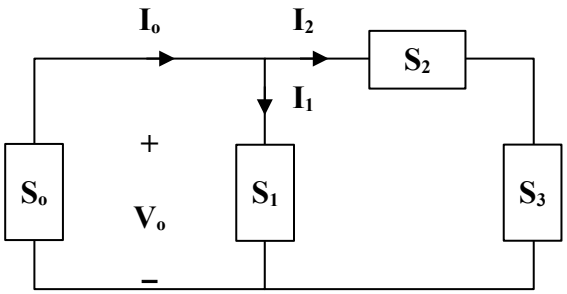
Chapter 11, Solution 61.

Consider the network shown below.



$$\mathbf{S}_2 = 1.2 - \text{j}0.8 \text{ kVA}$$

$$\mathbf{S}_3 = 4 + \text{j}\frac{4}{0.9}\sin(\cos^{-1}(0.9)) = 4 + \text{j}1.937 \text{ kVA}$$

Let $\mathbf{S}_4 = \mathbf{S}_2 + \mathbf{S}_3 = 5.2 + \text{j}1.137 \text{ kVA}$

But $\mathbf{S}_4 = \mathbf{V}_o \mathbf{I}_2^*$

$$\mathbf{I}_2^* = \frac{\mathbf{S}_4}{\mathbf{V}_o} = \frac{(5.2 + j1.137)\times 10^3}{100\angle 90°} = 11.37 - j52$$

$$\mathbf{I}_2 = 11.37 + j52$$

Similarly, $\mathbf{S}_1 = \sqrt{2} - \text{j}\frac{\sqrt{2}}{0.707}\sin(\cos^{-1}(0.707)) = \sqrt{2}(1 - \text{j}) \text{ kVA}$

But $\mathbf{S}_1 = \mathbf{V}_o \mathbf{I}_1^*$

$$\mathbf{I}_1^* = \frac{\mathbf{S}_1}{V_o} = \frac{(1.4142 - j1.4142)\times 10^3}{j100} = -14.142 - j14.142$$

$$\mathbf{I}_1 = -14.142 + \text{j}14.142$$

$$\mathbf{I}_o = \mathbf{I}_1 + \mathbf{I}_2 = -2.772 + \text{j}66.14 = \mathbf{66.2\angle 92.4° \text{ A}}$$

$$\mathbf{S}_o = V_o I_o^*$$

$$\mathbf{S}_o = (100\angle 90°)(66.2\angle -92.4°) \, VA$$

$$\mathbf{S}_o = \mathbf{6.62\angle –2.4° \text{ kVA}}$$

66.2∠92.4° A, 6.62∠–2.4° kVA