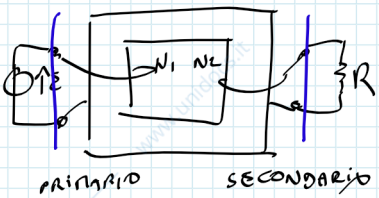
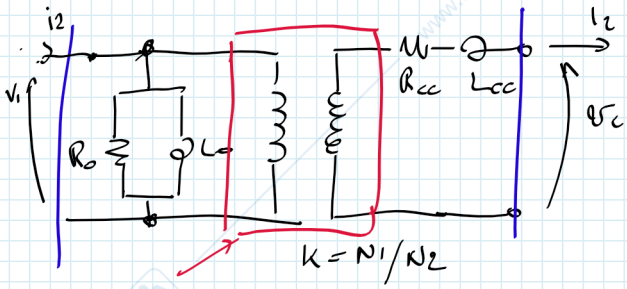
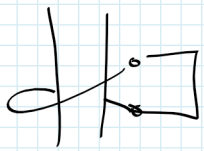
TRASFORMATORE



$N_1 > N_2$ ABBASSATORE

$N_1 < N_2$ INNALZATORE





TRASF. IDEALE $\rightarrow V_1 i_1 = V_2 i_2$ $\quad \frac{V_1}{V_2} = \frac{i_2}{i_1} = K$

R_{cc} → Resistenza avv. in rame

L_{cc} → Induttanza di dispersione

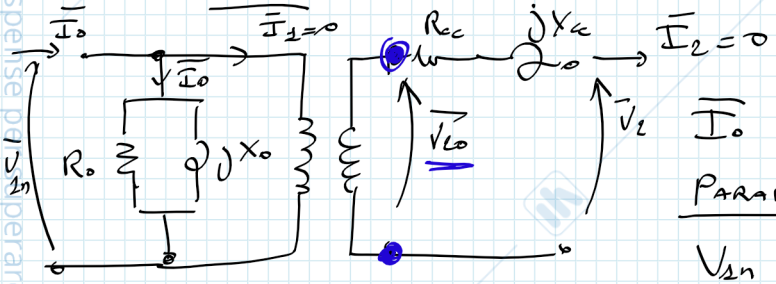
L_0 → Induttanza di magnetizzazione

R_0 → Resistenza "fittizia" → Perdite x isteresi e x corr. parass.

DUE TIPOLOGIE DI PROVE

PROVA A VUOTO → R_0, L_0 $\quad$ PROVA DI C.C. → R_{cc}, L_{cc}

PROVA A VUOTO → SENZA CARICO



$\bar{I}_0$ percorre il // di R_0, X_0

PARAMETRI NOMINALI

V_{1n} nom. primaria

V_{20} // secondario (a vuoto)

$A_n = V_{1n} I_{1n} = V_{20} I_{2n}$ [VA] ← APPARENTE

PROVA VUOTO → **TENSIONE NOMINALE**

si misurano:

P_0 → POTENZA A VUOTO (ATTIVA)

I_0 → corr. a vuoto

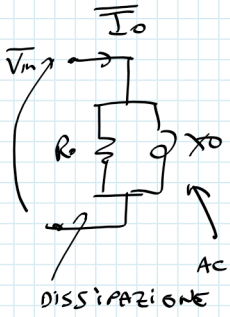
$p_0\% = \frac{P_0}{A_n} \cdot 100$ $\quad (1\% \div 10\%)$

$i_0\% = \frac{I_0}{I_{1n}} \cdot 100$ ← SULLA TARGA $\quad (1\% \div 5\%)$

$P_0 = \frac{p_0\%}{100} \cdot A_n$

$R_0 \rightarrow P_0 = V_{1n} \cdot I_0 \cos\varphi_0$ $\quad \cos\varphi_0 = \frac{P_0}{V_{1n} I_0}$

