Chapter 10, Solution 79.

For the op amp circuit in Fig. 10.122, obtain $v_o(t)$.

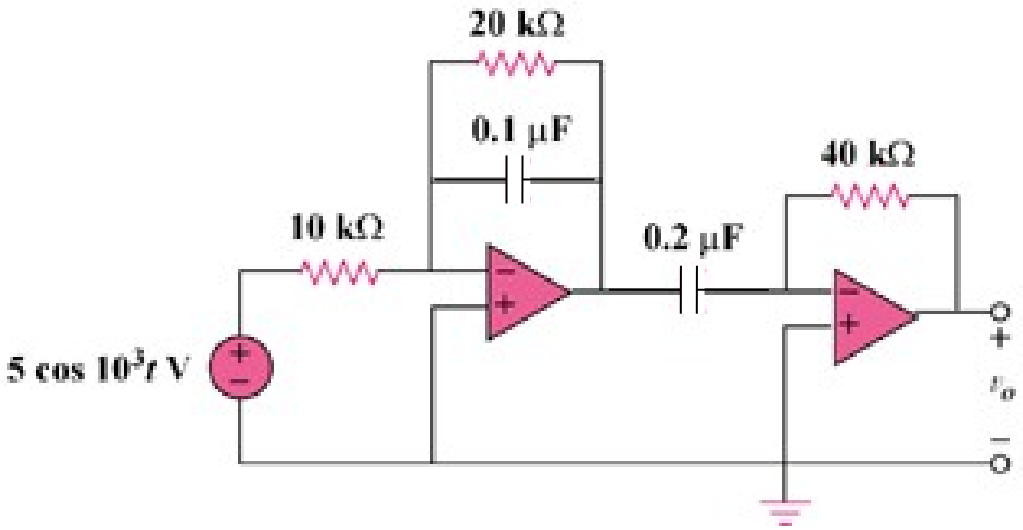


Figure 10.122
For Prob. 10.79.

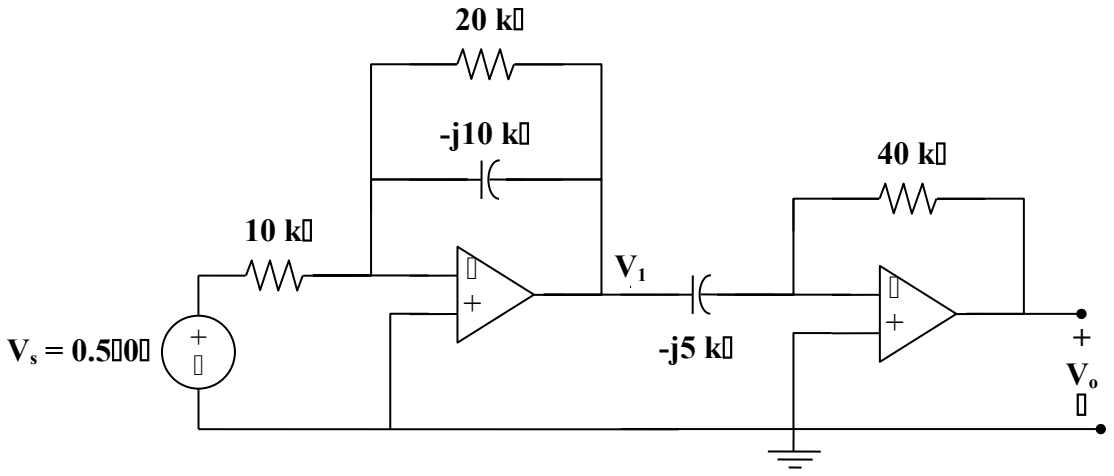
Solution

$$0.5\cos(1000t) \longrightarrow 0.5\angle 0°, \quad \omega = 1000$$

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

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

Consider the circuit shown below.



Since each stage is an inverter, we apply $\mathbf{V}_o = \frac{-\mathbf{Z}_f}{\mathbf{Z}_i}\mathbf{V}_i$ to each stage.

$$\mathbf{V}_o = \frac{-40}{-j5}\mathbf{V}_1 \tag{1}$$

and

$$\mathbf{V}_1 = \frac{-20 \,\|\, (-j10)}{10}\mathbf{V}_s \tag{2}$$

From (1) and (2),

$$\mathbf{V}_o = \left(\frac{-j8}{10}\right)\left(\frac{-(20)(-j10)}{20 - j10}\right)0.5\angle 0°$$

$$\mathbf{V}_o = 1.6(2 + j) = 35.78\angle 26.56°$$

Therefore, $v_o(t) =$ **3.578cos(1000t + 26.56°) V**