



ELEMENTS OF ELECTRICAL ENGINEERING

Course Code : UE25EE141A/B

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ELEMENTS OF ELECTRICAL ENGINEERING

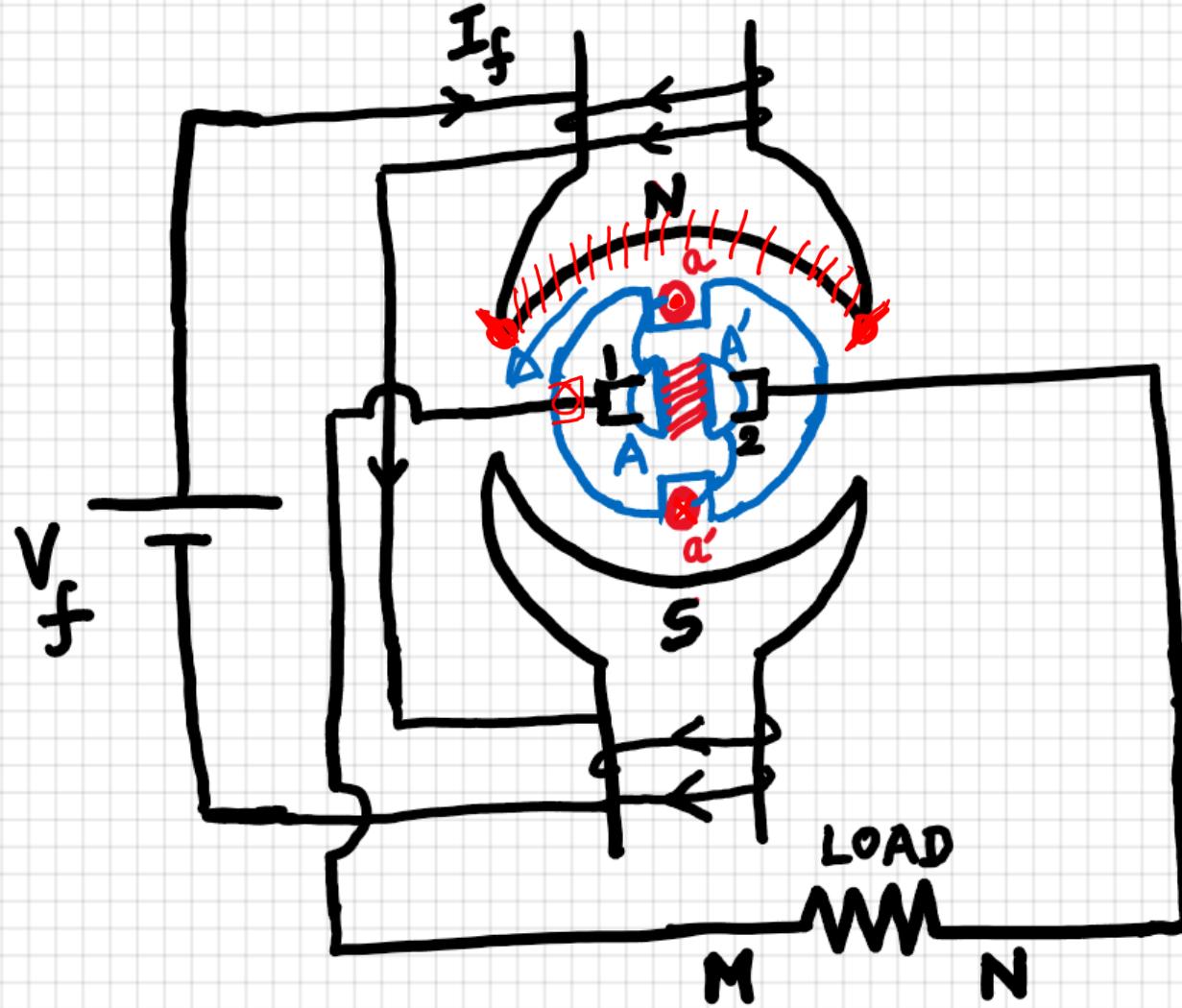