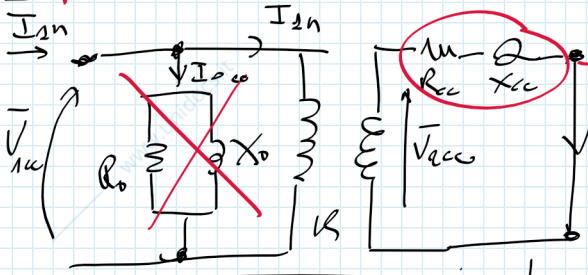
$X_0 \rightarrow Q_0 = V_{1n} I_0 \sin\varphi_0 \Leftarrow \varphi_0 = \arccos(\cos\varphi_0)$



$P_0 = \frac{V_{1n}^2}{R_0} \Rightarrow R_0 = \frac{V_{1n}^2}{P_0}$

$Q_0 = \frac{V_{1n}^2}{X_0} \Rightarrow X_0 = \frac{V_{1n}^2}{Q_0}$

PROVA CORTO CIRCUITO → annullo $\Rightarrow V_2 = 0$ (ai morsetti secondari)



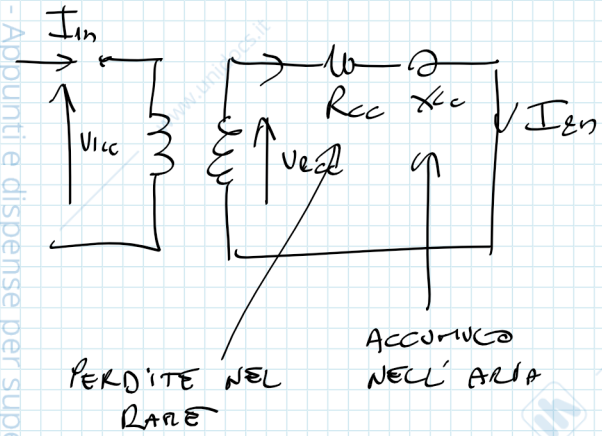
sono piccoli x costruzione
- ho limitato le perdite negli avv.
- ho limitato i flussi di dispersione

I_{2n} corr. nominale

V_{2cc} è ridotta $< V_{20}$

$$V_{2cc}\% = \frac{V_{2cc}}{V_{20}} \cdot 100 = \frac{V_{1cc}}{V_{1n}} \cdot 100 \quad (1 \div 10\%)$$

$$P_{cc}\% = \frac{P_{cc}}{A_n} \cdot 100 \quad (1 \div 10\%)$$

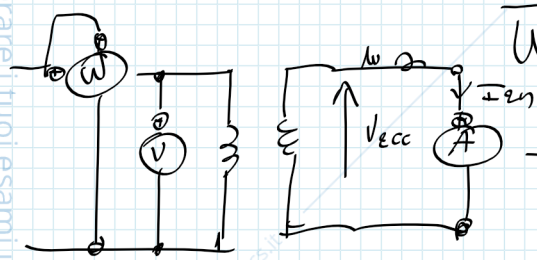


$$p_{cc} = \frac{P_{cc}\%}{100} \cdot A_n = V_{2cc} I_{2n} \cos\varphi_{cc}$$

$$\cos\varphi_{cc} = \frac{P_{cc}}{V_{2cc} I_{2n}} \Rightarrow Q_{cc} = V_{2cc} I_{2n} \sin\varphi_{cc}$$

$$P_{cc} = R_{cc} I_{2n}^2 \Rightarrow R_{cc} = \frac{P_{cc}}{I_{2n}^2}$$

$$Q_{cc} = X_{cc} I_{2n}^2 \Rightarrow X_{cc} = \frac{Q_{cc}}{I_{2n}^2}$$



$W = P_{cc}$

$V_{1cc} = K V_{2cc}$ ← piccola

A ≡ —

V ≡ — —

TARGA TRASFORMATORE

$$\frac{V_{1n}}{V_{20}} = \frac{I_{2n}}{I_{1n}} = \frac{N_1}{N_2} = K \quad \text{RAPP. DI TRASFORMAZIONE}$$

