Armature Reaction and Commutation

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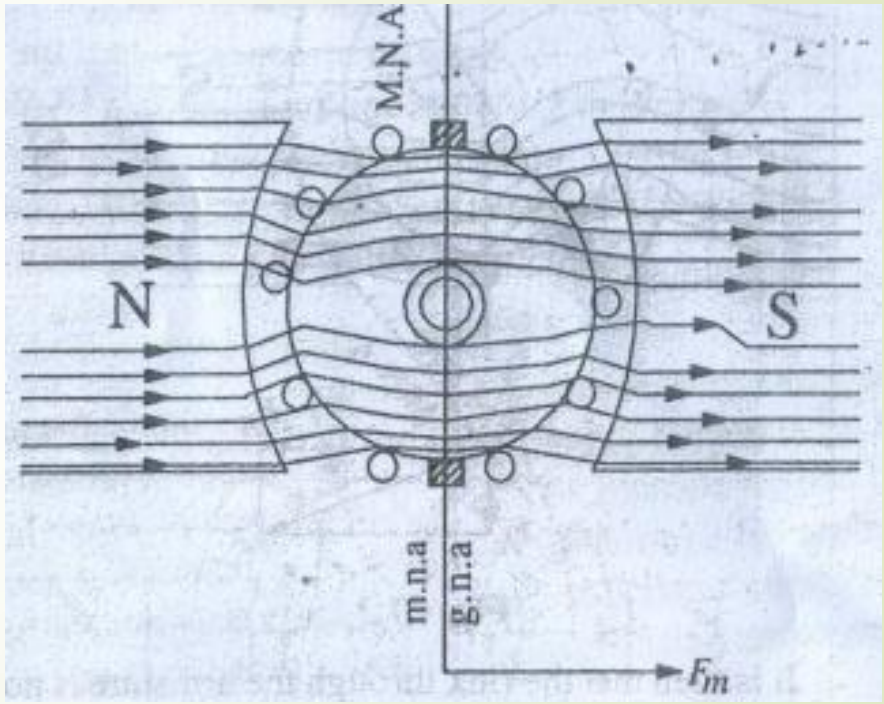
Magnetic Neutral Axis

- Axis along which no e.m.f is produced in the armature conductior because they then move parallel to the line of flux.
- M.N.A is the axis which is perpendicular to the flux passing through the armature.
- M.N.A is also called "axis of commutation" because reversal of current in armature conductor takes place across this axis.

