Chapter 10, Solution 80.

Obtain $v_o(t)$ for the op amp circuit in Fig. 10.123 if $v_s = 4\cos(1000t - 60°)$ V.

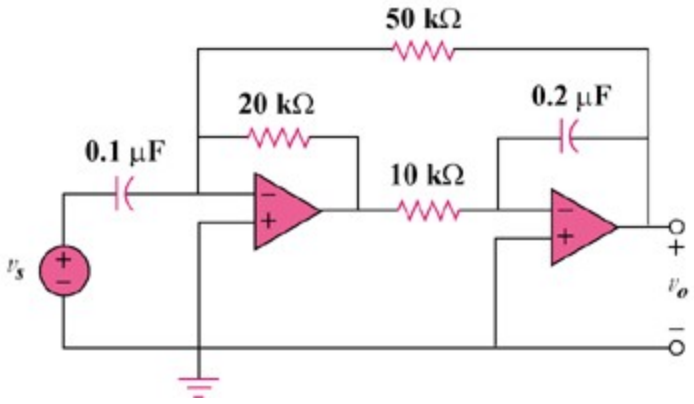

Figure 10.123
For Prob. 10.80.

Solution

$$4\cos(1000t - 60°) \longrightarrow 4\angle -60°, \quad \omega = 1000$$

$$0.1\ \mu F \longrightarrow \frac{1}{j\omega C} = \frac{1}{j(1000)(0.1\times 10^{-6})} = -j10\ k\Omega$$

$$0.2\ \mu F \longrightarrow \frac{1}{j\omega C} = \frac{1}{j(1000)(0.2\times 10^{-6})} = -j5\ k\Omega$$

The two stages are inverters so that

$$\mathbf{V}_o = \left(\frac{20}{-j10}\cdot(4\angle -60°) + \frac{20}{50}\mathbf{V}_o\right)\left(\frac{-j5}{10}\right)$$

$$= \frac{-j}{2}\cdot(j2)\cdot(4\angle -60°) + \frac{-j}{2}\cdot\frac{2}{5}\mathbf{V}_o$$

$$(1 + j/5)\,\mathbf{V}_o = 4\angle -60°$$

$$\mathbf{V}_o = \frac{4\angle -60°}{1 + j/5} = 3.922\angle -71.31°$$

Therefore, $v_o(t) =$ **3.922 cos(1000t – 71.31∘) V**