Continuous-Drive Actuators

Chapter 9

ME 473

Professor Sawyer B. Fuller

F = force on conductor of length l
$= i\, l \times B$

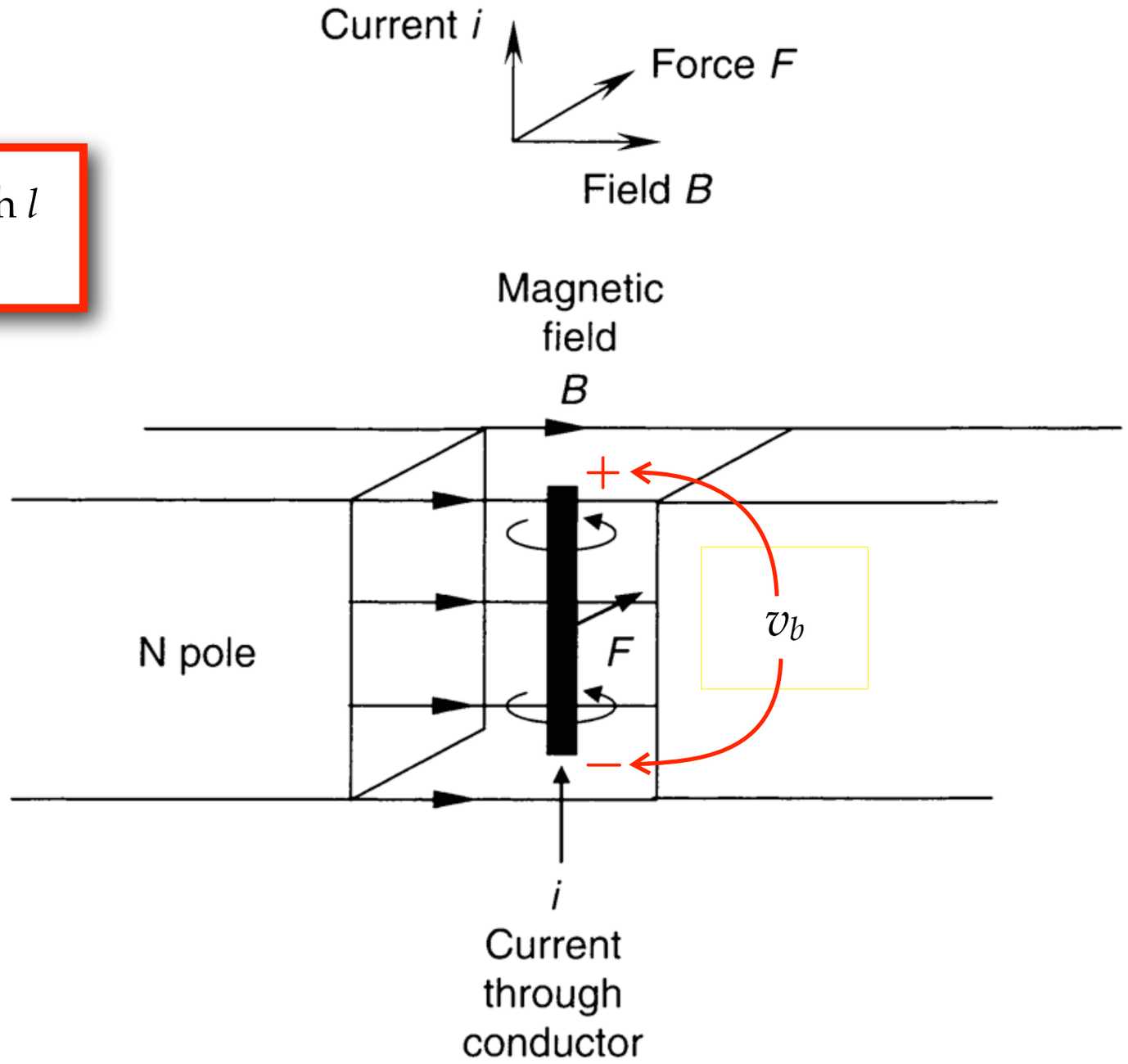
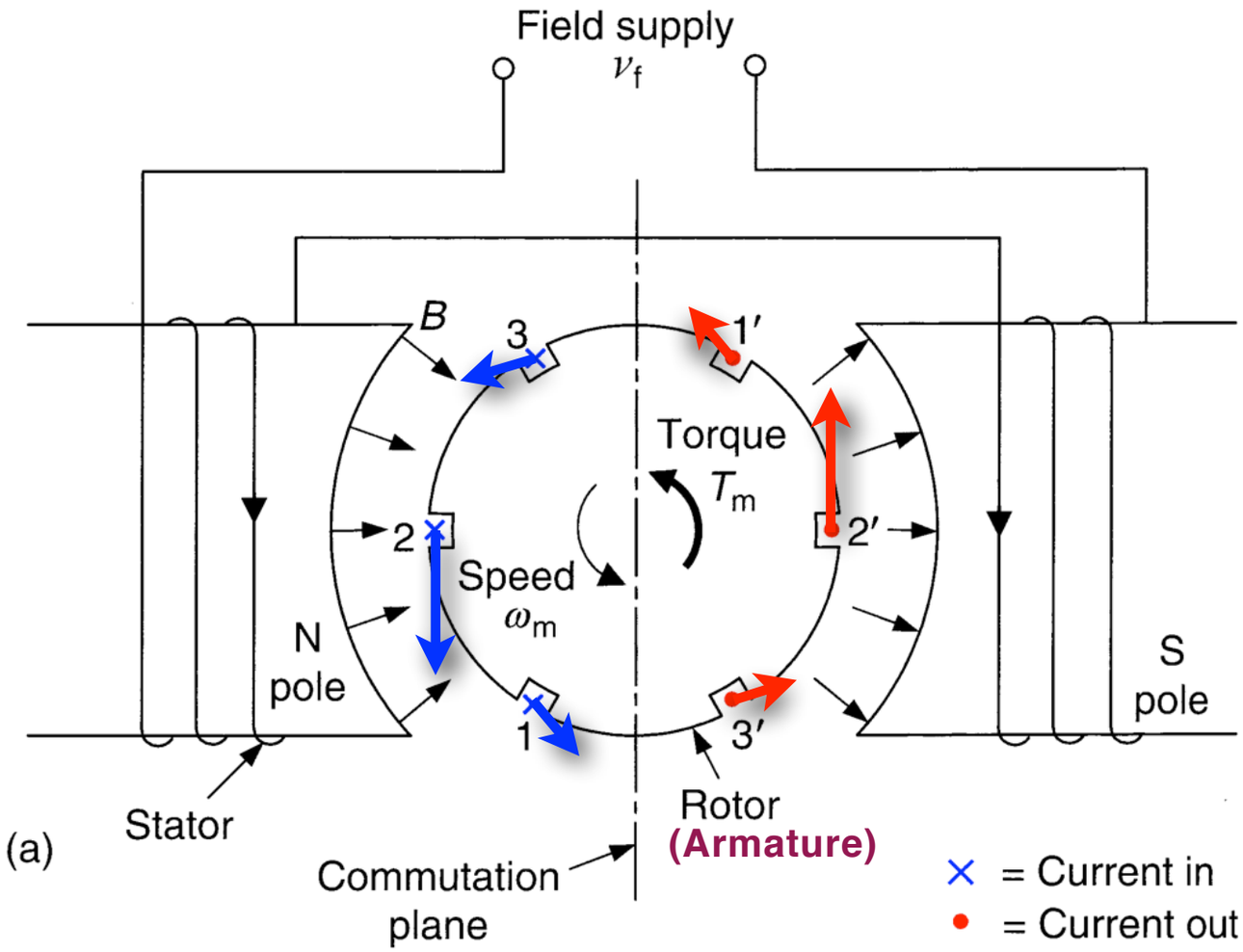
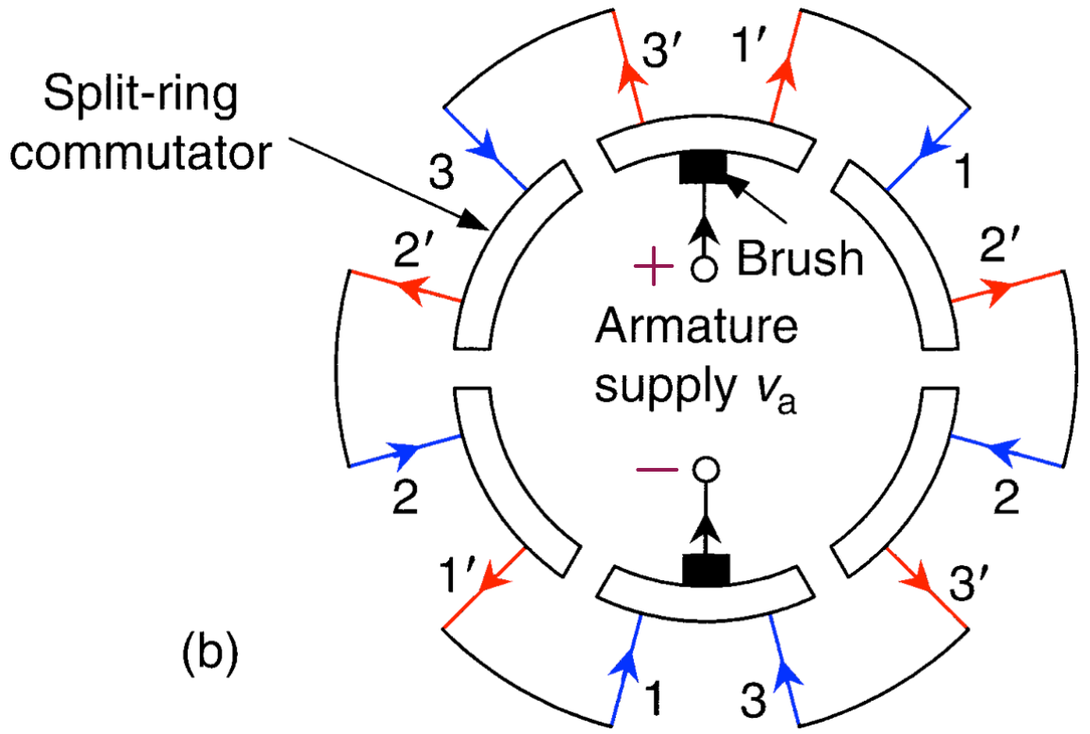


