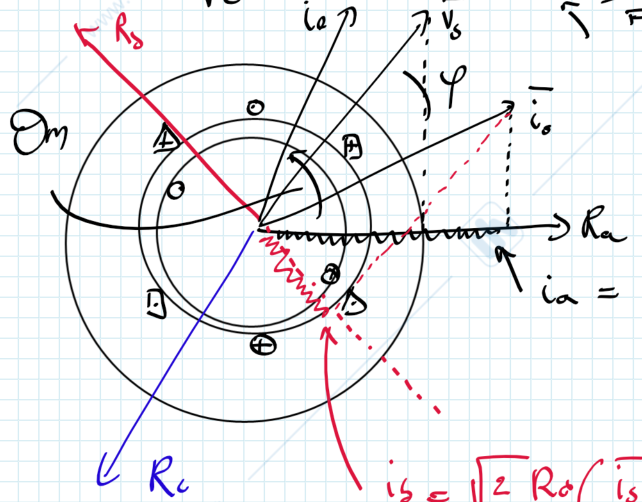
$$\bar{v}_s = \sqrt{\frac{2}{3}}\left(v_a + \alpha v_b + \alpha^2 v_c\right)$$

$$\bar{i}_s = \sqrt{\frac{2}{3}}\left(i_a + \alpha i_b + \alpha^2 v_c\right)$$

$$p = Re(\bar{v}_s\, \underline{i}_s)$$

← FASORI RAZIONALI



$$i_a = \sqrt{\frac{2}{3}}\, Re(\bar{i}_s)$$

$$i_b = \sqrt{\frac{2}{3}}\, Re\left(\bar{i}_s\, e^{-j\frac{2}{3}\pi}\right)$$

alimentiamo rot in C.C.

$$\bar{i}_r = \sqrt{\frac{3}{2}}\, I_r e^{j\theta_m}$$

$$I_r = Re\left(\bar{i}_r e^{-j\theta_m}\right) = cost$$

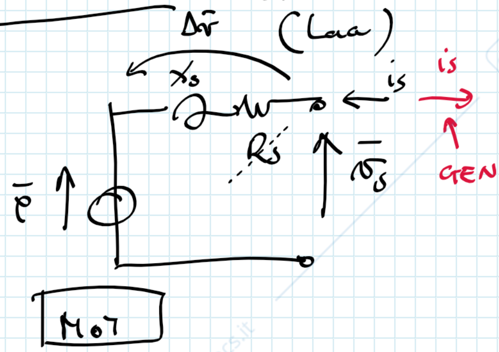
$$\theta_m = \omega t$$

$$T_{giunto} = -K I_i I_r \sin\theta \quad (\sim cost)$$

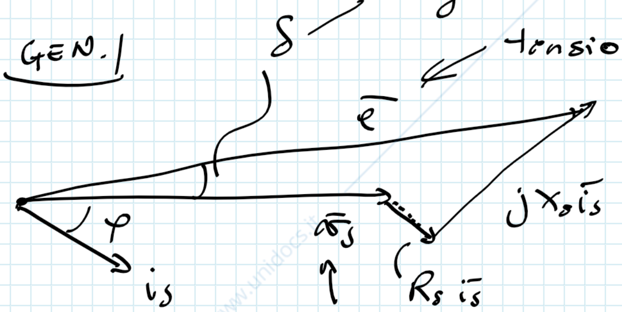
$$\bar{v}_s = j X_s \bar{i}_s + j X_f \bar{i}_r \longrightarrow \bar{v}_s = j X_s \bar{i}_s + \bar{e}$$

$\frac{3}{2}L$ — INDUTT. SINCRONA | autoind di statore (L_{aa})

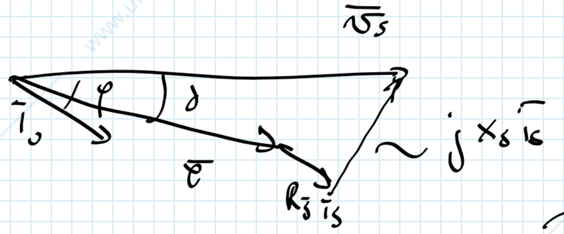
$\frac{3}{2}L_f$ — max. mutua indutt. tra rot / statore (L_{fa})



GEN.



