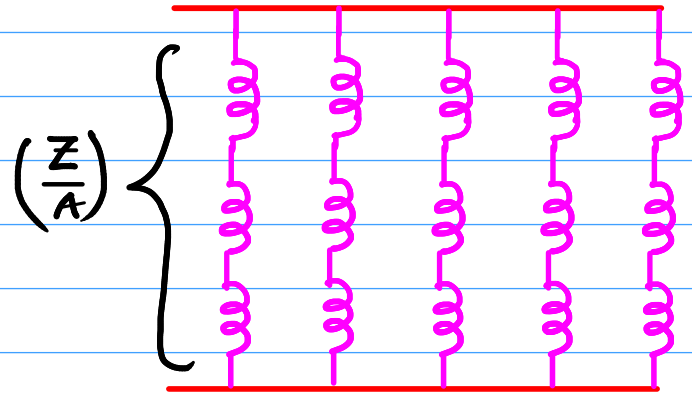
7. Commulator

8. Brushes





EMF induced in a DC M/c :-



Let us consider

ϕ = flux per pole.

Z = total number of armature conductors

= number of slots x number of conductors per slot

P = number of poles.

A = number of parallel paths

N = revolution per minute (RPM)

We can write emf generated/conductor = $\frac{d\phi}{dt}$

In one revolution of a conductor it cuts $P\phi$ flux

Time for one complete revolution $= \frac{60}{N}$

Therefore emf induced per Conductor is

$$= \frac{d\phi}{dt} = \frac{P\phi N}{60}$$

Number of conductors in each parallel path

$$= \left(\frac{Z}{A}\right)$$

Total emf induced in the DC M/c is

$$\boxed{e = \frac{P\phi N}{60} \times \frac{Z}{A}}$$

There are two type of winding

i) Lap winding $\Rightarrow$ A = no. of parallel path = P (Poles)

ii) wave winding $\Rightarrow$ A = 2 (always)