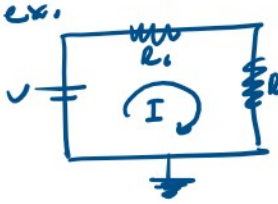
Magnetic Circuits

April 28, 2020 2:29 PM

Magnetic Circuits

- Control path of magnetic flux Φ

ex.



$V = I \cdot (R_1 + R_2)$

→ Resistance of material w/ conductivity σ given by:

$R = \frac{l}{\sigma S}$ l = length, S = cross-sectional surface

Components: Magnetic potential $V_m = \Phi \mathcal{R}$ (flux × Reluctance) → MMF
Reluctance $\mathcal{R}$
Electric Current Φ

MMF: $V_m = NI$

Magnetic Flux: $\Phi = \iint_S \vec{B} \cdot d\vec{S} \rightarrow \vec{B} = \frac{\Phi}{S}$

Reluctance: $\mathcal{R} = \frac{l}{\mu S} \rightarrow \mu = \frac{B}{H}$

- Reluctance when Δ in area, length or material

Potential energy & Forces

- Energy stored in magnetostatic field

$W_H = \frac{1}{2} \int_V \vec{B} \cdot \vec{H} dv = \frac{1}{2} \int_V \frac{B^2}{\mu} dv$

- Exists attractive force b/w poles of magnetic circuit
  ∴ can lift objects

Force in air gaps

$dW = F dL = \frac{B^2 S dL}{2\mu_0}$

$F = \frac{B^2 S}{2\mu_0}$