COSTRUZIONI DI BHEN-ESCHENBURG



$$p = Re(\bar{v}_s\, \underline{i}_s) = Re\left(\left(R_s \bar{i}_s + j X_s \bar{i}_s + \bar{e}\right)\underline{i}_s\right) = Re\left(R_s \bar{i}_s \underline{i}_s + j X_s \bar{i}_s \underline{i}_s + \bar{e}\,\underline{i}_s\right)$$

potenza complessa; $\bar{i}_s\underline{i}_s = i_s^2$; $Re = 0$; P_J

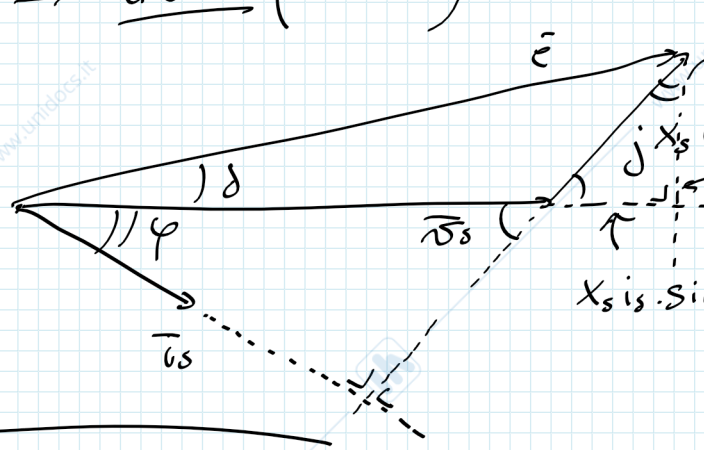
$$\bar{e} = j\omega L_f \bar{i}_r \quad (X_f)$$

$$P_m = Re(\bar{e}\,\underline{i}_s) = Re(j\omega L_f \bar{i}_r \cdot \underline{i}_s) = -Im(\omega L_f \bar{i}_r \underline{i}_s)$$

$$= -Im\left(\omega L_f \sqrt{\frac{3}{2}} I_r e^{j\theta_m} \sqrt{\frac{3}{2}} I_M e^{-j\omega t}\right) = \qquad \theta_m = \omega t + \theta$$

$$= -Im\left(\omega L_f \sqrt{\frac{3}{2}} I_r e^{j\theta} e^{j\omega t} \sqrt{\frac{3}{2}} I_M e^{-j\omega t}\right) = -\hat{K} I_r I_M \sin\theta$$

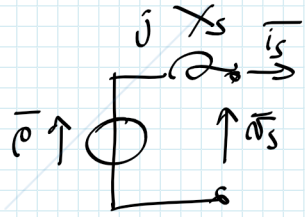
$T \Rightarrow$ GEN $(R_s \simeq 0)$



$i_s \cos\varphi = \dfrac{e \sin\delta}{X_s}$

$X_s i_s \cos\varphi = e \sin\delta$

$X_s i_s \sin\varphi = e\cos\delta - v_s$



$$\boxed{P = v_s i_s \cos\varphi}$$

$$\left.\begin{aligned} \bar{v}_s &= \sqrt{\tfrac{2}{3}}\left(v_a + \alpha v_b + \alpha^2 v_c\right) \\ \bar{i}_s &= \sqrt{\tfrac{2}{3}}\left(i_a + \alpha i_b + \alpha^2 i_c\right) \end{aligned}\right\} \quad P = Re\left(\bar{v}_s \bar{i}_s^*\right)$$

$i_a + i_b + i_c = 0$

$$P = \sqrt{\tfrac{2}{3}}\left(v_a + v_b e^{j\frac{2}{3}\pi} + e^{-j\frac{2}{3}\pi} v_c\right) \cdot \sqrt{\tfrac{2}{3}}\left(i_a + i_b e^{-j\frac{2}{3}\pi} + i_c e^{j\frac{2}{3}\pi}\right)$$

$$= \tfrac{2}{3}\left(v_a\underbrace{\left(i_a + i_b e^{-j\frac{2}{3}\pi} + i_c e^{j\frac{2}{3}\pi}\right)}_{\frac{3}{2} i_a} + \cdots = \right.$$

