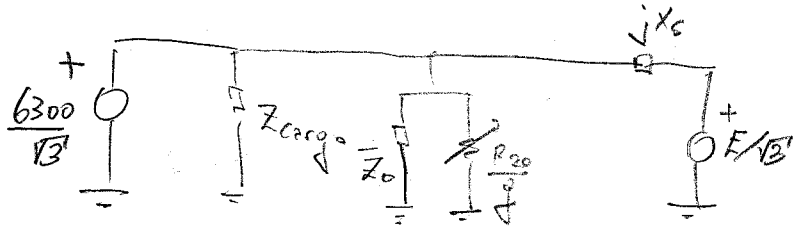
Problème 1

1)



MI $\quad g_N = \frac{1500-1470}{1500} = 0,02 \Rightarrow g_N = 2\%$ $\qquad 2\times10^6 = \frac{6300^2}{R_{20}} \times 0,02 \times 0,98$

$\Rightarrow R_{20} = 0,39\,\Omega$.

$Q_0 = \sqrt{(\sqrt{3}\times6300\times100)^2 - 76000^2} = 1,08\ MVAR = \frac{6300^2}{X_0} \Rightarrow X_0 = 36,75\,\Omega$

$P_0 = 76\times10^3\,W = \frac{6300^2}{R_0} \Rightarrow R_0 = 522,2\,\Omega$

Cargas : $\quad P_{carga} = 400\times0,8\ KW = 320\ KW$

$Q_{carga} = 400\times0,6\ KVAR = 240\ KVAR$

Ys $\quad X_s = 0,2 \times \frac{6,3^2}{1,5} = 5,3\,\Omega$

MI em vcão $\Rightarrow P_{MI} = 76\ KW \qquad Q_{MI} = 1,08\ KVAR.$

$P_{red} = P_{carga} + P_{MI} = 396\ KW$

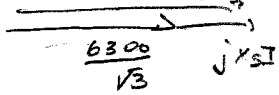
$Q_{red} = Q_{carga} + Q_{MI} = 1,32\ MVAR. \Rightarrow tg\,\varphi_{red} = \frac{Q_{red}}{P_{red}} = 3,33$

$\varphi_{red} = 73,3° \Rightarrow \cos\varphi_{red} = 0,29$ ind.

2) $\varphi_{red} = \text{Arcos}\ 0,95 = 18,2°$

$P_{red} = 396\ KW \Rightarrow Q_{red} = P_{red}\, tg\,\varphi_{red} = 1302\ KVAR = Q_{carga} + Q_{MI} - Q_{MS}$

$\Rightarrow \quad Q_{MS} = 1190\ KVAR \simeq 1,2\ MVAR.$



$I = \frac{1190\times10^3}{\sqrt{3}\times6300} = 109,2\ A \qquad E = \sqrt{3}\left(\frac{6300}{\sqrt{3}} + X_s I\right)$

$E = 7301,2\ V \Rightarrow i = 3,65\ A$

3) $\frac{6300^2}{157\times939} \times g = 8,83\times1500\times(1-g) \Rightarrow g = 902 = g_N \Rightarrow P_{MI} = (76 + 2000)\ KW$

$P_{red} = 2076 + 320 = 2396\ KW$

$Q_{carga} = 240\ KVAR \quad Q_{MI} = 1080\ KVAR \quad Q_{MS} = 1190 \Rightarrow Q_{red} = 1302\ KVAR$

$\Rightarrow \varphi_{red} = 3,11° \Rightarrow \cos\varphi_{red} = 0,998$ ind

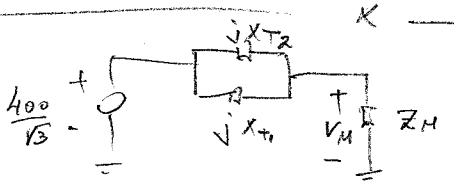
4) $\cos\varphi_{red} = 0{,}95 \Rightarrow \varphi_{red} = 18{,}2°$

$P_{red} = 2396\ KW \Rightarrow Q_{red} = P_{red}\ tg\ \varphi_{red} = 787{,}8\ KVAR = Q_{carga} + Q_{MI} - Q_{MS}$

