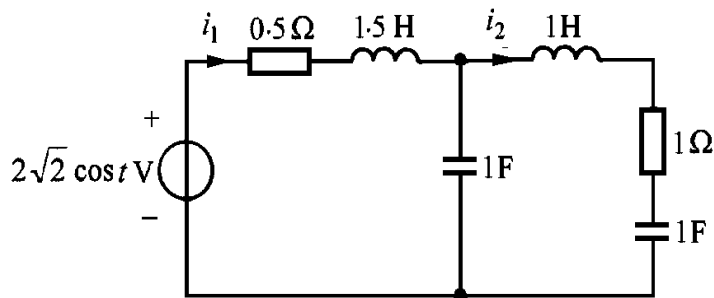




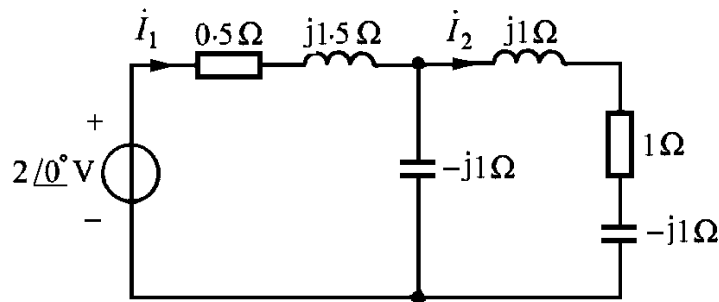
正弦激励下电路的稳态分析

习题讲解(二)

1. 电路工作于正弦稳态, 已知电压源电压为 $u_s(t) = 2\sqrt{2}\cos t$ V .
试求该电压源发出的平均功率。



(a)

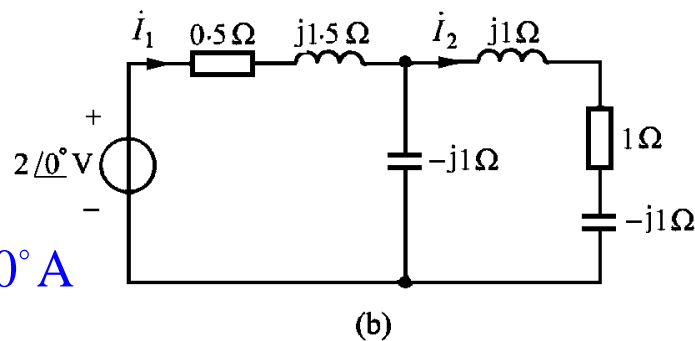


(b)

$$Z = 0.5 + j1.5 + \frac{(-j1)(j1+1-j1)}{1-j1} = 0.5 + j1.5 + 0.5 - j0.5 = 1 + j1 \Omega$$

$$i_1 = \frac{\dot{U}_s}{Z} = \frac{2\angle 0^\circ}{1+j1} = \sqrt{2}\angle -45^\circ \text{ A}$$

$$i_2 = \frac{-j1}{1-j1} \times i_1 = \frac{-j1}{\sqrt{2}\angle -45^\circ} \times \sqrt{2}\angle -45^\circ = -j1 = 1\angle -90^\circ \text{ A}$$



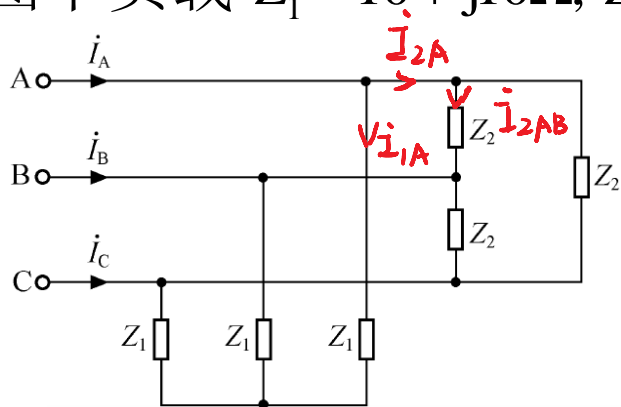
$$1 \quad P_{\text{发出}} = U_s I_1 \cos \theta_Z = 2 \times \sqrt{2} \times \cos 45^\circ = 2 \text{ W}$$

