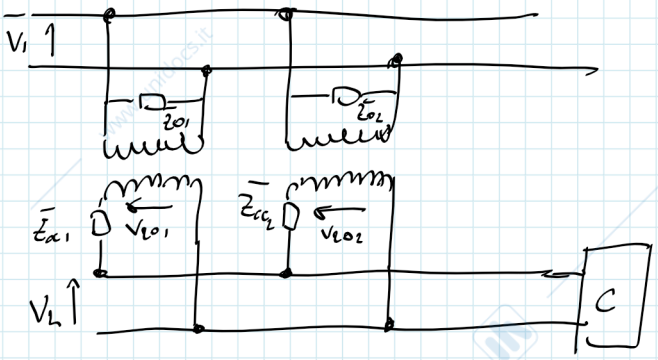
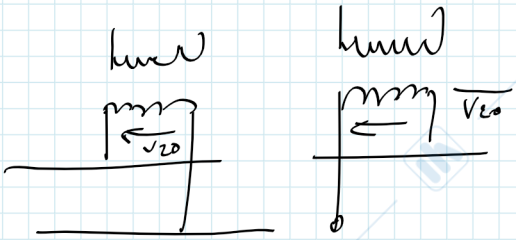
PARALLELO DI TRASFORMATORI

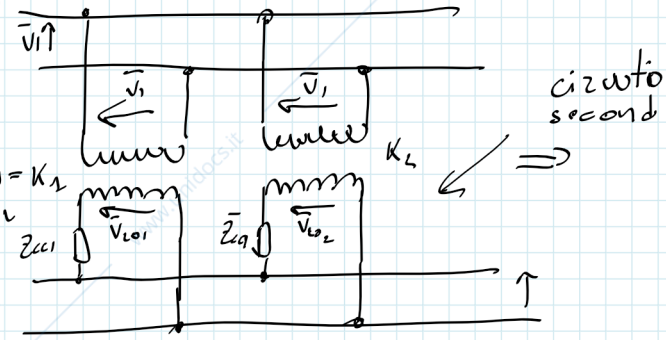


È buona norma che le tensioni nominali siano le stesse

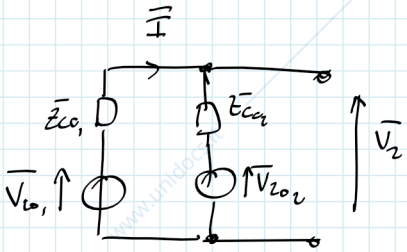
Att.!! non è detto che abbiano la stessa A_n



Nel caso a VUOTO



$\Rightarrow$ circuito secondario



$$\bar{I} = \frac{\bar{V}_{20_1} - \bar{V}_{20_2}}{\bar{z}_{cc_2} + \bar{z}_{cc_1}}$$

$\bar{V}_{20_1} \neq \bar{V}_{20_2}$ $\Leftarrow$ ci può essere una corr. anche a vuoto

$$\bar{I} = \frac{\bar{V}_1/K_1 - \bar{V}_1/K_2}{\bar{z}_{cc_2} + \bar{z}_{cc_1}} = \frac{(K_1^* - K_2^*)\bar{V}_1}{\bar{z}_{cc_1} + \bar{z}_{cc_2}} =$$

$K_1^* = 1/K_1$ $\quad K_2^* = 1/K_2$

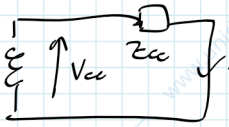
α = frazione di diff. tra K_1^* e K_2^*

$$= \frac{\alpha K_1^* \bar{V}_1}{2\bar{z}_{cc_1}}$$

$\bar{z}_{cc_1} = \bar{z}_{cc}$

$V_1 \sim V_2$

$$\bar{I} = \frac{\alpha K_1^* \bar{V}_1}{2\bar{z}_{cc_2}} \Rightarrow I_n = \frac{V_{cc}}{z_{cc}} \Rightarrow$$



prova di corto

$$= \frac{V_{cc}}{2z_{cc}} < \frac{I_n}{2}$$

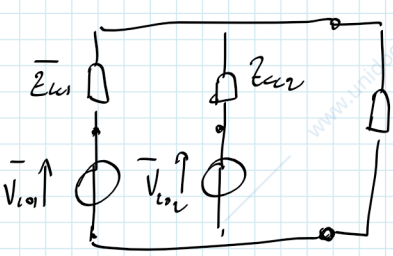
che se $\alpha = V_{cc\%}$ a VUOTO circolerebbe $I_n/2$

