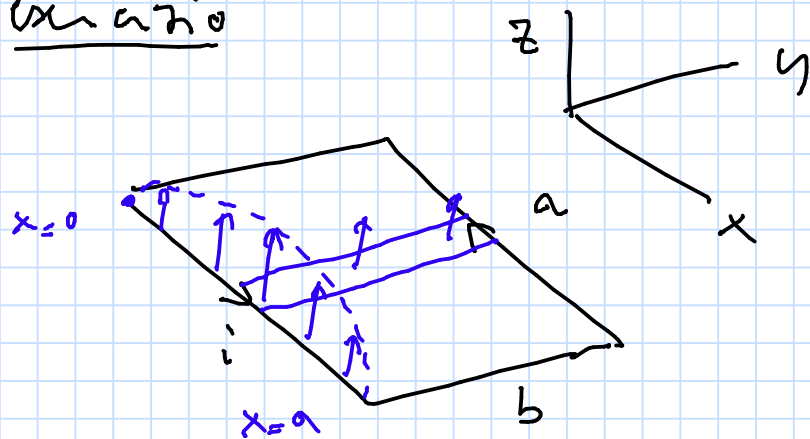


esercizio



$$\vec{B} = \left(B_0 \sin \frac{\pi x}{a} \right) \hat{y}$$

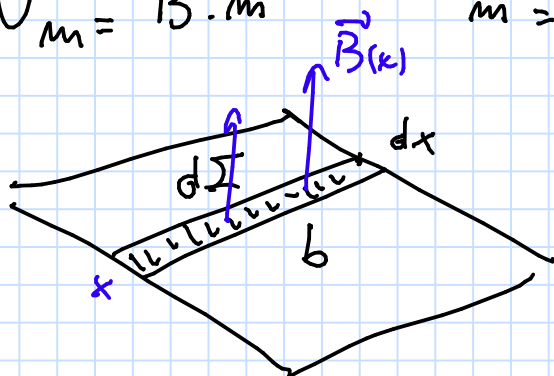
$$\vec{B}(x)$$

1) $U_m = ?$

$$U_m = \vec{B} \cdot \vec{m}$$

$$\vec{m} = i(ab)$$

NO, B non è costante



$$dU_m = \vec{B}(x) \cdot d\vec{m} =$$

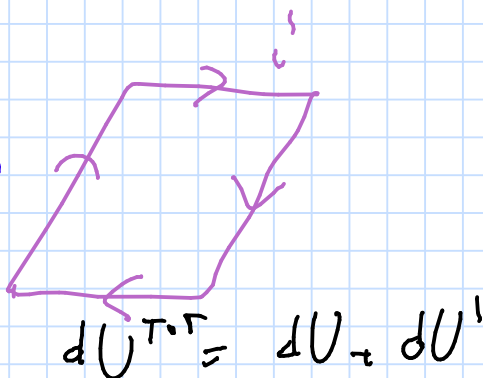
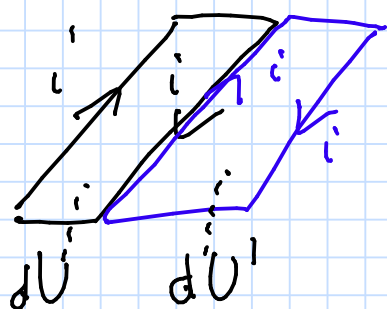
$$\left(B_0 \sin \frac{\pi x}{a} \right) b dx i$$

$$U_m = \int dU_m = B_0 b i \int_0^a \sin \frac{\pi x}{a} dx$$

$$= \left(\frac{2}{\pi} B_0 a b \right) i$$

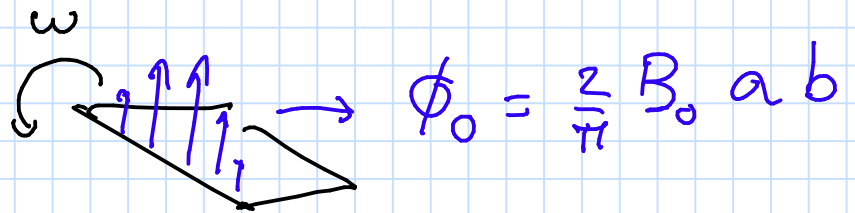
$$U_m = \int d\Phi_B \cdot i = \Phi_B \cdot i$$

perché si può sommare e fare somma di energie?



poniamo $i=0$ e iniziamo rotazione
attorno asse x , $\theta = \omega t$ ω costante

