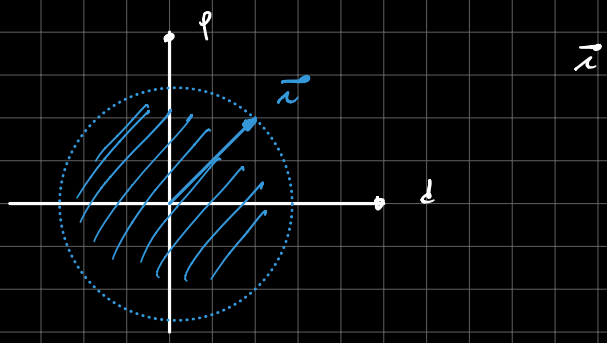
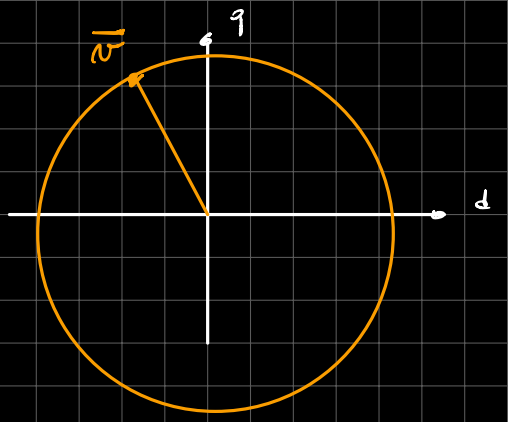
DIAGRAMMI LIMITE DELLA MACCHINA SINCRONA

Limite di corrente



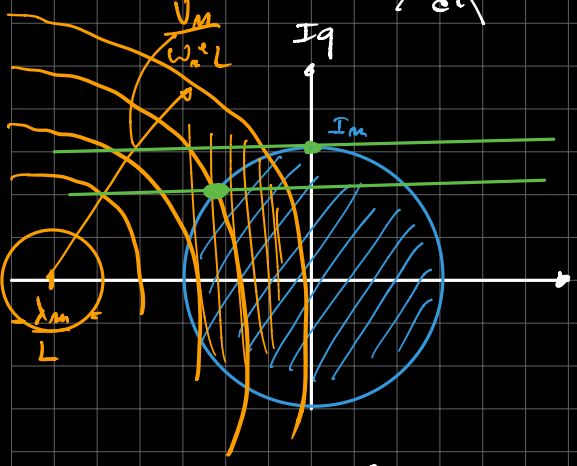
Limite di tensione



$$\vec{v}^R = R\vec{i}^R + L\frac{d\vec{i}^R}{dt} + j\omega_m \vec{\lambda}^R$$

$$\begin{cases} V_d = \cancel{R I_d} - \omega_m L I_q \\ V_q = \cancel{R I_q} + \omega_m (\lambda_m + L I_d) \\ \qquad \approx 0 \end{cases}$$

$$m = \frac{3}{2} p \lambda_m I_q$$



ω_m come parametro

$$|\vec{i}| \le I_m \qquad I_d^2 + I_q^2 \le I_m^2$$

$$|\vec{v}| \le V_m \qquad V_d^2 + V_q^2 \le V_m^2$$

$$(\omega_m L I_q)^2 + [\omega_m (\lambda_m + L I_d)]^2 \le V_m$$

$$\left(I_d + \frac{\lambda_m}{L}\right)^2 + I_q^2 \le \left(\frac{V_m}{\omega_m L}\right)^2$$

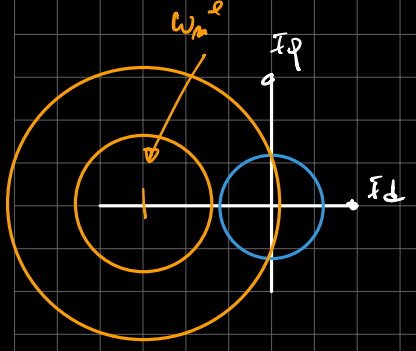
centro $\left(-\frac{\lambda_m}{L}; 0\right)$

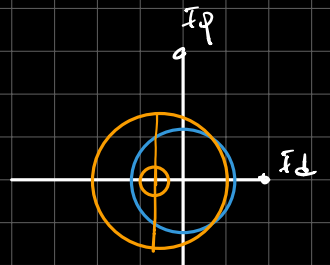
Raggio $\left(\frac{V_m}{\omega_m L}\right)$