$$2 \quad \tilde{S}_{\text{发出}} = \dot{U}_s \dot{I}_1^* = 2 \times \sqrt{2}\angle 45^\circ = 2 + j2 \rightarrow P_{\text{发出}} = \text{Re}(\tilde{S}) = 2 \text{ W}$$

$$3 \quad P_{\text{发出}} = I_1^2 R_1 + I_2^2 R_2 = 2 \times 0.5 + 1 \times 1 = 2 \text{ W}$$

$$4 \quad P_{\text{发出}} = I_1^2 \text{Re}(Z) = I_1^2 \text{Re}(1 + j1) = 2 \times 1 = 2 \text{ W}$$

2. 对称三相电路如题图所示, 设电源线电压 $\dot{U}_{AB} = 380\angle 0^\circ \text{V}$, 图中负载 $Z_1 = 10 + j10\Omega$, $Z_2 = 30 + j30\Omega$, 试求线电流 i_A 、 i_B 和 i_C 。



方法一: $\dot{U}_A = \frac{\dot{U}_{AB}}{\sqrt{3}} \angle -30^\circ \text{V} = 220\angle -30^\circ \text{V}$

$$\dot{i}_{1A} = \frac{\dot{U}_A}{Z_1} = 15.56\angle -75^\circ \text{A}$$

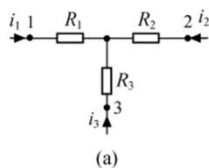
$$\dot{i}_{2AB} = \frac{\dot{U}_{AB}}{Z_2} = 8.86\angle -45^\circ \text{A}$$

$$\dot{i}_{2A} = \sqrt{3}\dot{i}_{2AB} \angle -30^\circ = 15.35\angle -75^\circ \text{A}$$

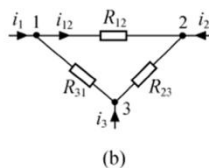
$$\dot{i}_A = \dot{i}_{1A} + \dot{i}_{2A} = 31\angle -75^\circ \text{A}$$

$$\dot{i}_B = 31\angle 165^\circ \text{A} \quad \dot{i}_C = 31\angle 45^\circ \text{A}$$

◆ 电阻星形连接与三角形连接的等效变换

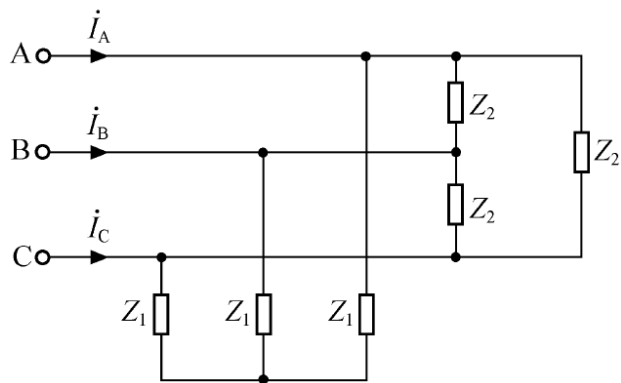


电阻星形连接



电阻三角形连接

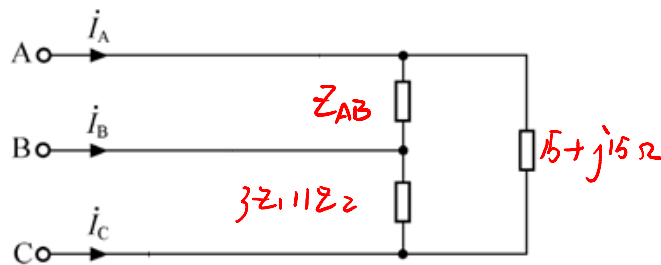
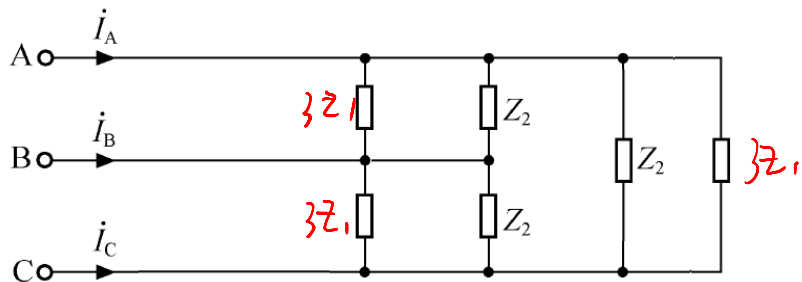
2. 对称三相电路如题图所示，设电源线电压 $\dot{U}_{AB} = 380\angle 0^\circ \text{ V}$ ，图中负载 $Z_1 = 10 + j10\Omega$, $Z_2 = 30 + j30\Omega$ ，试求线电流 i_A 、 i_B 和 i_C 。



