

Electronics for IoT

DC Motor

Bernhard E. Boser

University of California, Berkeley

boser@eecs.berkeley.edu

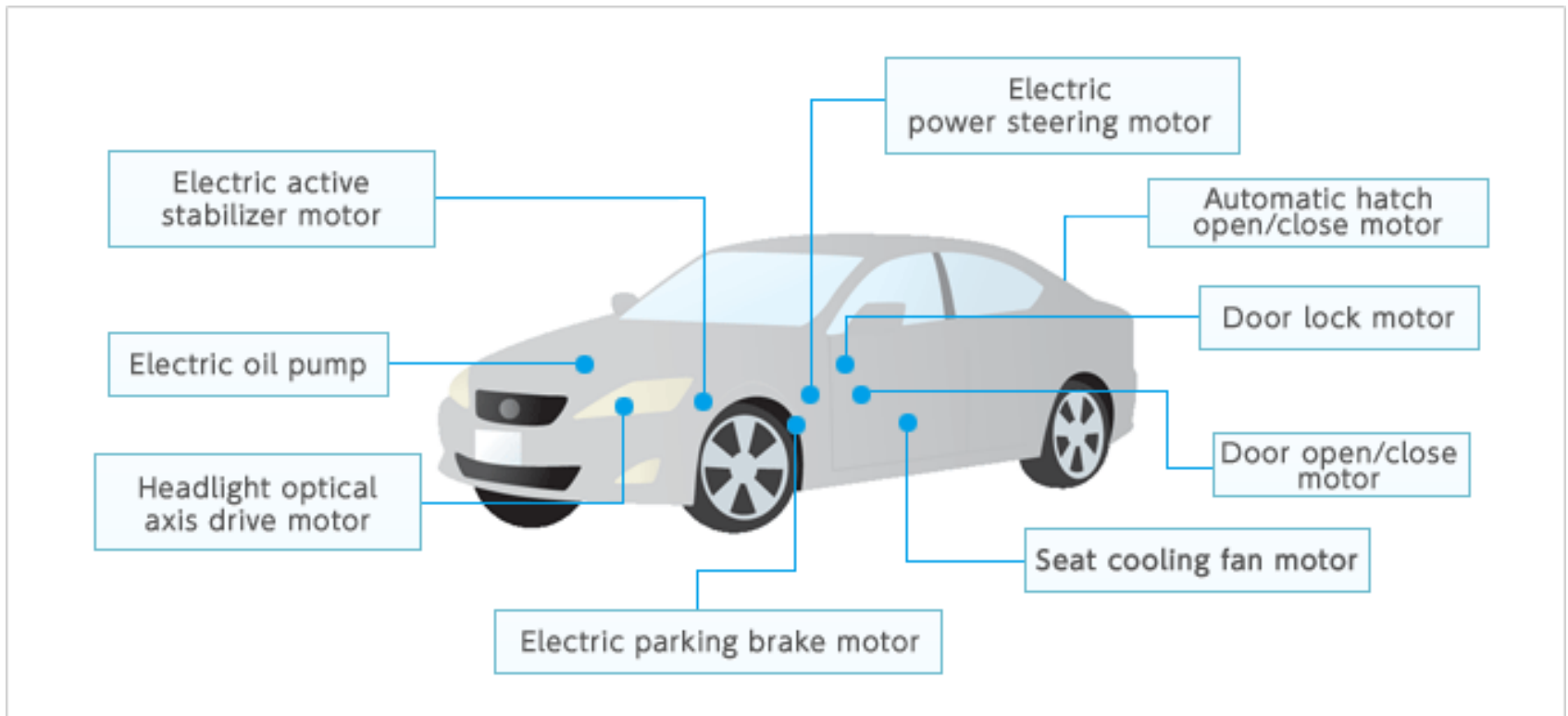
Types of Motors

- Many
- DC Motor

