05/11/2025

Revisão - Aula - Shuoga gravata
Eng Elétrica 10N

1- $V_{an} = 100\angle 0°\ V$ $\quad R_a = 10\Omega$ $\quad a = 1\angle 120°$

$V_{bn} = 50\angle -120°\ V$ $\quad R_b = 40\Omega$ $\quad a^2 = 1\angle 240°$ ou $1\angle -120°$

$V_{cn} = 80\angle 100°\ V$ $\quad R_c = 10\Omega$

$$\begin{bmatrix} I_a^0 \\ I_a^1 \\ I_a^2 \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix} \times \begin{bmatrix} 10\angle 0° \\ 1{,}25\angle -120° \\ 8\angle 100° \end{bmatrix} \text{ ou } \begin{bmatrix} 100\angle 0°\ V \\ 50\angle -120°\ V \\ 80\angle 100°\ V \end{bmatrix}$$

$$\begin{bmatrix} I_a^0 \\ I_a^1 \\ I_a^2 \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 10\angle 0° & 1{,}25\angle -120° & 8\angle 100° \\ 10\angle 0° & 1{,}25\angle 0° & 8\angle -20° \\ 10\angle 0° & 1{,}25\angle 120° & 8\angle -140° \end{bmatrix} = \begin{bmatrix} 3{,}49\angle 40{,}40° \\ 6{,}32\angle -8{,}29° \\ 1{,}73\angle -51{,}35° \end{bmatrix}$$

$I_a^0 = 3{,}49\angle 40{,}40°$

$I_a^1 = 6{,}32\angle -8{,}29°$

$I_a^2 = 1{,}73\angle -51{,}35°$

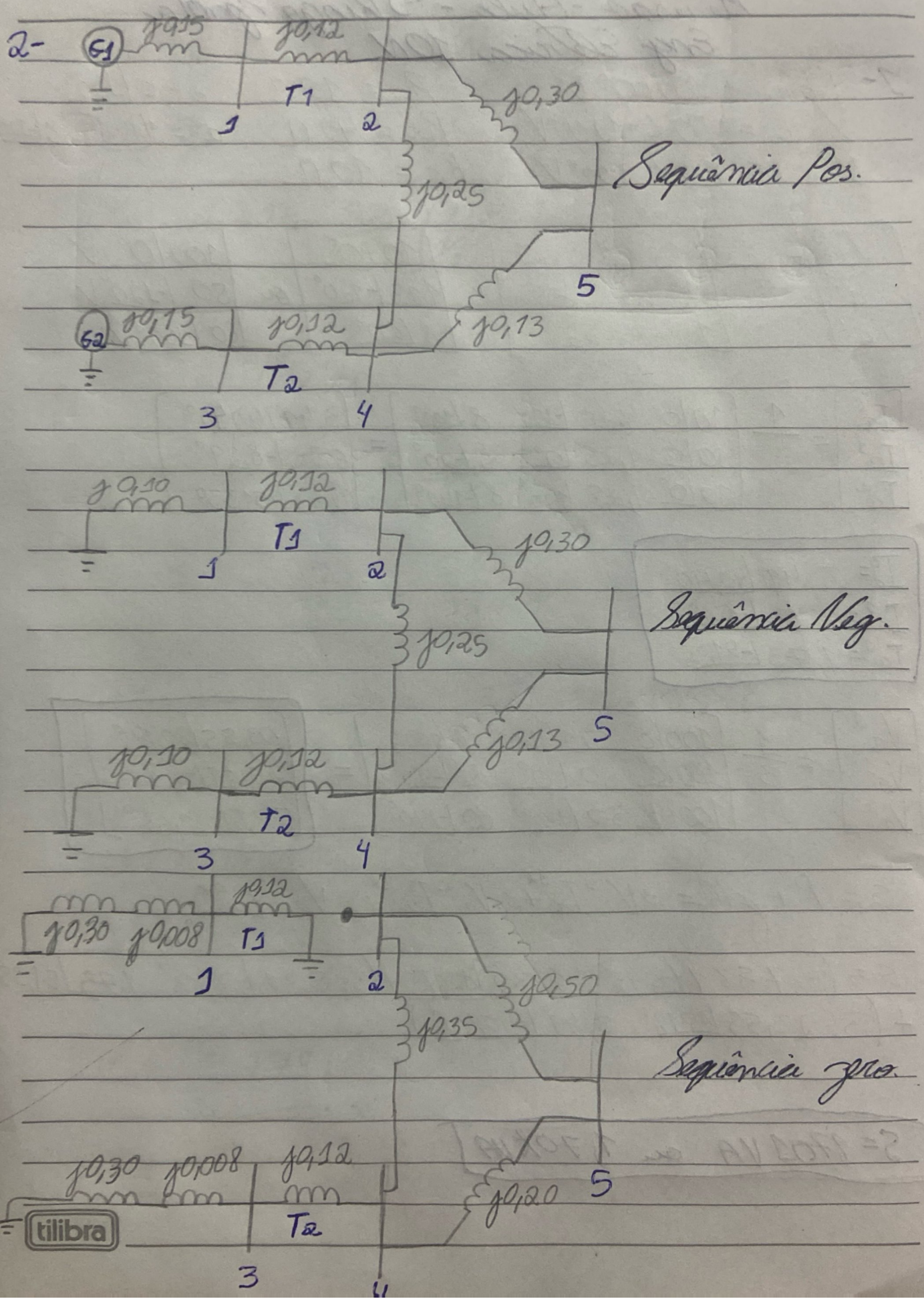
$$\begin{bmatrix} V_a^0 \\ V_a^1 \\ V_a^2 \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 100\angle 0° & 50\angle -120° & 80\angle 100° \\ 100\angle 0° & 50\angle 0° & 80\angle -20° \\ 100\angle 0° & 50\angle 120° & 80\angle -140° \end{bmatrix} = \begin{bmatrix} 23{,}55\angle 30{,}14° \\ 79{,}61\angle -6{,}93° \\ 5{,}31\angle -30{,}63° \end{bmatrix}$$

