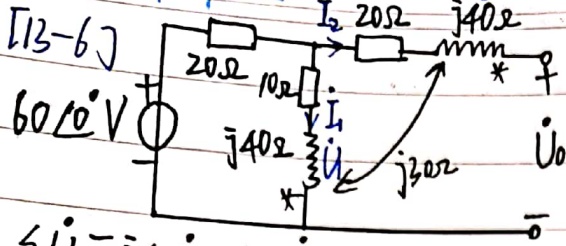


# 第十三章作业



$$\begin{cases} \dot{U}_1 = j40\dot{I}_1 + j30\dot{I}_2 \\ \dot{U}_2 = j40\dot{I}_2 + j30\dot{I}_1 \end{cases}$$

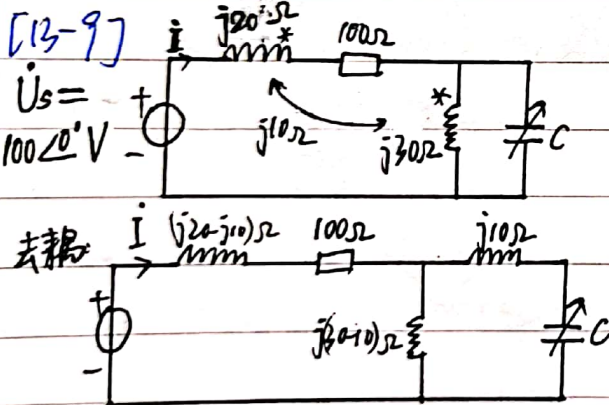
左侧回路KVL:  $60\angle 0^\circ = 20(\dot{I}_1 + \dot{I}_2) + 10\dot{I}_1 + \dot{U}_1$

$$\text{又 } \dot{I}_2 = 0$$

$$\therefore \dot{I}_1 = \frac{60\angle 0^\circ}{30 + j40} = \left( \frac{18}{25} - j\frac{24}{25} \right) A$$

$$\begin{aligned} \dot{U}_o &= 60\angle 0^\circ - 20\dot{I}_1 - \dot{U}_2 = 60\angle 0^\circ - (20 + j30)\dot{I}_1 \\ &= 17.0\angle -8.13^\circ \end{aligned}$$

$$\therefore \dot{U}_o = 17.0\angle -8.13^\circ V$$



∵  $\dot{I}$  与  $U_s$  同相 ∴  $Z_{eq}$  虚部都为0

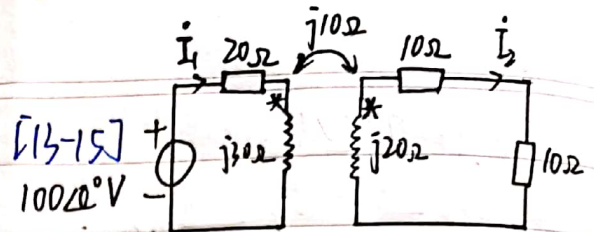
$$\begin{aligned} Z_{eq} &= \frac{j20 \parallel (j10 - jX_C) + j10 + 100}{j20 \times j(10 - X_C)} + j10 + 100 \\ &= \frac{j20 \times j(10 - X_C)}{j30 - jX_C} + j10 + 100 \end{aligned}$$

$$\therefore -\frac{20(X_C - 10)}{30 - X_C} + 10 = 0 \quad \therefore X_C = \frac{50}{3} \Omega = \frac{1}{\omega C}$$

$$\therefore C = 6mF$$

$$12) \dot{I} = \frac{\dot{U}_s}{R} = \frac{100\angle 0^\circ V}{100\Omega} = 1\angle 0^\circ A$$

$$\therefore \dot{I} = \cos 10t A$$

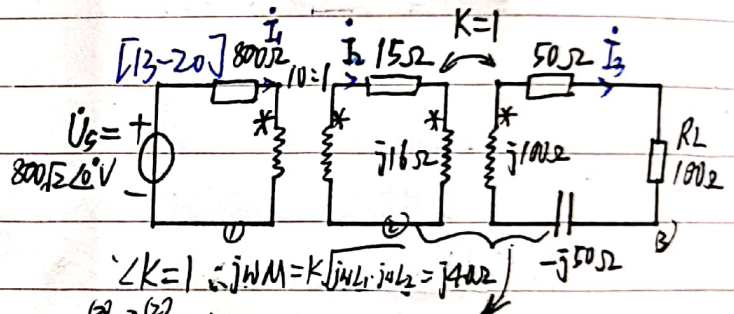


$$Z_r = \frac{10^2}{20 + j20} = \frac{5}{2}(1 - j)\Omega$$

$$\dot{I}_1 = \frac{100\angle 0^\circ}{20 + j30 + \frac{5}{2}(1 - j)} = \frac{(180 - j220)}{(101 - j220)} A = 2.81\angle -50.71^\circ A$$