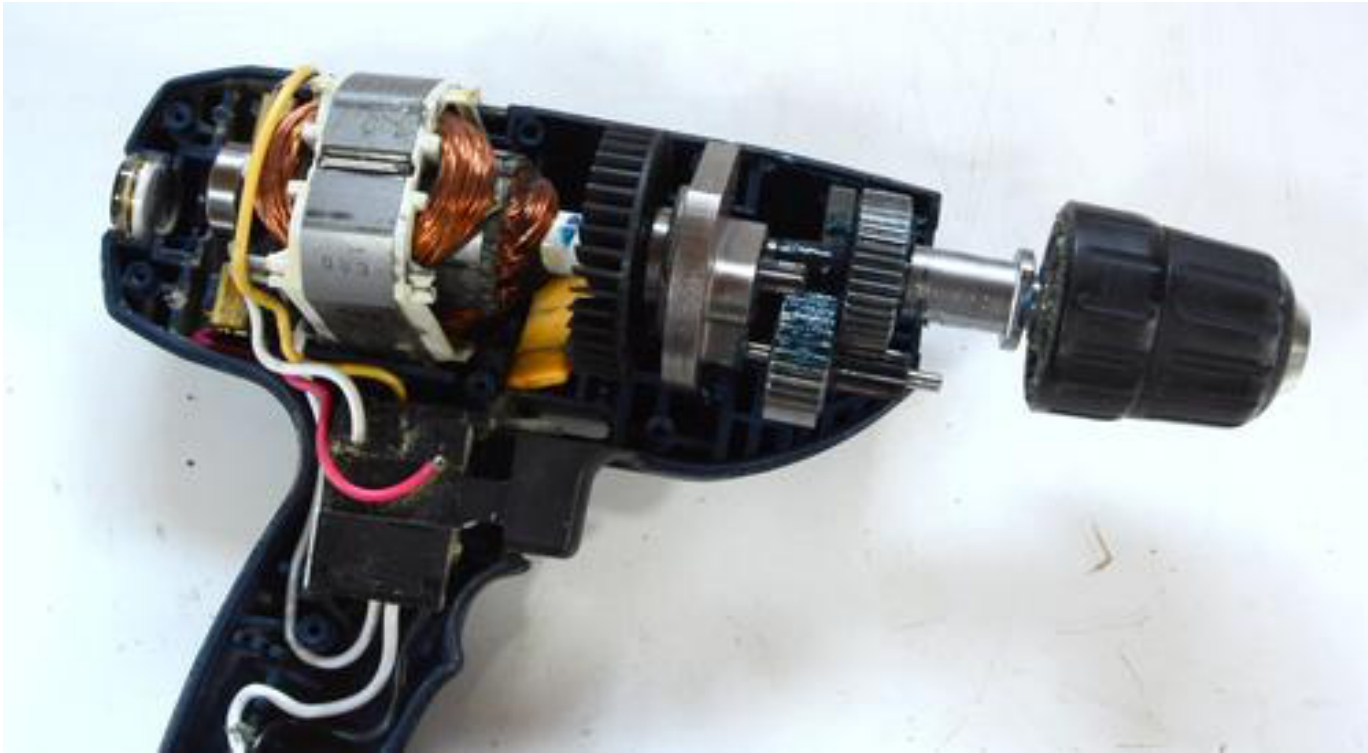
DC Motors



DC Motor Applications



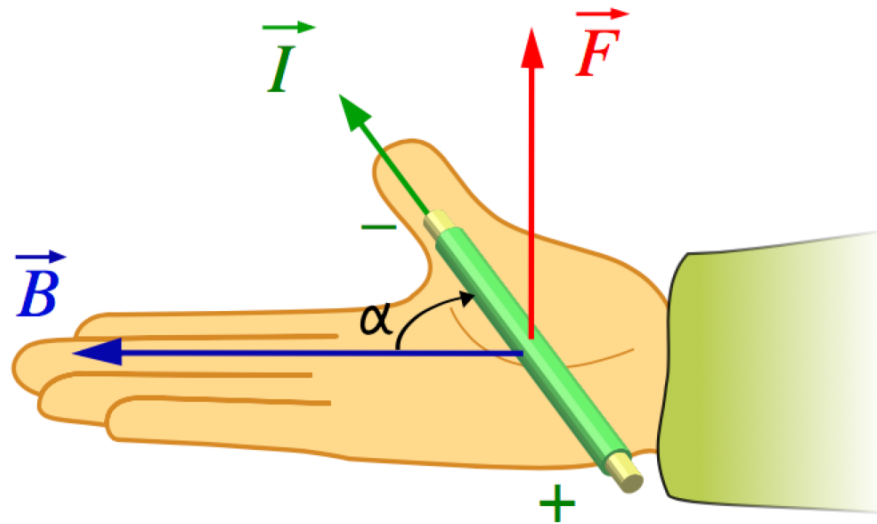
DC Motor Applications



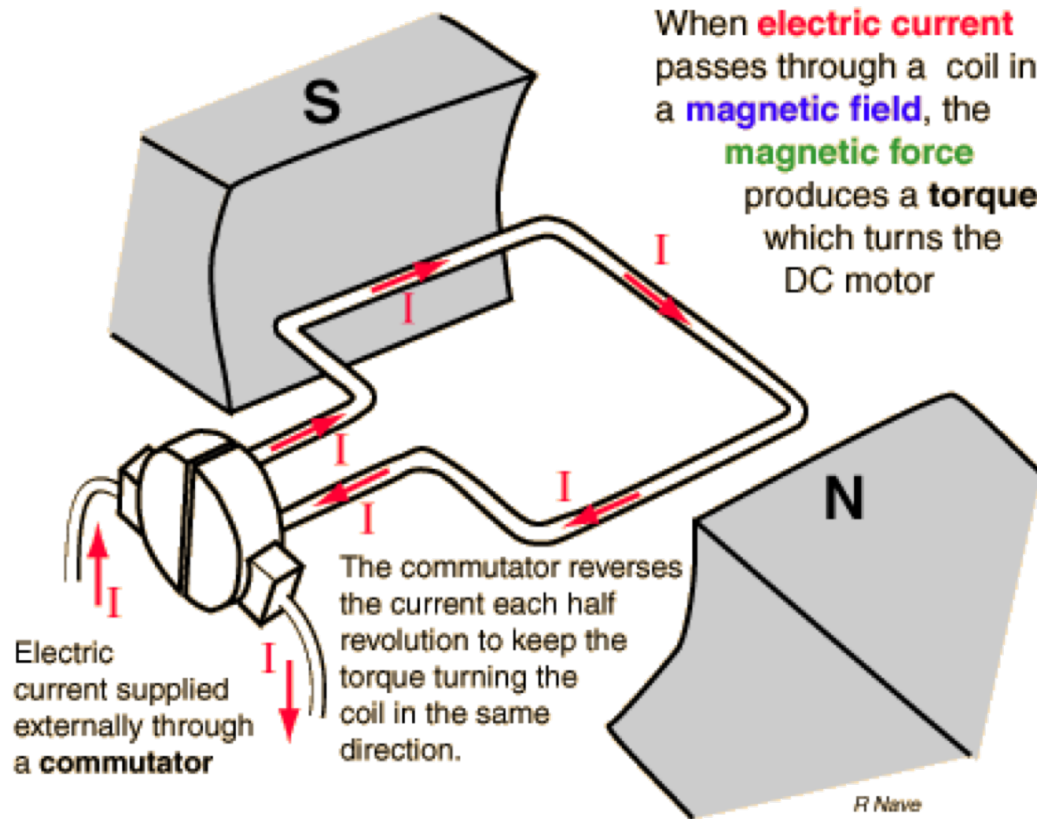