$$S = P + jQ = 3V_a^1 I_a^{1*} + 3 \cdot V_a^2 I_a^{2*} + 3 V_a^0 I_a^{0*}$$

$$S = (3 \cdot 79{,}61\angle -6{,}93° \cdot 6{,}32\angle 8{,}29° + (3 \cdot 5{,}31\angle -30{,}63° \cdot 1{,}73\angle 51{,}35°) + (3 \cdot 23{,}55\angle 39{,}14° \cdot 3{,}49\angle -40{,}40°).$$

$S = 1701\ VA$ ou $1{,}70\ kVA$

2-



3- $V_{bA} = 33\,KV$

$V_{bB} = \frac{110}{32} \cdot 33KV = 113,43\,KV$

$V_{bC} = V_{bB} = 113,43\,KV$

$V_{bD} = \frac{32}{110} \cdot 113,43KV = 33\,KV$

$Z_{T1}^{pu} = j0,08 \cdot \frac{100}{110} \cdot \left(\frac{110}{113,43}\right)^2 = j0,0683\,pu$

$Z_{T2}^{pu} = j0,08 \cdot \frac{100}{110} \cdot \left(\frac{32}{33}\right)^2 = j0,0683\,pu$

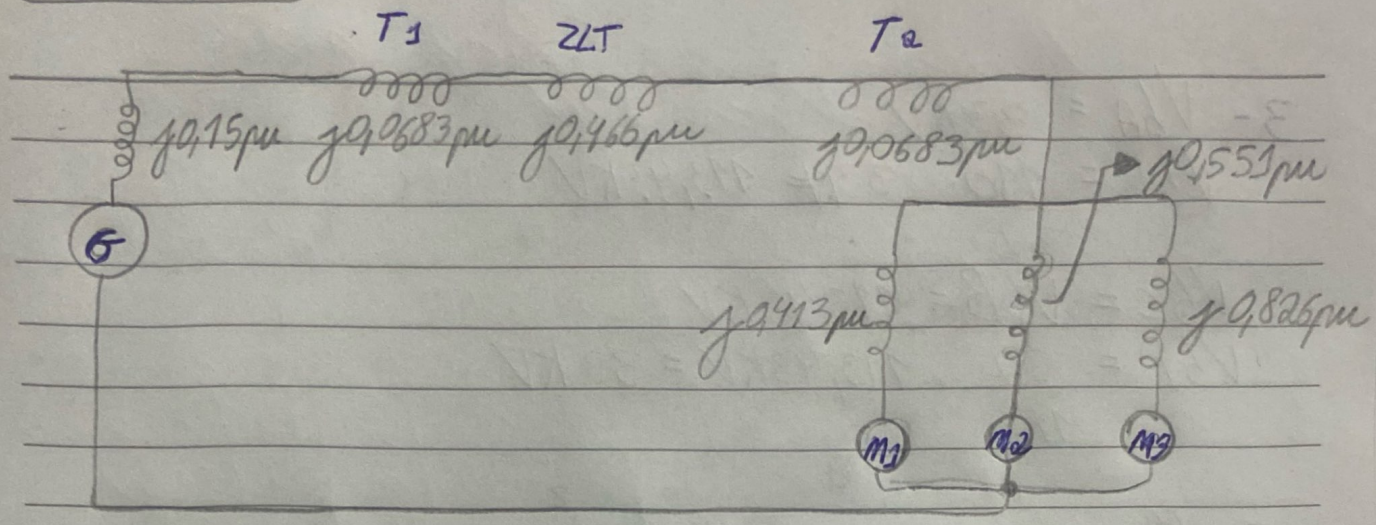
$Z_{LTbase} = \frac{(V_{bB})^2}{S_{base}} = \frac{(113,43)^2}{100} = 128,66\,\Omega$

