



Commutation in DC Machines

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Acknowledgement: The materials presented in this lecture has been taken from open source, reference books etc. This can be used only for student welfare and academic purpose.

Recap

- ❖ Armature reaction in DC generators
- ❖ Geometrical Neutral axis (GNA)
- ❖ Magnetic Neutral axis (MNA)
- ❖ Position of GNA and MNA against armature reaction
- ❖ Compensating winding and its position as well as connection

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Lecture-15 Objectives

- ❖ Commutation Process in DC generator
- ❖ Ideal Characteristics
- ❖ Practical Characteristics
- ❖ Methods of improving
- ❖ Resistance Commutation Method
- ❖ EMF Commutation Method
- ❖ Applications

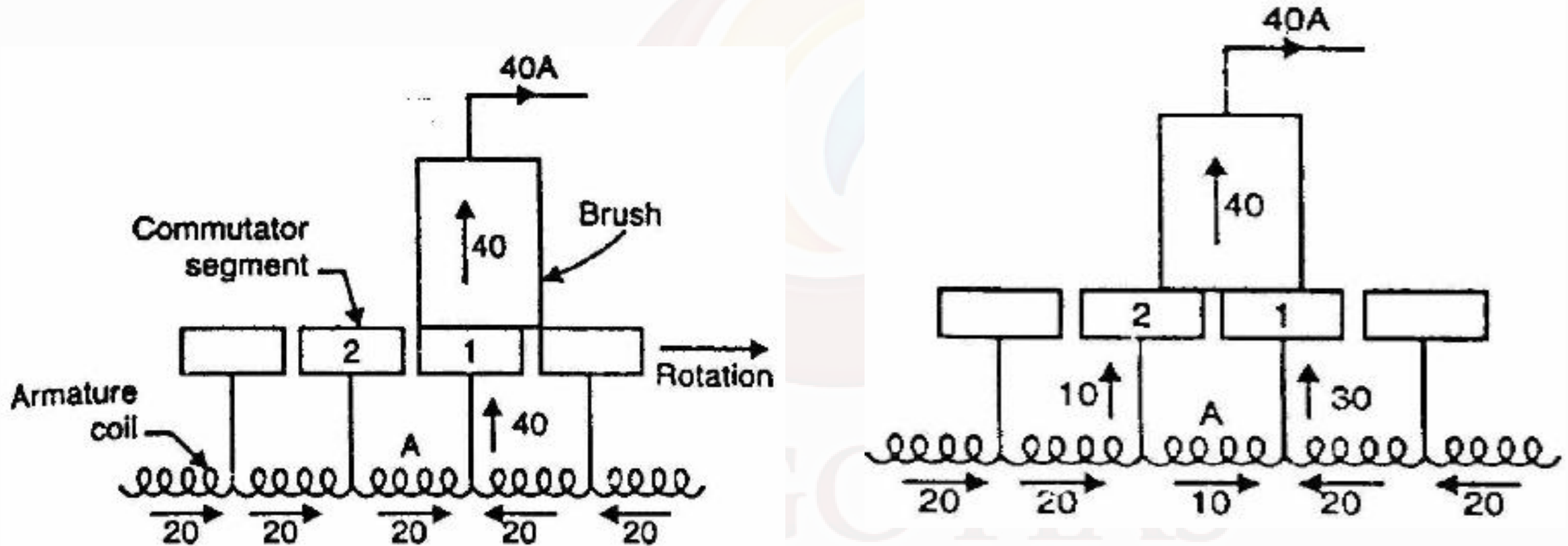
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Commutation in DC Generators

- The brief period during which the coil remains short circuited is known as commutation period T_c .
- If the current reversal is completed by the end of commutation period, it is called ideal commutation.
- If the current reversal is not completed by that time, then sparking occurs between the brush and the commutator which results in progressive damage to both.