Torque



Lorentz Force

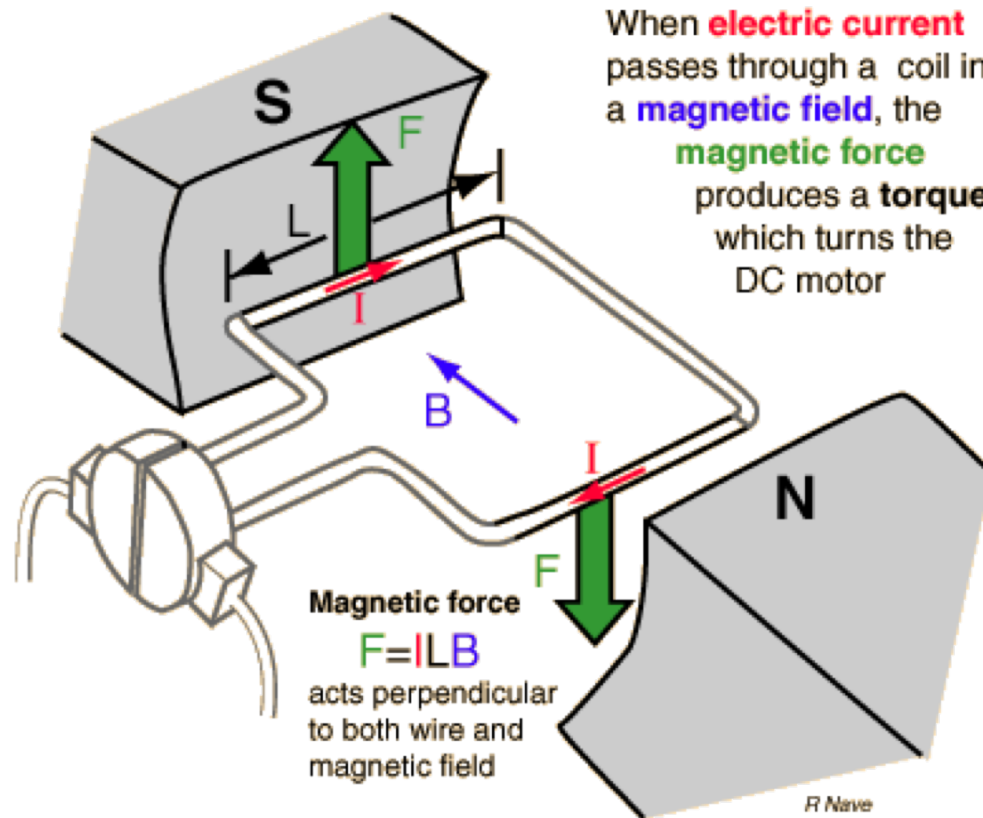


Electrical Motor Principle (1)



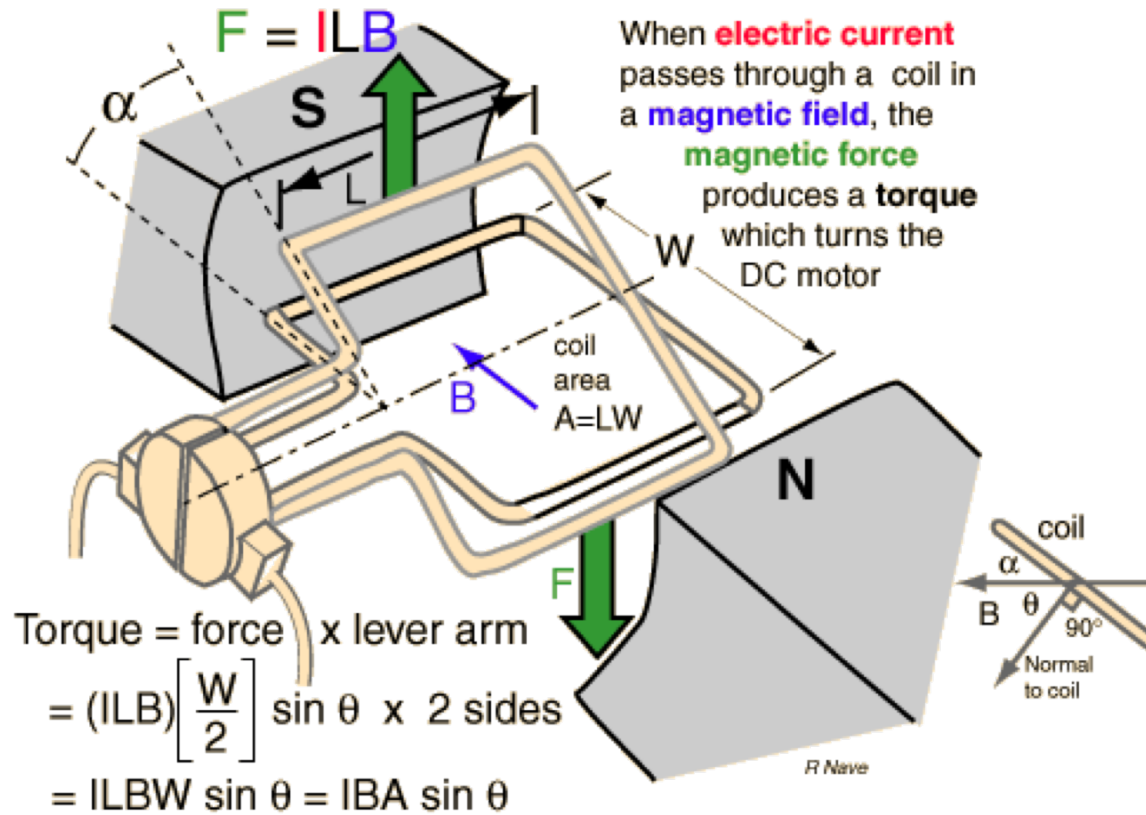
<https://www.pc-control.co.uk/dc-motors.htm>

