NOTA = 25

Nome: Weiktran Frederito de Oliveira Alves - 96708
Data: 9/3/2021 P1 - ELT 330

① Considerando o movimento vertical, temos: (Desconsiderando x_e)

Sobre o movimento de M_C:

$$\begin{cases} M_C \frac{d\dot{x}_C}{dt} + K_S \int_0^t x_C - x_\pi \, dt + B_S(\dot{x}_C - \dot{x}_\pi) \Rightarrow \\ (M_C s^2 + B_S s + K_S) X_C + (-B_S - K_S) X_\pi = F - F = 0 \end{cases}$$

a) $FT = \frac{x_C}{F}$

b) $FT = \frac{x_\pi}{F}$

Sobre o movimento de M_π:

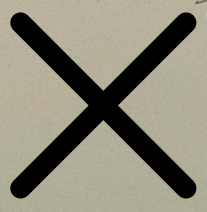
$$\begin{cases} M_\pi \frac{d\dot{x}_\pi}{dt} + B_S(\dot{x}_\pi - \dot{x}_C) + K_\pi \int_0^t (x_\pi - x_e) dt + K_S \int_0^t (x_\pi - x_C) dt \Rightarrow \\ (M_\pi s^2 + B_S s + (K_\pi + K_S)) X_\pi + (-B_S - K_S) X_C + (-K_\pi) X_e = F - F \end{cases}$$

$$\begin{bmatrix} (M_C s^2 + B_S s + K_S) & (-B_S - K_S) \\ (-B_S s - K_S) & (M_\pi s^2 + B_S s + K_\pi + K_S) \end{bmatrix} \begin{bmatrix} X_C \\ X_\pi \end{bmatrix} = \begin{bmatrix} 0 \\ X_e \end{bmatrix} \quad \det A = \Delta$$

$$\underbrace{\begin{bmatrix} (25s^2 + 1145s + 8090) & (-1145s - 8090) \\ (-1145s - 8090) & (265^2 + 1145s + 110090) \end{bmatrix}}_{A} \begin{bmatrix} X_C \\ X_\pi \end{bmatrix} = \begin{bmatrix} 0 \\ 102000 X_e \end{bmatrix}$$

a) $\frac{\Delta_1}{\Delta} = \frac{102000(-1145s - 8090) X_e}{\det A} \Rightarrow FT = \frac{X_C}{X_e} = \frac{102000(-1145s - 8090)}{\det A}$ ✓

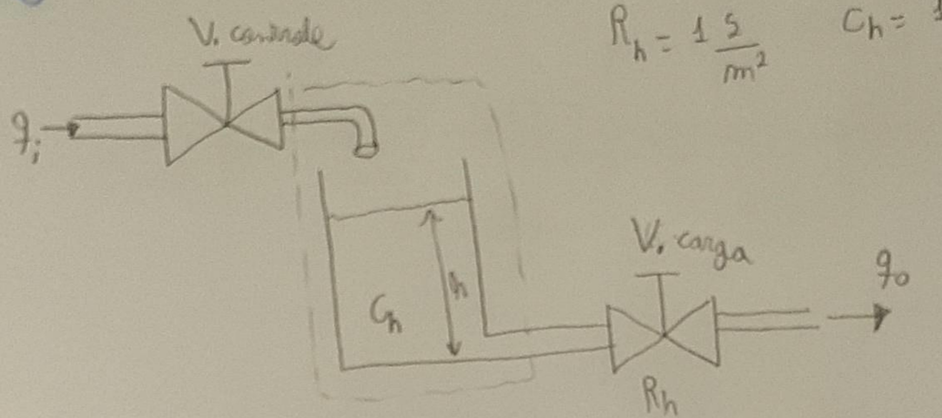
b) $= \frac{\Delta_2}{\Delta} = \frac{102000 X_e (25s^2 + 1145s + 8090)}{\det A} \Rightarrow FT = \frac{X_\pi}{X_e} = \frac{102000(25s^2 + 1145s + 8090)}{\det A}$ ✓



Wiilliam Alves - 96708

②

$R_h = 1 \frac{s}{m^2}$ $C_h = 1\ m^2$



a) $q_i = C_h \frac{dh}{dt} + q_o$ (1)

$q_o = \frac{h}{R_h} \Rightarrow h = q_o \cdot R_h$ (2)

• Aplicando Laplace em (1) e (2):

(3) $\Rightarrow Q_i = C_h S H + Q_o$

(4) $\Rightarrow H = Q_o R_h$

Substituindo (4) em (3): $Q_i = C_h R_h S Q_o + Q_o = Q_o [C_h R_h S + 1]$

$FT = \frac{Q_o}{Q_i} = \frac{1}{C_h R_h S + 1} \Rightarrow FT = \frac{1}{S+1}$

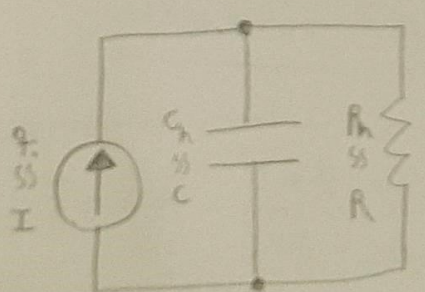
b) Em $t = 0^-$ tem-se $h = 0$.