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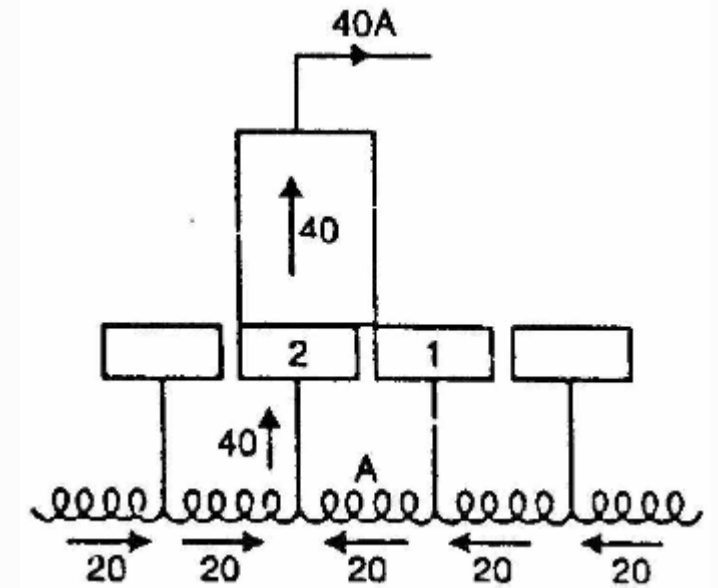
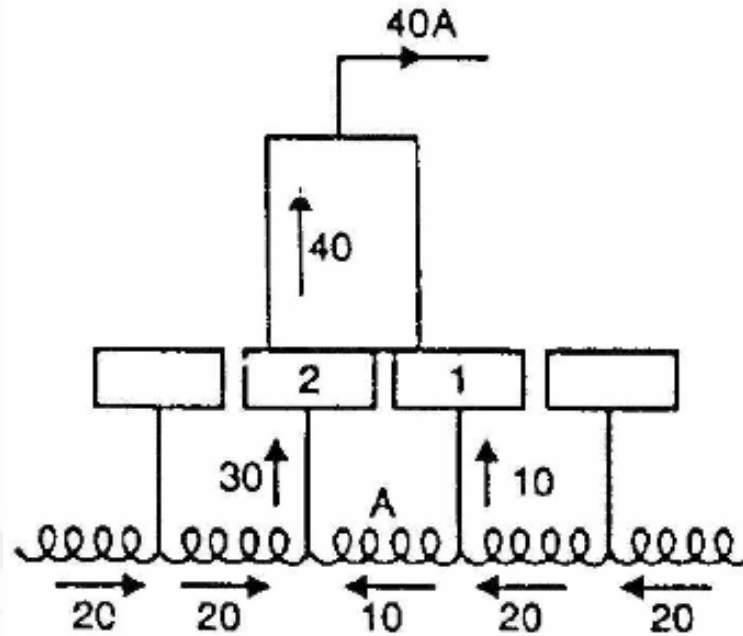
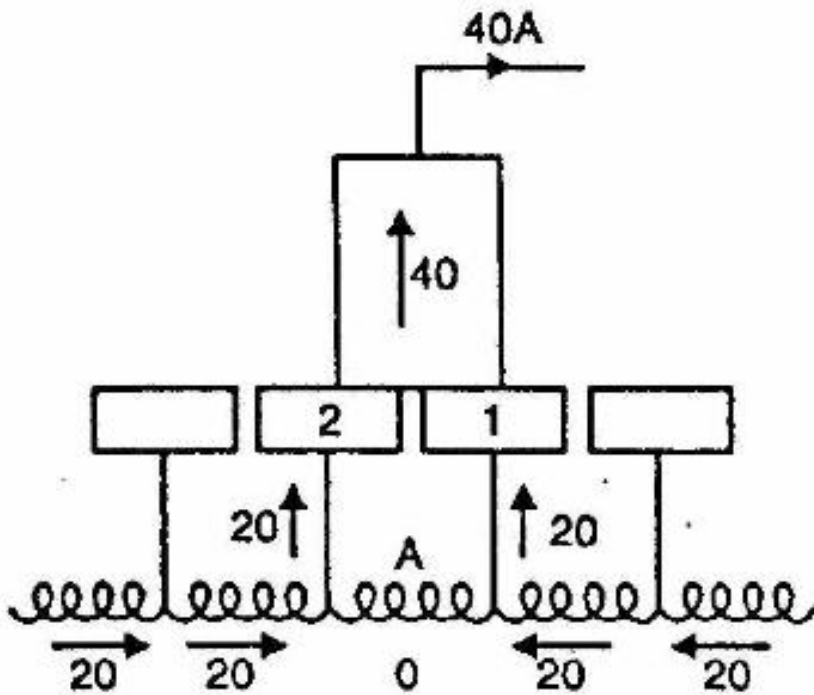
Ideal Commutation