Electrical Motor Principle (2)



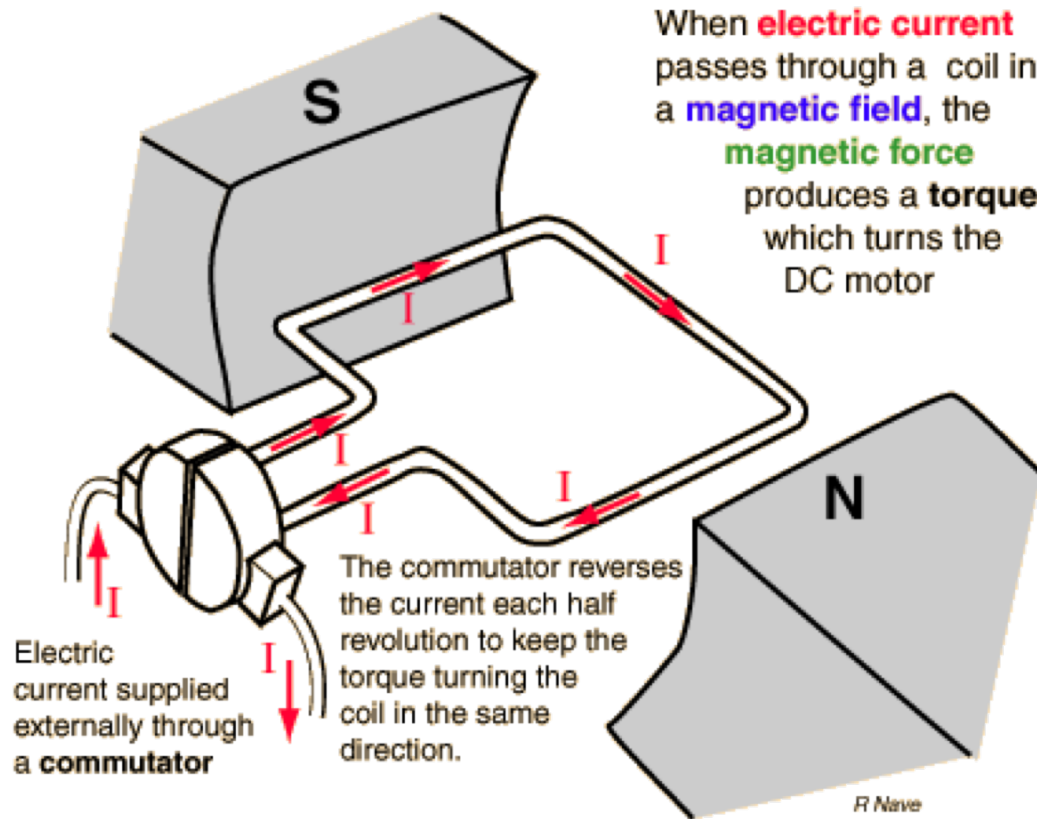
<https://www.pc-control.co.uk/dc-motors.htm>

Electrical Motor Principle (3)



<https://www.pc-control.co.uk/dc-motors.htm>

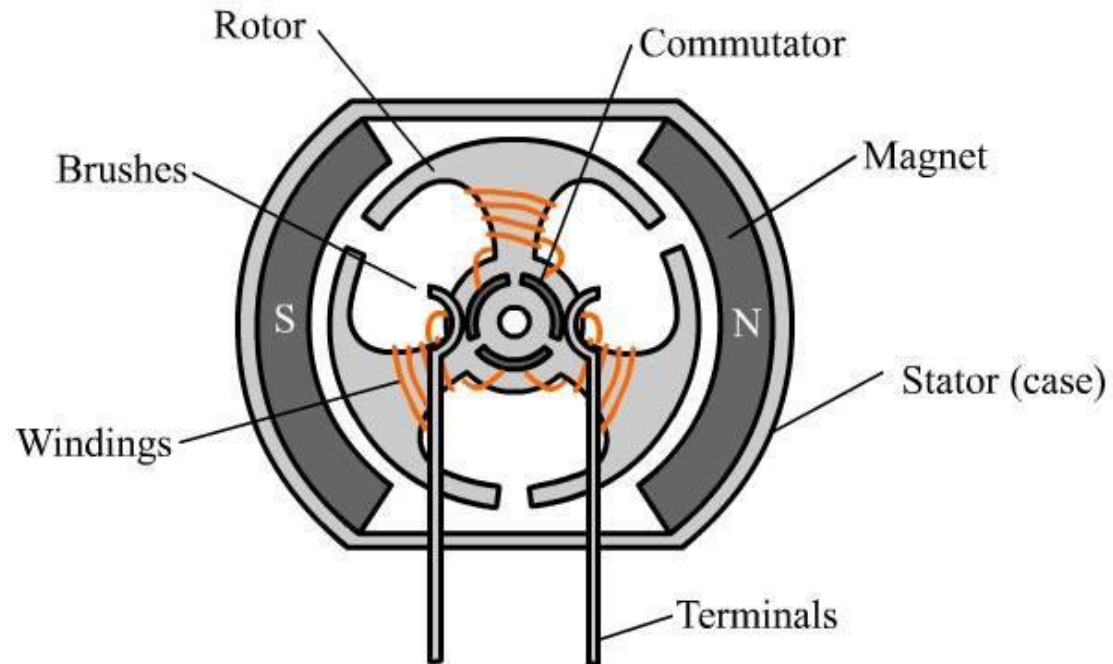
Electrical Motor Principle (4)



