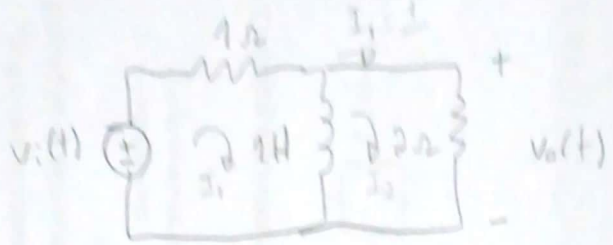
Roteiro 4a

Exs 17 até 18

17. a)



$$V_i(s) = 1I_1(s) + 1s(I_1(s) - I_2(s))$$

$$0 = s(I_2(s) - I_1(s)) + 2I_2(s)$$

$$\begin{bmatrix} V_i(s) \\ 0 \end{bmatrix} = \begin{bmatrix} s+1 & -s \\ -s & s+2 \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix}$$

$$V_i(s) = (s+1)I_1 - sI_2$$

$$0 = -sI_1 + I_2(s+2)$$

$$I_1 = \frac{I_2(s+2)}{s}$$

$$V_i(s) = \frac{(s+1)(s+2)I_2}{s} - sI_2$$

$$V_i(s) = \frac{(s^2+2s+s+2)I_2}{s} - sI_2$$

$$V_i(s) = \frac{I_2(s^2+3s+2)}{s} \Rightarrow V_i(s) = \frac{I_2(3s+2)}{s}$$

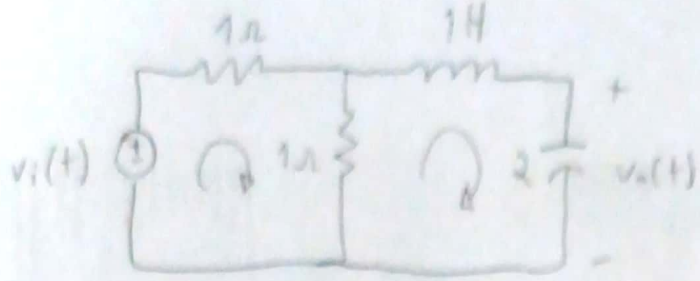
$$I_2(s) = \frac{V_i s}{(3s+2)}$$

Se $V_o = 2 \cdot I_2$

Logo $V_o = \frac{2 \cdot V_i(s) s}{(3s+2)}$

$$\frac{V_o(s)}{V_i(s)} = \frac{2s}{3s+2}$$

b)



$$\begin{bmatrix} V_i(s) \\ 0 \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ -1 & s+\frac{1}{2s}+1 \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix}$$

$$V_i = 2I_1 - I_2$$

$$0 = -I_1 + I_2\left(s+\frac{1}{2s}+1\right)$$

$$I_1 = I_2\left(s+\frac{1}{2s}+1\right)$$

$$V_i = 2I_2\left(s+\frac{1}{2s}+1\right) - I_2 \Rightarrow V_i = I_2\left(2s+\frac{1}{s}+1\right)$$

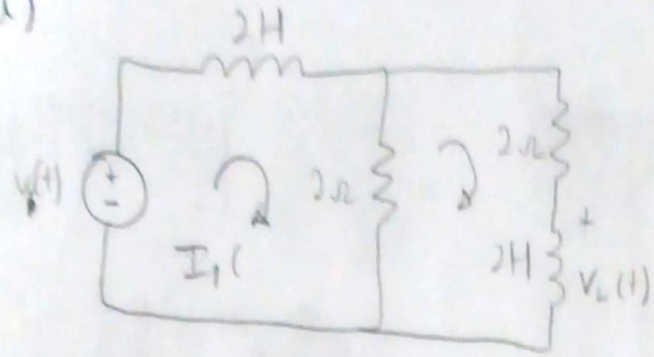
$$I_2 = \frac{V_i}{\left(2s+\frac{1}{s}+1\right)}$$

$$V_o = \frac{1}{2s} \cdot I_2$$

$$V_o = \frac{1}{2s} \cdot \frac{V_i}{\left(2s+\frac{1}{s}+1\right)}$$

$$\frac{V_o}{V_i} = \frac{1}{4s^2+2s+2}$$

18. a)



