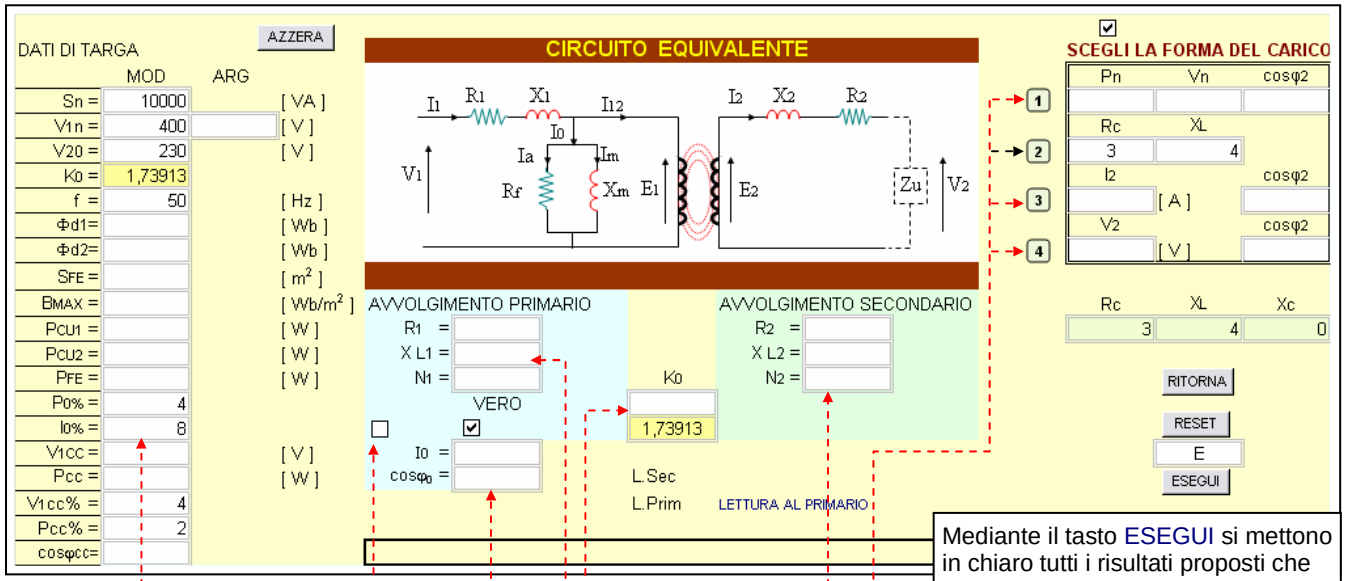
TRASFORMATORE
CIRCUITO EQUIVALENTE



Mediante il tasto ESEGUI si mettono in chiaro tutti i risultati proposti che si riescono a determinare mediante l'utilizzo del circuito equivalente fino al rifasamento

1 Si inseriscono i dati a disposizione del problema

Mediante il quadratino si può scegliere se la misura della corrente a vuoto è stata effettuata al primario o al secondario

2 Si inserisce una tipologia di carico

PARAMETRI A VUOTO

$I_{1n} = \frac{S_{1n}}{V_{1n}} =$ 2,5 [A]

$I_{2n} = \frac{S_{1n}}{V_{02}} =$ 4,347826 [A]

$\Phi_{max} = \frac{V1}{4{,}44 \cdot f \cdot N1} =$ [Wb]

$B_{max} = \frac{V1}{4{,}44 \cdot f \cdot N1 \cdot SFe} =$ [Wb/m²]

$N1 = \frac{V1}{4{,}44 \cdot f \cdot B_{max} \cdot SFe} =$

$N2 = \frac{V_{02}}{V_{1n}} \cdot N1 =$

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

$\cos\varphi_0$ dato =

$\cos\varphi_0 = \left(\frac{P_0\%}{I_0\%}\right) =$ 0,5

$\cos\varphi_0 = \frac{P_0\% \cdot S_{1n}}{100} \cdot \frac{1}{V_{1n} \cdot I_0} =$

FINALE

$\cos\varphi_0 =$ 0,5

$\varphi_0 = \cos^{-1}(\cos\varphi_0) =$ 60 [°]

$\text{sen}\varphi_0 =$ 0,866025

Io primario

$I_a = V_{1n} / R_f =$ 0,1 [A]

$I_m = V_{1n} / X_m =$ 0,173205 [A]

$I_0 = \sqrt{I_a^2 + I_m^2} =$ 0,2 [A]

Io dato= [A]

$I_0 = \frac{I_0\% \cdot I_{1n}}{100} =$ 0,2 [A]