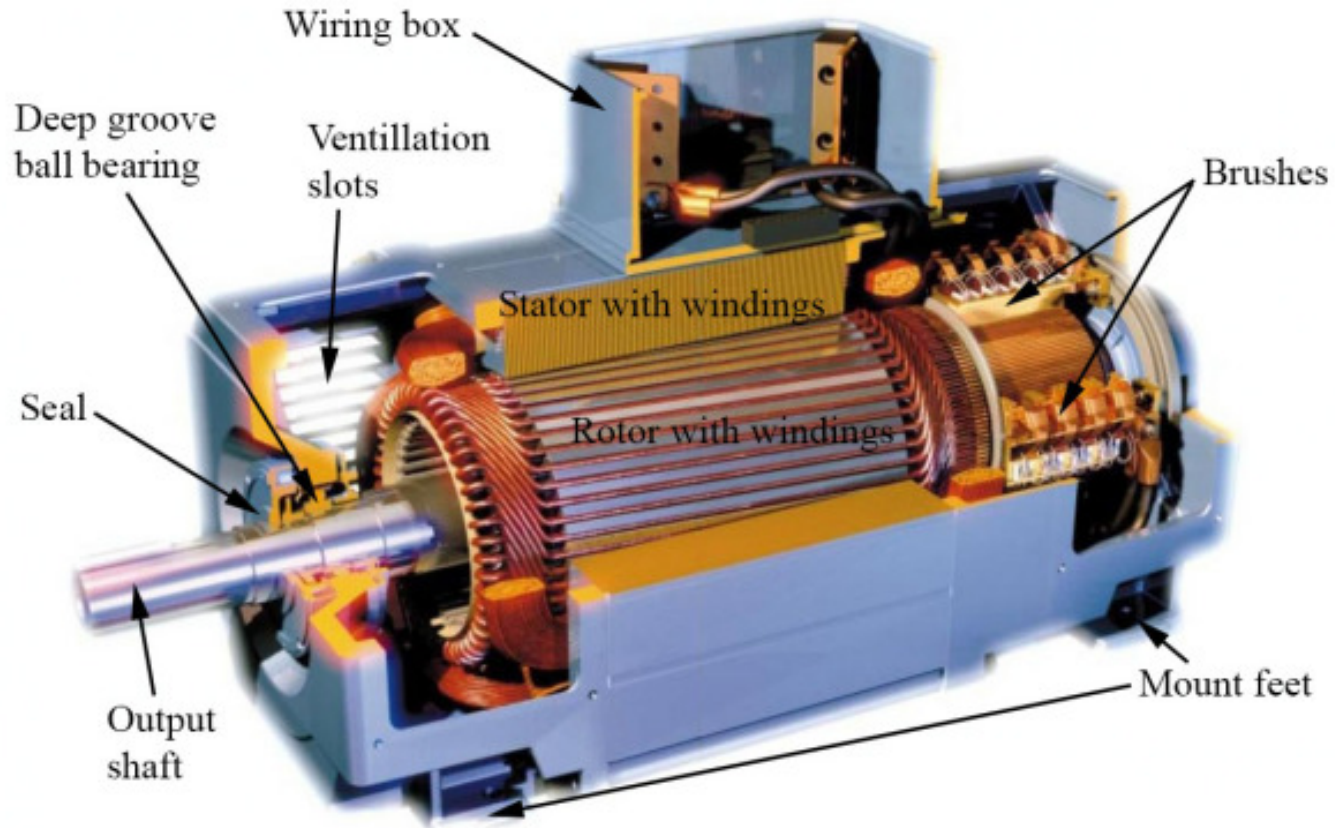
<https://www.pc-control.co.uk/dc-motors.htm>

