

$$I_1 = 10,6 \angle 0^\circ \text{ A}$$

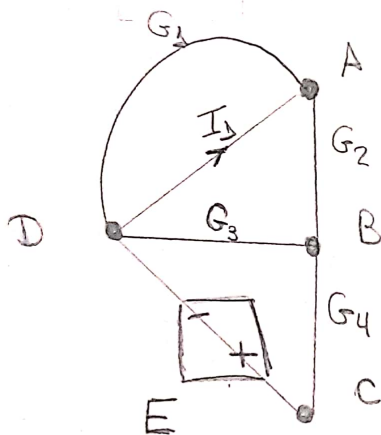
$$G_1 = 1/10 \text{ S}$$

$$G_2 = \frac{1}{1+j2} \text{ S}$$

$$G_3 = \frac{1}{-j5} \text{ S}$$

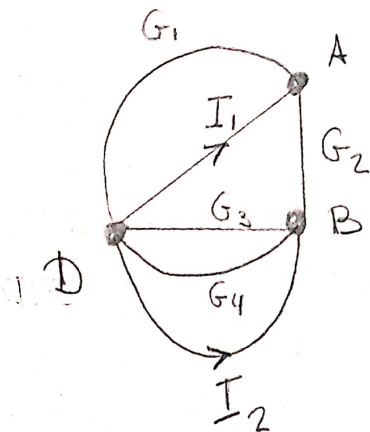
$$G_4 = \frac{1}{5} \text{ S}$$

grafo de potencial



$$I_x = (e_A - e_D) \cdot G_2$$

Super nodos: D <- C



$$e_C - e_D = E$$

$$e_C - e_D = 20 I_x$$

$$I_2 = 20 I_x \cdot G_4$$

$$\tilde{N} = Z \cdot I$$

$$\tilde{N} = \frac{1}{G} \cdot I \Rightarrow G \cdot \tilde{N} = I \Rightarrow \bar{G}^{-1} \cdot G \cdot \tilde{N} = \bar{G}^{-1} \cdot I$$

$$\tilde{N} = G^{-1} \cdot I$$

$$\begin{bmatrix} e_A \\ e_B \\ e_C \end{bmatrix} = \begin{bmatrix} G_1 + G_2 & -G_2 & -G_1 \\ -G_2 & (G_2 + G_3 + G_4) & -(G_3 + G_4) \\ -G_1 & -(G_3 + G_4) & (G_1 + G_3 + G_4) \end{bmatrix}^{-1} \begin{bmatrix} I_1 \\ I_2 \\ -(I_1 + I_2) \end{bmatrix}$$

$$\begin{cases} I_2 = 20 I_n G_4 \\ I_n = (e_A - e_B) \cdot G_2 \end{cases}$$

$$\begin{aligned} I_2 &= 20 \cdot (e_A - e_B) G_2 \cdot G_4 \\ &= \underbrace{20 G_2 G_4 e_A}_K - \underbrace{20 G_2 G_4 e_B}_K \end{aligned}$$

$$I = \begin{vmatrix} I_1 \\ 20 G_2 G_4 e_A - 20 G_2 G_4 e_B \\ -I_1 + 20 G_2 G_4 e_A + 20 G_2 G_4 e_B \end{vmatrix}$$

$$I = \begin{vmatrix} -I_1 \\ K e_A - K e_B \\ -I_1 - K e_A + K e_B \end{vmatrix}$$

$$\begin{bmatrix} e_A \\ e_B \\ e_D \end{bmatrix} = \begin{bmatrix} G_1 + G_2 & -G_2 & -G_1 \\ -G_2 + K & (G_2 + G_3 + G_4) + K & -(G_3 + G_4) \\ -G_1 + K & -(G_3 + G_4) - K & (G_1 + G_3 + G_4) \end{bmatrix} \begin{bmatrix} I_\Delta \\ 0 \\ I_\Delta \end{bmatrix}$$

$$K = 20 G_2 G_4 = 0.8 - j1.6$$

$$G = \begin{bmatrix} 0.3 - j0.4 & -0.2 + j0.4 & -0.1 \\ -1 + j2 & 1.2 - j1.8 & -0.2 - j0.2 \\ 0.7 - j1.6 & -1 + j1.4 & 0.3 + j0.2 \end{bmatrix}$$

$$\begin{bmatrix} e_A \\ e_B \\ e_D \end{bmatrix} = \begin{bmatrix} 0.3 - j0.4 & -0.2 + j0.4 & -0.1 \\ -1 + j2 & 1.2 - j1.8 & -0.2 - j0.2 \\ 0.7 - j1.6 & -1 + j1.4 & 0.3 + j0.2 \end{bmatrix} \begin{bmatrix} -10.6 \\ 0 \\ -10.6 \end{bmatrix}$$

$$e_A = -0.0231 + j6.40 \text{ V}$$

$$e_B = -0.4231 - j2.799 \text{ V}$$

$$e_D = -68.423 - j23.2006 \text{ V}$$

$$I_n = (e_A - e_B) \cdot G_2 = 3.76 + j1.68 \text{ A}$$

$$I_a = (e_a - e_s) \cdot G_2 = 6,84 - j1,68 \text{ A}$$

$$e_c - e_D = 20 \cdot I_n$$

$$e_c = 20 I_n + e_D = 6,776 + j56,8 \text{ V}$$

$$I_b = (e_B - e_c) \cdot G_4 = -1,44 - j11,92 \text{ A}$$

$$I_c = (e_B - e_D) \cdot G_3 = 5,2 + j13,6 \text{ A}$$