14.5 Use Laplace transforms and nodal analysis to find $i_1(t)$ for $t > 0$ in the network shown in Fig. P14.5. Assume zero initial conditions.

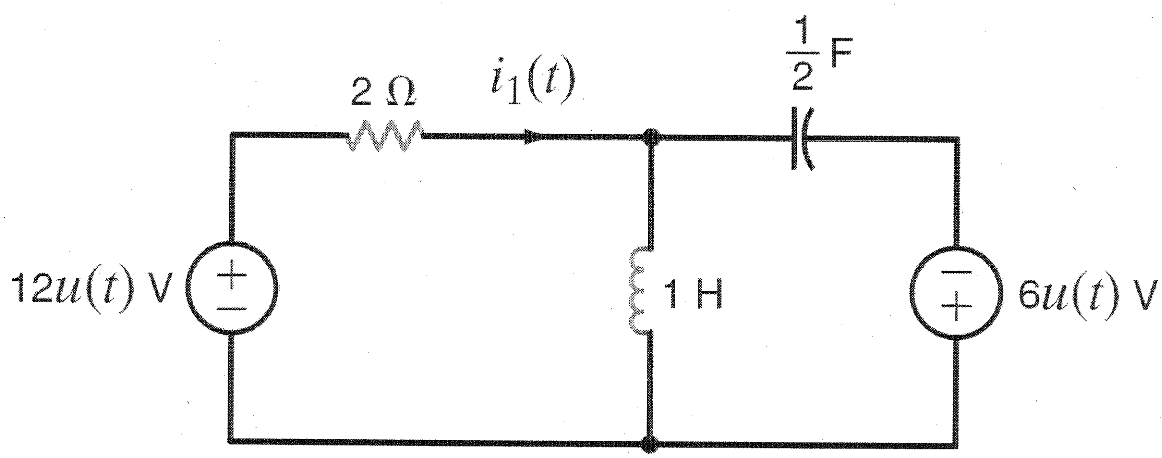
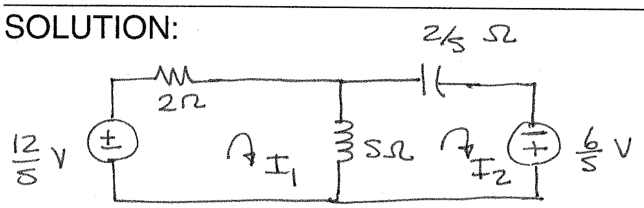


Figure P14.5

SOLUTION:



$$\frac{12}{s} = I_1[s+2] - sI_2$$

$$\frac{6}{s} = -sI_1 + I_2\left[s + \frac{2}{s}\right]$$

or, $\frac{12}{s} = I_1[s+2] - sI_2$ & $\frac{6}{s} = -sI_1 + I_2\left[\frac{s^2+2}{s}\right]$

Solve for I_1 yields $I_1(s) = \dfrac{3(3s^2+4)}{s(s^2+s+2)}$

$$I_1(s) = \frac{K_1}{s} + \frac{K_2}{s+\frac{1}{2}-j\frac{\sqrt{7}}{2}} + \frac{K_2^*}{s+\frac{1}{2}+j\sqrt{7}/2} \qquad K_1 = 6$$

$$K_2 = \left.\frac{3(3s^2+4)}{s(s+\frac{1}{2}+j\sqrt{7}/2)}\right|_{s=-\frac{1}{2}+j\sqrt{7}/2} = 3.21 \angle 62.1^\circ$$

$$i_1(t) = \left[6 + 6.42e^{-t/2}\cos\left(\sqrt{7}t/2 + 62.1^\circ\right)\right]u(t) \text{ V}$$