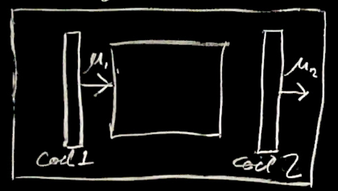
Magnet



$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

$$\tau_z = \mu_x B_y - \mu_y B_x$$

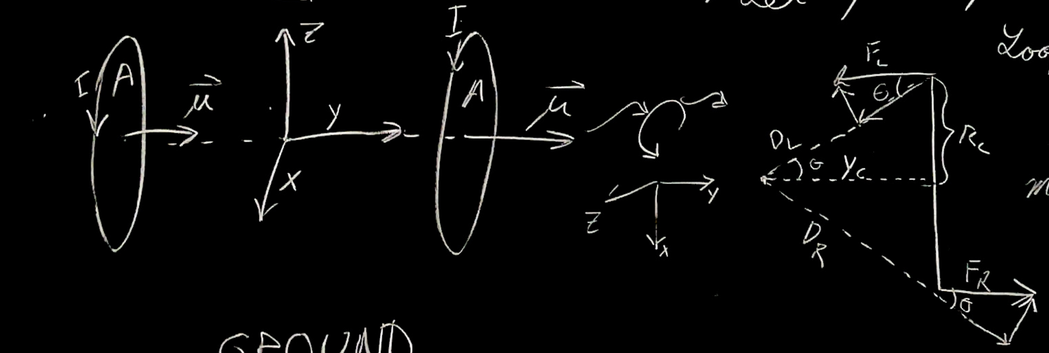
$\rightarrow \mu \perp B \Rightarrow \tau_{max}$

$\Rightarrow$ Let $\vec{\mu} = \hat{y} I A$, $\vec{B}_\perp = -\hat{x}(\vec{B}\cdot\hat{x})$

Loop: $\vec{\tau}_{max} = \vec{\mu} \times \vec{B}_\perp = -IAB_x(\hat{y}\times\hat{x}) = IAB_x\hat{z}$

$= \vec{R}_c \times \vec{F}_L - \vec{R}_c \times \vec{F}_R = \{(-\hat{x}R_c)\times(-\hat{y}F)\} + \{(\hat{x}R_c)\times(\hat{y}F)\} = 2R_cF\hat{z} \Rightarrow F = \frac{IAB_x}{2R_c}$

magnet: $\vec{\tau}_{mag} = \vec{D}_L \times \vec{F}_L + \vec{D}_R \times \vec{F}_R = 2DF\sin\theta\,\hat{z} = 2D\frac{R_c}{D}F\hat{z} = IAB_x\hat{z}$



GROUND