Practical Motor

Typical Brushed Motor in Cross-section



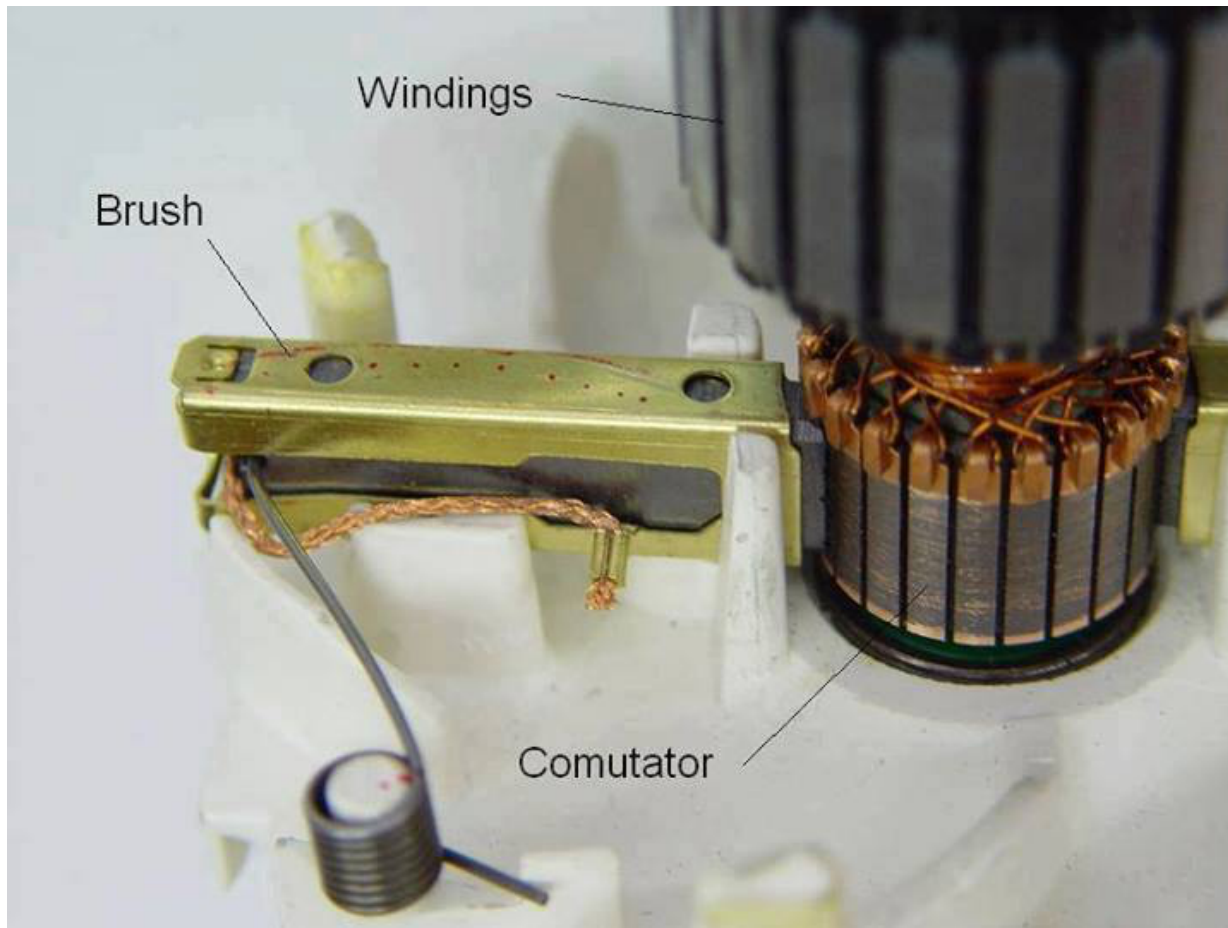
DC Motor



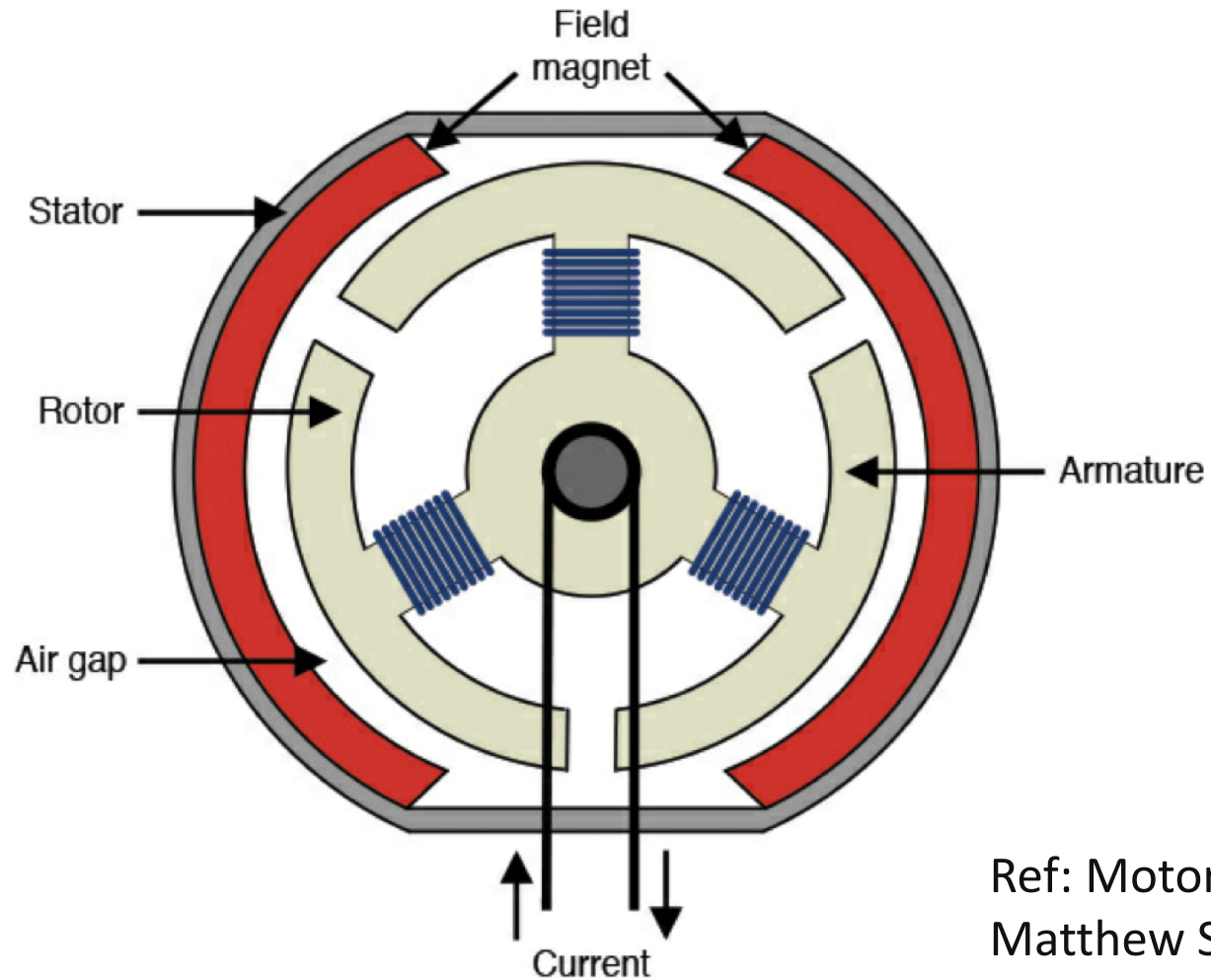
Winding



Commutator



Motor Nomenclature



Ref: Motors for Makers,