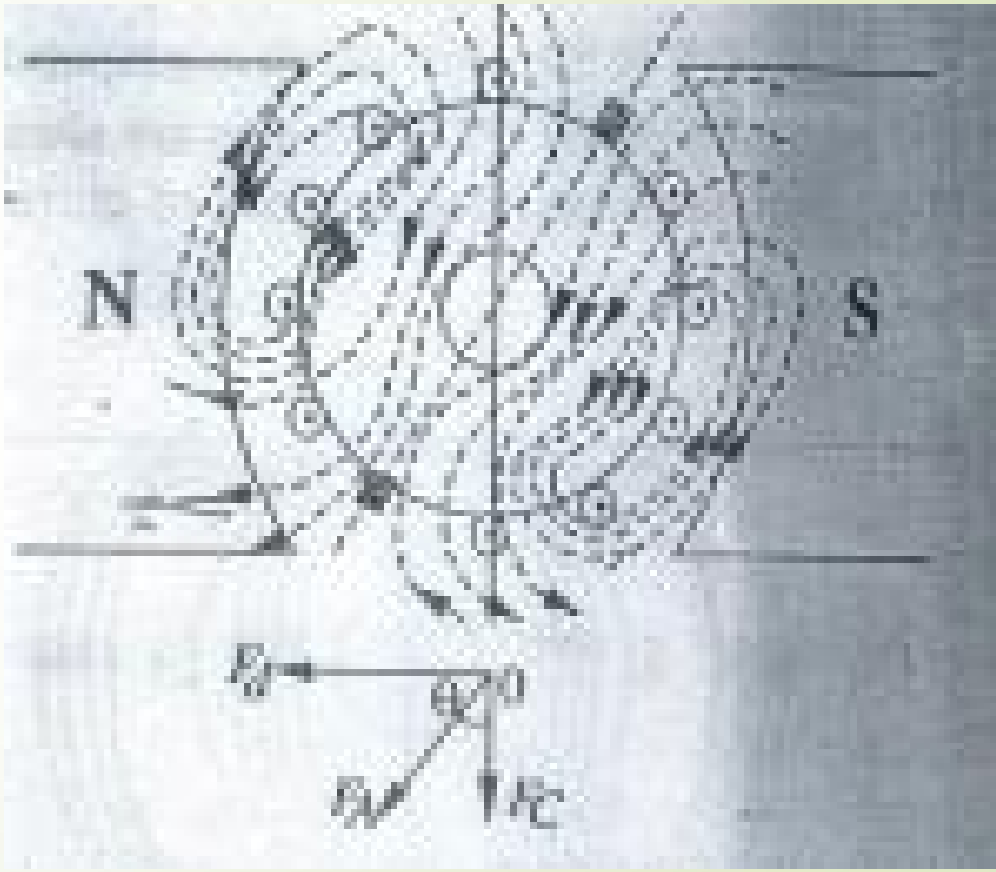


Armature Reaction and its causes

- Armature reaction is meant the effect of magnetic field set up by armature current on the distribution of flux under main poles of a generator. (Shifting of M.N.A)

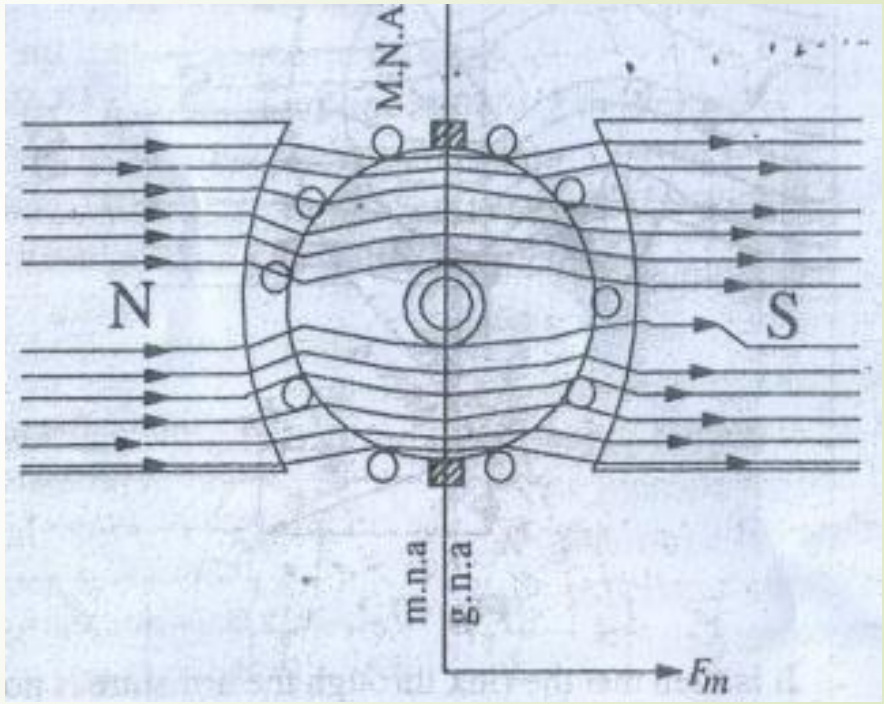
Causes:

- M.N.A moves/shift with every change in load.
- M.N.A shift direction changes with the change of the operation of the DC machine. (Generator/Motor)