$$\begin{bmatrix} V_i(s) \\ 0 \end{bmatrix} = \begin{bmatrix} 2s+2 & -2 \\ -2 & 2s+4 \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix}$$

$$V_i = (2s+2) I_1 - 2 I_2$$

$$0 = -2 I_1 + (2s+4) I_2$$

$$I_1 = \frac{(2s+4) I_2}{2} = (s+2) I_2$$

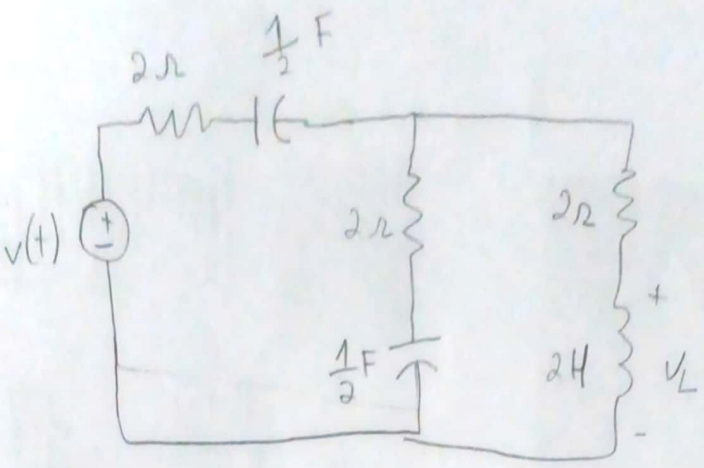
$$V_i = (2s+2) \cdot (s+2) I_2 - 2 I_2$$

$$V_i = (2s^2 + 4s + 2s + 4) I_2 - 2 I_2 = (4s^2 + 6s + 2) \cdot I_2$$

$$\Rightarrow I_2 = \frac{V_i}{2s^2 + 6s + 2} \qquad V_o = s I_2$$

$$V_o = \frac{s V_i}{2s^2 + 6s + 2} \Rightarrow \frac{V_o}{V_i} = \frac{s}{2s^2 + 6s + 2}$$

b)



$$\begin{bmatrix} V_1(s) \\ 0 \end{bmatrix} = \begin{bmatrix} \frac{1}{s}+4 & -\left(\frac{1}{2s}+2\right) \\ -\left(\frac{1}{2s}+2\right) & 2s+\frac{1}{2s}+4 \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix}$$

$$V_i = \left(\frac{1}{s}+4\right) I_1 - \left(\frac{1}{2s}+2\right) I_2$$

$$0 = -\left(\frac{1}{2s}+2\right) I_1 + \left(2s+\frac{1}{2s}+4\right) I_2$$

$$I_1 = \frac{\left(2s+\frac{1}{2s}+4\right) I_2}{\frac{1}{2s}+2}$$

$$V_i = \left(\frac{1}{s}+4\right) \cdot \left(\frac{2s+\frac{1}{2s}+4}{\frac{1}{2s}+2}\right) \cdot I_2 - \left(\frac{1}{2s}+2\right) I_2$$

$$V_i = \left(\frac{1+4s}{s}\right) \cdot \left(\frac{\frac{4s^2+8s+1}{2s}}{\frac{4s+1}{2s}}\right) \cdot I_2 - \left(\frac{1}{2s}+2\right) I_2$$

$$V_i = \left(\frac{1+4s}{s}\right) \cdot \left(\frac{4s^2+8s+1}{4s+1}\right) \cdot I_2 - \left(\frac{1}{2s}+2\right) I_2$$

$$V_i = \left(\frac{4s^2+8s+1+16s^3+32s^2+4s}{4s^2+s}\right) \cdot I_2 - \left(\frac{1}{2s}+4\right) I_2$$

$$V_i = \left(\frac{8s^3+16s^2+2s+32s^4+64s^3+8s-4s-s-16s^3-4s}{8s^3+2s^2}\right) I_2$$

$$I_2 = \frac{V_i(8s^3+2s^2)}{(32s^4+58s^3+16s^2+s)}$$

$$V_o = 2s\, I_2$$

$$\frac{V_o}{V_i} = \frac{16s^4+4s^3}{(32s^4+58s^3+16s^2+s)}$$