

$$\textcircled{5} \quad \begin{array}{l} +G_{11}V_1 - G_{12}V_2 - G_{13}V_3 = I_{sc1} \\ -G_{21}V_1 + G_{22}V_2 - G_{23}V_3 = I_{sc2} \\ -G_{31}V_1 - G_{32}V_2 + G_{33}V_3 = I_{sc3} \end{array}$$

$$V_1 = V_A$$

$$V_2 = V_B$$

$$V_3 = V_C$$

$$G_{11} = \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} = \frac{1}{5} S$$

$$G_{22} = \frac{1}{R_6} + \frac{1}{R_5} + \frac{1}{R_2} = \frac{7}{60} S$$

$$G_{33} = \frac{1}{R_4} + \frac{1}{R_1} + \frac{1}{R_5} = \frac{7}{60} S$$

$$G_{12} = G_{21} = \frac{1}{R_5} = \frac{1}{20} S$$

$$G_{13} = G_{31} = \frac{1}{R_4} = \frac{1}{20} S$$

$$G_{23} = G_{32} = \frac{1}{R_5} = \frac{1}{20} S$$

$$I_{sc1} = 0A$$

$$I_{sc2} = \frac{E_2}{R_2} = 2A$$

$$I_{sc3} = \frac{E_1}{R_1} = \frac{5}{3}A$$



$$\begin{array}{l} +\frac{1}{5}V_1 - \frac{1}{20}V_2 - \frac{1}{20}V_3 = 0 \\ -\frac{1}{20}V_1 + \frac{7}{60}V_2 - \frac{1}{20}V_3 = 2 \\ -\frac{1}{20}V_1 - \frac{1}{20}V_2 + \frac{7}{60}V_3 = \frac{5}{3} \end{array}$$

$$\textcircled{2} \quad V_1 = 22V \quad V_2 = 45V \quad V_3 = 43V$$

$$\textcircled{d} \quad I_{R_1} = \frac{E_1 - U_{30}}{R_1} = \frac{100 - 43}{60} = 0.95A \quad [G \rightarrow C]$$

$$I_{R_2} = \frac{E_2 - U_{30}}{R_2} = \frac{120 - 45}{60} = 1.25A \quad [G \rightarrow B]$$

$$I_{R_3} = \frac{U_{10}}{R_3} = \frac{22}{10} = 2.2A \quad [A \rightarrow G]$$

$$\textcircled{6} \quad \begin{aligned} \underline{U} &= 220 \angle -30^\circ \text{ V} \\ \underline{I} &= 4.4 \angle 30^\circ \text{ A} \end{aligned} \Rightarrow \underline{Z}_T = \frac{\underline{U}}{\underline{I}} = \frac{220 \angle -30^\circ}{4.4 \angle 30^\circ} =$$

$$= (25 - j43.3) \Omega = 50 \angle -60^\circ \Omega$$



זווית המאפיין בין המרחב הזוויתי של הזווית הזוויתית

-60°



הזווית של הזווית, כלומר, אים המאפיין הזווית.

$$\textcircled{7} \quad \underline{S}_T = \underline{I}^* \cdot \underline{U} = 4.4 \angle -30^\circ \cdot 220 \angle -30^\circ = (484 - j838.312) \text{ VA} = 968 \angle -60^\circ \text{ VA}$$