Figure 9.1
Operating principle of a dc motor.

If the conductor is free to move, then we can calculate the voltage across it:
v_b = voltage induced across conductor due to its velocity v in the direction of F
= the "back electromotive force" = the "back e.m.f."
$= B\, l\, v$





Brushes: Fixed to Stator

Commutator Ring: Fixed to Rotor

force on conductor j =
(current through conductor j) times (length of conductor j)
× magnetic flux (field) seen by conductor j

Figure 9.2
(a) Schematic diagram of a dc motor.
(b) Commutator wiring.

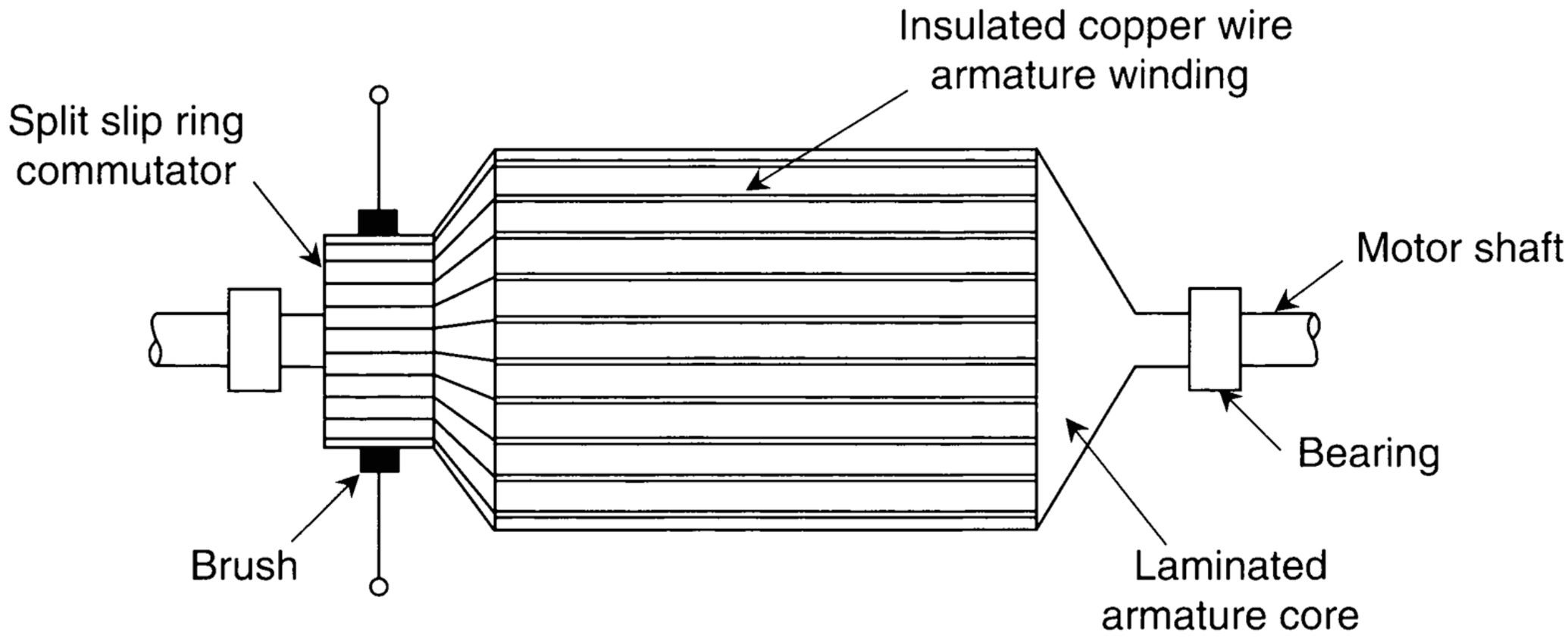
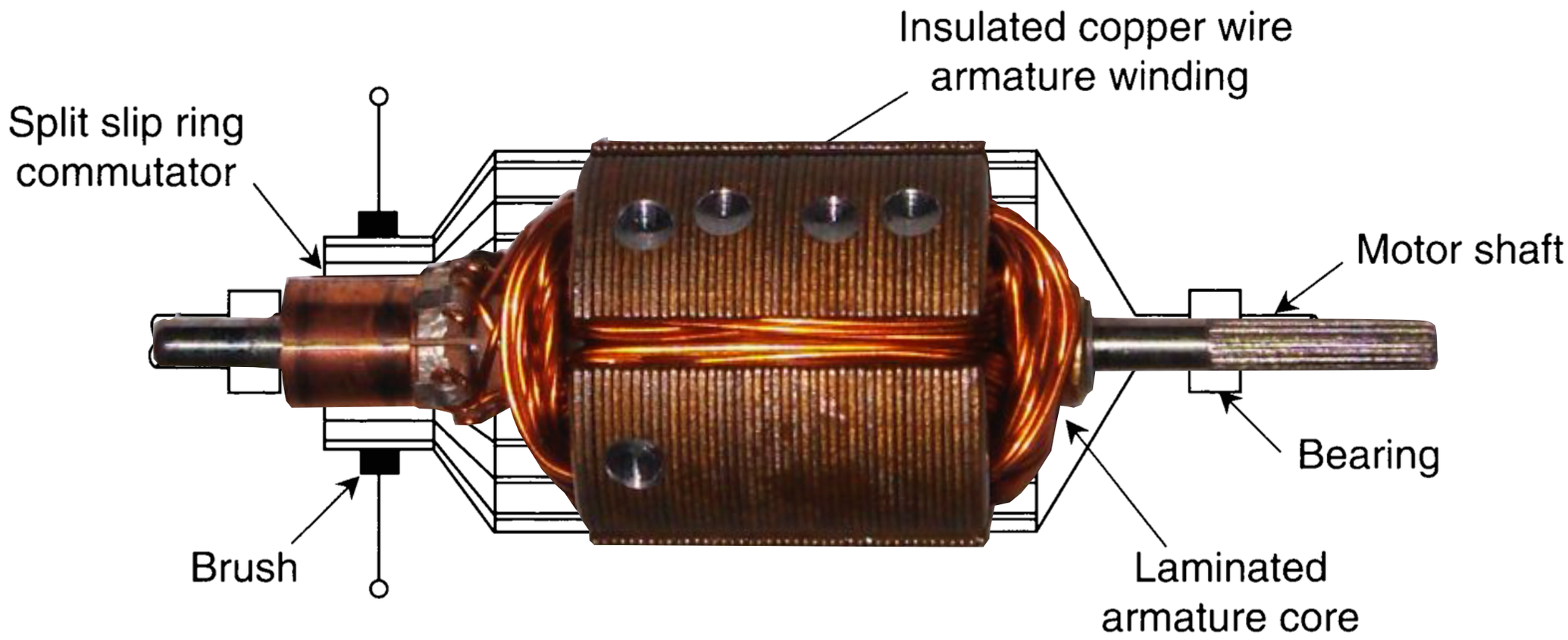


Figure 9.3
Physical construction of the rotor of a dc motor.



