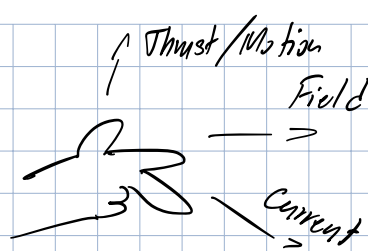


Flaming left rule:



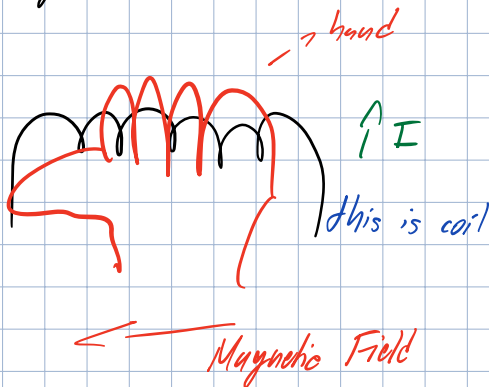
Field:

$N \rightarrow S$

Current:

$+ \rightarrow -$

Ampere right rule:



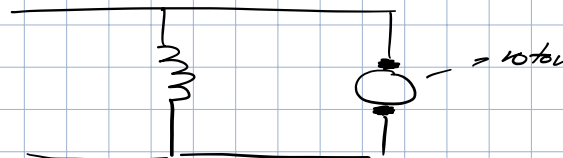
Types of DC brushed motor:

- permanent magnet

- wound stator

- shunt wound

- series wound  $\rightarrow$  to step v seri



Brushed motor problem:

- brushes aligned across the gap

= zero torque, short circuit

$\Rightarrow$  Solution: move poles on commutator

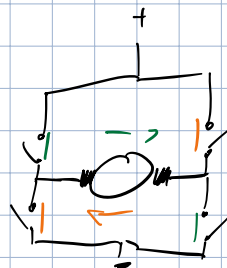
Speed control: (DC motor)

- by controlling voltage

$\hookrightarrow$  we can integrate it:  $\left\{ \begin{array}{l} \frac{1}{4}t - ON \\ \frac{3}{4}t - OFF \end{array} \right\}$  In time, only  $\frac{1}{4}$  voltage is given

$\hookrightarrow$  Pulse-duration modulation

Direction Control:



DC brushless motors:

- Stators made of coils
- Rotor made of permanent magnet
- External commutating - coil switching

Advantages:

- fewer wearable parts
- more reliable
- lighter, better dynamics
- high rpm