A_n = pot. App. nominale $= V_{1n} \cdot I_{1n} = V_{20} \cdot I_{2n}$

PROVA A VUOTO (V_{1n}) ← sottointeso

$$P_0\% = \frac{P_0}{A_n} \cdot 100 \quad \text{(ATTIVA)}$$

$$i_0\% = \frac{I_0}{I_{1n}} \cdot 100$$

PROVA CORTO CIRCUITO (I_{2n}) ←

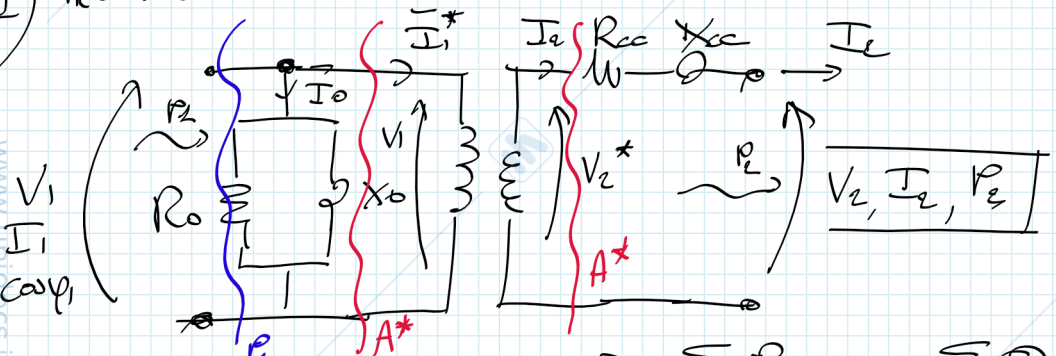
$$P_{cc}\% = \frac{P_{cc}}{A_n} \cdot 100 \quad \text{(ATTIVA)}$$

$$V_{cc}\% = \frac{V_{2cc}}{V_{20}} \cdot 100$$

Sia dato un trafo → DATI TARGA ($\cos\varphi_0$, $\cos\varphi_{cc}$)
Sia date le condiz. di alimentazione (i_0, P_0) (V_{cc}, P_{cc})

↓

1) TROVARE i PARAMETRI R_0, X_0, R_{cc}, X_{cc} dalle prove



$V_2 = 220\,V$ $P_2 = 1\,kW$
$I_2 = 10\,A$
$A_2 = V_2 I_2 = 220 \cdot 10 = 2200\,VA$

APP. BOUCHEROT. $\Rightarrow \Sigma P = 0$ $\Sigma Q = 0$

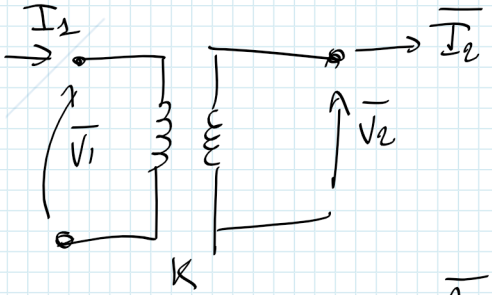
$$\begin{cases} P^* = P_2 + R_{cc} \cdot I_2^2 \\ Q^* = Q_2 + X_{cc} I_2^2 \end{cases} \quad \underline{A^*} = \sqrt{P^{*2} + Q^{*2}} = V_2^* \cdot \underline{I_2} \Rightarrow V_2^* = \frac{\underline{A^*}}{\underline{I_2}}$$

$V_1 = V_2^* \cdot K$ $\quad A^* = V_1 \cdot I_1^*$ (potenza trafo ideale)

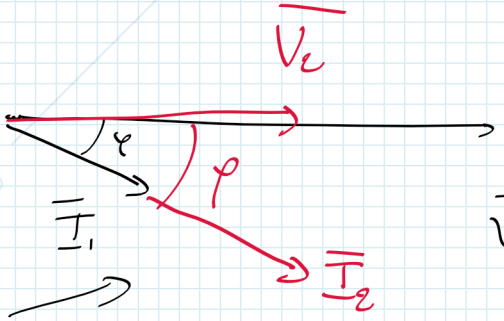
$$\rightarrow P_1 = P^* + \frac{V_1^2}{R_0} \qquad Q_1 = Q^* + \frac{V_1^2}{X_0} \qquad A_1 = \sqrt{P_1^2 + Q_1^2} = V_1 \underline{I_1}$$

$I_1 = \frac{A_1}{V_1}$ ⋐ ATT!! NO DA LKC !!