Placement of Brushes

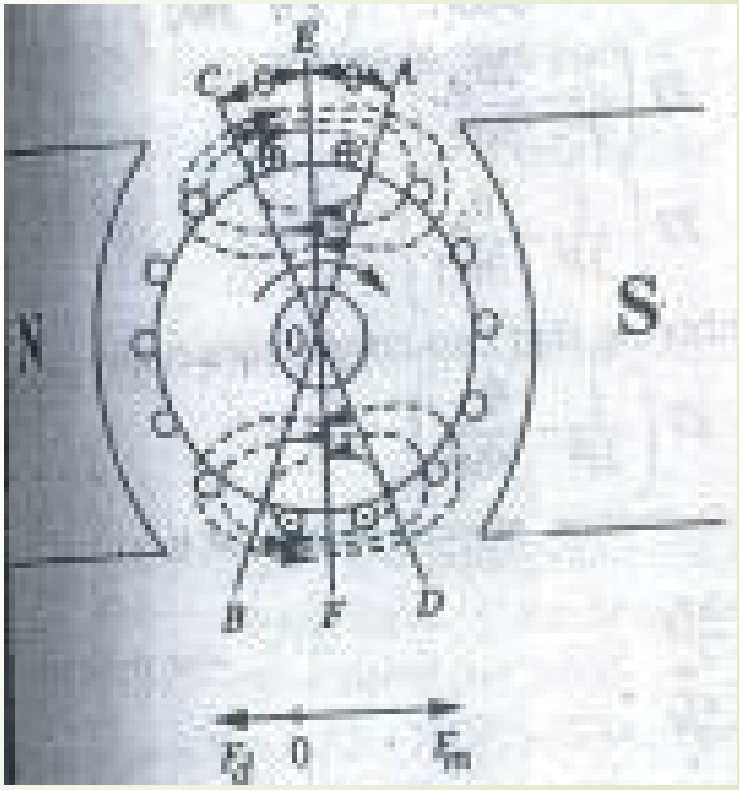
- M.N.A is also called "axis of commutation" because reversal of current in armature conductor takes place across this axis.
- This M.N.A is also the brush axis where the brushes are placed without any arc and spark.



Effect of Armature Reaction

- Armature magnetic field has two effects:

1. **It demagnetizes or weakens the main flux**

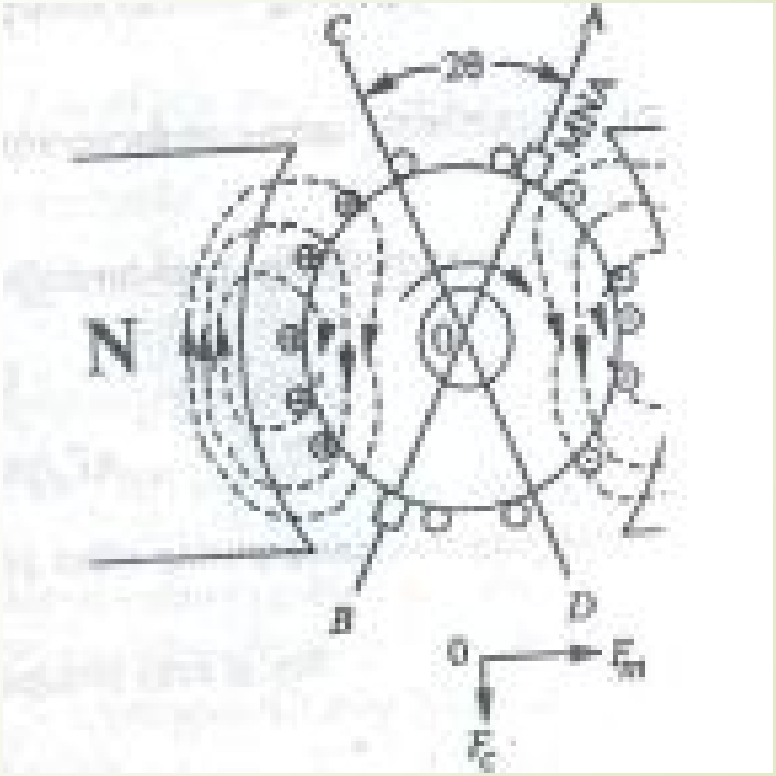


Electric Machinery

Effect of Armature Reaction

1. It demagnetizes or weakens the main flux

2. **It cross-magnetizes or distorts it.**



Remedies of Armature Reaction

1. Brush Shifting
2. Commutating poles or Interpoles
3. Compensating Windings

Brush Shifting

- Shifting the brushes may have stopped the brush sparking, but it actually aggravated the flux weakening effect of the armature reaction in the machine. It is beacuase of;

