PROBLEM SET #6

Chapter 15, Solution 37.

(b) $G(s)=\dfrac{A}{s+3}+\dfrac{Bs+C}{s^2+2s+2}$

$$s^2+4s+5=(Bs+C)(s+3)+A(s^2+2s+2)$$

Equating coefficients,

s^2: 1= B + A (1)

s: 4 = 3B + C + 2A (2)

Constant: 5 =3C + 2A (3)

Solving (1) to (3) gives

$$A=\frac{2}{5},\qquad B=\frac{3}{5},\qquad C=\frac{7}{5}$$

$$G(s)=\frac{0.4}{s+3}+\frac{0.6s+1.4}{s^2+2s+2}=\frac{0.4}{s+3}+\frac{0.6(s+1)+0.8}{(s+1)^2+1}$$

$g(t)=\underline{0.4e^{-3t}+0.6e^{-t}\cos t+0.8e^{-t}\sin t}$

(c) $f(t)=\underline{e^{-2(t-4)}u(t-4)}$

Chapter 15, Solution 20.

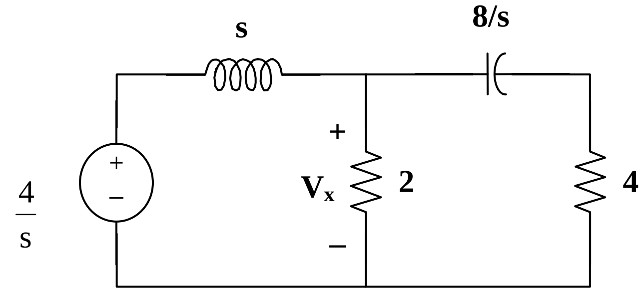
Let
$$\begin{aligned} g_1(t)&=\sin(\pi t),\quad 0<t<1\\ &=\sin(\pi t)\left[u(t)-u(t-1)\right]\\ &=\sin(\pi t)u(t)-\sin(\pi t)u(t-1)\end{aligned}$$

Note that $\sin(\pi(t-1))=\sin(\pi t-\pi)=-\sin(\pi t)$.

So, $g_1(t)=\sin(\pi t)u(t)+\sin(\pi(t-1))u(t-1)$

$$G_1(s)=\frac{\pi}{s^2+\pi^2}(1+e^{-s})$$

Chapter 16, Solution 2.



$$\frac{V_x - \frac{4}{s}}{s} + \frac{V_x - 0}{2} + \frac{V_x - 0}{4 + \frac{8}{s}} = 0$$

$$V_x(4s + 8) - \frac{(16s + 32)}{s} + (2s^2 + 4s)V_x + s^2 V_x = 0$$

$$V_x(3s^2 + 8s + 8) = \frac{16s + 32}{s}$$

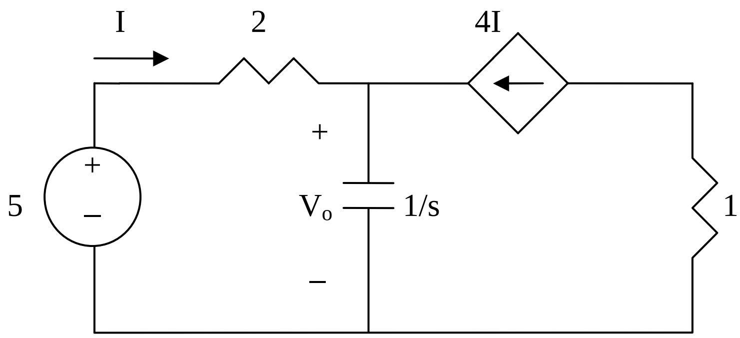
$$V_x = -16\frac{s + 2}{s(3s^2 + 8s + 8)} = -16\left(\frac{0.25}{s} + \frac{-0.125}{s + \frac{4}{3} + j\frac{\sqrt{8}}{3}} + \frac{-0.125}{s + \frac{4}{3} - j\frac{\sqrt{8}}{3}}\right)$$

$$v_x = \underline{(-4 + 2e^{-(1.3333 + j0.9428)t} + 2e^{-(1.3333 - j0.9428)t})u(t)\text{ V}}$$

$$v_x = \underline{4u(t) - e^{-4t/3}\cos\left(\frac{2\sqrt{2}}{3}t\right) - \frac{6}{\sqrt{2}}e^{-4t/3}\sin\left(\frac{2\sqrt{2}}{3}t\right)\text{ V}}$$

Chapter 16, Solution 4.

The circuit in the s-domain is shown below.



$$I + 4I = \frac{V_o}{1/s} \longrightarrow 5I = sV_o$$

But $I = \dfrac{5 - V_o}{2}$

$$5\left(\frac{5 - V_o}{2}\right) = sV_o \longrightarrow V_o = \frac{12.5}{s + 5/2}$$

$$v_o(t) = \underline{12.5e^{-2.5t} \text{ V}}$$