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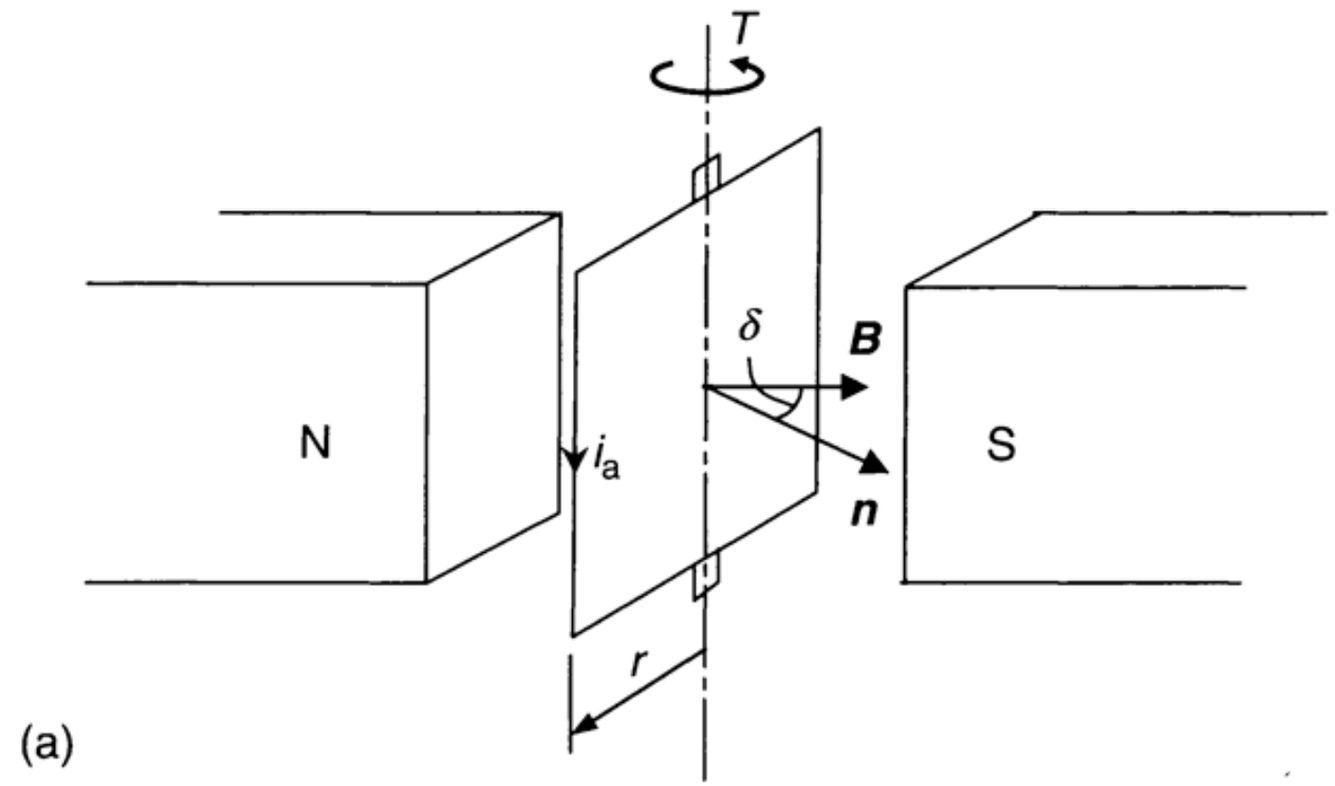
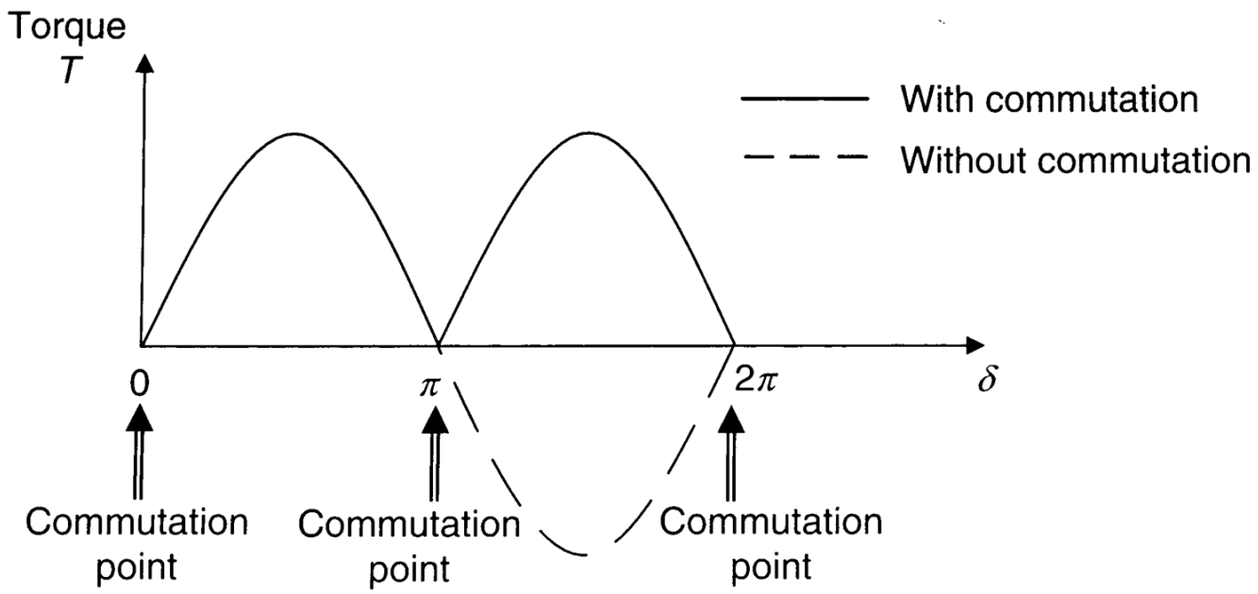


Figure 9.4
(a) Torque generated in a planar rotor.
(b) Nomenclature.