$\Rightarrow$ dimando



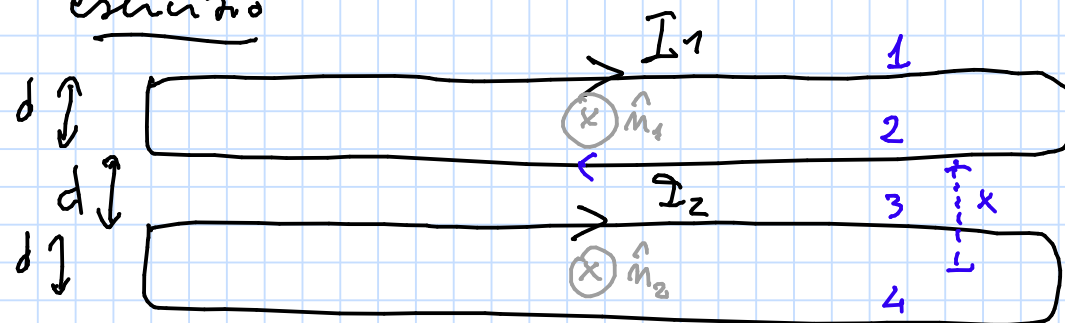
2) energia dissip. per secondo,
e c'è R ?

$$\phi_B(t) = \phi_0 \cdot \cos \omega t$$

$$\text{f.e.m.} \quad \mathcal{E}_i = - \frac{d\phi_B}{dt} \rightarrow i = \frac{\mathcal{E}_i}{R} \rightarrow P(t) = \frac{i^2}{R}$$
$$\downarrow$$
$$\overline{P} = \frac{1}{2R} i^2$$

$$\mathcal{E}_i = \omega \phi_0 \sin \omega t$$

esercizio



$$L \gg d \iff B = \frac{\mu_0 I}{2\pi r} \quad \text{B.S.}$$

1) $M = ?$

$M < 0$: circuito 2 prende campo 1 nella zona in cui forma indotto

$$B_1 = \frac{\mu_0 I_1}{2\pi} \left[-\frac{1}{x} + \frac{1}{x+d} \right]$$

$$\phi_1 = L \int_{x=d}^{x=2d} B_1(x) dx = M I_1$$

$$M = -\frac{\mu_0 L}{2\pi} \log \frac{4}{3}$$

2) F per mantenerli fermi

$$\vec{F} = \vec{F}_{14} + \vec{F}_{13} + \vec{F}_{24} + \vec{F}_{23}$$

$$F = \frac{\mu_0 L}{2\pi} \frac{I_1 I_2}{d} \left(\frac{1}{3} - \frac{1}{2} - \frac{1}{2} + 1 \right) =$$

$$= \frac{\mu_0 L}{2\pi} \frac{I_1 I_2}{3d} \quad \text{repulsiva}$$

3) se poniamo $F=0$, lasciamo circuito 2 libero di muoversi $\Rightarrow$ ene. cinetica in contanza?

$$U_I - U_F \stackrel{?}{=} E_{\text{cin}} = K \quad \Rightarrow U_I - U_F < 0$$

I_1, I_2 mantenute costanti

correttamente, consideriamo anche lo stesso fatto due generatori che mantengono I_1, I_2 costanti

$$U_I + W_{\text{gen}} = U_F + K$$

$$W_{\text{gen}} = U_I^{\text{gen}} - U_F^{\text{gen}}$$

$$\stackrel{\alpha=1,2}{=} \sum_{\alpha=1}^2 I_{\alpha} \cdot \mathcal{E}_{\alpha} = \sum_{\alpha=1}^2 I_{\alpha} \cdot (-\mathcal{E}_{i_{\alpha}})$$

$$= \sum_{\alpha=1}^2 \int I_{\alpha} \cdot \frac{d\phi_{\alpha}}{dt} dt$$

$$= \sum_{\alpha=1}^2 I_{\alpha} [\phi_{\alpha F} - \phi_{\alpha I}]$$

$$= I_1 [0 - M I_2] + I_2 [0 - M I_1]$$

non stiamo considerando auto flusso di I_1 che rimane invariato

$$= -2 M I_1 I_2$$

$$U = \frac{1}{2} L_{\alpha' \alpha''} I_{\alpha'} I_{\alpha''} = \frac{1}{2} L I_1^2 + \frac{1}{2} L I_2^2 + M I_1 I_2$$

$$U_I - U_F = M I_1 I_2 \quad \parallel \quad K = (U_F - U_I) + W_{\text{gen}} = (1-2) M I_1 I_2 = -M I_1 I_2 > 0 \quad \text{da } M < 0$$