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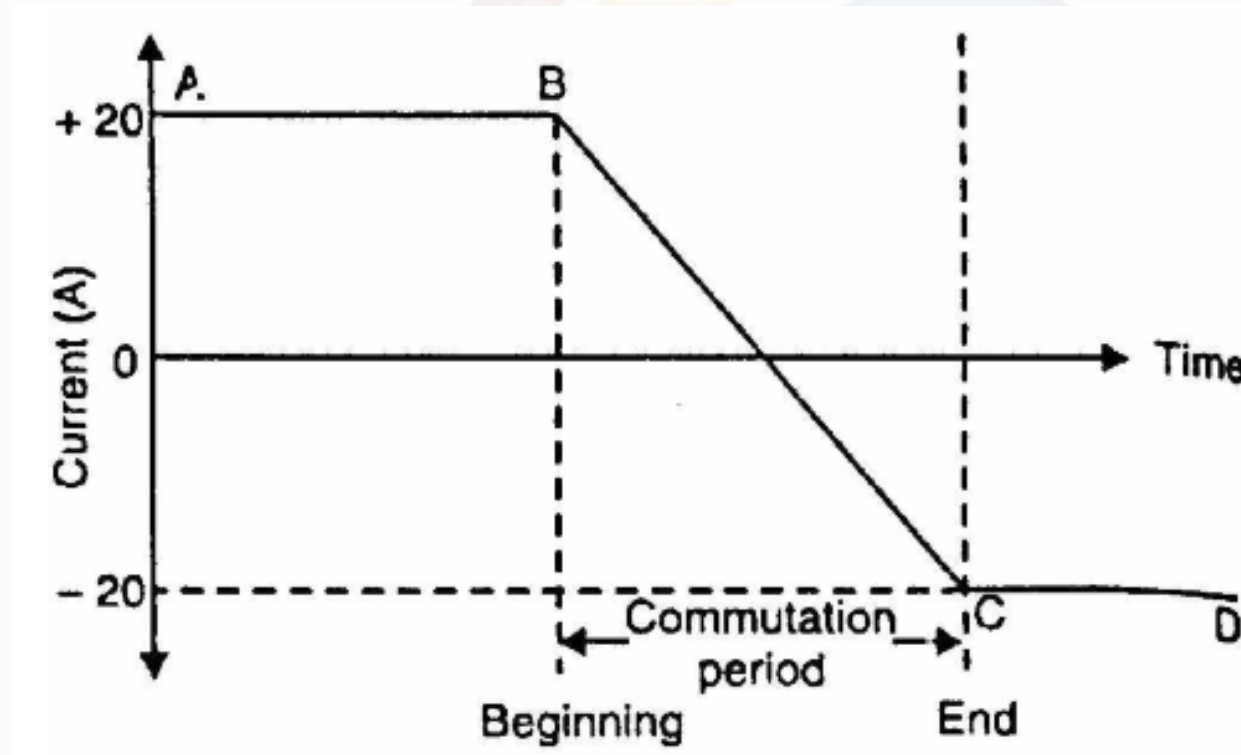
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Ideal Commutation



