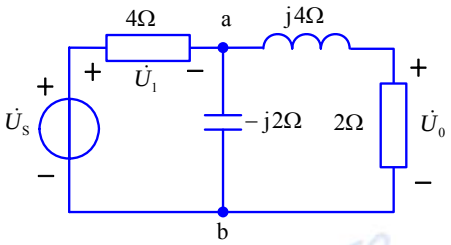
三系学习生活部

【题 1】已知：$\dot{U}_1 = 12\angle 30^\circ \text{V}$



求：$\dot{U}_0$ 及电源电压有效值 U_S。

解：$\dot{U}_1 = 12\angle 30^\circ \text{V}$

$$\dot{I}_1 = \frac{\dot{U}_1}{4} = 3\angle 30^\circ \text{A}$$

$$Z_{ab} = \frac{(2+\text{j}4)(-\text{j}2)}{2+\text{j}4-\text{j}2} = \frac{8-\text{j}4}{2+\text{j}2} = \frac{4-\text{j}2}{1+\text{j}} = \frac{\sqrt{20}\angle -26.6^\circ}{\sqrt{2}\angle 45^\circ} = \sqrt{10}\angle -71.6^\circ \Omega$$

$$\dot{U}_{ab} = Z_{ab}\dot{I}_1 = 3\sqrt{10}\angle -41.6^\circ \text{V}$$

$$\dot{U}_0 = \frac{2}{2+\text{j}4}\dot{U}_{ab} = \frac{2}{\sqrt{20}\angle 63.4^\circ} \times 3\sqrt{10}\angle -41.6^\circ = 3\sqrt{2}\angle -105^\circ \text{V}$$

$$\begin{aligned}\dot{U}_S &= \dot{U}_1 + \dot{U}_{ab} \\ &= 12\angle 30^\circ + 3\sqrt{10}\angle -41.6^\circ \\ &= 10.39 + \text{j}6 + 7.09 - \text{j}6.3 \\ &= 17.48 - \text{j}0.3\end{aligned}$$

$$U_S = 17.5\text{V}$$

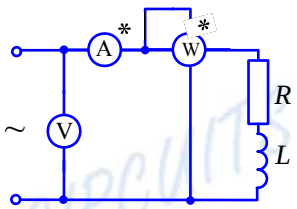
【题 2】

已知：电压表读数为 200V(有效值)

电流表 A 的读数为 2A（有效值）

功率表的读数为 240W（平均功率）

电源频率 f=31.85Hz



求：R, L。

解：$P=UI\cos\varphi$ $\quad \cos\varphi = \dfrac{240}{200\times 2} = 0.6$

$P = I^2R$ $\quad 240 = 2^2 \times R \Rightarrow R = 60\Omega$

$$Q = UI\sin\varphi = 200\times 2\times\sqrt{1-0.6^2} = 320\text{Var}$$

$Q = I^2\omega L$ $\quad L = \dfrac{Q}{I^2\omega} = \dfrac{320}{2^2\times 2\times 3.14\times 31.85} = 400\text{mH}$

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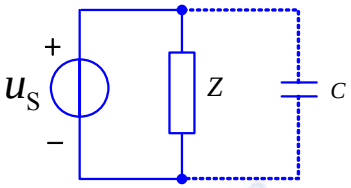
【题 3】已知：$u_S=100\cos 100t(\mathrm{V})$

负载 Z 为感性，Z 的平均功率为 6W，无功功率为 8var。若要求电源的功率因数为 1，求应并联的电容值。



解：并联电容后，$Q'=0\mathrm{Var}$

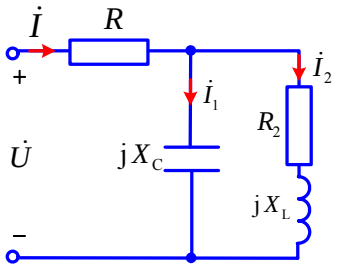
则 $Q_C=Q_L$

$$Q_C=\frac{U^2}{X_C}$$

$$X_C=\frac{U^2}{Q_C}=\frac{(\frac{100}{\sqrt{2}})^2}{8}\qquad \frac{1}{\omega C}=\frac{\frac{10^4}{2}}{8}\qquad C=\frac{16}{10^4\times 100}=16\mu\mathrm{F}$$

【题 4】已知：$U=220\mathrm{V}$，$R_2=5\Omega$，

$I_1=10\mathrm{A}, I_2=20\mathrm{A}$，$\dot{U},\dot{I}$ 同相



求：I, R, X_L, X_C

解：$I=\sqrt{I_2^2-I_1^2}=\sqrt{400-100}=10\sqrt{3}\mathrm{A}$

$$U_{R_2}=I_2R_2=100\mathrm{V}$$

$$\frac{I}{U_{R_2}}=\frac{I_1}{U_{X_L}}=\frac{I_2}{U_{X_C}}\qquad \frac{10\sqrt{3}}{100}=\frac{10}{U_{X_L}}=\frac{20}{U_{X_C}}\qquad \frac{\sqrt{3}}{10}=\frac{10}{U_{X_L}}=\frac{20}{U_{X_C}}$$

$$U_{X_L}=\frac{100}{\sqrt{3}}\mathrm{V}, U_{X_C}=\frac{200}{\sqrt{3}}=\frac{200\sqrt{3}}{3}\mathrm{V}$$

$$U_{X_L}=I_2X_L\qquad X_L=\frac{100}{I_2\sqrt{3}}=\frac{100}{20\sqrt{3}}=2.89\Omega$$

$$U_{X_C}=-I_1X_C\qquad X_C=-\frac{200}{I_1\sqrt{3}}=-\frac{200}{10\sqrt{3}}=-11.55\Omega$$

$$U_R=U-U_{X_C}=104.53\mathrm{V}$$

$$R=\frac{U_R}{I}=\frac{104.53}{10\sqrt{3}}=6\Omega$$

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