PRINCIPLE OF OPERATION OF A DC SEPARATELY EXCITED GENERATOR/MOTOR

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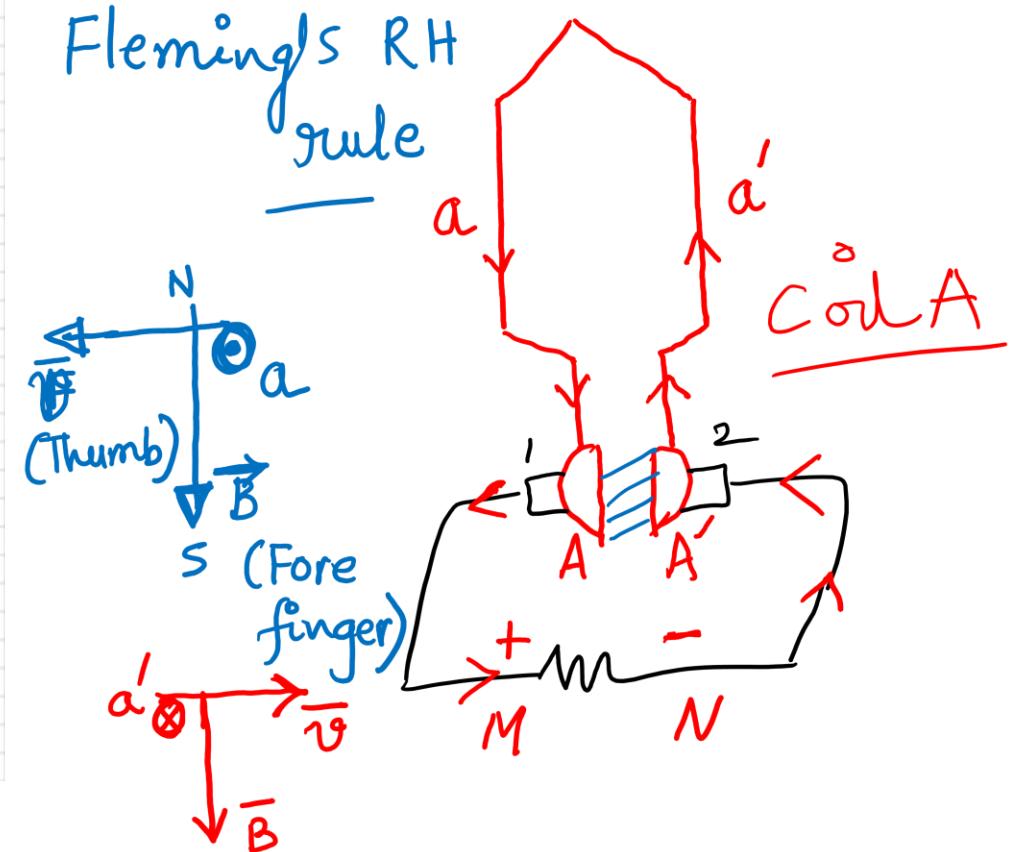
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Principle of Operation – DC Generator