1. The cross-magnetizing component of the rotor mmf that opposes the main pole mmf.

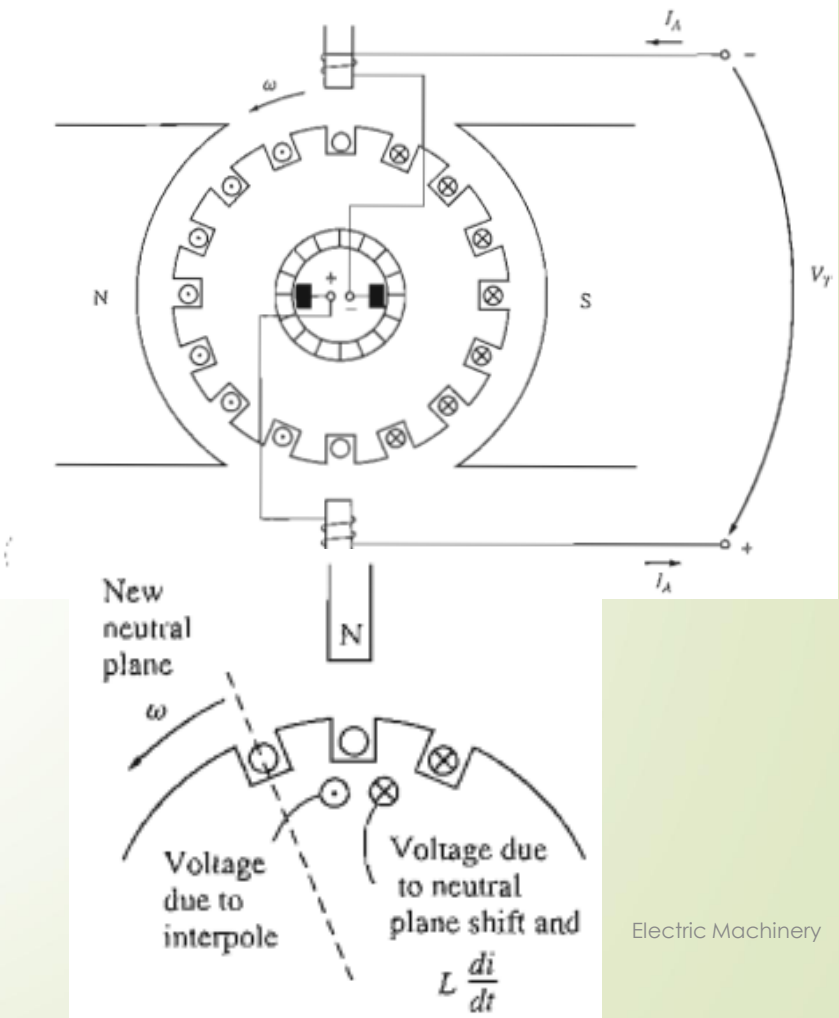
2. Change in armature current distribution causes the flux to bunch up even more at the saturated parts of the pole.

Commutating Pole or Interpole

- Voltage in the wire undergoing commutation can be made zero using the small pole called commutating pole or interpoles.
- Placed in midway between the main pole and connected in series with the winding on the rotor.
- To oppose the voltage in commutating conductor, the interpole must have the opposite flux. For that;