FINALE

Io = 0,2 [A]

Io = 0,2

$I_a = I_0 \cos\varphi_0 =$ 0,1 [A]

$I_m = I_0 \text{sen}\varphi_0 =$ 0,173205 [A]

$P_{FE} = \frac{Po\% \cdot Sn}{100} =$ 40 [W]

40

P_{FE} dato = [W]

$P_{FE} = V_{1n} \cdot I_0 \cdot \cos\varphi_0 =$ 40 [W]

$P_{FE} = V_{1n} \cdot I_0 \cdot \cos\varphi_0 =$ 40

$Q_{FE} = P_{FE} \cdot \tan\varphi_0 =$ 69,28203 [VAR]

$R_f = \frac{V_{1n}^2}{P_{FE}} =$ 4000 [Ω]

$X_m = \frac{V_{1n}^2}{Q_{FE}} = \frac{V_{1n}^2}{P_{FE} \cdot \tan\varphi_0} =$ 2309,401 [Ω]

MOD ARG

$V_{20} = V_{1n} \cdot \frac{1}{K_0} =$ 230 0 [V]

$R_1 = \frac{P_{cu1}}{I_{1n}^2} =$ [Ω]

$X_{L1} = \omega L_1 = 2\pi \frac{\Phi_{d1}}{I_{1n}} =$ [Ω]

$R_2 = \frac{Pcu2}{I_{2n}^2} =$ [Ω]

$X_{L2} = \omega L_2 = 2\pi \frac{\Phi_{d2}}{I_{2n}} =$ [Ω]

$R''_{eq} = R_1 \left(\frac{N_2}{N_1}\right)^2 + R_2 =$ [Ω]

$X''_{eq} = X_1 \left(\frac{N_2}{N_1}\right)^2 + X_2 =$ [Ω]

$Z''_{eq} = \sqrt{R''^2_{eq} + X''^2_{eq}} =$ [Ω]

$\cos\varphi_{cc} = \frac{R''_{eq}}{Z''_{eq}} =$ [Ω]

$P_{cc} = R''_{eq} \cdot I_{2n}^2 =$ [W]

$R'_{eq} = R_2 \left(\frac{N_1}{N_2}\right)^2 + R_1 =$ [Ω]

$X'_{eq} = X_2 \left(\frac{N_1}{N_2}\right)^2 + X_1 =$ [Ω]

$Z'_{eq} = \sqrt{R'^2_{eq} + X'^2_{eq}} =$ [Ω]

$\cos\varphi_{cc} = \frac{R'_{eq}}{Z'_{eq}} =$ [Ω]

$Pcc = R'_{eq} \cdot I_{1n}^2 =$ [W]

V1cc dato=

$V_{1cc} = \frac{V1cc\% \cdot V_{1n}}{100} =$ 16 [V]

$V_{1cc} = \frac{Pcc\%}{\cos\varphi_{cc}} \cdot \frac{V_{1n}}{100} =$ [V]

V1CC = 16 [V]

$V_{2cc} = \frac{V_{1cc}(dato)}{K_0} =$ [V]

$V_{2cc} = Z''_{eq} \cdot I_{2n} =$ [V]

$V_{2cc} = \frac{V_{1cc}}{K_0} =$ 9,2 [V]

V2CC = 9,2 [V]

$\cos\varphi_{cc} = \frac{Pcc\%}{V1cc\%} =$ 0,5

$\cos\varphi_{cc} = \frac{Pcc}{V_{1cc} \cdot I_{1n}} =$

$\cos\varphi_{cc} = \frac{Pcc}{V_{2cc} \cdot I_{2n}} =$ 0,5

$\cos\varphi_{cc}$ dato =

$\cos\varphi_{cc} = \frac{R''_{eq}}{Z''_{eq}} =$

$\cos\varphi_{cc} = \frac{R'_{eq}}{Z'_{eq}} =$

FINALE

$\cos\varphi_{cc} =$ 0,5

$\varphi_{cc} = \cos^{-1}(\cos\varphi_{cc}) =$ 60 [°]

$Pcc = \frac{Pcc\% \cdot Sn}{100} =$ 20 [W]

$P_{cc} = V_{1cc} \cdot I_{1n} \cdot \cos\varphi_{cc} =$ 20 [W]

$P_{cc} = V_{2cc} \cdot I_{2n} \cdot \cos\varphi_{cc} =$ 20 [W]

$P_{cc} = R''_{eq} \cdot I_{2n}^2 =$ [W]

$Pcc = R'_{eq} \cdot I_{1n}^2 =$ [W]

