Instituto Federal de Educação, Ciência e Tecnologia do Ceará
Aplicação de Controle
Prof. Paulo Régis C. de Araújo

8,5

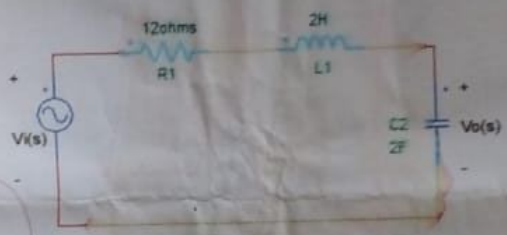
Nome: JOÃO GABRIEL CARNEIRO MEDEIROS

1. Utilizando a transformada de Laplace, converta as seguintes funções para o domínio da frequência:
A) $x(t) = 3*e^{-2t} + 4*e^{-4t}$
B) $x(t) = 4*t + t/3;$

2. Encontre a transformada Z das seguintes funções de transferência:
A) $F(s) = 2/(s+2).(s+5)$
B) $G(s) = (s+4)/(s+1).(s+2).(s+3)$

3. Determine a saída de um filtro mediano dada a seguinte amostra de entrada.
Entrada = (4, 5, 5, 6, 100, 5, 2, 1, 2, 90, 2)

4. No circuito abaixo, determine a relação Vo(s)/Vi(s).



$\frac{t^{(2-1)}}{(2-1)!} = \frac{1}{s^2}$

Obs: $t^{(n-1)}/(n-1)! = 1/S^n$
$e^{-at} \Rightarrow 1/s+a \Rightarrow z/z - e^{-aT} \Rightarrow e^{-akT}$
$L[f(t)] = \int f(t).e^{-st}\,dt$

$e^{-a.t} \xrightarrow{[L]} \frac{1}{s+a} \xrightarrow{[Z]} \frac{z}{z-e^{-aT}} \xrightarrow{[z^{-1}]} e^{-a.k.t}$

$\frac{3}{4} + 1 = \frac{3+4}{4} = \frac{7}{4}$

$\frac{2.5}{2.40.5 + 4.5^2 + 1}$

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ÇÕES DO ALUNO: JOÃO GABRIEL C.M

a) $x(t) = 3 \cdot e^{-2t} + 4 \cdot e^{-4t} \xrightarrow[[L]]{} X(t) = 3 \cdot \left(\frac{1}{s+2}\right) + 4 \cdot \left(\frac{1}{s+4}\right)$

$= \left[\frac{3}{s+2} + \frac{4}{s+4}\right]$ // 10,0

b) $x(t) = 4 \cdot t + \frac{t}{3} \xrightarrow[[L]]{} X(t) = 4 \cdot \frac{1}{s} + \frac{1}{3} \cdot \frac{1}{s} =$

$= \left[\frac{4}{s^2} + \frac{1}{3 \cdot s^2}\right]$ //

2) A) $F(s) = \frac{2}{(s+2)\cdot(s+5)} \xrightarrow[[Z]]{} \frac{2}{(s+2)\cdot(s+5)} = \frac{A}{(s+2)} + \frac{B}{(s+5)}$

$A=1 \rightarrow \frac{2 \cdot (s+2)}{(s+2)\cdot(s+5)} = \frac{A \cdot (s+2)}{(s+2)} + \frac{B \cdot (s+2)}{(s+5)} \Big|_{s=-2} \rightarrow$

$\rightarrow \frac{2}{s+5} = A \therefore A = \frac{2}{s+5} = \frac{2}{}$ //

$= \left[\frac{1}{s^2} + \frac{1}{3 \cdot s^2} \right]$ //

2) A) $F(s) = \frac{2}{(s+2).(s+5)} \xrightarrow{[Z]} \frac{2}{(s+2).(s+5)} = \frac{A}{(s+2)} + \frac{B}{(s+5)}$

A=?

$\rightarrow \frac{2.(s+2)}{(s+2).(s+5)} = \frac{A.(s+2)}{(s+2)} + \frac{B.(s+2)}{(s+5)} \Big|_{s=-2} \rightarrow$

$\rightarrow \frac{2}{s+5} = A \therefore A = \frac{2}{-2+5} = \frac{2}{3}$ //

B=?