I CONDIZIONE: I RAPPORTI DI TRASF. DEVONO ESSERE UGUALI

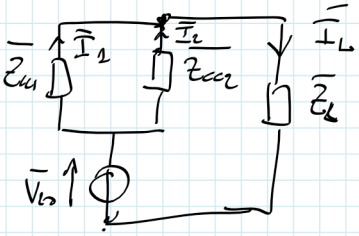
MOLTO STRINGENTE

FUNZIONAMENTO A CARICO

$\bar{V}_{20_1} = \bar{V}_{20_2} = \bar{V}_{20}$



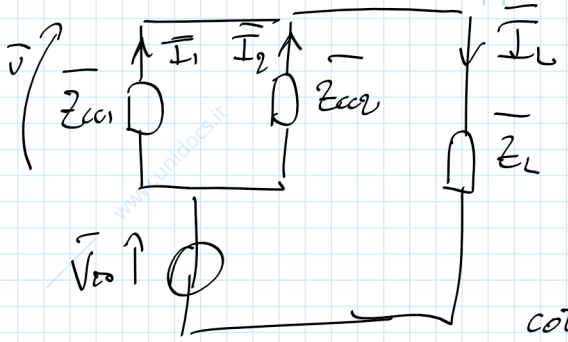
$\Rightarrow$



Le potenze nom. possono essere div.

$A_{2n} = V_{20} I_{1n}$

$A_{2n} = V_{20} I_{2n}$



$\rightarrow A_{1n} = V_{20} I'_{1n}$ (100 kVA) $\qquad A_{2n} = V_{20} I''_{2n}$ (50 kVA)

$\rightarrow$ 150 kVA $\Rightarrow V_{20} I_L$

in condizioni nominali:

$I'_{1n} = 2 I''_{2n}$ $\qquad \frac{1}{3} I_L = I''_{2n}$

corr. in cond. quadr. $\rightarrow$ $\qquad \frac{2}{3} I_L = I'_{1n}$

FATTORE DI CARICO $\alpha_1 = \frac{I_1}{I'_{1n}}$ $\qquad \alpha_2 = \frac{I_2}{I''_{2n}}$

in tutte le condizioni $\boxed{\alpha_1 = \alpha_2}$

$\bar{Z}_{cc1} \bar{I}_1 = \bar{Z}_{cc2} \bar{I}_2 \Rightarrow \frac{\bar{I}_1}{\bar{I}_2} = \frac{\bar{Z}_{cc2}}{\bar{Z}_{cc1}} \Rightarrow \frac{\bar{I}_1}{\bar{I}_2} \cdot \frac{\bar{I}''_{2n}}{\bar{I}''_{2n}} = \frac{\bar{Z}_{cc2}}{\bar{Z}_{cc1}} \cdot \frac{\bar{I}''_{2n}}{\bar{I}'_{1n}}$ (α_1 $\quad$ $1/\alpha_2$)

$\frac{\alpha_1}{\alpha_2} = \frac{Z_{cc2} I''_{2n}}{Z_{cc1} I'_{1n}} = \frac{V_{cc2}}{V_{cc1}} = \frac{v_{cc\%2} V_{20}}{v_{cc\%1} V_{20}} = \frac{v_{cc\%2}}{v_{cc\%1}}$

(V_{cc2} sopra $Z_{cc2} I''_{2n}$; V_{cc1} sotto $Z_{cc1} I'_{1n}$)

II CONDIZIONE: $\times$ avere $\alpha_1 = \alpha_2$ in tutte le cond. di funz

$v_{cc\%1} = v_{cc\%2}$

NON STRINGENTE

$\alpha_1 = 80\%$ (100 kVA) $\rightarrow$ 80% · 100 · kVA

$\alpha_2 = 90\%$ (50 kVA) $\rightarrow$ 90% 50 kVA

se il carico aumenta α_2 aggr. il 100% prima di α_1

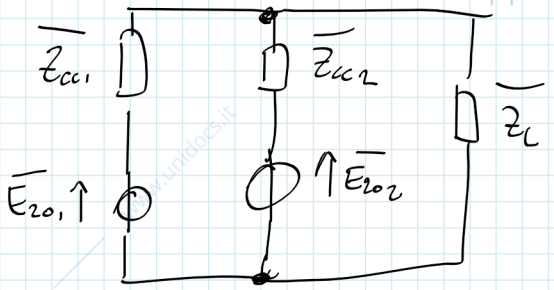
non riesco a fornire 100 + 50

Posso sovraccaricare ($\alpha > 100\%$) ma solo x brevi periodi

CONDIZIONI X UN BUON PARALLELO (MONOFASE)

