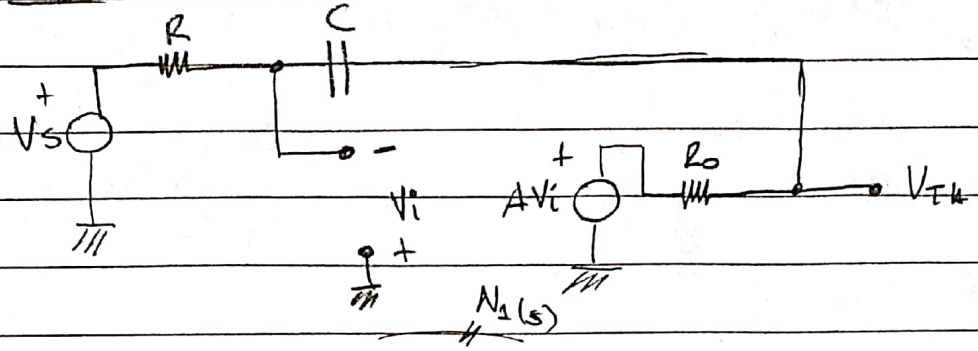
Problema 3

a)

V_{TH}:



$$V_{TH}(s) = \frac{R_o V_s + (1/Cs + R) A V_i}{R_o + R + 1/Cs}$$

$N_1(s)$ sobre $R_o V_s + (1/Cs + R) A V_i$; $D(s)$ sobre $R_o + R + 1/Cs$

V_i:

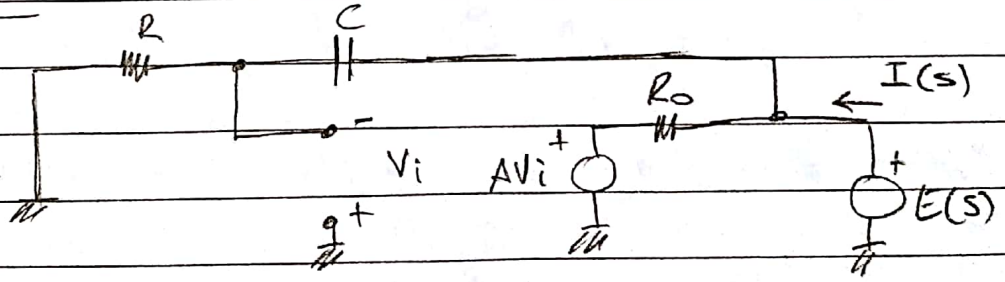
$$-V_i(s) = \frac{RA V_i(s) + (R_o + 1/Cs) V_s}{R_o + R + 1/Cs}$$

$N_2(s)$ sobre $RA V_i(s) + (R_o + 1/Cs) V_s$; $D(s)$ sobre $R_o + R + 1/Cs$

$$\Rightarrow \boxed{V_i(s) = \frac{N_2(s)}{D(s)[-D(s) - RA]} V_s}$$

$$\Rightarrow \boxed{V_{TH}(s) = \frac{D(s)[D(s) - RA]R_o + N_1(s)N_2(s)A}{D(s)^2[-D(s) - RA]} V_s}$$

Z_{TH}:



$$I(s) = \frac{E - AV_i}{R_o} + \frac{E}{N_1(s)}, \quad V_i^o = \frac{-R}{N_1(s)} E$$

$$\Rightarrow \boxed{Z_{TH}(s) = \frac{R_o N_1(s)}{N_1(s) + AR + R_o}}$$

b)

$Z_{TH} = 0\,\Omega$ (op. ideal)

$$V_{TH} = V_y(s) = C(sI - A)^{-1} B V_i(s)$$

$$= \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} \frac{1}{s+2} & \frac{4}{(s+1)(s+2)} \\ 0 & \frac{1}{(s+1)} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} V_i(s)$$

$$= \left(\frac{1}{s+2} + \frac{4}{(s+1)(s+2)} \right) V_i(s) = \frac{s+5}{(s+1)(s+2)} V_i(s)$$

c)

i.-) $$I(s) = \frac{V_{TH}^1 - V_{TH}^2}{Z_{TH}^1}$$

ii.-)
$$\begin{cases} V_1(s) = sL_1 I_1(s) + Ms\, I_2(s) \\ V_2(s) = sL_2 I_2(s) + Ms\, I_1(s) \end{cases}$$

Donde:

$$V_1(s) = V_{TH}^2 \; ; \; I_2(s) = -\frac{V_2(s)}{R}$$

$$\Rightarrow \boxed{V_2(s) = \frac{MR}{L_1 R + s(L_1 L_2 - M^2)} V_{TH}^2}$$

$$V_o(s) = -V_2(s) = \underbrace{\frac{-MR}{L_1 R + s(L_1 L_2 - M^2)} \frac{(s+5)}{(s+1)(s+2)}}_{H(s)} V_i(s)$$

iii.-) Transferencia propia (estricta)

polos: $\{-1, -2, \frac{-L_1 R}{L_1 L_2 - M^2}\}$ $\Rightarrow$ SI BIBO