$* \int \frac{1}{A-x} dx = -\ln|A-x|$

$q_i = C_h \frac{dh}{dt} + \frac{h}{R_h} \Rightarrow \frac{dh}{dt} = \frac{R_h q_i - h}{R_h C_h} \Rightarrow \frac{dh}{R_h q_i - h} = \frac{dt}{R_h C_h} \overset{*}{\Rightarrow} \ln|R_h q_i - h| = -\frac{t}{R_h C_h} \Rightarrow$

$\Rightarrow e^{-\frac{t}{R_h C_h}} = R_h q_i - h \Rightarrow h = R_h q_i - e^{-\frac{t}{R_h C_h}} \Rightarrow h = 1 - e^{-3} \cong 0{,}95\ m$

c) $q \sim I$



$q_i = 1 \frac{m^3}{s}$

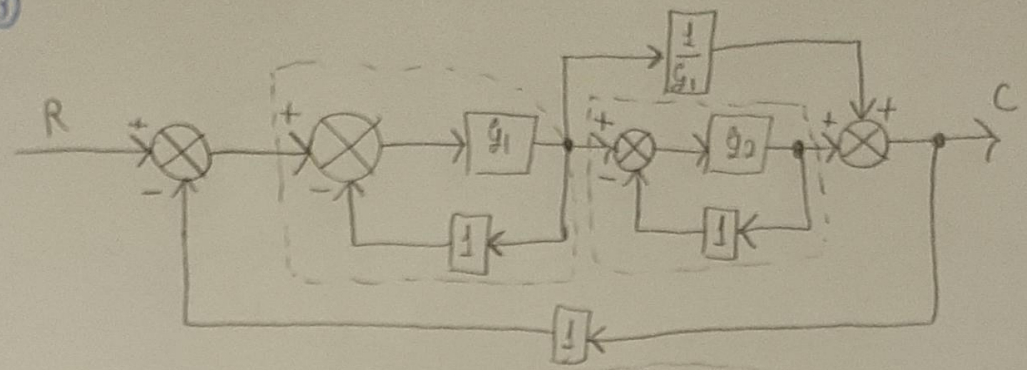
$C_h = 1 m^2$

$R_h = 1 \frac{s}{m^2}$

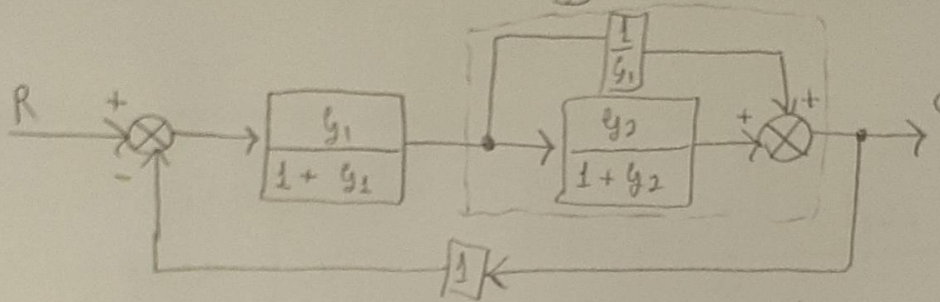
Wirlam Alves - 96708

③

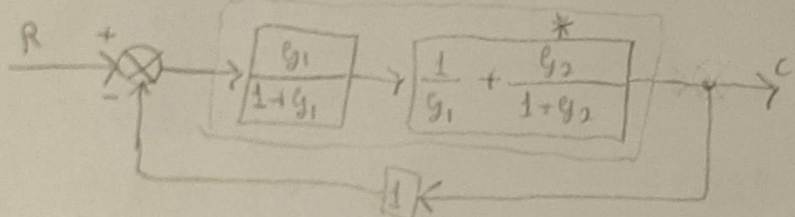
①



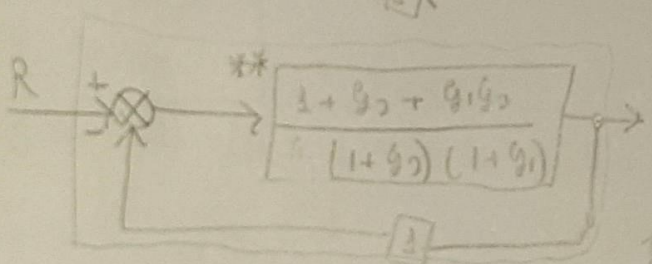
②



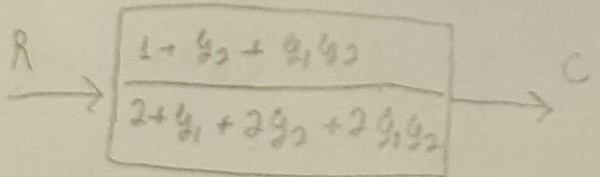
③



④



⑤



$$FT = \frac{C}{R} = \frac{1+G_2+G_1G_2}{2+G_1+2G_2+2G_1G_2}$$

✓

* $\frac{1+G_2+G_1G_2}{G_1(1+G_2)}$

** $\frac{1+G_2+G_1G_2}{G_1(1+G_2)} \cdot \frac{G_1}{1+G_1}$

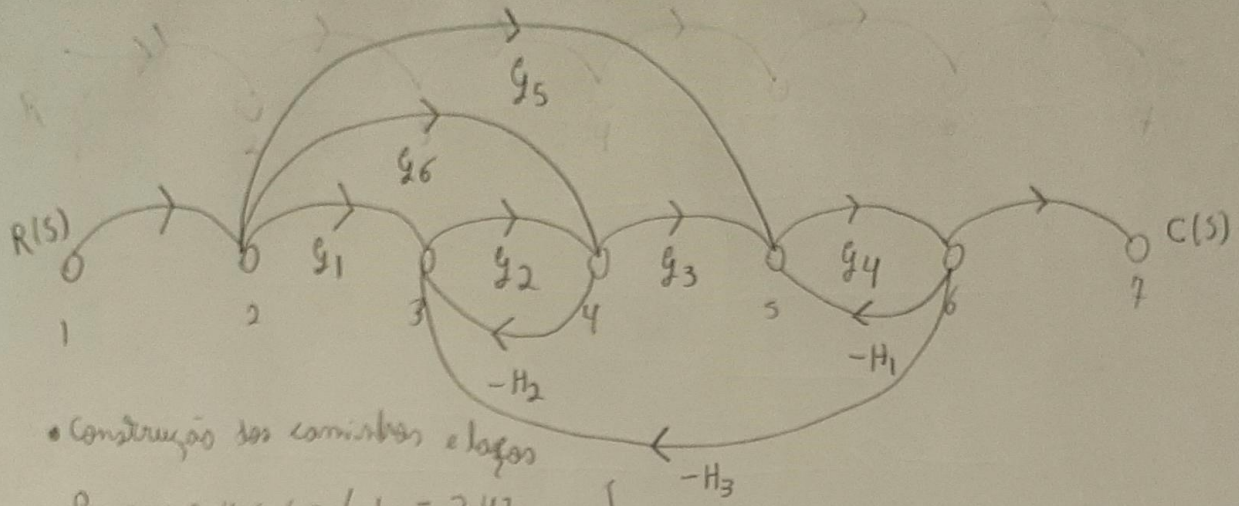