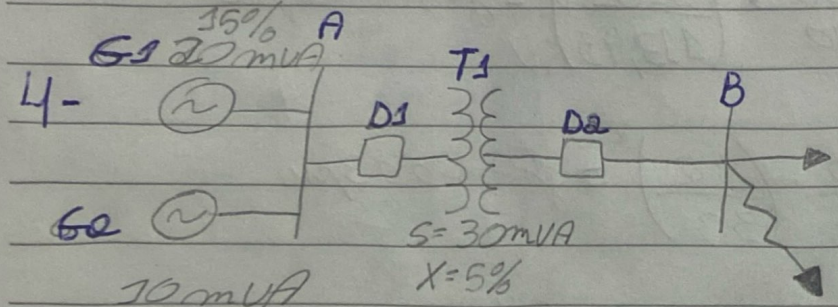
$Z_{LT}^{pu} = \frac{Z_{LT}}{Z_{LTBase}} = \frac{60}{128,66} = j0,466\,pu$

$Z_{m1}^{pu} = j0,2 \cdot \frac{100}{40} \cdot \left(\frac{30}{33}\right)^2 = j0,413\,pu$

$Z_{m2}^{pu} = j0,2 \cdot \frac{100}{30} \cdot \left(\frac{30}{33}\right)^2 = j0,551\,pu$

$Z_{m3}^{pu} = j0,2 \cdot \frac{100}{20} \cdot \left(\frac{30}{33}\right)^2 = j0,826\,pu$





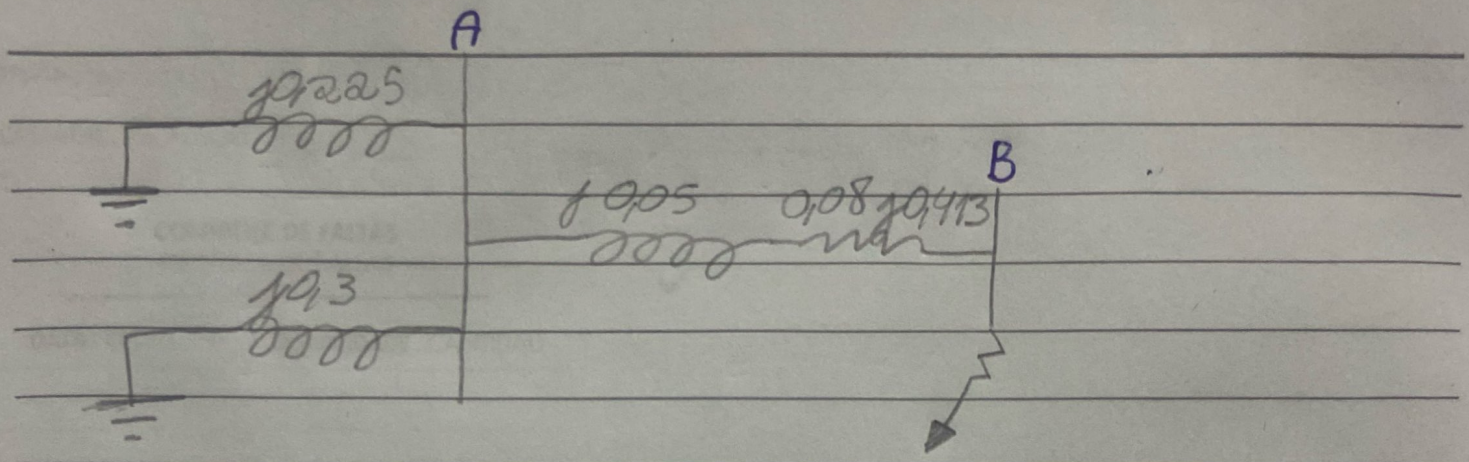
$$X_{G1} = j0,15 \cdot \frac{30}{20} \cdot \left(\frac{11}{11}\right)^2 = j0,225pu$$

$$X_{G2} = j0,1 \cdot \frac{30}{10} \cdot \left(\frac{11}{11}\right)^2 = j0,3pu$$

$$X_{T1} = j0,05 \cdot \frac{30}{30} \cdot \left(\frac{11}{11}\right)^2 = j0,05pu$$

$$R_b = \frac{(V_b^2)}{S_b} = \frac{(33)^2}{30} = 36,3\Omega$$

$$Z_{LT} = \frac{3 + j15}{36,30} = 0,08 + j0,413$$



$Zth = (0,08 + j0,413 + j0,05) + (j0,225 // j0,3)$

$Zth = 0,08 + j0,463 + j0,128$

$Zth = 0,596 pu$

$$I_{CC3}^{pu} = \frac{1 pu}{Zth} = -j1,676 pu$$

$$Ib = \frac{Sb}{\sqrt{3}\,Vb} \qquad Sb = \sqrt{3}.Vb.Ib$$

$$Ib = \frac{30.10^6}{\sqrt{3}.33.10^3} = 524,86A$$

$$I_{CC3} = I_{CC3}^{pu}.Ib = -j1,676 \times 524,86 = 879,96A$$

$S = \sqrt{3}.VL.I_{CC}$

$S = \sqrt{3}.33.10^3.879,96A = \boxed{50 mVA}$