I COND: Stesso rapporto di trasf. $\Rightarrow$ Eguale I a vuoto

II COND: Stessa tensione di corto circ. $\Rightarrow \alpha_1 = \alpha_2$



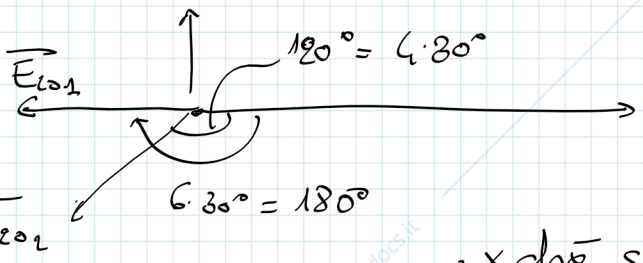
$\bar{E}_{20,1} = \bar{E}_{20,2} \Rightarrow V_{20,1} = V_{20,2}$

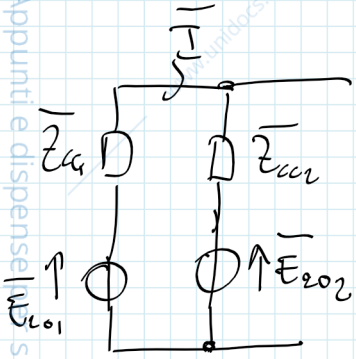
Le prime due condizioni valgono anche per il Trifase

$K_1 = \frac{V_{1n}}{V_{20}} \overset{\text{conc}}{=} K_2$

Yy 6	Yy 4
K_1	$= K_2$
$V_{cc\%1}$	$= V_{cc2\%}$

INDICE ORARIO È LO SFAS. DI RIF. DELLA TENS. SEC.

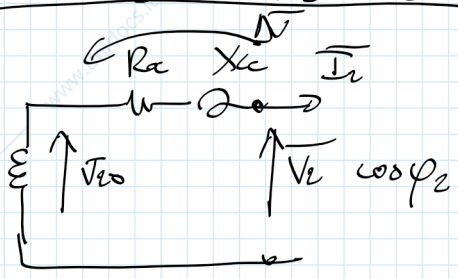


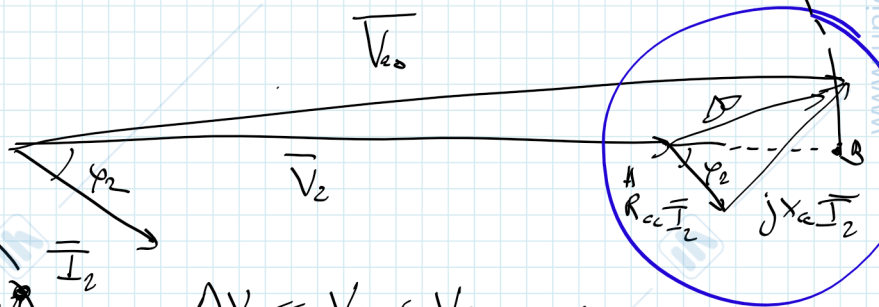


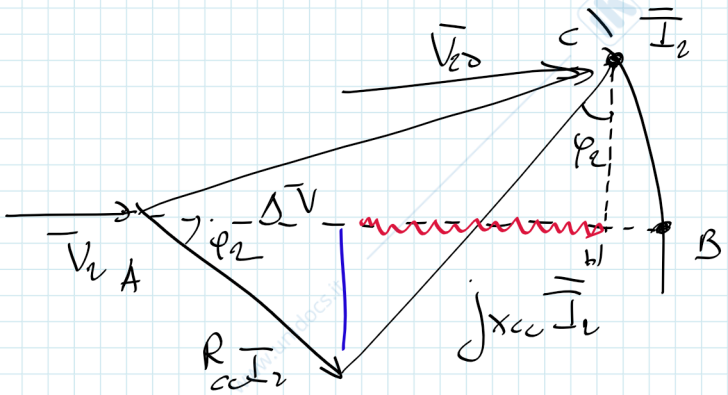
$\bar{I} = \frac{\bar{E}_{20,1} - \bar{E}_{20,2}}{\bar{Z}_{cc1} + \bar{Z}_{cc2}} \neq 0$ ← x dhè sfasato !!

III COND: Stesso indice orario STRINGENTE !!

CADUTA DI TENSIONE APPROX.







