

阻抗和导纳 例题

例1 电阻 $R=15\ \Omega$ 、电感 $L=12\text{mH}$ 的线圈与 $C=5\mu\text{F}$ 的电容器串联，接在电压 $u=100\cos 5000t\text{V}$ 的电源上。求电流 i 、电容器端电压 u_C 和线圈端电压 u_W 。

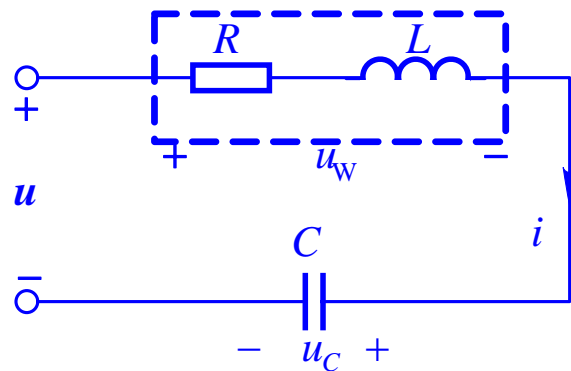
解： RLC 串联阻抗为

$$\begin{aligned} Z &= R + j\left(\omega L - \frac{1}{\omega C}\right) \\ &= 15 + j\left[5000 \times 12 \times 10^{-3} - \frac{1}{5000 \times 5 \times 10^{-6}}\right] \\ &= 25 \angle 53.1^\circ \Omega \end{aligned}$$

电流相量和瞬时表达式分别为

$$i = 4 \cos(5000t - 53.1^\circ) \text{ A}$$

$$\dot{I}_m = \frac{\dot{U}_m}{Z} = \frac{100 \angle 0^\circ \text{ V}}{25 \angle 53.1^\circ \Omega} = 4 \angle -53.1^\circ \text{ A}$$





电容电压相量和瞬时表达式

$$\dot{U}_{Cm} = jX_C \dot{I}_m = -j40 \times 4 \angle -53.1^\circ = 160 \angle -143.1^\circ \text{ V}$$

$$u_C = 160 \cos(5000t - 143.1^\circ) \text{ V}$$

线圈看成 RL 串联，其阻抗

$$Z_W = R + j\omega L = (15 + j60) \Omega = 62 \angle 76^\circ \Omega$$

线圈电压相量和瞬时表达式

$$\dot{U}_m = Z_W \dot{I}_m = 62 \angle 76^\circ \times 4 \angle -53.1^\circ = 248 \angle 22.9^\circ \text{ V}$$

$$u_W = 248 \cos(5000t + 22.9^\circ) \text{ V}$$

