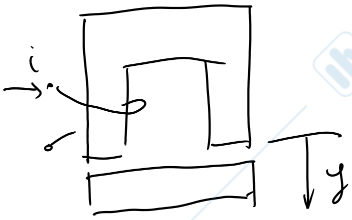
Forze nei Sistemi MAGNETICI



$$dW = [i]^t [v]\,dt - F\,dy \quad \leftarrow \text{1 sola porta meccanica}$$

$$\underbrace{\qquad}_{v_1 i_1 + v_2 i_2 + \dots} \quad \text{posso avere + bobine}$$

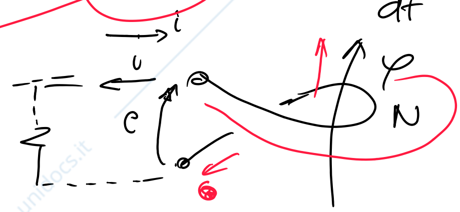
$$dW = [i]^t\, d[\psi] - F\,dy \qquad e = \frac{d\psi}{dt}$$

$$dW([\psi], y) = \frac{\partial W}{\partial[\psi]}\, d[\psi] + \frac{\partial W}{\partial y}\, dy$$

$$\cancel{dW([i], y)}$$

$$\psi = L i$$

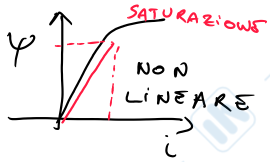
$$d\psi = d(L) i + L\,di$$

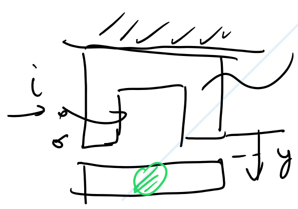


con la regola del cavatappi

$$F = -\frac{\partial W([\psi], y)}{\partial y}$$

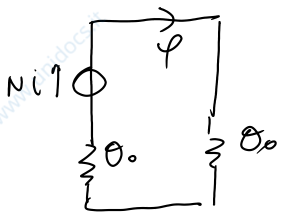
$$L \text{ lineari} \Rightarrow L(y)$$





$$W(\varphi, y) \qquad W = \frac{1}{2} L i^2 = \frac{1}{2}\frac{\varphi^2}{L(y)}$$

$$\varphi = L i$$



$$\theta_0 = \frac{1}{\mu_0}\cdot\frac{y}{A_{fe}} \qquad \varphi = \frac{Ni}{2\theta_0} \Rightarrow L = \frac{\varphi}{i} = \frac{N^2}{2\theta_0}$$

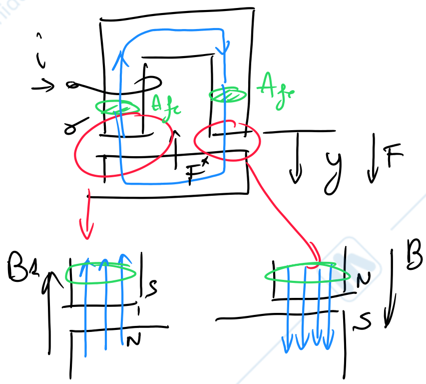
$$L = \frac{N^2}{2\theta_0} = \frac{N^2}{2\,\frac{1}{\mu_0}\cdot\frac{y}{A_{fe}}} = \frac{N^2 \cdot A_{fe}\,\mu_0}{2y}$$

$$-\frac{\partial}{\partial y}(W) = \frac{1}{2}\,\frac{\varphi^2}{\frac{N^2 A_{fe}\mu_0}{2y}} = -\frac{\partial}{\partial y}\left(\frac{1}{2}\,\frac{\varphi^2}{N^2 A_{fe}\mu_0}\cdot 2y\right) \Rightarrow F = \frac{-\varphi^2}{N^2 A_{fe}\mu_0}$$

attrat.

PRESSIONE MAGNETICA

$$\sigma = \frac{F}{A_{TOT}} \leftarrow \text{area su cui agisce la forza magnetica}$$



$$F = -\frac{\psi^2}{N^2 A_{fe}\mu_0} \qquad \psi = N\varphi \qquad \varphi = BA$$

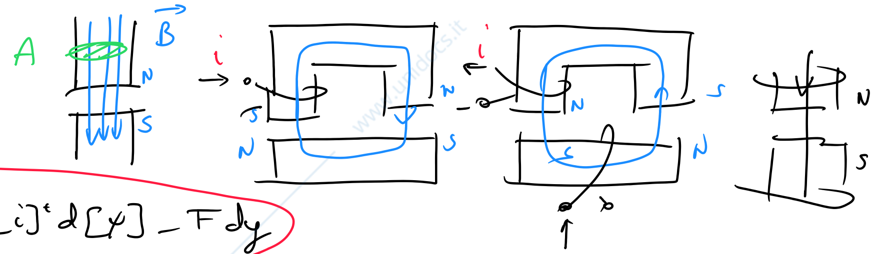
$$\sigma = \frac{|F|}{A_{TOT}} = \frac{\frac{\psi^2}{N^2 A_{fe}\mu_0}}{2A_{fe}} = \frac{N^2\varphi^2}{2N^2A_{fe}^2\mu_0} = \frac{\cancel{N^2}B^2\cancel{A_{fe}^2}}{2\cancel{N^2}\cancel{A_{fe}^2}\mu_0}$$

$$\sigma = \frac{B^2}{2\mu_0}$$

PRESSIONE MAGNETICA

$$F = \sigma \cdot A_{TOT} = \sigma_1 \cdot A_1 + \sigma_2 A_2 + \sigma_3 A_3 \qquad \sigma_3 = \frac{B_3^2}{2\mu_0}$$

$$\sigma = \frac{B^2}{2\mu_0}$$



$$dW(\psi, y) = [i]^t d[\psi] - F dy$$

W^* = COENERGIA = $[i]^t[\psi] - W$ (TRASF. DI LEGENDRE)

