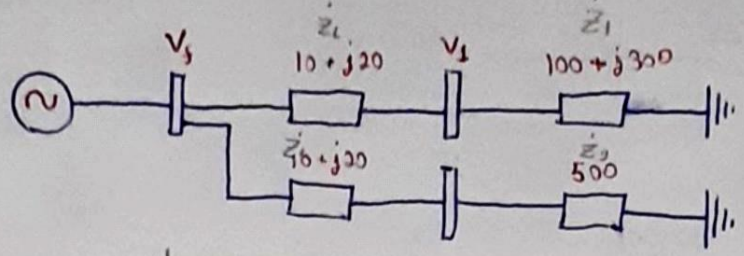
Wérikson F. de O. Alves - 96708 - ELT 492

Lista de exercícios - 2

5.2



$V_1 = 220\,V$; ABC; $V_{bn} \angle 0°$

a) V_s

b) V_2

c) I_T

d) FP

e) S

V = Linha

V' = Fase

a) $V_1 = 220\angle 30° \Rightarrow V_1' = \frac{220}{\sqrt{3}}\angle 0°$

$\dot{I}_1 = \frac{V_1'}{Z_1} \Rightarrow \dot{V}_s' = \dot{V}_1' + \hat{I}_1 \dot{Z}_L \Rightarrow \dot{V}_s = \dot{V}_1'\left[1 + \frac{\dot{Z}_L}{\dot{Z}_1}\right]\sqrt{3}\angle 30° = 235.41\angle 29.46°\ [V]$

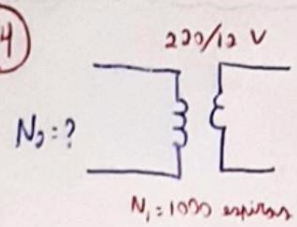
b) $\dot{I}_2 = \frac{V_s'}{\dot{Z}_2 + \dot{Z}_L} \Rightarrow \dot{V}_2' = \hat{I}_2 * \dot{Z}_2 \Rightarrow \dot{V}_2 = \left[\frac{\dot{V}_s'}{\dot{Z}_2 + \dot{Z}_L}\right]\left[\dot{Z}_2\right]\left[\sqrt{3}\angle 30°\right] = 230.62\angle 27.22°\ [V]$

c) $\dot{I}_T = \dot{I}_1 + \dot{I}_2 = \frac{\dot{V}_1'}{\dot{Z}_1} + \frac{\dot{V}_s'}{\dot{Z}_2 + \dot{Z}_L} = 0.56\angle -45.07°\ [A]$

d) $FP = \cos((+0.54°) - (-45.07°)) = 0.713$

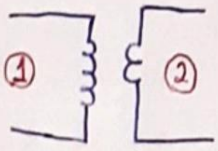
e) $S_{3\phi} = 235.41 \times 0.56 \times \sqrt{3} = 226.8\ [VA]$

5.4



$\frac{V_1}{V_2} = \frac{N_1}{N_2} \Rightarrow N_2 = 1000 \times \frac{12}{220} = \frac{600}{11} \simeq 55$ espiras

5.8



$r_1' = 0.5\,\Omega$

$x_1' = 1.5\,\Omega$

z_2 = ?

$\dot{z}_2$ = ?

conclusão?

$S_{b_1} = 1\,KVA$	$S_{b_2} = 1\,KVA$
$V_{b_1} = 220\,V$	$V_{b_2} = 110\,V$
$I_{b_1} = \frac{50}{11}\,A$	$I_{b_2} = \frac{100}{11}\,A$
$Z_{b_1} = \frac{242}{5}\,\Omega$	$Z_{b_2} = \frac{121}{10}\,\Omega$

$\dot{Z}_1 = 0.5 + 1.5j = \frac{\sqrt{10}}{2}\angle 71.57°\,\Omega$

$z_1 = \frac{\dot{Z}_1}{Z_{b_1}} = 0.03\angle 71.57°$ pu

$z_1 = 0.01 + 0.03j$ pu

$r = 1\%$ pu

$x = 3\%$ pu

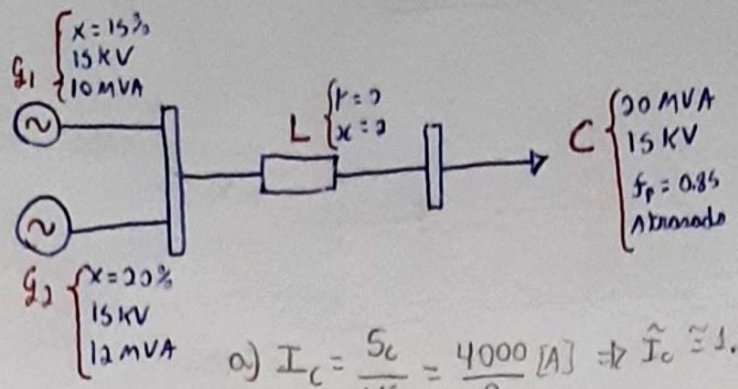
Impedância Refletida

$\dot{Z}_2 = \left(\frac{110}{220}\right)^2 \cdot \dot{Z}_1 = \frac{\sqrt{10}}{8}\angle 71.57° = 0.13 + 0.38j$

$z_2 = \frac{\dot{Z}_2}{Z_{b_2}} = 0.03\angle 71.57° = 0.01 + 0.03j$ pu $\Rightarrow$ $r = 1\%$ pu, $x = 3\%$ pu

Logo, conclui-se que os valores são iguais ao lado de alta tensão.