$\frac{1+G_2+G_1G_2}{(1+G_2)(1+G_1)}$

$\frac{1+G_2+G_1G_2}{(1+G_1)(1+G_2)} \cdot \frac{1}{1+\frac{1+G_2+G_1G_2}{(1+G_1)(1+G_2)}}$

$\frac{1+G_2+G_1G_2}{1+G_1+G_2+G_1G_2+1+G_2+G_1G_2}$

Vinicius Alves 96709

(4)



• Construção dos caminhos e laços

$P_1 = 1, 2, 3, 4, 5, 6, 7$ | $L_1 = 3, 4, 3$

$P_2 = 1, 2, 4, 5, 6, 7$ | $L_2 = 5, 6, 5$

$P_3 = 1, 2, 5, 6, 7$ | $L_3 = 3, 4, 5, 6, 3$

$$F = \frac{P_1\Delta_1 + P_2\Delta_2 + P_3\Delta_3}{\Delta}$$

$P_1 = G_1 G_2 G_3 G_4$ | $L_1 = -G_2 H_2$ | $L_a = -G_2 H_2 - G_4 H_1 - G_2 G_3 G_4 H_3$

$P_2 = G_6 G_3 G_4$ | $L_2 = -G_4 H_1$ | $L_b L_c = G_2 H_2 G_4 H_1$

$P_3 = G_5 G_4$ | $L_3 = -G_2 G_3 G_4 H_3$ | $L_d L_e L_f = 0$

$$\Delta = 1 - L_a + L_b L_c = 1 + G_2 H_2 + G_4 H_1 + G_2 G_3 G_4 H_3 + G_2 H_2 G_4 H_1$$

$\Delta_1 = 1$, $\Delta_2 = 1$, $\Delta_3 = 1 + G_2 H_2 +$

$$FT = \frac{C(s)}{R(s)} = \frac{G_1 G_2 G_3 G_4 + G_6 G_3 G_4 + G_5 G_4 (1 + G_2 H_2)}{1 + G_2 H_2 + G_4 H_1 + G_2 G_3 G_4 H_3 + G_2 H_2 G_4 H_1}$$

✓