Commutation in DC Machines

Ideal Commutation



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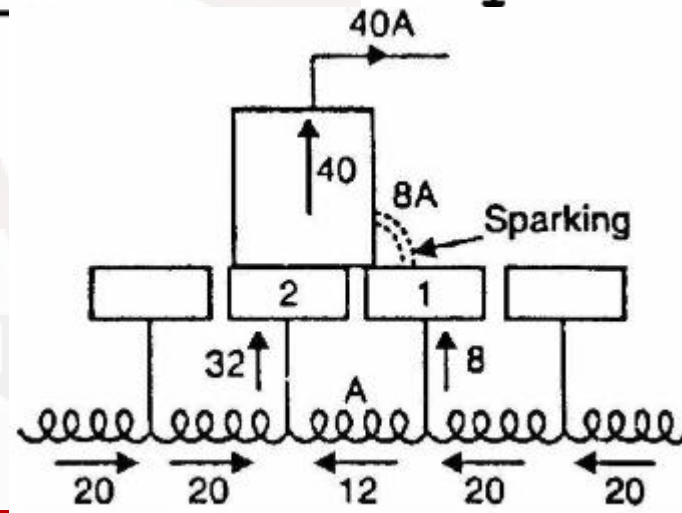
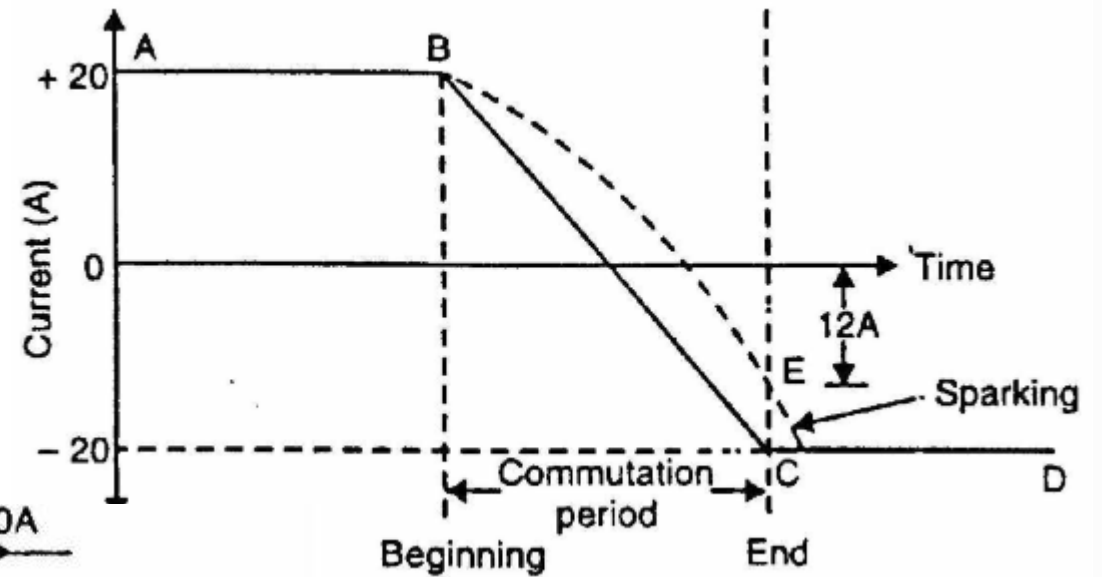
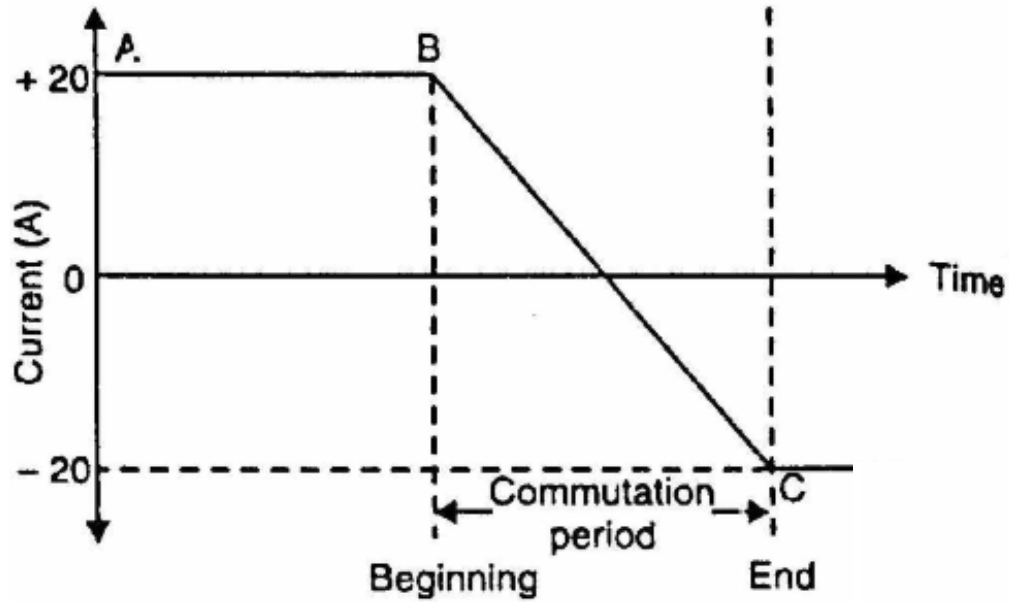
Practical Difficulties

- Armature coils have appreciable inductance.
- When the current in the coil undergoing commutation changes, self-induced e.m.f. is produced in the coil.
- This is called reactance voltage and it opposes the change of current in the coil undergoing commutation.
- Hence change of current in the coil undergoing commutation occurs more slowly.

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Practical Difficulties



Methods of Improving Commutation

- ❖ Improving commutation means to make current reversal in the short-circuited coil as spark-less as possible.
- ❖ The following are the two principal methods of improving commutation:
 - ❖ Resistance commutation
 - ❖ E.M.F. commutation

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Resistance commutation

- ❖ The contact resistance between the brush and the commutator is made large so as to control the current during commutation.
- ❖ This is achieved by using carbon brushes (instead of Cu brushes) which have high contact resistance.

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E.M.F. commutation

- An arrangement is made to neutralize the reactance voltage by producing a reversing voltage in the coil undergoing commutation.
- The reversing voltage acts in opposition to the reactance voltage and neutralizes it to some extent.
- If the reversing voltage is equal to the reactance voltage, the effect of the latter is completely wiped out and we get spark-less commutation.

Applications of D.C Generators

Shunt Generators:

- ✓ as source for electro plating
- ✓ for battery recharging
- ✓ as exciters for AC generators

Series Generators :

- ✓ as boosters to compensate voltage drop
- ✓ as exciter for DC locomotive for regenerative braking
- ✓ as source for series arc lighting

Commutation in DC Machines

Summary

- ❖ Commutation Process in DC generator
- ❖ Ideal Characteristics and Practical Characteristics
- ❖ Methods of improving
- ❖ Applications

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