右侧由KVL:  $20\dot{I}_2 + j20\dot{I}_2 - j10\dot{I}_1 = 0$

$$\therefore \dot{I}_2 = \frac{j}{2(1 + j)} \times 2.81\angle -50.71^\circ = 1.00\angle -5.71^\circ A$$



$$\begin{aligned} \angle K = 1 \quad \therefore j\omega M &= K \sqrt{j\omega L_1 \cdot j\omega L_2} = j40\Omega \\ \text{②} \rightarrow \text{③} \quad Z_r &= \frac{40^2}{150 + j50} = (9.6 - j3.2)\Omega \end{aligned}$$

$$\begin{aligned} Z_{eq} &= \left( \frac{10}{1} \right)^2 \times (15 + 9.6 - j3.2 + j16) \\ &= (2460 + j1280)\Omega \end{aligned}$$

$$\dot{I}_1 = \frac{800\sqrt{2}}{2460 + j1280 + 800} = \left( \frac{1304}{6133} - j\frac{512}{6133} \right) A$$

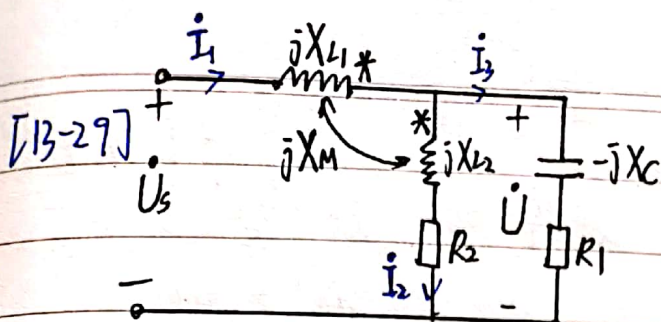
$$\dot{I}_2 = 10\dot{I}_1$$

又 ∵ ③回路中KVL:  $(150 + j50)\dot{I}_3 - j40\dot{I}_2 = 0$

$$\therefore \dot{I}_3 = \frac{40j}{15 + j5} \dot{I}_1 = (0.37 + j0.44) A$$

$$\therefore P_L = I_3^2 R_L = 93.05 W$$

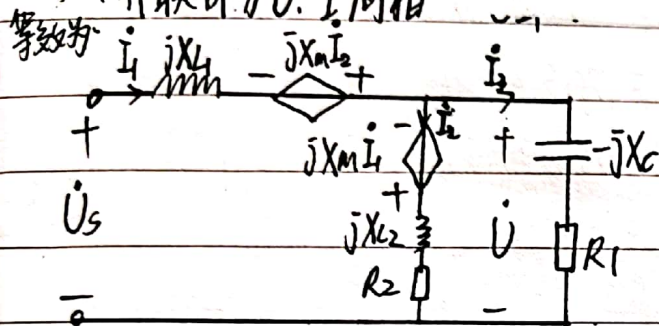




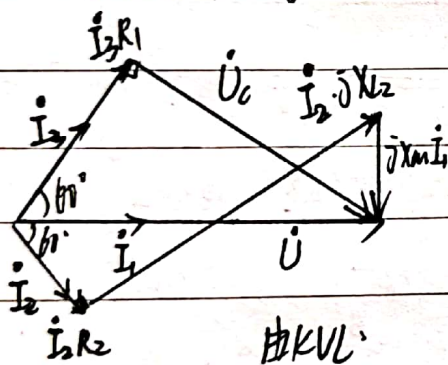
电路吸收的功率  $P = I_2^2 R_2 + I_3^2 R_1 = \frac{2}{3} I^2 R = 60 \text{ W}$

∵ 电路并联部分处于谐振状态

∴ 并联部分  $\dot{U}$ 、 $\dot{I}$  同相



选电压  $\dot{U}$  为参考向量



由 KVL:

$$\dot{U} = R_1 \dot{I}_3 + \dot{I}_3 (-jX_C) = -jX_M \dot{I}_1 + jX_{L2} \dot{I}_2 + R_2 \dot{I}_2$$

由图知,  $I_1 R = U \cos 60^\circ = 20 \text{ V}$

$$\therefore I_1 = 2 \text{ A} \quad R = 10 \Omega$$

$$\therefore R_2 = \frac{1}{2} R \quad \therefore I_2 R_2 = \frac{1}{2} I_1 R_1$$

$$\therefore jX_M I_1 = \frac{U}{2} \times \tan 30^\circ = \frac{20}{\sqrt{3}} \text{ V}$$

$$\therefore X_M = \frac{10}{\sqrt{3}} \Omega$$

$$\sin 30^\circ \cdot I_2 jX_{L2} = jX_M I_1 + \frac{U}{2} \cos 60^\circ \cdot \frac{\sqrt{3}}{2}$$

$$\therefore I_2 jX_{L2} = \frac{70}{\sqrt{3}} \text{ V}$$

$$\therefore X_{L2} = \frac{35}{\sqrt{3}} \Omega$$