$\cos\varphi_1 = \frac{P_1}{V_1 I_1} = \frac{P_1}{A_1}$ FATTORE DI POTENZA



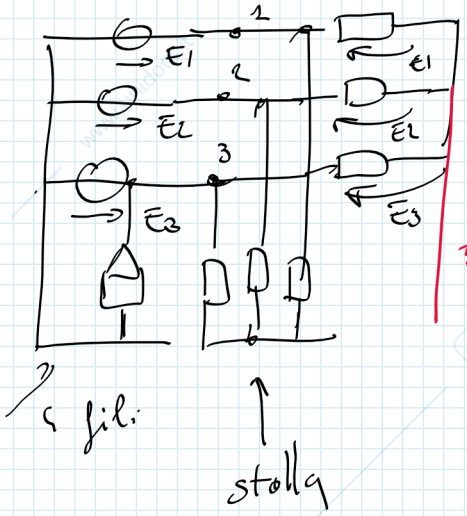
TRATO IDEALE $\quad \underline{A_1} = \underline{A_2}$

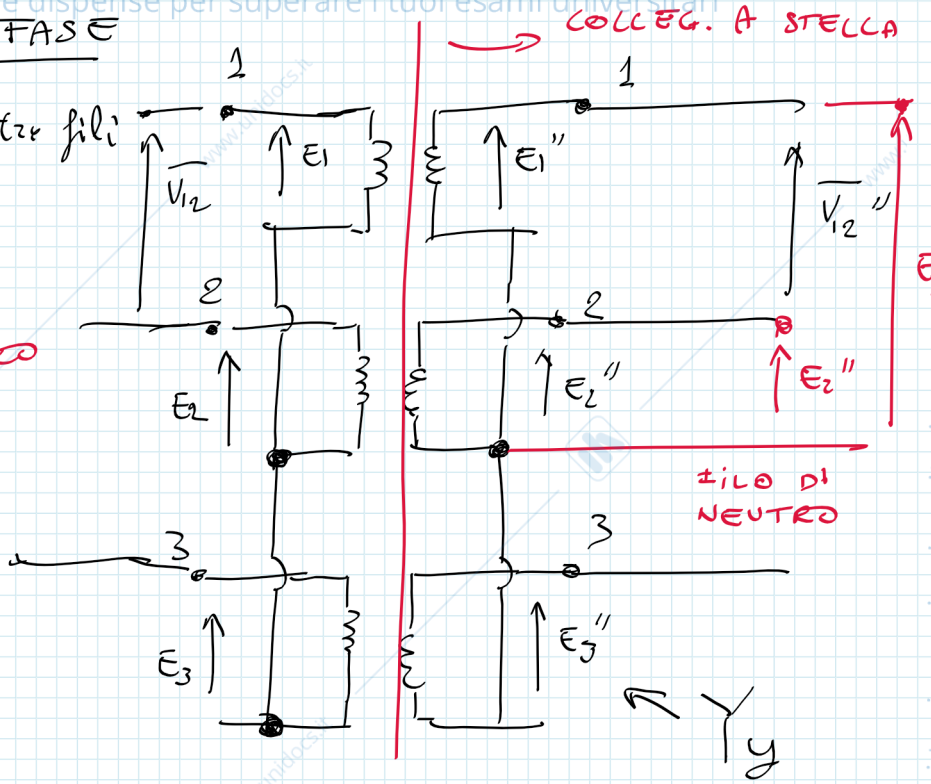


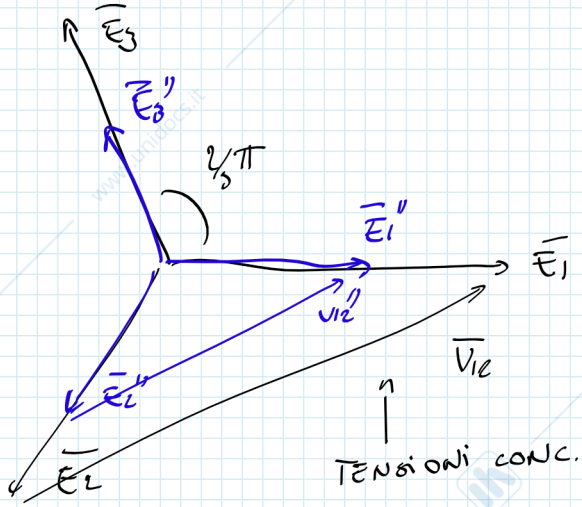
$\Rightarrow R_0$

$\underline{V_1 I_1} = \underline{V_2 I_2}$

TRASFORMATORE TRIFASE







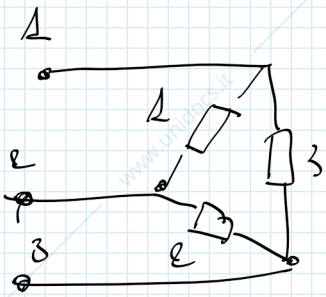
$$V_{12} = V_{23} = V_{31} = V = \sqrt{3}\,E = 380\,V$$