$$e_{MN} \uparrow$$



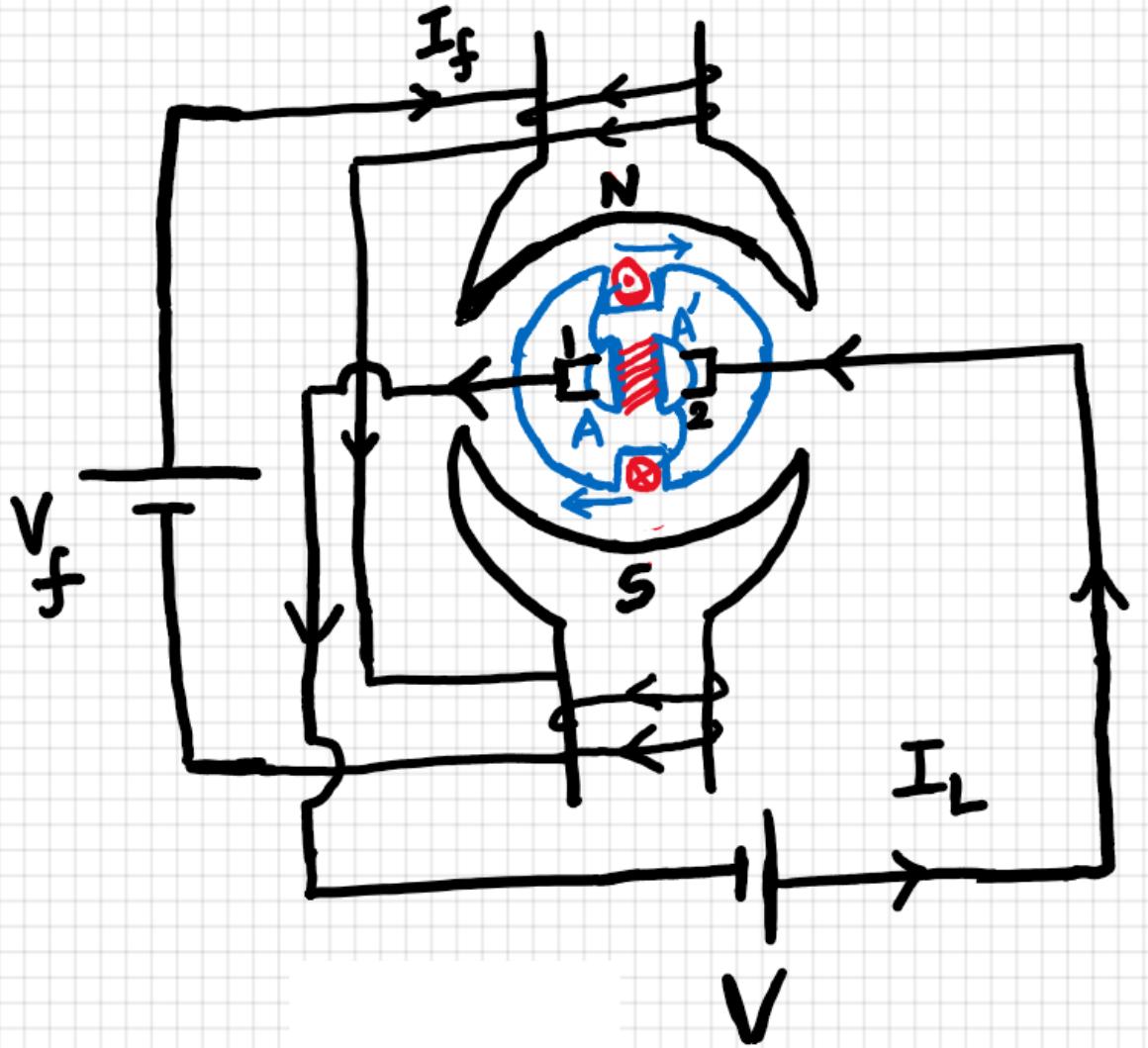
Principle of operation



It works on the principle of Faraday's laws of Electromagnetic induction i.e., whenever there is rate of change of flux with a conductor or coil, an EMF is induced in it.

As the rotor is rotated with the help of a prime mover, the rotor conductors experience rate of change of flux which induces a dynamically induced EMF in these conductors. The magnitude of this EMF is directly proportional to rate of change of flux linkages and the polarity of this EMF is given by Fleming's Right Hand Rule.

Principle of Operation – DC Motor



Fleming's LH rule
gives direction of force
on current carrying conductor
Placed in magnetic field

Principle of Operation – DC Motor (Contd..)

DC Motor works based on the principle that a current carrying conductor placed in a magnetic field experiences a force.

As current flows in the rotor conductors, these conductors in the presence of stator magnetic field experience a force, which creates a torque & motor runs at uniform speed in one direction.

Concept of Back EMF in a DC Motor

As the motor starts running, the armature conductors are moving in the magnetic field and hence experience rate of change of flux. This leads to a dynamically induced EMF in these conductors. The polarity of this EMF can be obtained by applying Fleming's Right-Hand Rule. It can be observed that the polarity of this EMF is opposite to the Supply Voltage. Hence it is called Back EMF or counter EMF represented by E_b .

The electrical power which is spent in overcoming the opposition of the back EMF i.e., $E_b * I_a$ is converted from electrical form to mechanical form.

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshtha, 2nd Edition, McGraw-Hill. 2019
3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10th Edition McGraw Hill, 2023
2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.



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THANK YOU

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