(a)

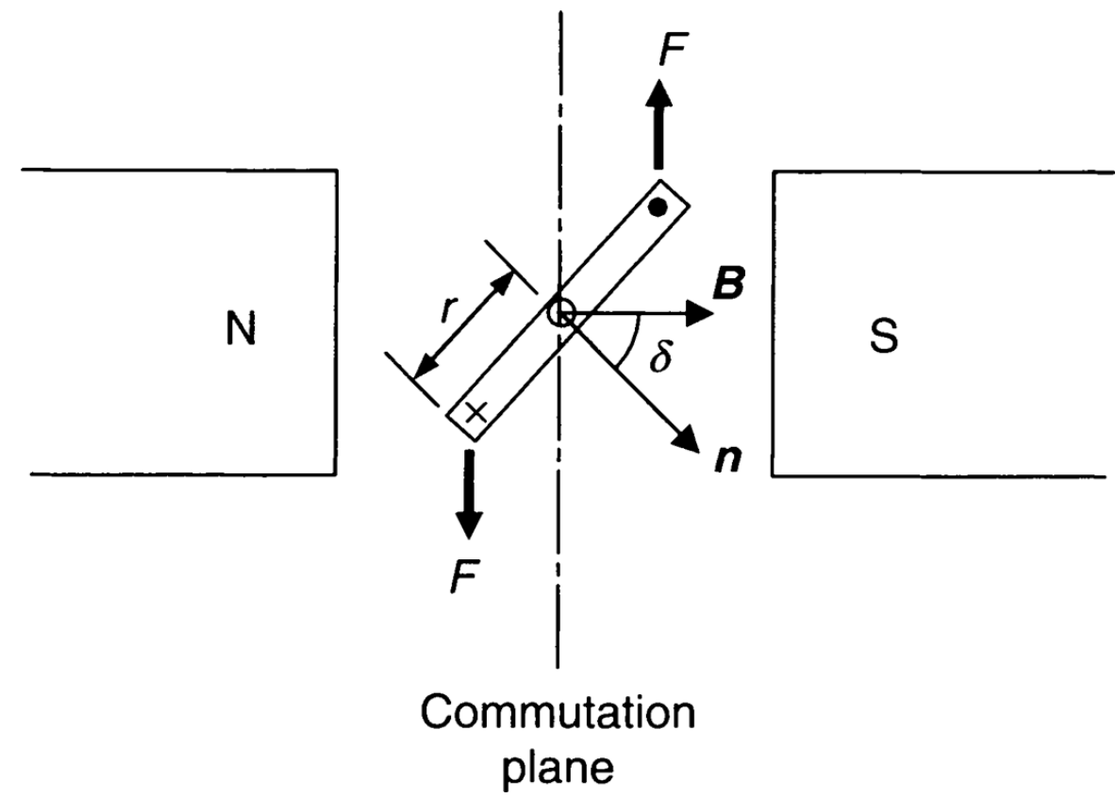
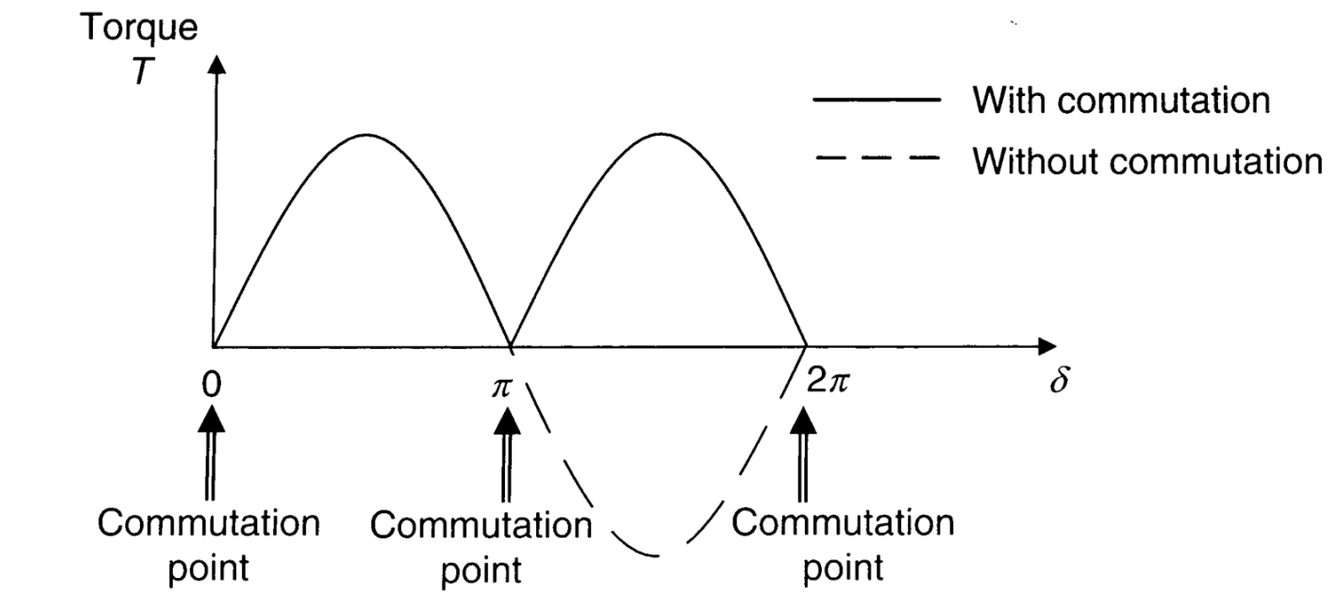


Figure 9.5
(a) Torque profile from a coil segment due to commutation.



(a)