5.10



$V_{AN}^c = 15\angle 0°$ kV

$S_c = 20$ MVA

$\arccos(0.85) = 31.79°$

a) V_g'

b) r {20 MVA, 15 kV}

c) $S_{3\phi}$

a) $I_c = \frac{S_c}{V_{AN}^c} = \frac{4000}{3}$ [A] $\Rightarrow \hat{I}_c \cong 1.33\angle -31.79°$ [KA]

$\dot{V}_g' = \tilde{I}_c^* (\dot{Z}_L + \dot{Z}_c) = \hat{I}_c \dot{Z}_L + V_{AN}^c = 16.56\angle 7.87°$ [KV]

b) $S_b = 20$ MVA, $V_b = 15$ kV, $I_b = 1.33$ KA, $Z_b = 11.25\ \Omega$

Mudança de base

$X_1 = (0.15)\left(\frac{20M}{10M}\right)\left(\frac{15K}{15K}\right) = 0.3$ pu

$X_2 = (0.2)\left(\frac{20M}{12M}\right)\left(\frac{15K}{15K}\right) = 1/3$ pu

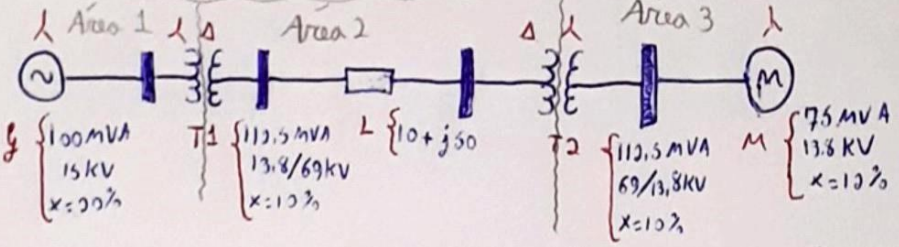
$X_{eq} = \frac{\left(\frac{3}{10}\right)\left(\frac{1}{3}\right)}{\left(\frac{3}{10}\right)+\left(\frac{1}{3}\right)} = \frac{3}{19}$

$X_{eq} = 0.1579 \Rightarrow 15.79\%$

c) $S_{3\phi} = \dot{V}_g' \cdot \hat{I}_c^* = 22.08\angle 39.66°$ MVA

5.14

$V_1 = aV_2$



a) Diagrama (150 MVA, 69 KV)

b) $V_m = 1$ pu, $f_p = 1$

$V_g' = ?$ $S_g = ?$

a) relação de transformação dos trafo: $T1 = \frac{\sqrt{3}}{5}\angle 30°$ e $T2 = \frac{5}{\sqrt{3}}\angle -30°$

$S_{b_2} = 150$ MVA, $V_{b_2} = 69$ KV $\angle 0°$

$V_{b_1} = 13.8$ KV, $S_{b_1} = 150$ MVA

$S_{b_3} = 150$ MVA, $V_{b_3} = 13.8$ KV

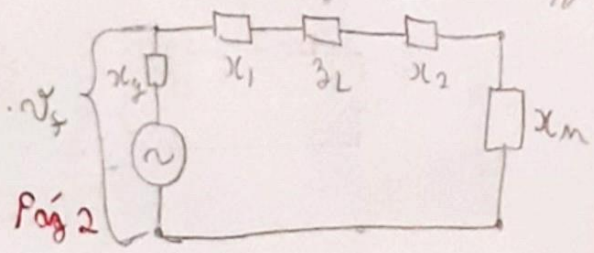
$X_g = (0.2j)\left(\frac{160}{100}\right)\left(\frac{15K}{13.8K}\right)^2 = 0.3544j$ pu

$X_1 = (0.1j)\left(\frac{150M}{112.5M}\right)\left(\frac{13.8K}{13.8K}\right)^2 = 0.1333j$ pu

$Z_{b_2} = \frac{V_{b_2}^2}{S_{b_2}} \Rightarrow Z_L = \frac{\dot{Z}_L}{Z_{b_2}} = \frac{\dot{Z}_L S_{b_2}}{V_{b_2}^2} = 0.3151 + 1.575j$ pu

$X_2 = (0.1j)\left(\frac{150M}{112.5M}\right)\left(\frac{13.8K}{13.8K}\right)^2 = 0.1333j$ pu

$X_m = (0.12j)\left(\frac{150}{95}\right)\left(\frac{13.8K}{13.8K}\right)^2 = 0.24j$ pu



b) $V_m = 1$ pu $\Rightarrow V_m = 1\angle 0°$ pu

$S_m = \frac{S}{S_b} = \frac{75M}{150M} = 0.5$ pu $\Rightarrow S_m = 0.5\angle 0°$ pu

$i = \frac{0.5}{1} = 0.5$ pu $\Rightarrow i = 0.5\angle 0°$ pu

$V_f = V_m + i(X_1 + X_2 + Z_L) = 1.48\angle 38.5$ pu

$V_f' = V_f \cdot V_{b_1} = 20.4\angle 38.50°$ [KV]

$S_f = V_f \cdot i = 1.48\angle 38.5° \cdot 0.5\angle 0° = 0.74\angle 38.5°$ pu

$S_f = S_b \cdot S_f = (150M)\cdot(0.74\angle 38.5) = 110.9\angle 38.5°$ [MVA]