$$= \tfrac{2}{3}\left(\tfrac{3}{2} v_a i_a + \tfrac{3}{2} v_b i_b + \tfrac{3}{2} v_c i_c\right) = \boxed{v_a i_a + v_b i_b + v_c i_c}$$

$$\boxed{P = v_s i_s \cos\varphi = v_s \frac{e \sin\delta}{X_s}} \Rightarrow \boxed{T = \frac{v_s e \sin\delta}{X_s \cdot \omega}}$$

tensione vuoto

$$\boxed{Q = v_s i_s \sin\varphi = v_s \frac{e\cos\delta - v_s}{X_s}}$$

ANGOLO CARICO = sfas. tra la tensione a vuoto ($\bar{e}$) e quella a carico ($\bar{v}_s$, $\bar{i}_s \neq 0$)

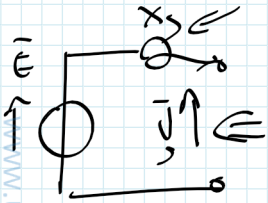
$$P = \frac{V_s E \sin\delta}{X_s} \qquad T = \frac{V_s E \sin\delta}{X_s \omega}$$

$$P = R_e(\bar{V}_s \bar{i}_s^*)$$

↑ potenza istantanea

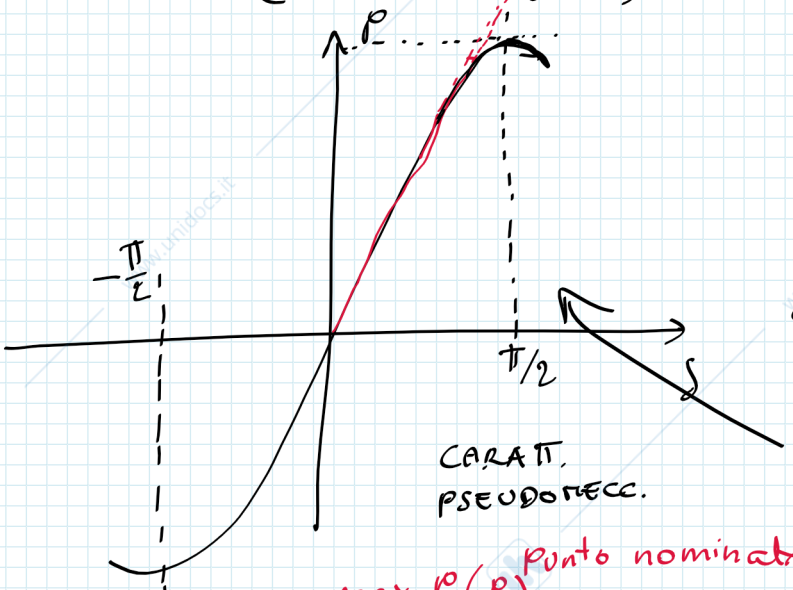
$$= \frac{V_s E \sin\delta}{X_s} \qquad T = \frac{V_s E \sin\delta}{X_s \omega}$$

$V_s = |\bar{V}_s|$ = modulo del fasore spaz.



∈ modello dell'intera macchina (non è di fase)

$$V_s = \sqrt{\frac{3}{2}} V_M = \sqrt{\frac{3}{2}} \sqrt{2} V = V_s = \sqrt{3} V_{fase} = V_{concat.}$$



