Chapter 11, Solution 67.

For the op amp shown in Fig. 11.86, calculate:

(a) the complex power delivered by the voltage source
(b) the average power dissipated by the 12-Ω resistor

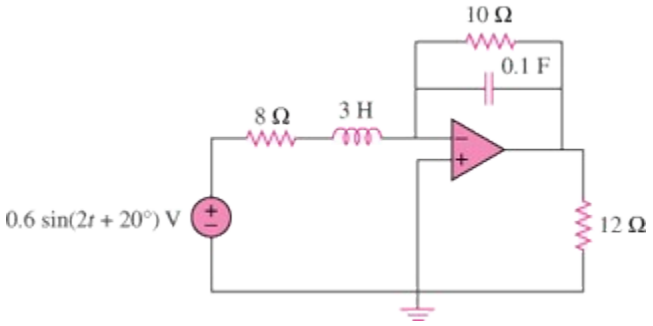


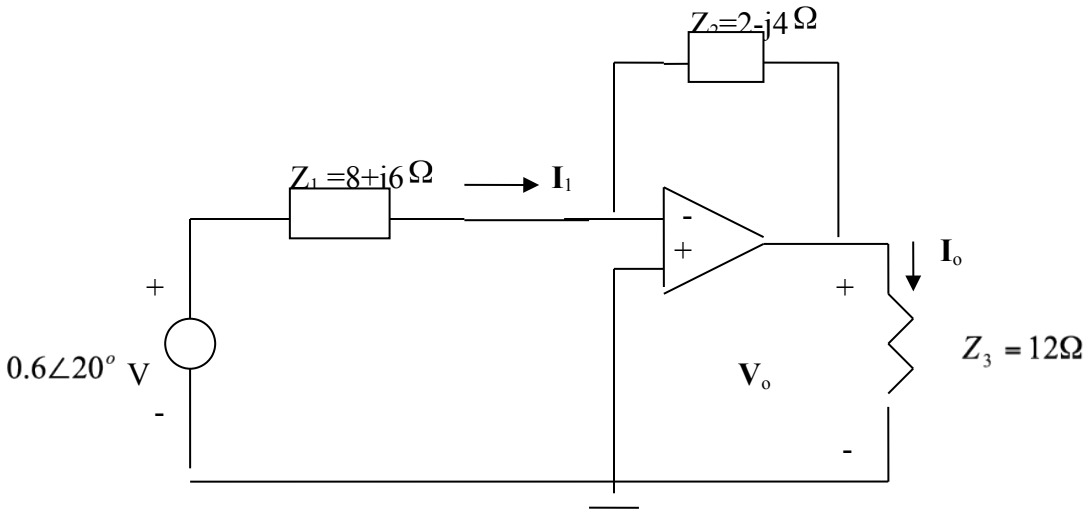
Figure 11.86
For Prob. 11.67.

Solution

$$\omega = 2, \quad 3\text{H} \longrightarrow j\omega L = j6, \quad 0.1\text{F} \longrightarrow \frac{1}{j\omega C} = \frac{1}{j2x0.1} = -j5$$

$$10 /\!/ (-j5) = \frac{-j50}{10 - j5} = 2 - j4$$

The frequency-domain version of the circuit is shown below.



(a)
$$I_1 = \frac{0.6\angle 20^o - 0}{8 + j6} = \frac{0.5638 + j0.2052}{8 + j6} = 0.06\angle -16.87^o$$

$$S = \frac{1}{2} V_s I_1^* = (0.3\angle 20^o)(0.06\angle +16.87^o) = \underline{14.4 + j10.8\,\text{mVA}} = \underline{18\angle 36.86^o\ \text{mVA}}$$

S = (14.4+j10.8) mVA = 18∠36.86° mVA

(b)
$$V_o = -\frac{Z_2}{Z_1} V_s, \qquad I_o = \frac{V_o}{Z_3} = -\frac{(2 - j4)}{12(8 + j6)}(0.6\angle 20^o) = 0.0224\angle 99.7^o$$

$$P = \frac{1}{2} |I_o|^2 R = 0.5(0.0224)^2 (12) = \underline{2.904\,\text{mW}}$$

P = 2.904 mW

(a) 18∠36.86° mVA, (b) 2.904 mW