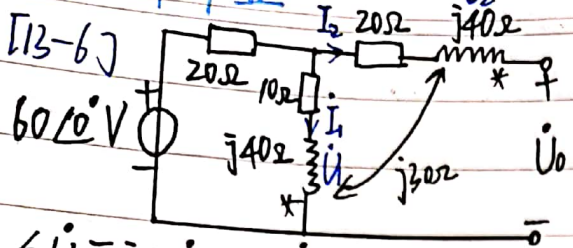


第十三章作业



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

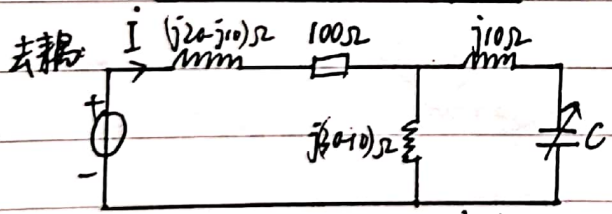
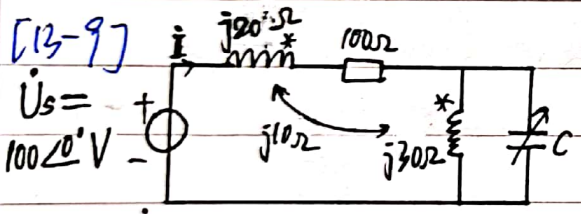
左侧回路KVL: $60\angle 0^\circ = 20(\dot{I}_1 + \dot{I}_2) + 10\dot{I}_1 + \dot{U}_1$

又 $\dot{I}_2 = 0$

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

$$\begin{aligned} \dot{U}_0 &= 60\angle 0^\circ - 20\dot{I}_1 - \dot{U}_2 = 60\angle 0^\circ - (20 + j30)\dot{I}_1 \\ &= 17.0\angle -8.13^\circ \end{aligned}$$

$$\therefore \dot{U}_0 = 17.0\angle -8.13^\circ V$$



∵ \dot{I} 与 U_s 同相 ∴ Z_{eq} 虚部都为0

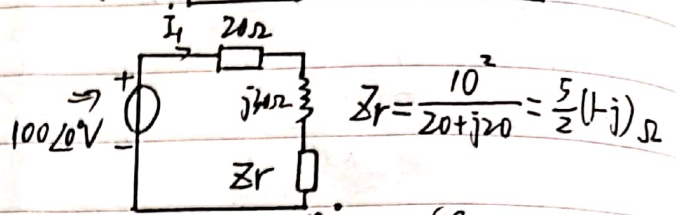
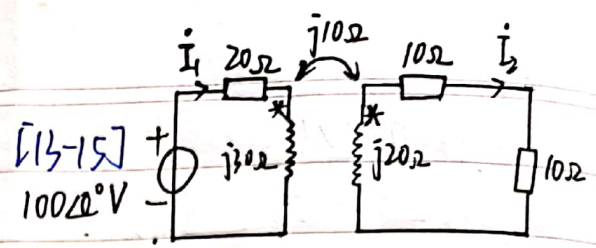
$$\begin{aligned} Z_{eq} &= j20 // (j10 - jX_C) + j10 + 100 \\ &= \frac{j20 \times j(10 - X_C)}{j30 - jX_C} + j10 + 100 \end{aligned}$$

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

$$\therefore C = 6mF$$

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

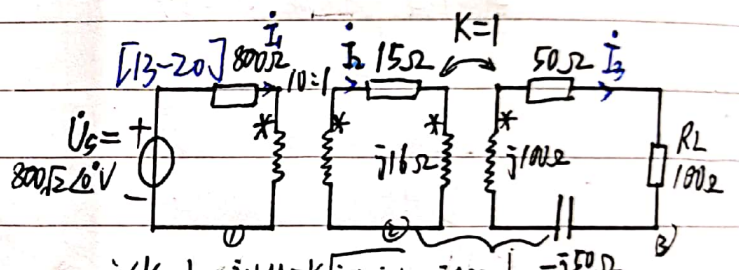
$$\therefore \dot{I} = 0.03107 A$$



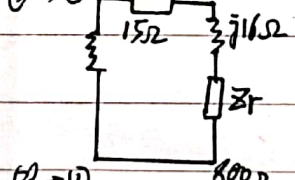
$$\begin{aligned} \dot{I}_1 &= \frac{100\angle 0^\circ}{20 + j30 + \frac{10^2}{20 + j20}} = \frac{(180 - j220)}{(101 - j201)} A \\ &= 2.81\angle -50.71^\circ A \end{aligned}$$

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

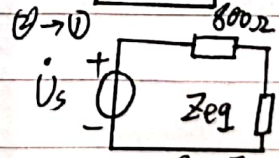
$$\therefore \dot{I}_2 = \frac{j}{2(1+j)} \times 2.81\angle -50.71^\circ = 1.00\angle -5.71^\circ A$$



∵ $K=1 \therefore j\omega M = K\sqrt{j\omega L_1 \cdot j\omega L_2} = j40\Omega$



$$Z_L = \frac{40^2}{150 + j50} = (9.6 - j3.2)\Omega$$



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

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

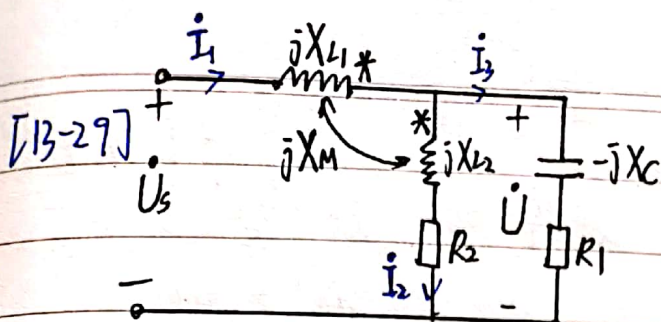
$$\dot{I}_2 = 10\dot{I}_1$$

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

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

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

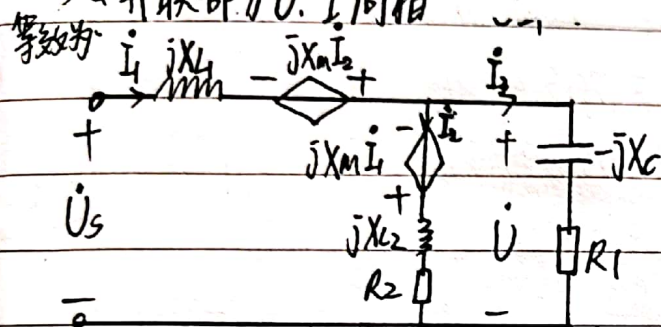




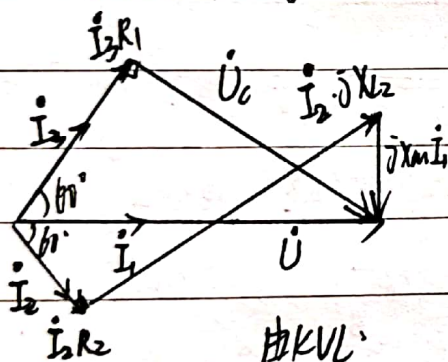
电路吸收的功率 $P = I_2^2 R_2 + I_3^2 R_1 = \frac{2}{3} I^2 R = 60 \text{ W}$

∵ 电路并联部分处于谐振状态

∴ 并联部分 U, I 同相



选电压 U 为参考向量



由 KVL:

$$U = R_1 I_3 + I_3 (-jX_C) = -jX_M I_1 + jX_{L2} I_2 + R_2 I_2$$

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

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

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

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

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

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

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

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