Pcc dato [W]

FINALE

Pcc= 20 [W]

20 [W]

$Z''_{eq} = \frac{V_{1cc} \cdot \frac{1}{K_0}}{I_{2n}} =$ 2,116 [Ω]

$R''_{eq} = Z''_{eq} \cos\varphi_{cc} =$ 1,058 [Ω]

$X''_{eq} = Z''_{eq} \text{sen}\varphi_{cc} =$ 1,83251 [Ω]

$R''_{eq} = \frac{Pcc}{I_{2n}^2} =$ 1,058 [Ω]

$X''_{eq} = R''_{eq} \tan\varphi_{cc} =$ 1,83251 [Ω]

$Z''_{eq} = \sqrt{R''^2_{eq} + X''^2_{eq}} =$ 2,116 [Ω]

$R'_{eq} = \frac{Pcc}{I_{1n}^2} =$ 3,2 [Ω]

$X'_{eq} = R'_{eq} \tan\varphi_{cc} =$ 5,542563 [Ω]

$Z'_{eq} = \sqrt{R'^2_{eq} + X'^2_{eq}} =$ 6,4 [Ω]

$P_{cc} = R'_{eq} \cdot I_{1n}^2 =$ 20 [W]

$Q_{cc} = X'_{eq} \cdot I_{1n}^2 =$ 34,64102 [VAR]

$P_{cc} = R''_{eq} \cdot I_{2n}^2 =$ 20 [W]

$Q_{cc} = X''_{eq} \cdot I_{2n}^2 =$ 34,64102 [VAR]

$\cos\varphi_{cc} = \frac{R''_{eq}}{Z''_{eq}}$ = 0,5

R''_{eq} = 1,058 [Ω]
X''_{eq} = 1,83251 [Ω]
Z''_{eq} = 2,116 [Ω]

R'_{eq} = 3,2 [Ω]
X'_{eq} = 5,542563 [Ω]
Z'_{eq} = 6,4 [Ω]

$\varphi_{cc} = \varphi_{Zeq'} = \tan^{-1}\left[\frac{X'_{eq}}{R'_{eq}}\right]$ = 60 [°]

$\varphi_{cc} = \varphi_{Zeq''} = \tan^{-1}\left[\frac{X''_{eq}}{R''_{eq}}\right]$ = 60 [°]

I1n = 2,5 [A]
I2n = 4,347826 [A]

SOLUZIONE APPROSSIMATA

$I_2 = \frac{\Delta V}{Z''_{eq}\cdot\cos(\varphi_{Zeq''}+\varphi_2)}$ = [A]
32,37012 [A]

$\Delta V = I_2\cdot\left|\left(R''_{eq}\cos\varphi_2\right)+\left(X''_{eq}\operatorname{sen}\varphi_2\right)\right|$ = 68,00341 [V]
68,00341

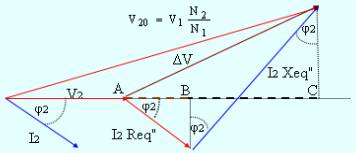
$I_2 = \frac{V_{20}}{\sqrt{\left(R''_{eq}+R_C\right)^2+\left(X''_{eq}+X_C\right)^2}}$ = 32,37012 [A]

$\Delta V = V_{02} - V_2$ = [V]

$V_2 = V_{02} - \Delta V$ = 161,9966 [V]

$\Delta V\% = \frac{\Delta V}{V_{02}}\cdot 100$ = 29,5667 %

I2 = [A]
$V_2 = \sqrt{R_C^2+X_C^2}\cdot I_2$ = 161,8506 [V]
cosφ2 = 0,6
senφ2 = 0,8
INDUTTIVO φ2 = 53,1301



Rc = 3 [Ω]
Xc = 4 [Ω]
$R'_C = R_C\cdot K_0^2$ = 9,073724 [Ω]
$X'_C = X_C\cdot K_0^2$ = 12,0983 [Ω]

$P_2 = V_2 I_2\cos\varphi_2$ = 3143,475 [W]

$P_{cu} = P_{cc}\left(\frac{I_2}{I_{2n}}\right)^2$ = 1108,599 [W]

$P_{cu} = R_1\cdot I_1^2 + R_2\cdot I_2^2$ = [W]

$P_{cu} = \left[R_1\left(\frac{N_2}{N_1}\right)^2 + R_2\right]I_2^2$ =

P_{FE} = 40 [W]