Nota: centro si ottiene $V_d = 0 = -\omega_m L I_q$ $\quad I_q = 0$

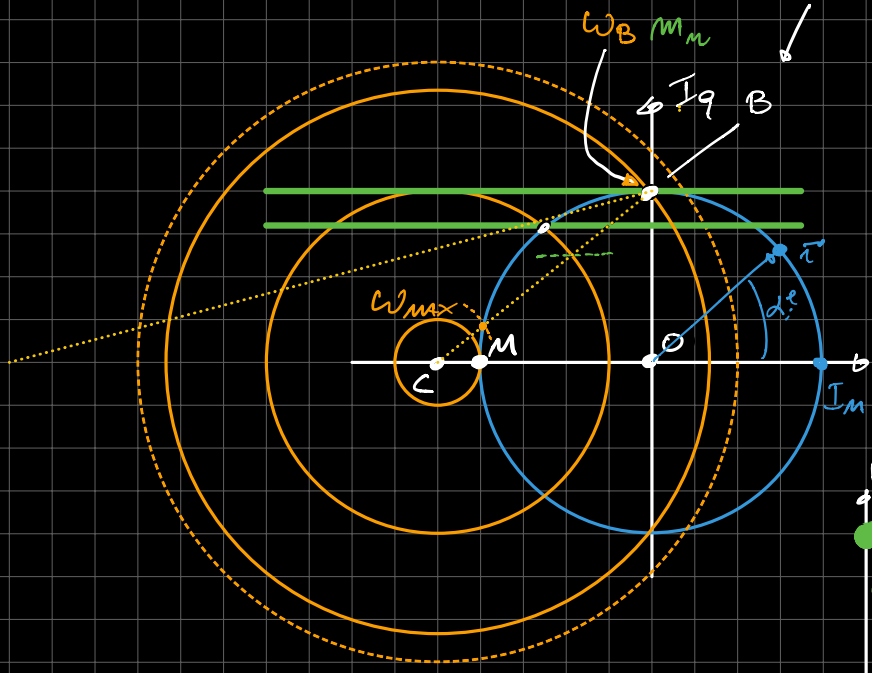
$V_q = 0 = \omega_m (\lambda_m + L I_d)$ $\quad I_d = -\frac{\lambda_m}{L}$

$$I_{ch} = -\frac{\lambda_m}{L}$$





Punto BASE

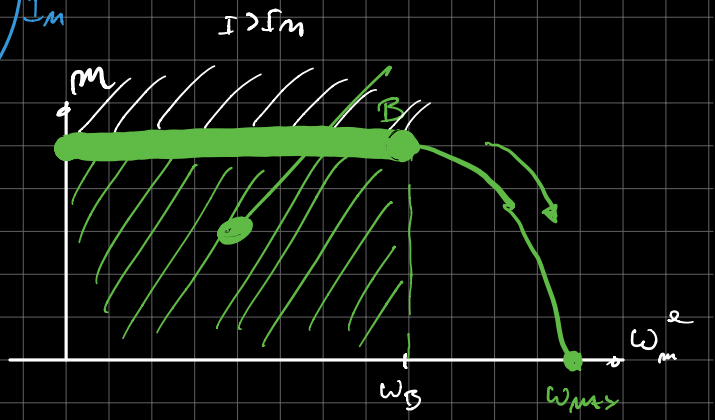


$$m_m = \frac{3}{2} p \lambda_m I_m$$

$$I_q = I_m$$

$\overline{OB}$ = MTPA $\quad \omega_m^e < \omega_B$

"COPPIA COSTANTE"



$$m = \frac{3}{2} p \lambda_m |\bar{i}| \sin \alpha_i^e$$

$$\frac{dm}{d\alpha_i^e} = 0 = \cos \alpha_i^e \qquad \alpha_i^e = \frac{\pi}{2}$$

CALCOLO ω_B $\quad (\omega_B L I_q)^2 + \omega_B^2 (L I_d + \lambda_m)^2 = U_m^2$ con $I_q = I_m$ $\quad I_d = 0$