$$P_T = 484 \text{ W} \quad \leftarrow \quad Q_T$$

$$\textcircled{8} \quad \underline{Z}_T = (25 - j43.3) \Omega$$

$$R_T = R_1 + R_2$$

$$25 = 20 + R_2$$

$$\boxed{R_2 = 5 \Omega}$$

$$\textcircled{9} \quad \underline{X}_T = \underline{X}_1 + \underline{X}_2$$

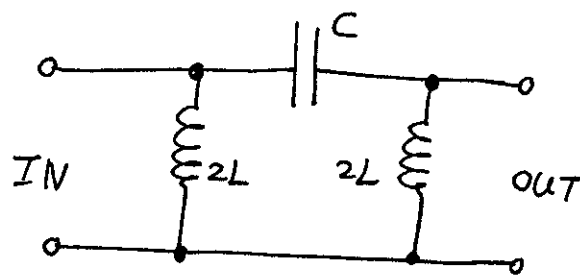
$$-j43.3 = j30 + \underline{X}_2$$

$$\underline{X}_2 = -j73.3 \Omega$$

$$\boxed{X_2 = 73.3 \Omega}$$



⑥

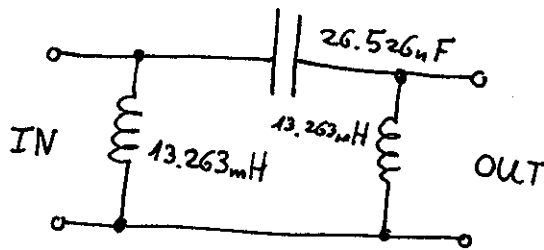


$$R_0 = 500 \Omega \quad f_c = 6 \text{ kHz}$$



$$L = \frac{R_0}{4\pi f_c} = \frac{500}{4\pi \cdot 6000} = 6.631 \text{ mH} \Rightarrow 2L = 13.263 \text{ mH}$$

$$C = \frac{1}{4\pi f_c R_0} = \frac{1}{4\pi \cdot 6000 \cdot 500} = 26.526 \text{ nF}$$



$$\begin{aligned} \textcircled{a} \quad Z_{o\pi} &= \frac{R_0}{\sqrt{1 - \left(\frac{\omega_c}{\omega}\right)^2}} = \frac{R_0}{\sqrt{1 - \left(\frac{f_c}{f}\right)^2}} = \frac{500}{\sqrt{1 - \left(\frac{6 \cdot 10^3}{10 \cdot 10^3}\right)^2}} \\ &= 625 \Omega \end{aligned}$$

$$\begin{aligned} \textcircled{b} \quad \alpha &= 2 \cosh^{-1} \left( \frac{\omega_c}{\omega} \right) = 2 \cosh^{-1} \left( \frac{2\pi \cdot 6000}{2\pi \cdot 30000} \right) = 2.634 \text{ neper} \\ N_{[\text{dB}]} &= 8.69 \cdot \alpha = 22.888 \text{ dB} \end{aligned}$$

$$\textcircled{c} \quad n = \frac{80}{N_{[\text{dB}]}} = \frac{80}{22.888} \approx 3.5 \Rightarrow \frac{30 \text{ dB}}{10 \text{ dB}} \Rightarrow n = 4$$

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$$I = 5 \angle 0^\circ \text{ A}$$

$$U = 220 \angle 0^\circ \text{ V}$$

$$Q_o = 10$$



$$\textcircled{1} R = \frac{U}{I} = \frac{220 \angle 0}{5 \angle 0} = 44 \Omega$$



$$\textcircled{2} Q_o = \frac{R}{\omega_o L}$$

$$10 = \frac{44}{X_L} \Rightarrow X_L = 4.4 \Omega$$



②

$$\omega_o L = 4.4$$

$$\omega_o \cdot 1 \cdot 10^{-3} = 4.4$$

$$\Leftarrow \omega_o = 4400 \frac{\text{rad}}{\text{sec}}$$

$$f_o = \frac{\omega_o}{2\pi} = \frac{4400}{2\pi} \text{ Hz}$$

$$\approx 700 \text{ Hz}$$



$$\textcircled{3} 700 = \frac{1}{2\pi \sqrt{LC}}$$

$$4400 = \frac{1}{\sqrt{1 \cdot 10^{-3} C}}$$

$$C = 51.653 \mu\text{F}$$

$$\textcircled{2} BW = \frac{f_o}{Q_o} = \frac{700}{10} = 70 \text{ Hz}$$



$$f_1 = f_o - \frac{BW}{2} = 700 - 35 = 665 \text{ Hz}$$

$$f_2 = f_o + \frac{BW}{2} = 700 + 35 = 735 \text{ Hz}$$