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

momento di dipolo magnetico

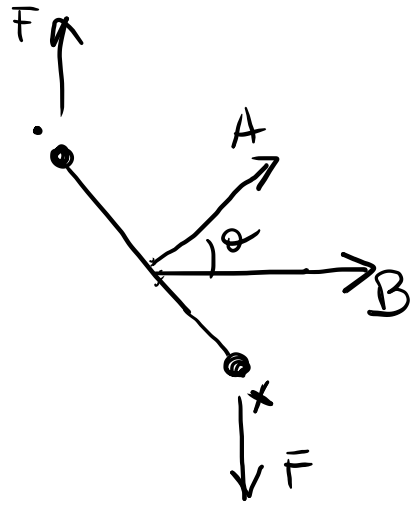
$$\vec{\mu} = I\vec{A}$$

$$\vec{\mu}_{BOBINA} = N I \cdot \vec{A}$$

$$|\tau| = \mu B \operatorname{sen}\theta$$

$$= N I A B \operatorname{sen}\theta$$

$$\boxed{U_B = -\vec{\mu} \cdot \vec{B}}$$



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Bobina composta da 50 spire $N = 50$
circolare di raggio $r = 5\,cm$

$B = 0{,}5\,T$ $\quad I = 25\,mA$

$\tau_{MAX} = ?$

$|\tau| = I \cdot N \cdot A \cdot B \cdot \underbrace{\operatorname{sen}\theta}_{1}$ $\quad \theta = 90°$

$|\tau_{MAX}| = I \cdot N \cdot A \cdot B$

$= 25 \cdot 10^{-3} \cdot 50 \cdot \pi \cdot (5 \cdot 10^{-2})^2 \cdot 0{,}5$

$= \underbrace{2{,}5 \cdot 5 \cdot \pi \cdot 2{,}5 \cdot 0{,}5}_{49{,}06} \cdot 10^{-4} = 4{,}906 \cdot 10^{-3}\,N \cdot m$

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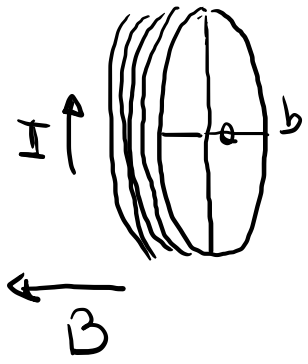


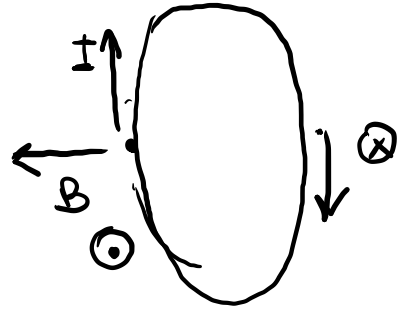
$N = 8$

$a = 40\ cm$

$b = 30\ cm$

$I = 6\ A$

$B = 2 \cdot 10^{-4}\ T$



$$A = \pi \cdot \frac{b}{2} \cdot \frac{a}{2}$$

$$\tau = N \cdot B \cdot I \cdot A$$

$$= 8 \cdot 2 \cdot 10^{-4} \cdot 6 \left[\pi \cdot 0{,}2 \cdot 0{,}15 \right]$$

$$= 8 \cdot 2 \cdot 6 \cdot \pi \cdot 0{,}2 \cdot 0{,}15 \cdot 10^{-4} = 9{,}04 \cdot 10^{-4}\ N \cdot m$$

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80 spire rettangolari

$a = 2{,}5\ cm$

$b = 4\ cm$

$B = 0{,}8\ T$

$I = 10\ mA$

$\vec{A} \perp \vec{B}$

- τ_{MAX} sapendo che $3{,}6 \cdot 10^3 \frac{giri}{minuto}$
- Potenza massima
- Lavoro per ogni giro
- Potenza media

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

$$|\tau| = \mu B \operatorname{sen}\theta \qquad \theta = 90^\circ$$

$$|\tau_{MAX}| = N \cdot I \cdot A \cdot B$$

$$= 80 \cdot (10 \cdot 10^{-3}) \cdot [2{,}5 \cdot 10^{-2} \cdot 4 \cdot 10^{-2}] \cdot 0{,}8$$

$$= \underbrace{8 \cdot 1 \cdot 2{,}5 \cdot 4 \cdot 0{,}8 \cdot 10^{-5}}$$

$$64 \cdot 10^{-5} = \boxed{6{,}4 \cdot 10^{-4}\ N \cdot m}$$

$$P = \tau \cdot \omega$$

$$P_{max} = \tau_{max} \cdot \omega$$

$$\omega = \frac{2\pi}{T} = 2\pi \cdot f$$

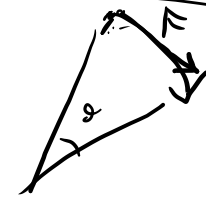
$$3{,}6 \cdot 10^{3} \ \frac{\text{giri}}{\text{minuto}}$$

$$3600 \ \frac{\text{giri}}{\text{minuto}} = \frac{3600}{60} [Hz]$$

$$\downarrow 60 \ Hz$$

$$P_{MAX} = 6{,}4 \cdot 10^{-4} \cdot 2\pi \cdot 60$$
$$= 0{,}241 \ W$$

$$W = \int_{r_1}^{r_2} F \cdot d\vec{r}$$



$$= \int_{r_1}^{r_2} F \cdot (d\vec{\theta} \times \vec{r})$$

$$= \int_{\theta_1}^{\theta_2} (\vec{r} \times \vec{F}) \, d\theta$$

$$\int_{\theta_1}^{\theta_2} \tau \, d\theta$$

$$P = \frac{dW}{dt} = \tau \frac{d\theta}{dt} = \omega$$
$$= \tau \omega$$

$$U_B = -\vec{\mu} \cdot \vec{B}$$

meio giro

$$W = U_f - U_i$$

$$= -\mu B \cos(180°) - \left(-\mu B \cos(0)\right)$$

$$= 2\mu B$$

$$= 2 \cdot N \cdot I \cdot A \cdot B = 2 \cdot (6{,}4 \cdot 10^{-4}) = 1{,}28 \cdot 10^{-3}\ J$$

$$W_{giro\ único} = 2W = 2{,}56 \cdot 10^{-3}\ J$$

$$T = \frac{1}{f}$$

$f = 60\ Hz$

$T = \frac{1}{60}\ s$

$$\boxed{P_{media} = \frac{W_{giro}}{T} = \frac{2{,}56 \cdot 10^{-3}}{1/60} = 0{,}154\ W}$$