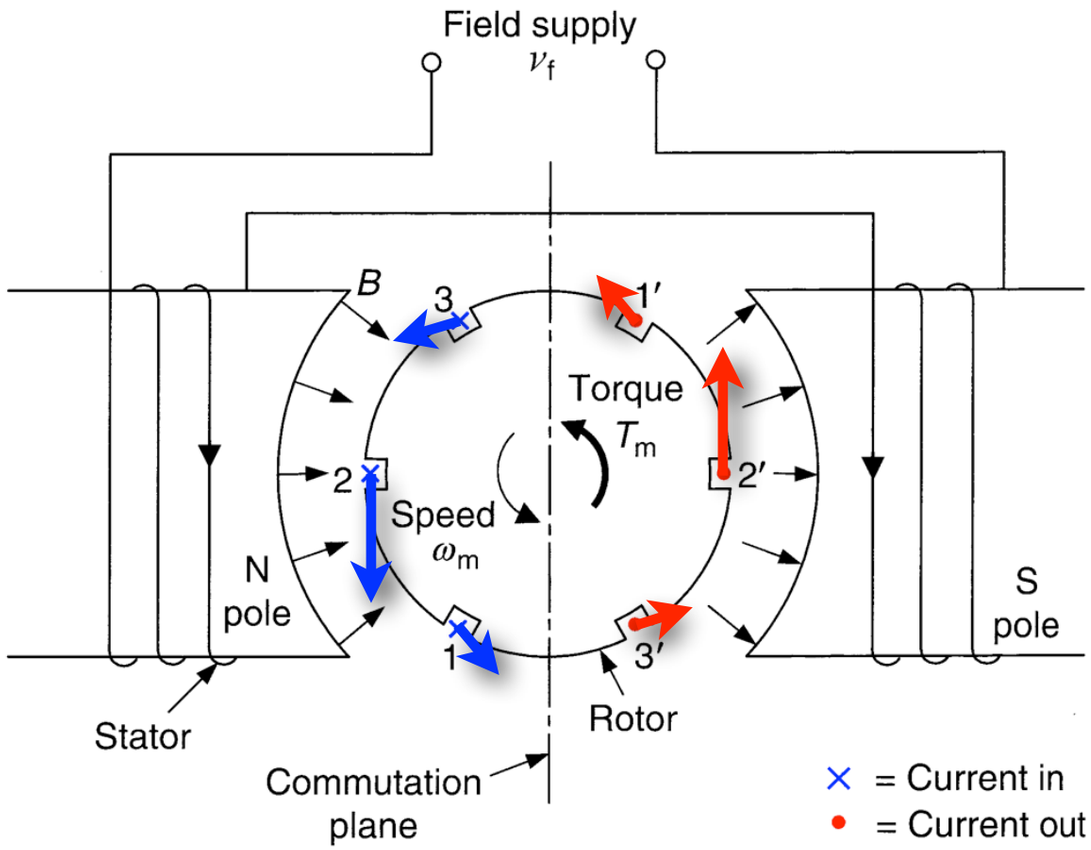
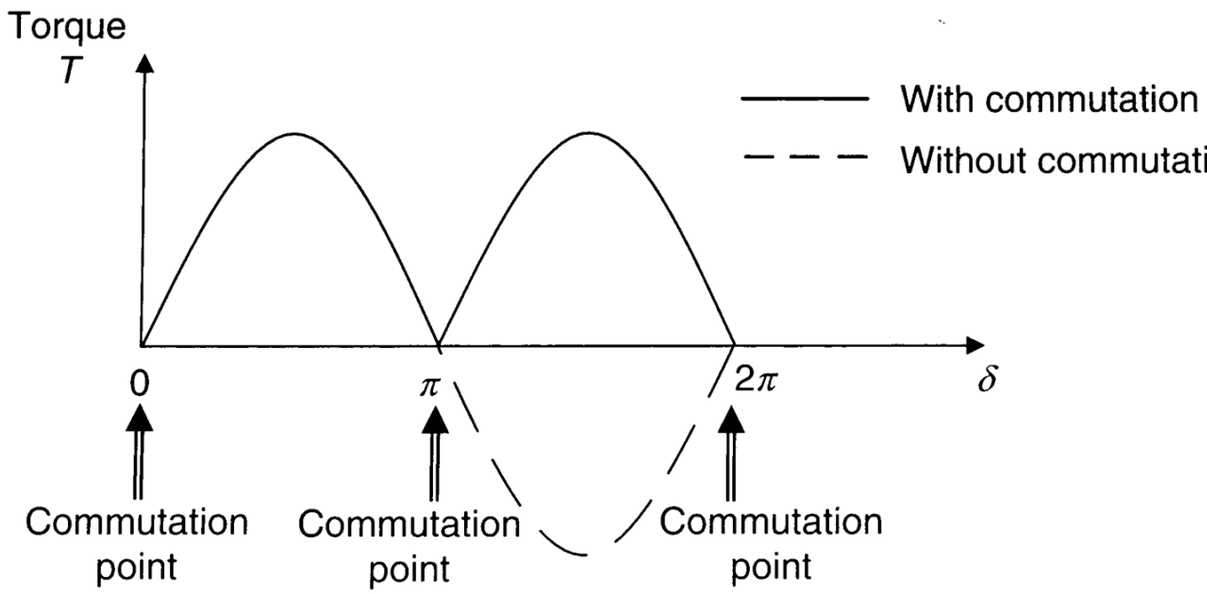
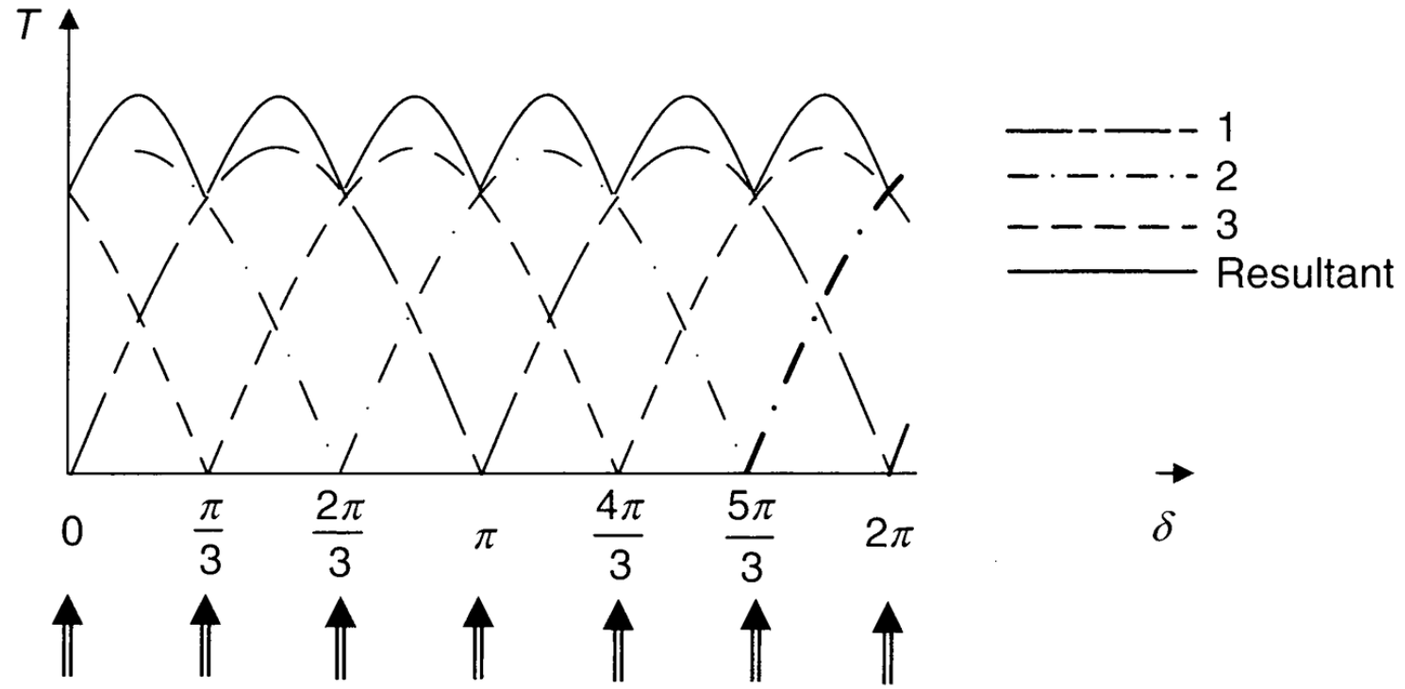