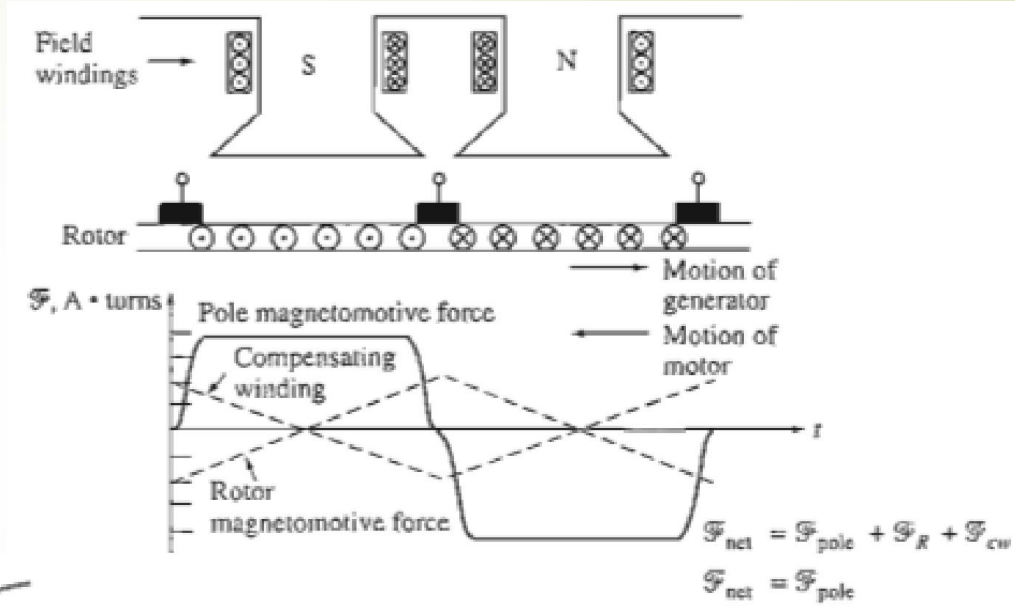
1. In generator, the interpoles must be of the same polarity as the next upcoming main pole.

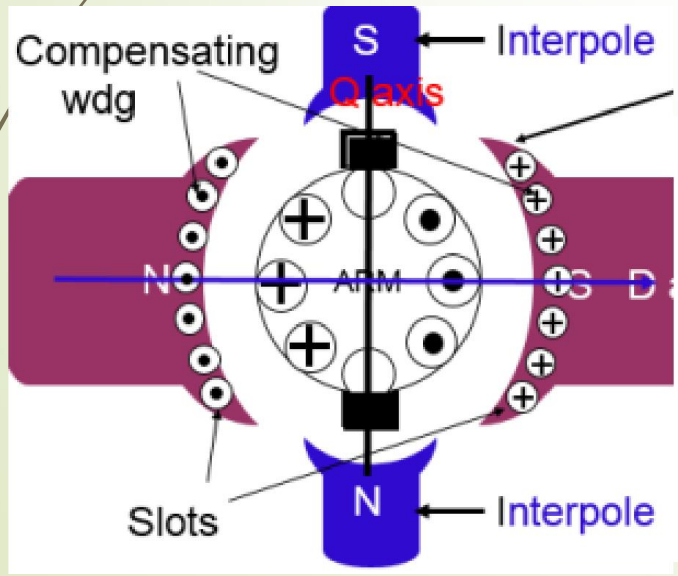
2. In motor, the interpoles must be of the same polarity as the previous main pole.

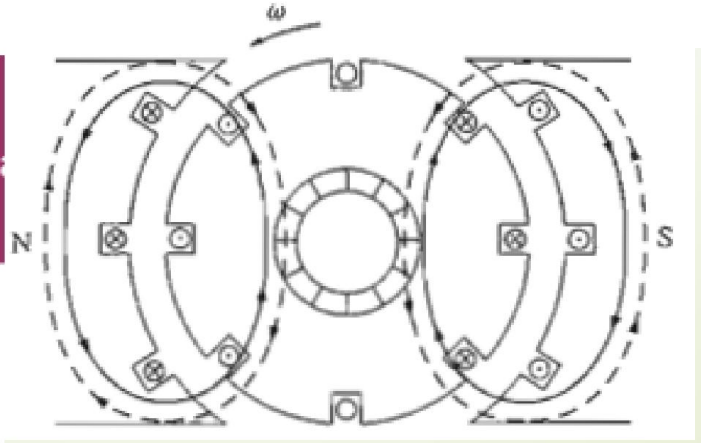


Compensating Winding

1. Used in large DC machines which has large fluctuations in load.
2. Neutralize the cross magnetizing effect of the armature reaction.







DC Motor Cross-Sectional View