$\Rightarrow Q_{MS} = 532{,}2\ KVAR = \sqrt{3} \times 6300\ I \Rightarrow I = \frac{532{,}2 \times 10^3}{\sqrt{3} \times 6300} = 48{,}8A.$

$E = \sqrt{3}\left(\frac{6300}{\sqrt{3}} + X_S\ I\right) = 6747{,}4V \Rightarrow \underline{i = 3{,}37\ A}$

Problema 2



$X_{T_1} = 0{,}06 \times \frac{400^2}{300 \times 10^3} = 0{,}032\ \Omega$

$X_{T_2} = 0{,}04 \times \frac{400^2}{200 \times 10^3} = 0{,}032\ \Omega$

1) $\bar{Z}_{cc} = \frac{100/\sqrt{3}}{480} \angle Arcos\left(\frac{12000}{\sqrt{3} \times 100 \times 480}\right) = 0{,}12 \angle 81{,}7 = (0{,}017 + 0{,}119)\ \Omega$

$X_1 + X_{2e} = 0{,}119\ \Omega \qquad R_1 = R_{2e} = 8{,}5 \times 10^{-3}\ \Omega.$

Arranque en $\lambda \Rightarrow (X_1 + X_{2e})_\lambda = 3 \times 0{,}119 = 0{,}357\ \Omega \qquad R_1 = R_{2e} = 3 \times 8{,}5 \times 10^{-3} = 0{,}0255\ \Omega$

$I_{Arr} = \frac{400/\sqrt{3}}{0{,}051 + j0{,}357 + j\frac{0{,}032}{2}} = \frac{231{,}2}{0{,}051 + j0{,}373} = \frac{231{,}2}{0{,}376 \angle \gamma} = \underline{614{,}9\ A \angle -\gamma}.$

2) $P_{red} = 440\ KW \Rightarrow P_{MI} = P_0 + P_{2e} = 440\ KW \qquad P_0 = 0 \Rightarrow P_{2e} = 440\ KW$

$440 \times 10^3 = 3\left(R_1 + \frac{R_{2e}}{g}\right) I_{2e}^2 \qquad I_{2e}^2 = \frac{400^2}{3}$

Iterando con g:

$$\begin{cases} 440 \times 10^3 = 3\left(R_1 + \frac{R_{2e}}{g}\right) I_{2e}^2 \Rightarrow I_{2e} = \sqrt{\frac{440 \times 10^3}{3\left(R_1 + \frac{R_{2e}}{g}\right)^2 + (X_1 + X_{2e})^2}} \\ \bar{I}_{2e} = I_{2e} \angle -Arctg\left(\frac{X_1 + X_{2e}}{R_1 + \frac{R_{2e}}{g}}\right) \\ \bar{I}_0 = 200\ \frac{V_M}{400} \angle -90° \\ \bar{I} = \bar{I}_{2e} + \bar{I}_0 \\ \bar{V}_f = j\frac{X_T}{2}\bar{I} + V_M \end{cases} \Rightarrow \begin{cases} |V_f| = \frac{400}{\sqrt{3}} \Rightarrow \text{Solución} \\ |V_f| \neq \frac{400}{\sqrt{3}} \end{cases}$

Supongo g:

$V_M = \sqrt{\left(R_1 + \frac{R_{2e}}{g}\right)^2 + j(X_1 + X_{2e})^2} \times I_{2e}$

↳ tomo como origen de fase.

Itero. ⟵ Solución

$g = 0{,}03$
$V_M = 387V$
$I_{2e} = 708{,}9A$
$\bar{I} = (654{,}5 - j461)A$
$|I| = 802\ A.$

3) $I_{NT_1} = \frac{302 \times 10^3}{\sqrt{3} \times 400} = 433{,}5A \qquad I_{NT_2} = \frac{200 \times 10^3}{\sqrt{3} \times 400} = 288{,}4A$

$I_{T_1} = I_{T_2} = \frac{802}{2} = 401A \Rightarrow T_1)\ 92{,}5\% \quad T_2)\ 139\% \Rightarrow$ Sobrecarga

4) $I_{M2x} = 2\ I_{NT_2} = 578A \Rightarrow S_{MAX} = \sqrt{3} \times 400 \times 578 = \underline{400\ KVA}$