Figure 9.5
(a) Torque profile from a coil segment due to commutation.



(a)



(b)

Figure 9.5
(a) Torque profile from a coil segment due to commutation.
(b) Resultant torque from a rotor with three-coil segments.

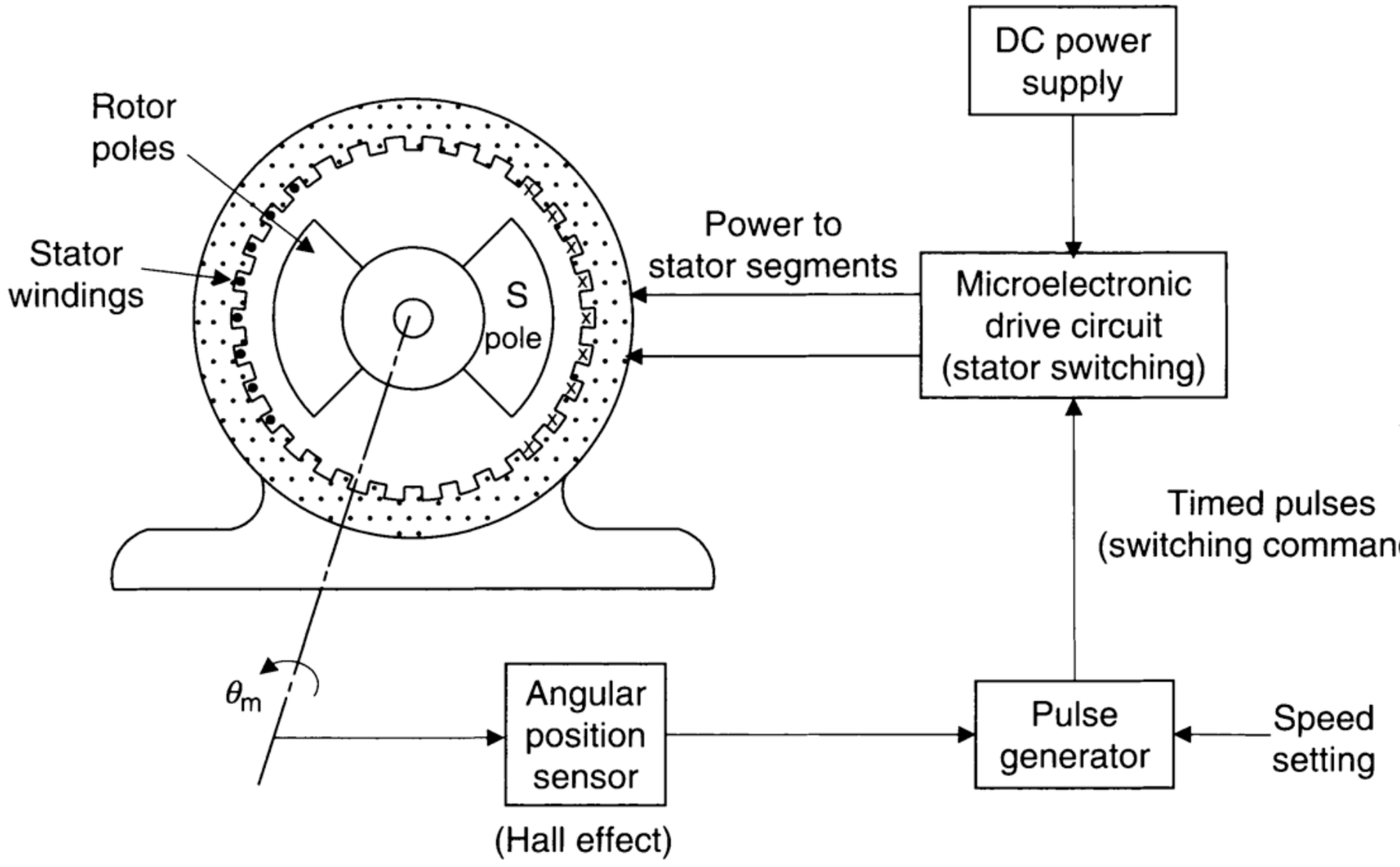
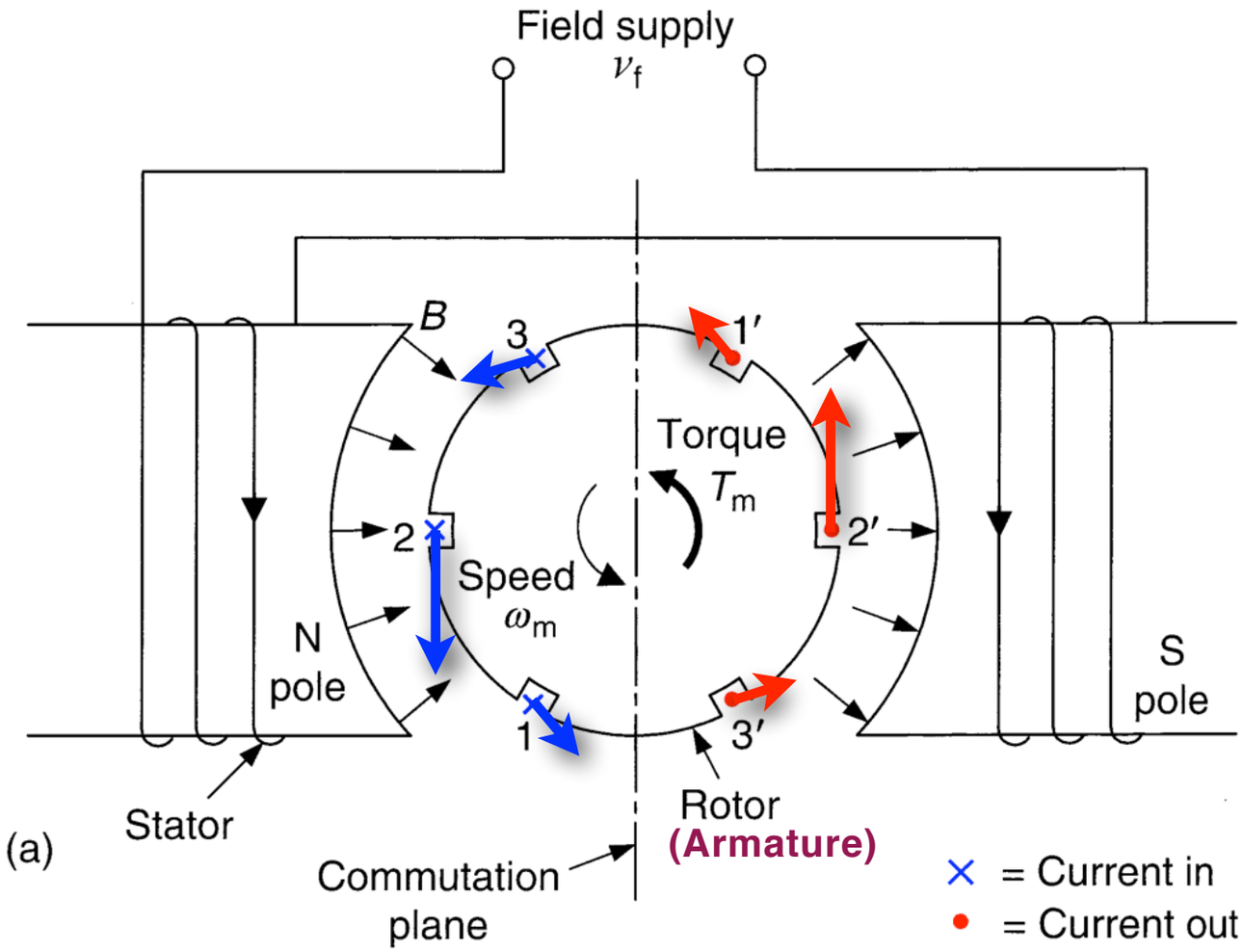
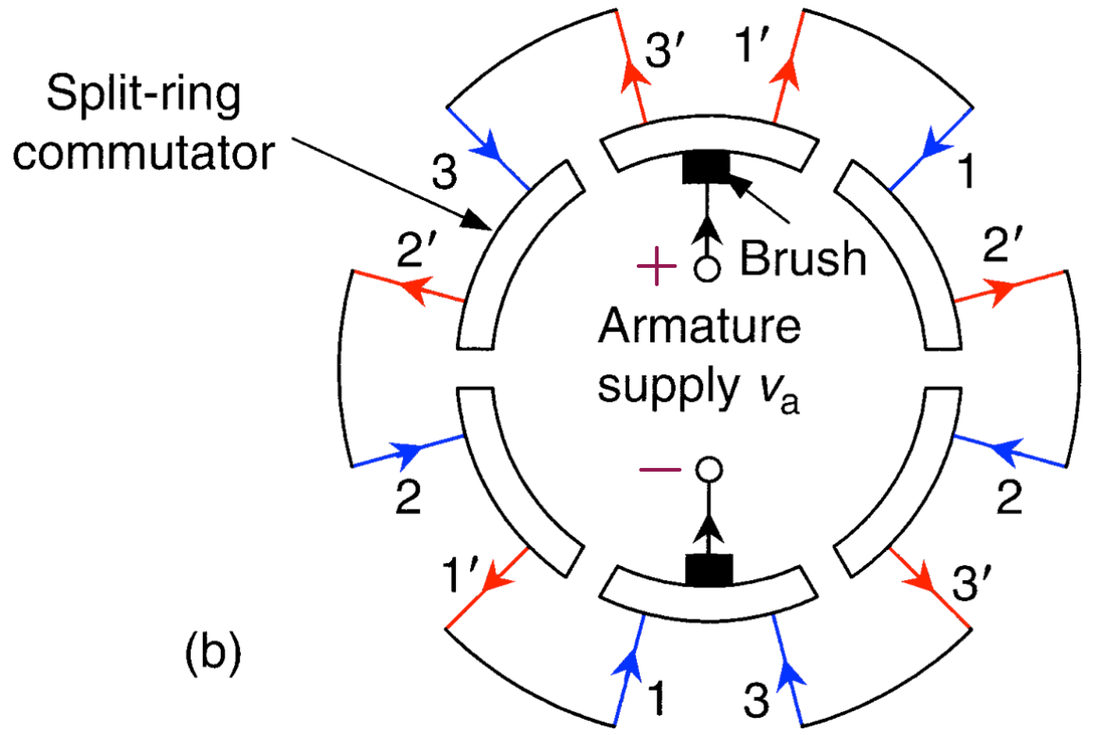


Figure 9.6
A brushless dc motor system.





Brushes: Fixed to Stator

Commutator: Fixed to Rotor

Force on Conductor j =
Current through Conductor j
$*$ Length of Conductor j
$\times$ Magnetic Flux seen by Conductor j

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(a) Schematic diagram of a dc motor.
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