a) $S_b = 100\ MVA$

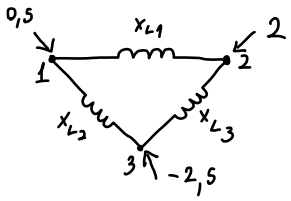
$P_G = 2\ pu$

$P_D = 2{,}5\ pu$

$X_{L_1} = 0{,}1\ pu$

$X_{L_2} = 0{,}05\ pu$

$X_{L_3} = 0{,}1\ pu$



$$[-B] = \begin{bmatrix} \frac{1}{x_{L_1}} + \frac{1}{x_{L_2}} & -\frac{1}{x_{L_1}} & -\frac{1}{x_{L_2}} \\ -\frac{1}{x_{L_1}} & \frac{1}{x_{L_1}} + \frac{1}{x_{L_3}} & -\frac{1}{x_{L_3}} \\ -\frac{1}{x_{L_2}} & -\frac{1}{x_{L_3}} & \frac{1}{x_{L_3}} + \frac{1}{x_{L_2}} \end{bmatrix} = \begin{bmatrix} 30 & -10 & -20 \\ -10 & 20 & -10 \\ -20 & -10 & 30 \end{bmatrix}$$

↳ Parte que interessa!

b) $$\begin{bmatrix} \theta_2 \\ \theta_3 \end{bmatrix} = \begin{bmatrix} 20 & -10 \\ -10 & 30 \end{bmatrix}^{-1} \cdot \begin{bmatrix} 2 \\ -2{,}5 \end{bmatrix} \Leftrightarrow \begin{matrix} \theta_2 = 0.07\ rad \\ \theta_3 = -0.06\ rad \end{matrix}$$

$$P_{12} \approx \frac{1}{x_{L_1}}(\theta_1 - \theta_2) = -0{,}7\ pu \rightarrow -70\ MW$$

$$P_{13} \approx \frac{1}{x_{L_2}}(\theta_1 - \theta_3) = 1{,}2\ pu \rightarrow 120\ MW$$

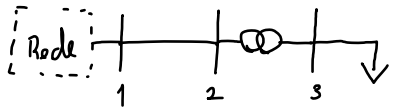
$$P_{23} \simeq \frac{1}{x_{L_3}}(\theta_2 - \theta_3) = 1{,}3\ pu \rightarrow 130\ MW$$

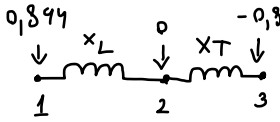
Logo $P_{L_1} = P_{21} = -P_{12} = 70\ MW$

$P_{L_2} = P_{13} = 120\ MW$

$P_{L_3} = P_{23} = 130\ MW$

Do teste B





$X_T = 0{,}04\ pu$

$$X_L = \frac{6{,}7}{\frac{(110\,kV)^2}{300\,k}} = 0{,}0201\ pu \approx 0{,}02\ pu$$

$$\frac{P_3}{S_b} = \frac{300\,k \cdot 0{,}894}{} = -0{,}894$$

$$\begin{bmatrix} P_1 \\ P_2 \\ P_3 \end{bmatrix} = \begin{bmatrix} \frac{1}{x_L} & -\frac{1}{x_L} & 0 \\ -\frac{1}{x_L} & \frac{1}{x_L} + \frac{1}{x_T} & -\frac{1}{x_T} \\ 0 & -\frac{1}{x_T} & \frac{1}{x_T} \end{bmatrix} \cdot \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \end{bmatrix}$$

Logo $$\begin{bmatrix} \theta_2 \\ \theta_3 \end{bmatrix} = \begin{bmatrix} 75 & -25 \\ -25 & 25 \end{bmatrix}^{-1} \begin{bmatrix} 0 \\ -0{,}894 \end{bmatrix} \Leftrightarrow \begin{matrix} \theta_2 = -0.01798\ rad \\ \theta_3 = -0.05364\ rad \end{matrix}$$

$$\Delta\theta = \theta_1 - \theta_3 = 0.05364\ rad \approx 3^\circ$$