Matthew Scarpino

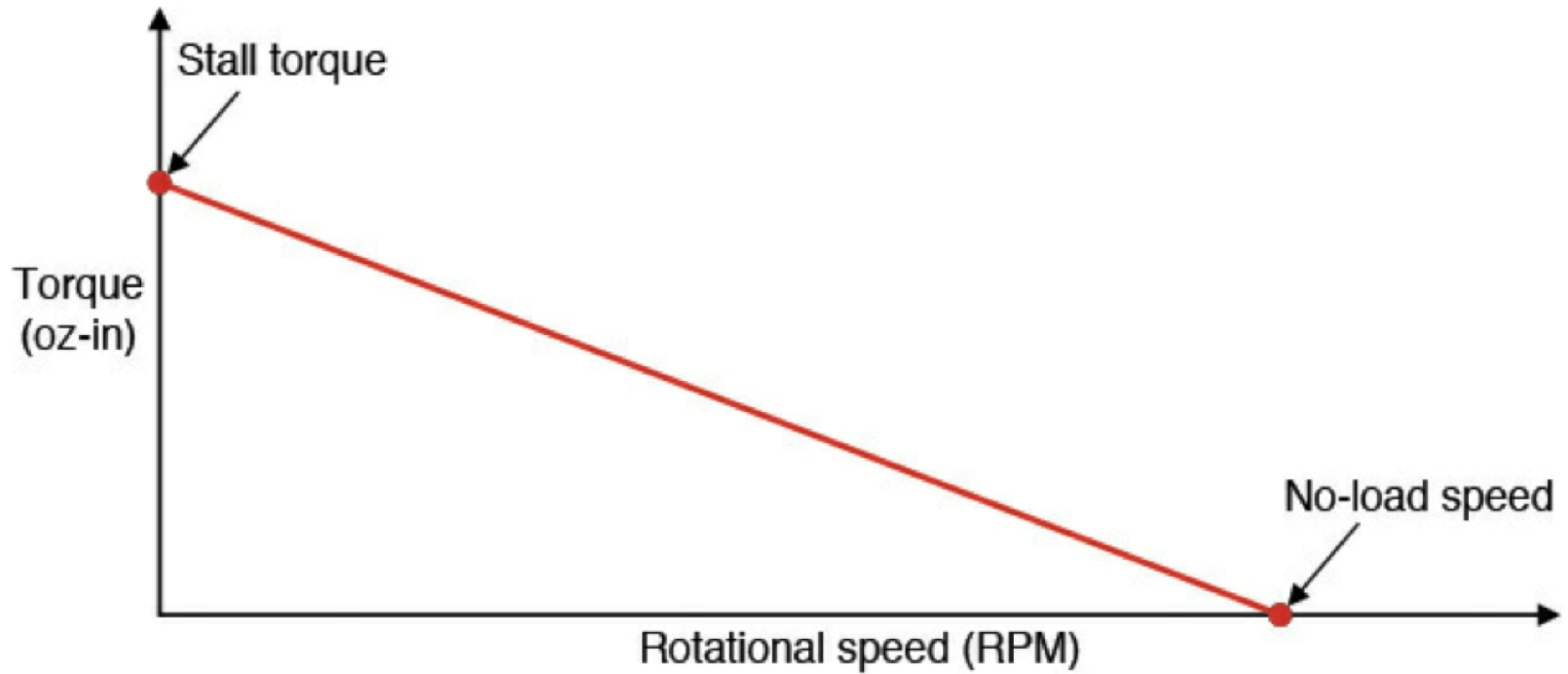
I, V, τ , ω

Power

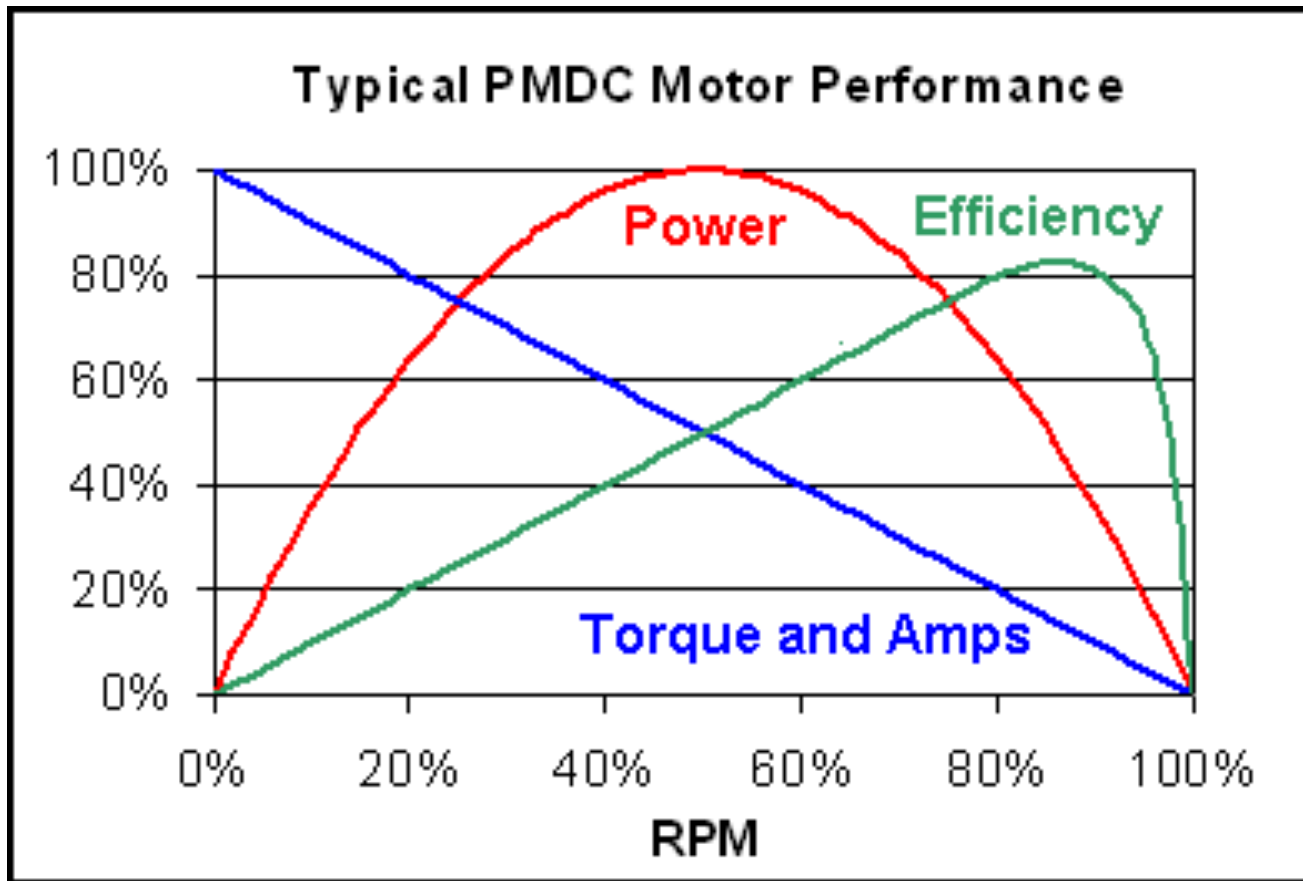
RPM vs rad/s

Motor I , V , τ , ω

τ VS ω



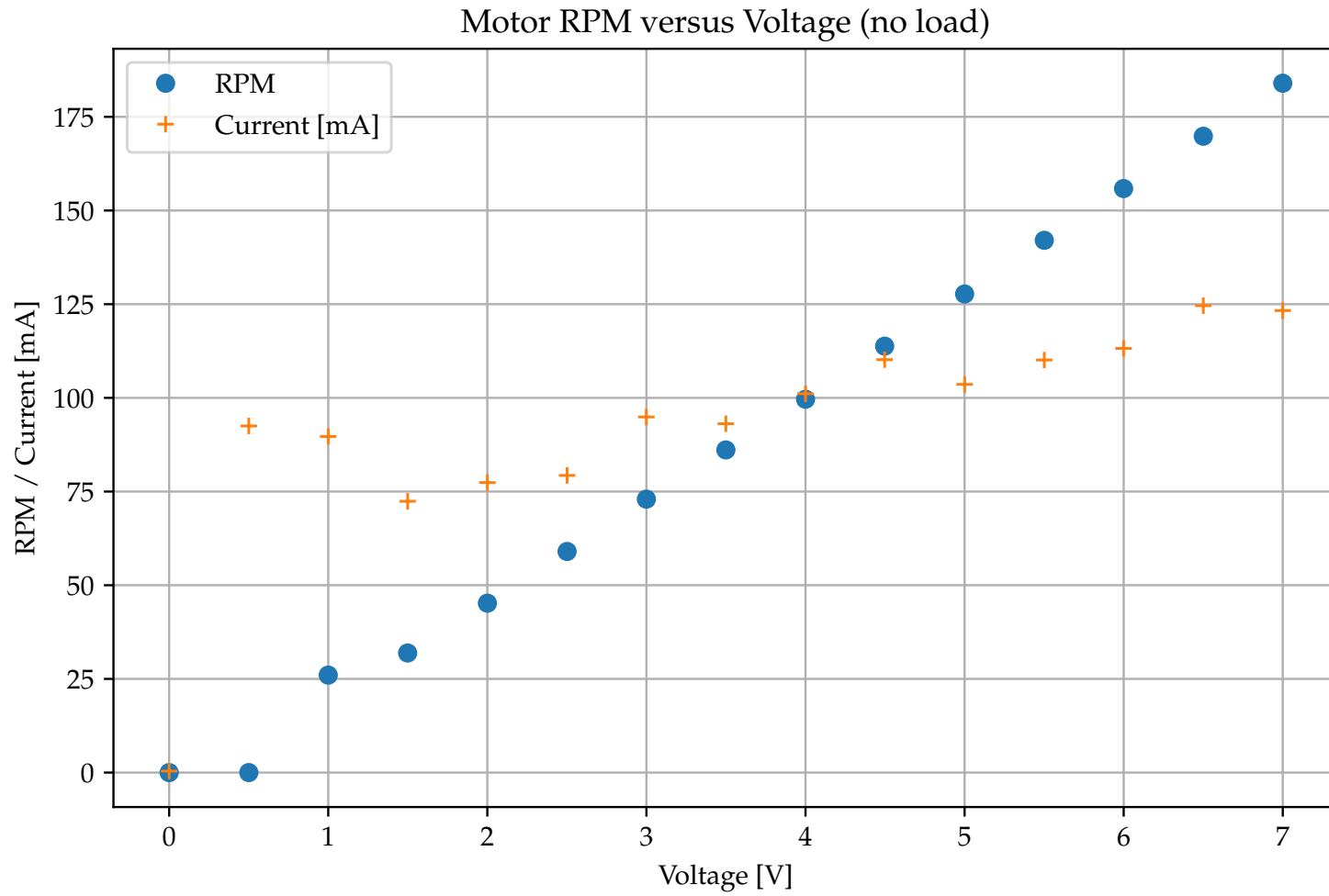
Power vs ω



Gear Motors



Speed Control



Summary

- Current flow →
 - Lorentz Force
 - Magnetic Field
- DC motor
 - Mechanical power == Electrical Power
 - (Minus loss)
 - $\tau\omega = IV$
 - Maximum torque at $\omega = 0$