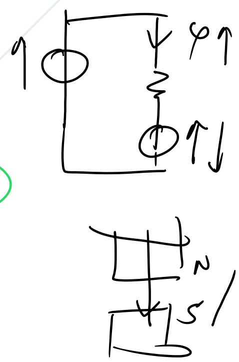
$$dW^*$$

$$d([i]^t[\psi]) = d[i]^t[\psi] + [i]^t d[\psi]$$

$$dW(\psi, y) = d([i]^t[\psi]) - d[i]^t[\psi] - F dy$$

$$d([i]^t[\psi]) - dW(\psi, y) = d[i]^t[\psi] + F dy$$

$$d(\underbrace{[i]^t[\psi] - W(\psi, y)}_{W^*}) = d[i]^t[\psi] + F dy$$

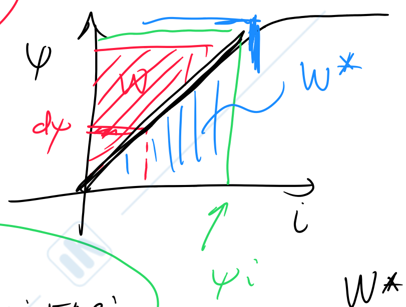


$$\underbrace{dW^*}_{W^*([i]^t,\, y)} = d[i]^t[\psi] + F dy = \frac{\partial W^*}{\partial [i]^t} d[i]^t + \frac{\partial W^*}{\partial y} dy$$

$$F = \frac{\partial W^*(i, y)}{\partial y}$$

$$F=\frac{\partial W^*}{\partial y}$$

$$W^* = [i]^t[\psi] - W$$



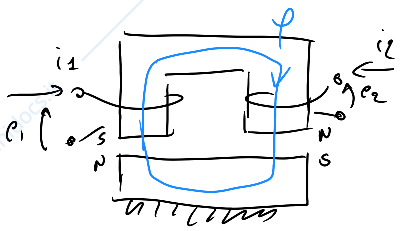
$$W=\frac{1}{2}Li^2=\frac{1}{2}\frac{\psi^2}{L}=\frac{1}{2}\psi i$$

$$\int dW=\int i\,d\psi$$

$$L=\frac{N^2}{\frac{1}{\mu_0}\cdot\frac{2y}{A_{fe}}}$$

$W = W^*$ × INDUTTORI LINEARI

$$W^* = W = \frac{1}{2}Li^2 + \dots$$



$$\varphi=\frac{N_1 i_1 + N i_2}{2\mathcal{R}_0}$$

$$L_{11}=\left.\frac{\psi_1}{i_1}\right|_{i_2=0} \qquad L_m=\left.\frac{\psi_1}{i_2}\right|_{i_1=0}$$

$$\boxed{\begin{aligned}\psi_1 &= L_{11}i_1 + L_m i_2\\ \psi_2 &= L_m i_1 + L_{22} i_2\end{aligned}}$$

$$L_{12}=L_{21}=L_m$$

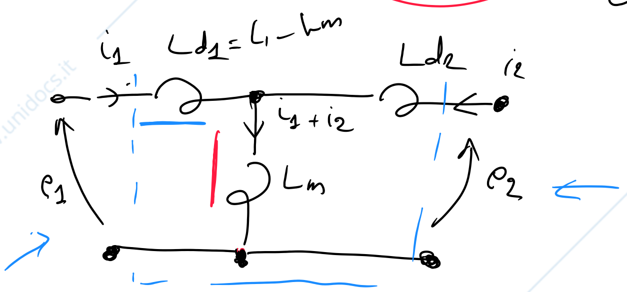
$$\begin{cases} e_1=\frac{d\psi_1}{dt}=L_{11}\frac{di_1}{dt}+L_m\frac{di_2}{dt}=L_{11}pi_1+L_m pi_2\\ e_2=\frac{d\psi_2}{dt}=L_m\frac{di_1}{dt}+L_{22}\frac{di_2}{dt}=L_m pi_1+L_{22}pi_2\end{cases}$$

$$\frac{d}{dt}=p$$

operatore di heaviside

$$\begin{cases} e_1=L_{11}pi_1+L_m pi_2 \pm L_m pi_1 = \overbrace{(L_{11}-L_m)}^{L_{d1}}pi_1 + L_m p(i_1+i_2)\\ e_2=L_{22}pi_2+L_m pi_1 \pm L_m pi_2 = \underbrace{(L_{22}-L_m)}_{L_{d2}}pi_2 + L_m p(i_1+i_2)\end{cases}$$

$\frac{d}{dt}$



INDUTTANZA DI DISPERSIONE.