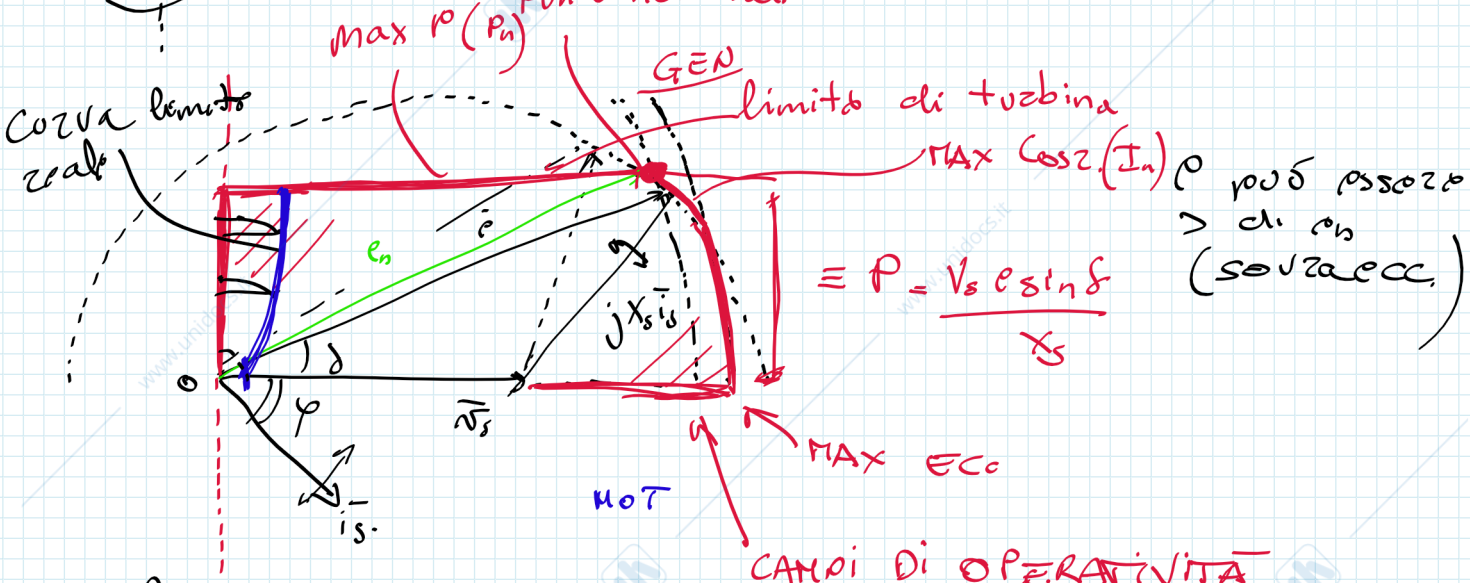
A REGIME

$P_m = P$

↑ Potenza richiesta

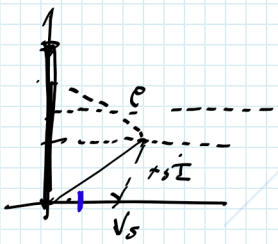
Potenza che mi può fornire $= \frac{V_s E \sin\delta}{X_s}$

$\delta > \frac{\pi}{2}$ | perdita di passo.

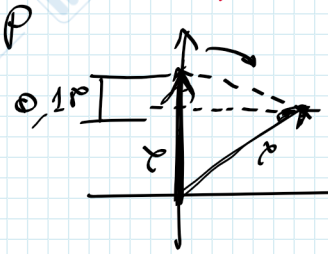


CAMPI DI OPERATIVITÀ

$\equiv P$



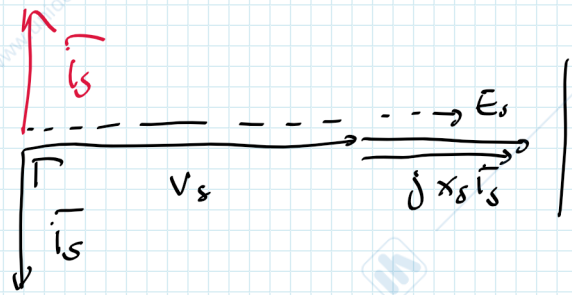
$0,1\,P$

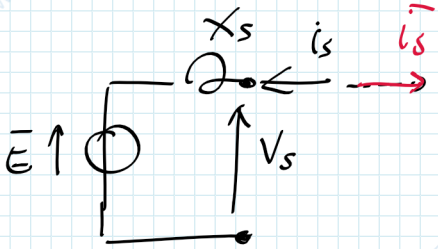


$$P = \frac{V_s E \sin\delta}{X_s} \qquad Q = \frac{V_s (E\cos\delta - V_s)}{X_s} \qquad \sin\delta = 0$$

$P = \frac{V_s E \cdot \sin\delta}{X_s}$ $\quad Q = \frac{V_s E\cos\delta - V_s}{X_s}$ $\quad \sin\delta = 0$

$P = 0$ ⇐





Si sta comportando come un Condensatore

COMPENSATORE SINCRONO

P = compensare le perdite (R_s, attriti)