Chapter 11, Solution 47.

For each of the following cases, find the complex power, the average power, and the reactive power:

(a) $v(t) = 112 \cos(\omega t + 10°)$ V, $i(t) = 4 \cos(\omega t - 50°)$ A

(b) $v(t) = 160 \cos(377t)$ V, $i(t) = 4 \cos(377t + 45°)$ A

(c) $\mathbf{V} = 80 \angle 60°$ V rms, $\mathbf{Z} = 50 \angle 30° \ \Omega$

(d) $\mathbf{I} = 10 \angle 60°$ A rms, $\mathbf{Z} = 100 \angle 45° \ \Omega$

Solution

(a) $\mathbf{V} = 112\angle 10°$, $\mathbf{I} = 4\angle -50°$

$$\mathbf{S} = \frac{1}{2}\mathbf{V}\mathbf{I}^* = 224\angle 60° = \mathbf{[112 + j194]\ VA}$$

Average power = **112 W**

Reactive power = **194 VAR**

(b) $\mathbf{V} = 160\angle 0°$, $\mathbf{I} = 4\angle 45°$

$$\mathbf{S} = \frac{1}{2}\mathbf{V}\mathbf{I}^* = 320\angle -45° = \mathbf{226.3 - j226.3}$$

Average power = **226.3 W**

Reactive power = **–226.3 VAR**

(c) $$\mathbf{S} = \frac{|\mathbf{V}|^2}{\mathbf{Z}^*} = \frac{(80)^2}{50\angle -30°} = 128\angle 30° = \mathbf{110.85 + j64}$$

Average power = **110.85 W**

Reactive power = **64 VAR**

(d) $$\mathbf{S} = |\mathbf{I}|^2 \mathbf{Z} = (100)(100\angle 45°) = \mathbf{[7.071 + j7.071]\ kVA}$$

Average power = **7.071 kW**

Reactive power = **7.071 kVAR**