

复功率

一端口吸收的复功率

阻抗 $Z = R + jX$

$$\tilde{S} = \dot{U} I^* = Z \dot{I} I^* = Z I^2 = R I^2 + jX I^2 = P + jQ = \sqrt{P^2 + Q^2} \angle \left(\arctan \frac{Q}{P} \right) = S \angle \varphi$$

复功率就是端口电压相量与电流共轭复相量的乘积

阻抗为感性， jX 前为正号， \tilde{S} 虚部为正，表示感性无功功率

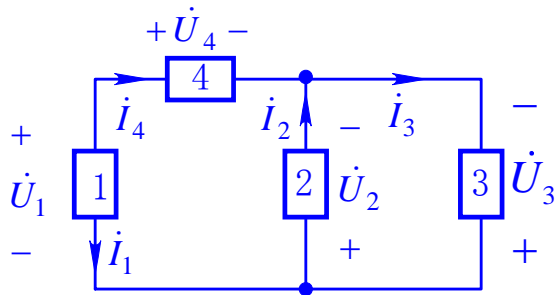
阻抗为容性， jX 前为负号， \tilde{S} 虚部为负，表示容性无功功率

复功率守恒，即各支路发出的复功率代数和等于零：

$$\sum_{k=1}^b \dot{U}_k I_k^* = \sum_{k=1}^b P_k + j \sum_{k=1}^b Q_k = 0$$

正弦电路的功率

例5 图中 $\dot{U}_1 = (1+j)\text{V}$, $\dot{U}_2 = -j2\text{V}$, $\dot{I}_3 = (1-j)\text{A}$, $\dot{I}_4 = (1+j)\text{A}$, 求各元件功率, 并判断其类型



解: $\dot{U}_3 = \dot{U}_2 = -j2 \text{ (V)}$
 $\dot{U}_4 = \dot{U}_1 + \dot{U}_2 = 1 - j \text{ (V)}$
 $\dot{I}_1 = -\dot{I}_4 = -1 - j \text{ (A)}$
 $\dot{I}_2 = \dot{I}_3 - \dot{I}_4 = -j2 \text{ (A)}$

各元件吸收功率

$$\tilde{S}_1 = \dot{U}_1 \dot{I}_1^* = (1+j)(-1+j) = -2\text{W} \quad \text{电源}$$

$$\tilde{S}_2 = \dot{U}_2 \dot{I}_2^* = -j2 \times j2 = 4\text{W} \quad \text{电阻}$$

$$\begin{aligned} \tilde{S}_3 &= -\dot{U}_3 \dot{I}_3^* = -(-j2) \times (1+j) \\ &= -2\text{W} + j2 \text{ var} \end{aligned} \quad \text{感性电源}$$

$$\tilde{S}_4 = \dot{U}_4 \dot{I}_4^* = (1-j) \times (1+j) = -j2 \text{ var} \quad \text{电容}$$