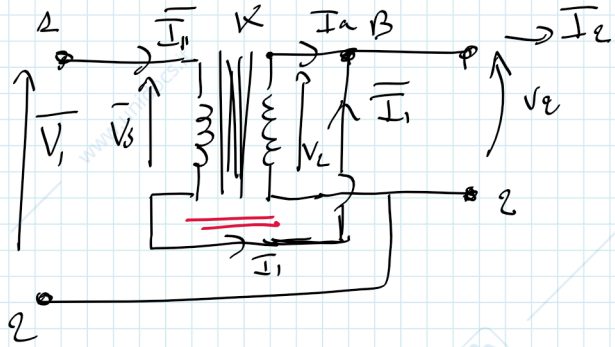
$\Delta V \ll V_2 \in V_{20}$ V_2 è in fase V_{20}

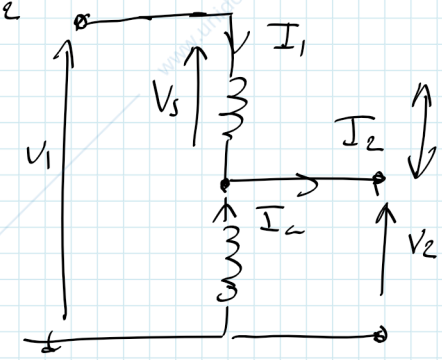
$AB \simeq AH$

$\Delta V \simeq R_{cc} I_2 \cos\varphi_2 + X_{cc} I_2 \sin\varphi_2$

$V_{20} = V_2 + \Delta V$

AUTOTRASFORMATORE





$$\bar{V}_s = \frac{N_1}{N_2}\bar{V}_2 = K\bar{V}_2$$

$$I_a = \frac{N_1}{N_2} I_1 = K I_1$$

$$\bar{V}_1 = \bar{V}_s + \bar{V}_2 = \frac{N_1}{N_2} V_2 + V_2 = \frac{N_1 + N_2}{N_2} V_2 \qquad K = \frac{N_1 + N_2}{N_2}$$

$$\bar{I}_1 = \bar{I}_2 - \bar{I}_a = I_2 - \frac{N_1}{N_2} I_1 \Rightarrow \frac{N_1 + N_2}{N_2} I_1 = I_2$$

$$V_1 I_1 = \frac{N_1 + N_2}{N_2} V_2 \cdot \frac{N_2}{N_1 + N_2} I_2 = V_2 I_2$$

$V_s I_1$ potenza dim I bobina (V, I applicata alla bobina) *

$$A_D = \underbrace{\frac{N_1}{N_2}}_{V_s} V_2 \cdot I_1 = \frac{N_1}{N_2} V_2 \cdot I_2 \cdot \frac{N_2}{N_1 + N_2} = \underbrace{\frac{N_1}{N_1 + N_2} V_2 I_2}_{A_{TRASFORM.}}$$

↑ DI DIMENSIONAMENTO

$$A_D = \frac{N_1}{N_1 + N_2} A_T \qquad \boxed{A_D < A_T}$$

SI PERDE L'ISOLAMENTO

$K = 1 \Rightarrow$ TRASFORMATORI DI ISOLAMENTO (SEPARO GALVANICAM. IL PRIMARIO DAL SECONDARIO)

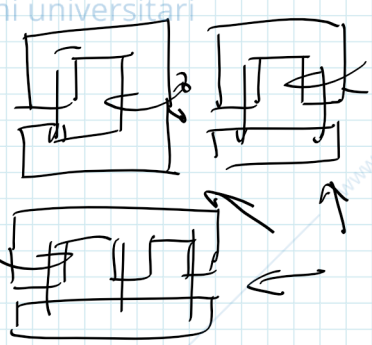
$$\sigma = \frac{B^2}{2\mu_0}$$

PRESSIONE MAGNETICA $\left(\frac{N}{m^2}\right)$

Impasto

$\varphi = BA$

$\mathcal{R} \equiv$



$$\sigma = \frac{1^2}{2 \cdot 4\pi \cdot 10^{-7}} = \frac{1}{2 \cdot 10^{-6}} = 500\ \frac{kN}{m^2}$$

~ 10

$$\sigma = \frac{D^2}{2\varepsilon_0} = \frac{\varepsilon_0^2 E^2}{2\varepsilon_0} = \frac{\varepsilon_0 E^2}{2}$$

$E = 1000\ V/mm = 10^6\ V/m$ ↖ RIGIDITÀ DIELETTRICA ARIA

$$\sigma = \frac{10^{-11}\left(10^6\right)^2}{2} = \frac{10}{2} = 5\ N/m^2$$