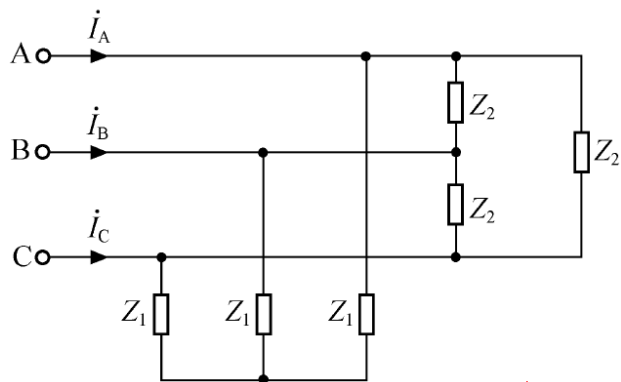
方法二:
$$\dot{I}_{AB} = \frac{\dot{U}_{AB}}{Z_{AB}} = \frac{380\angle 0^\circ}{15 + j15} = 17.91\angle -45^\circ \text{ A}$$

$$\dot{I}_A = \sqrt{3}\dot{I}_{AB}\angle -30^\circ = 31\angle -75^\circ \text{ A}$$

$$\dot{I}_B = 31\angle 165^\circ \text{ A} \quad \dot{I}_C = 31\angle 45^\circ \text{ A}$$



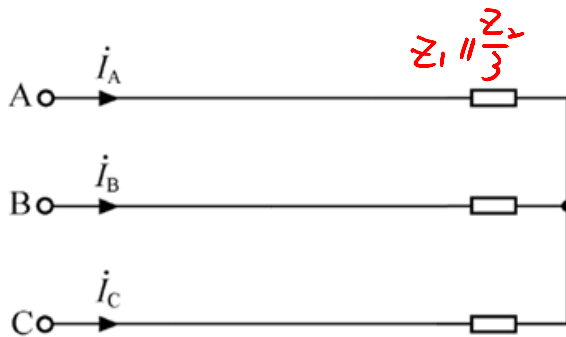
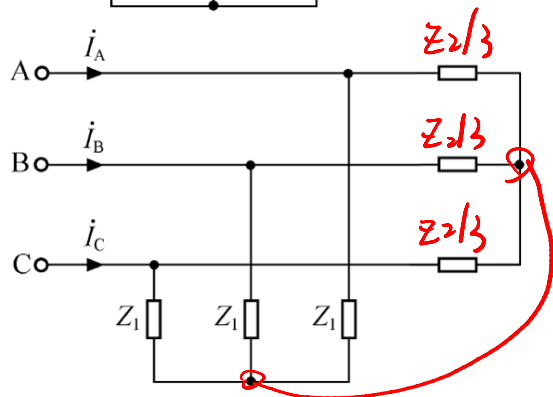
2. 对称三相电路如题图所示, 设电源线电压 $\dot{U}_{AB} = 380\angle 0^\circ \text{V}$, 图中负载 $Z_1 = 10 + j10\Omega$, $Z_2 = 30 + j30\Omega$, 试求线电流 i_A 、 i_B 和 i_C 。



方法三: $\dot{U}_A = \frac{\dot{U}_{AB}}{\sqrt{3}} \angle -30^\circ = 220\angle -30^\circ \text{V}$

$$\dot{I}_A = \frac{\dot{U}_A}{Z_A} = \frac{220\angle -30^\circ}{5 + j5} = 31\angle -75^\circ \text{A}$$

$$\dot{I}_B = 31\angle 165^\circ \text{A} \quad \dot{I}_C = 31\angle 45^\circ \text{A}$$



THE END