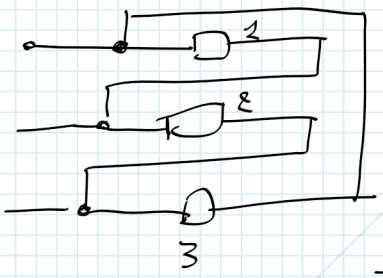
$$E_1 = E_2 = E_3 = E = 220\,V$$

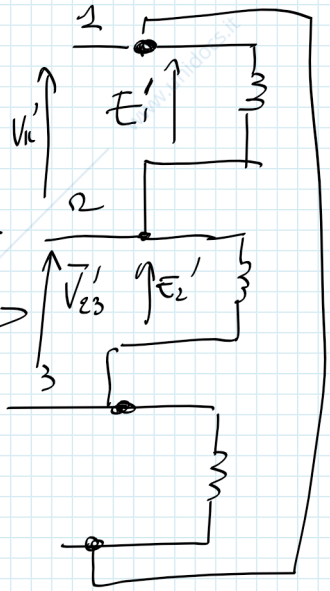
$$\bar{V}_{12} = \bar{E}_1 - \bar{E}_2$$

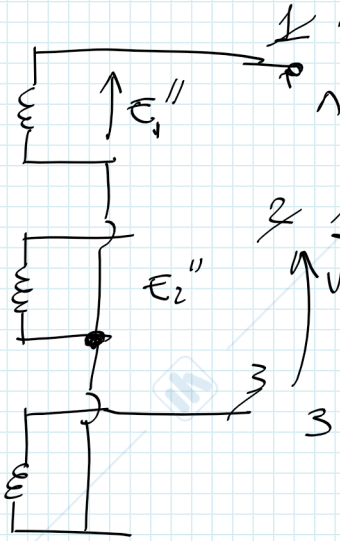
COLLEGAMENTO A STELLA → Y primario y secondario

COLLEGAMENTO A TRIANGOLO → D d

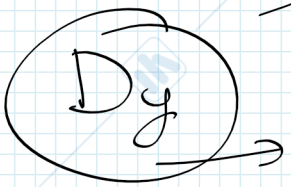


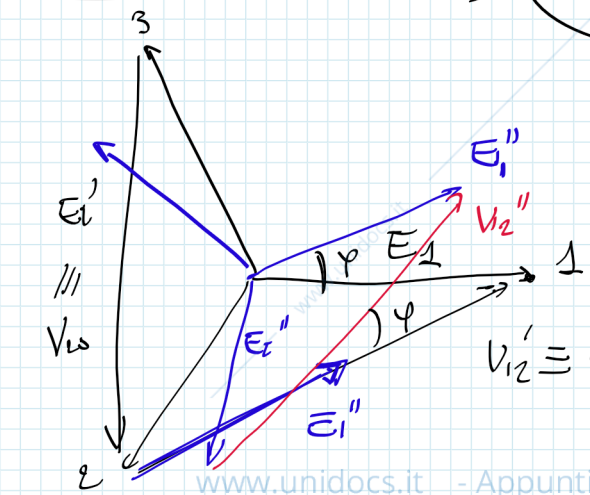






IL COLL. INFLUISCE SULLO SFASAMENTO





SEMPRE !!

$V_{12}' \equiv E_2'$ ↖ Tensione bobina $\neq E_1$