$\rightarrow \frac{2.(s+5)}{(s+2).(s+5)} = \frac{A.(s+5)}{(s+2)} + \frac{B.(s+5)}{(s+5)} \Big|_{s=-5} \rightarrow$

$\rightarrow \frac{2}{s+2} = B \therefore B = \frac{2}{-5+2} = -\frac{2}{3}$ //

$\rightarrow F(s) = \frac{2}{3}.\left(\frac{1}{s+2}\right) - \frac{2}{3}.\left(\frac{1}{s+5}\right)$

$\xrightarrow{[Z]} \left[F(s) = \frac{2.z}{3.(z-e^{-2t})} - \frac{2.z}{3(z-e^{-5t})} \right]$

B) $G(s) = \frac{(s+4)}{(s+1).(s+2).(s+3)} \xrightarrow{[Z]} \frac{(s+4)}{(s+1).(s+2).(s+3)} = \frac{A}{(s+1)} + \frac{B}{(s+2)} + \frac{C}{(s+3)}$

$$\rightarrow \frac{2\cdot(s+5)}{(s+2)\cdot(s+5)} = \frac{A\cdot(s+5)}{(s+2)} + \frac{B\cdot(s+5)}{(s+5)} \Big|_{s=-5} \rightarrow$$

$$\rightarrow \frac{2}{s+2} = B \therefore B = \frac{2}{-5+2} = -\frac{2}{3} \rightarrow F(s) = \frac{2}{3}\cdot\left(\frac{1}{s+2}\right) - \frac{2}{3}\cdot\left(\frac{1}{s+5}\right)$$

$$\xrightarrow{[z]} \left[F(s) = \frac{2\cdot z}{3\cdot(z-e^{-2t})} - \frac{2\cdot z}{3(z-e^{-5t})}\right]$$

B) $G(s) = \dfrac{(s+4)}{(s+1)\cdot(s+2)\cdot(s+3)} \xrightarrow{[z]} \dfrac{(s+4)}{(s+1)\cdot(s+2)\cdot(s+3)} = \dfrac{A}{(s+1)} + \dfrac{B}{(s+2)} + \dfrac{C}{(s+3)}$

$$A=? \quad \frac{(s+4)\cdot(s+1)}{(s+1)\cdot(s+2)\cdot(s+3)} = \frac{A(s+1)}{(s+1)} + \frac{B\cdot(s+1)}{(s+2)\cdot(s+1)} + \frac{C\cdot(s+1)}{(s+3)\cdot(s+1)} \Big|_{s=-1}$$

$$\rightarrow \frac{-1+4}{(-1+2)\cdot(-1+3)} = A \therefore A = \frac{3}{2}$$

$$B=? \quad \frac{(s+4)\cdot(s+2)}{(s+1)\cdot(s+2)\cdot(s+3)} = \frac{A\cdot(s+2)}{(s+1)} + \frac{B(s+2)}{(s+2)} + \frac{C((s+2)}{(s+3)} \Big|_{s=-2}$$

$$\rightarrow \frac{-2+4}{(-2+1)\cdot(-2+3)} = B \therefore B = -2$$

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01.

a) $x(t) = 2 \cdot e^{-3t} \cdot u(t) + e^{-2t} \cdot u(t)$

C = ? $\quad \frac{(s+4)\cdot(s+3)}{(s+1)\cdot(s+2)\cdot(s+3)} = \frac{A\cdot(s+2)\cdot(s+3)}{(s+1)} + \frac{B\cdot(s+1)\cdot(s+3)}{(s+2)} + \frac{C\cdot(s+1)\cdot(s+2)}{(s+3)} \Big|_{s=-3}$

$\rightarrow \frac{(-3+4)}{(-3+1)\cdot(-3+2)} = C \quad \therefore \quad C = \frac{1}{2}$