$\eta = \frac{P_2}{P_2 + P_{FE} + P_{cu}}$ = 0,732391

$\cos\varphi_0 = \frac{P_0}{V_{1n}\cdot I_0}$ = 0,5
$\varphi_0 = \cos^{-1}(\cos\varphi_0)$ = 60
$\operatorname{sen}\varphi_0$ = 0,866025

Ia= 0,1 [A]
Im= 0,173205 [A]
Io = 0,2 [A]

$\eta_{conv} = \frac{V_{20} I_2\cos\varphi_2}{V_{20} I_2\cos\varphi_2 + P_{Fe} + P_{cu}}$ = 0,795466

$I_{12} = \frac{V_{1n}}{\sqrt{\left(R'_{eq}+R'_C\right)^2+\left(X'_{eq}+X'_C\right)^2}}$ = 18,61282 [A]

$I_{12} = I_2\cdot\frac{V_{20}}{V_{1n}}$ = 18,61282 [A]

$I_1 = \sqrt{(I_0\cos\varphi_0 + I_{12}\cos\varphi_{12})^2 + (I_0\operatorname{sen}\varphi_0 + I_{12}\operatorname{sen}\varphi_{12})^2}$ = 18,81212 INDUTTIVO
18,81212

$I_1 = \sqrt{(I_0\cos\varphi_0 - I_{12}\cos\varphi_{12})^2 + (I_0\operatorname{sen}\varphi_0 + I_{12}\operatorname{sen}\varphi_{12})^2}$ =

$\cos\varphi_{12} = \cos\left\{\tan^{-1}\left[\frac{(X'_{eq}+X'_C)}{(R'_{eq}+R'_C)}\right]\right\}$ = 0,571122

$\operatorname{sen}\varphi_{12} = \operatorname{sen}\left\{\tan^{-1}\left[\frac{(X'_{eq}+X'_C)}{(R'_{eq}+R'_C)}\right]\right\}$ = 0,820865

POTENZE ATTIVE REATTIVE E APPARENTI AL SECONDARIO E AL PRIMARIO
RENDIMENTO

$Q_{FE} = P_{FE}\cdot\tan\varphi_0$ = 69,28203 [VAR]

$Q_2 = V_2\cdot I_2\cdot\operatorname{sen}\varphi_2$ = 4191,3 [VAR]

$Q_{Fe} = V_1\cdot I_0\cdot\operatorname{sen}\varphi_0$ = 69,28203 [VAR]

$Q_{X''_{eq}} = X''_{eq}\cdot I_2^2$ = 1920,149 [VAR]

$P_2 = V_2 I_2\cos\varphi_2$ = 3143,475 [W]

$P_{cu} = P_{cc}\left(\frac{I_2}{I_{2n}}\right)^2$ = 1108,599 [W]

P_{FE} = 40 [W]

$\eta = \frac{P_2}{P_2 + P_{FE} + P_{cu}}$ = 0,732391

$Q_1 = Q_2 + Q_{Fe} + Q_{Xeq'}$ = 6180,731 [VAR]

$P_1 = P_2 + P_{FE} + P_{cu}$ = 4292,073 [W]

$S_1 = \sqrt{P_1^2 + Q_1^2}$ = 7524,848 [VA]

$I_1 = \frac{S_1}{V_1}$ = 18,81212 [A]

$\cos\varphi_1 = \frac{P_1}{S_1}$ = 0,570387

φ_1 = 55,2228 [°]

RIFASAMENTO

IMPORRE $\cos\varphi_{rif}$
$\cos\varphi_{rif}$ = 0,9
φrif = 25,84193 [°]

$C_{rif} = \frac{P_1\left(\tan\varphi_1 - \tan\varphi_{rif}\right)}{\omega V_1^2}$ = 8,16E-05 [F]

RIEPILOGO RISULTATI

R1	X L1	N1	R2	X L2	N2	K0	R"eq	X"eq	Z"eq	R'eq	X'eq	Z'eq
						1,73913	1,058	1,83251	2,116	3,2	5,542563	6,4

Rf	Xm	V1n	V20	V1cc	V2cc	Io	Ia	Im	I2n	I1n	I12	I1
4000	2309,401	400	230	16	9,2	0,2	0,1	0,173205	4,347826	2,5	18,61282	18,81212

V2	I2	cosφ2	Rcar	Xcar	ΔV	Pcu1	Pcu2	Pcc	P2	Pcu	PFE
161,8506	32,37012	0,6	3	4	68,00341			20	3143,475	1108,599	40

cosφ12	cosφcc	φcc	cosφ0	φ0
0,571122	0,5	60	0,5	0,5

Qcc	η	ηconv	QFE
34,64102	0,732391	0,795466	69,28203