$$\omega_B^2 (L I_m)^2 + (\omega_B \lambda_m)^2 = U_m^2$$

$$\omega_B = \frac{V_m}{\sqrt{\lambda_m^2 + (L I_m)^2}}$$

CALCOLO ω_{max} $\quad U_d^2 + U_q^2 = U_m^2$

$I_d = -I_m$

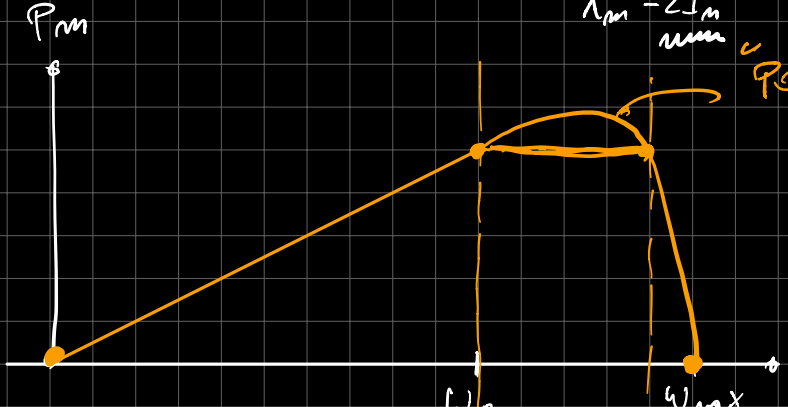
$I_q = 0$

$\omega_m^e = \omega_{max}$

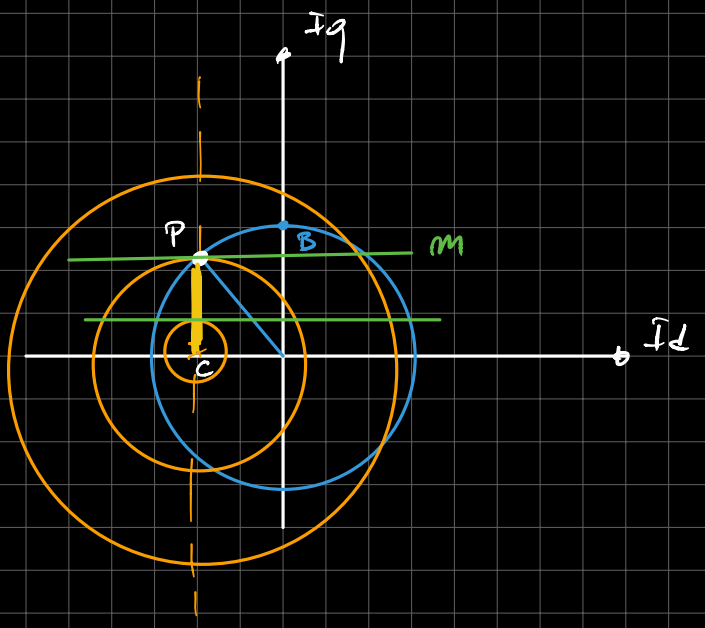
$$(\omega_{max} L I_q)^2 + \omega_{max}^2 (\lambda_m + L I_d)^2 = U_m^2$$

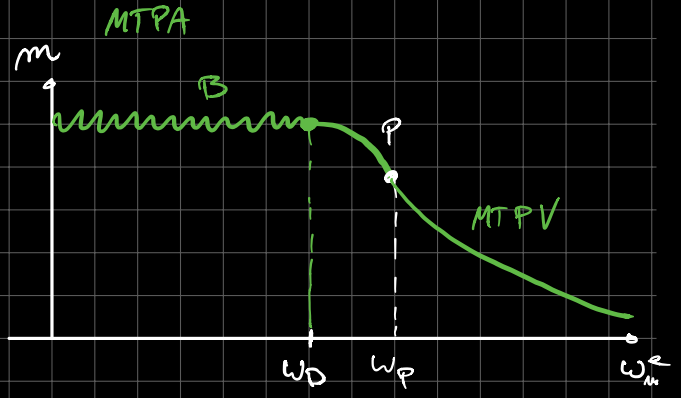
$$\omega_{max}^2 (\lambda_m - L I_m)^2 = U_m^2$$

$$\omega_{max} = \frac{U_m}{\lambda_m - L I_m} \qquad L I_m \ll \lambda_m \quad \omega_B \approx \omega_{max}$$



LUNGO BC ω_r mb $T_m = cost$





Note: $I_d < 0$ $\quad \begin{cases} \lambda_d = \lambda_m + L I_d \\ \lambda_q = L I_q \end{cases}$ λ Deflussi

Esempio

$V_{m,RMS} = 250\ V$ concatenata

$I_{m,RMS} = 200\ A$

$L = 0,15\ mH$

$2p = 8$

$K_E = 0,6$ $\quad \frac{V_{RMS}}{rad/s}$ ✓ concatenata

$R \simeq 0$

$\lambda_m = ?$

$$V_m = \frac{\sqrt{2} \cdot 250}{\sqrt{3}} = 204\ V$$

$$I_m = \sqrt{2} \cdot 200 = 282,8\ A$$

CONCATENATA

$$K_E \omega_m = V_{RMS} = \frac{\sqrt{3} E}{\sqrt{2}} = \sqrt{\frac{3}{2}}\, \omega_m^e \lambda_m = \sqrt{\frac{3}{2}}\, \omega_m \cdot p\, \lambda_m$$

$$\lambda_m = \sqrt{\frac{2}{3}} \frac{K_E}{p} = \sqrt{\frac{2}{3}} \frac{0,6}{4} = 0,122\ Vs$$