$\rightarrow G(s) = \frac{3}{2}\cdot\left(\frac{1}{s+1}\right) + 2\cdot\left(\frac{1}{s+2}\right) + \frac{1}{2}\cdot\left(\frac{1}{s+3}\right) \xrightarrow{[Z]}$

$= \left[\frac{3\cdot z}{2\cdot(z-e^{-t})} - \frac{2\cdot z}{z-e^{-2t}} + \frac{z}{2\cdot(z-e^{-3t})}\right]$

3) ENTRADA = 4(4,5,5,6,100,5,2,1,2,90,2)2

4,4,5 = 4 $\quad$ 2,5,100 = 5 $\quad$ 9,2,90 = 2

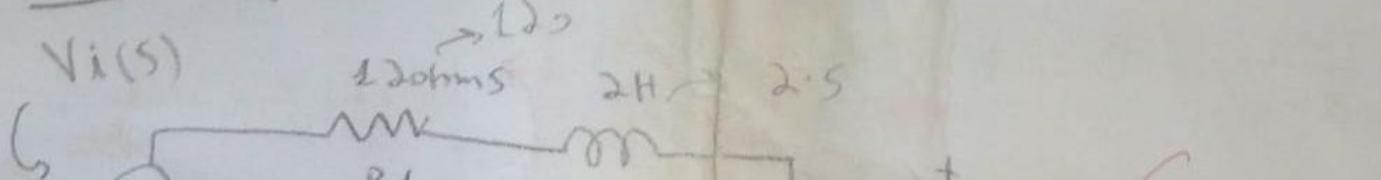
$$= \left[\frac{3 \cdot z}{2 \cdot (z - e^{-t})} - \frac{2 \cdot z}{z - e^{-2t}} + \frac{z}{2 \cdot (z - e^{-t})} // \right]$$

3) ENTRADA = (4(4,5,5,6,100,5,2,1,2,90,2)2

$$\begin{cases} 4,4,5 = 4 \\ 4,5,5 = 5 \\ 5,5,6 = 5 \\ 5,6,100 = 6 \\ 5,6,100 = 6 \end{cases} \qquad \begin{cases} 2,5,100 = 5 \\ 1,2,5 = 2 \\ 1,2,2 = 2 \\ 1,2,90 = 2 \\ 2,2,90 = 2 \end{cases} \qquad 2,2,90 = 2$$

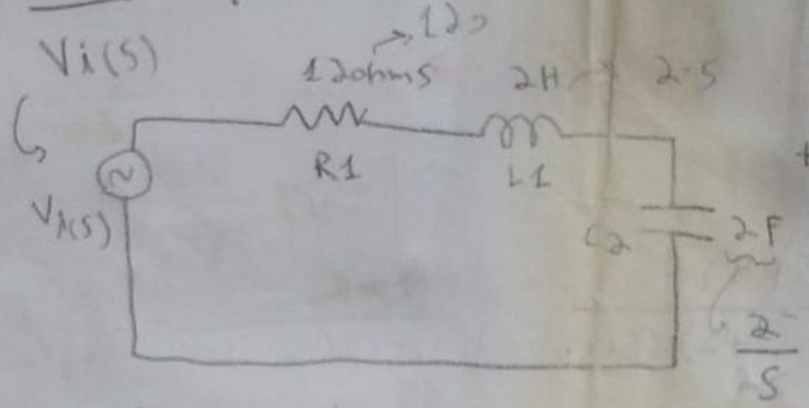
[SAÍDA = (4, 5, 5, 6, 6, 2, 2, 2, 2, 2)//]

4) $\frac{V_o(s)}{V_i(s)} = ?$



[SAÍDA = (4, 5, 5, 6, 0, 2, 2, 2, 2, 2)]

4) $\frac{V_o(s)}{V_i(s)} = ?$



$\therefore$ DIV. DE TENSÃO $\Rightarrow$ $V_o(s) = \frac{\frac{2}{s}}{120 + 2{\cdot}5 + \frac{2}{s}} \cdot V_i(s)$

$$\left[\frac{V_o(s)}{V_i(s)} = \frac{2}{s \cdot \left(120 + 2{\cdot}5 + \frac{2}{s}\right)} \right]$$