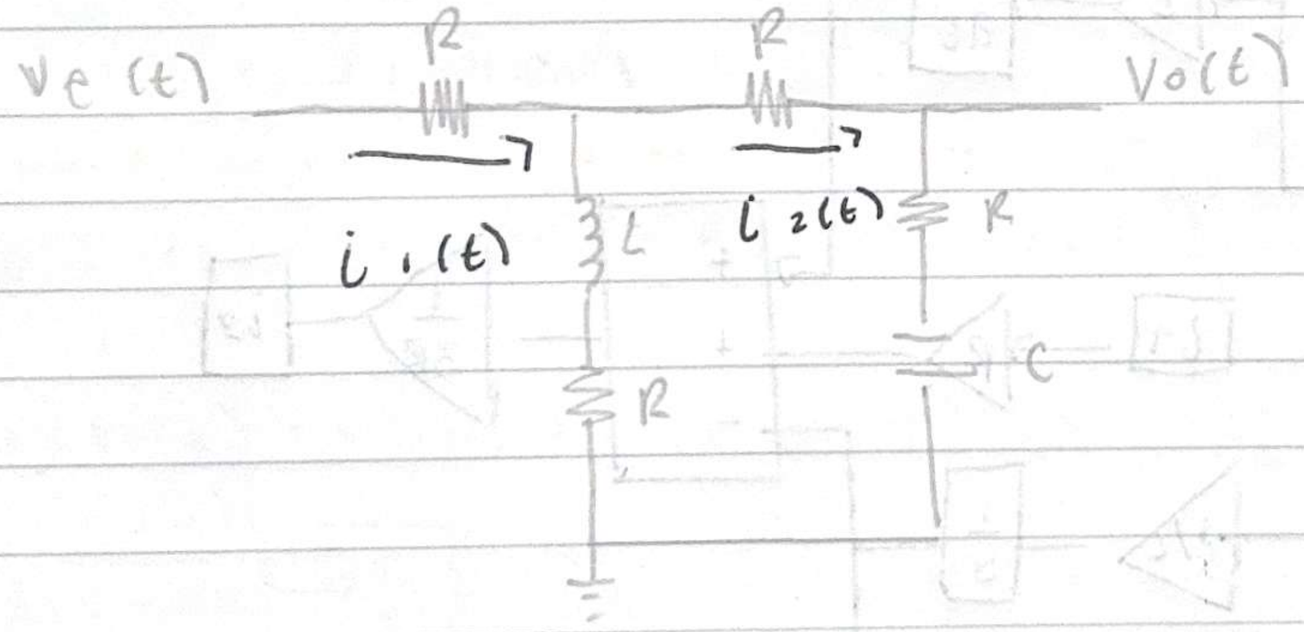
rgb(0, 128, 157)



$$\frac{Vs(s)}{Ve(s)} = \frac{?}{?} \quad \frac{\mp z(s)}{Iz(s)}$$

Ec. principales

$$ve(t) = R i_1(t) + L \frac{d[i_1(t) - i_2(t)]}{dt} + R[i_1(t) - i_2(t)]$$

$$L \frac{d[i_1(t) - i_2(t)]}{dt} + R[i_1(t) - i_2(t)] = R i_2(t) + R i_2(t) + \frac{1}{C}\int i_2(t) dt$$

$$Vs(t) = R i_2(t) + \frac{1}{C}\int i_2(t)\, dt$$

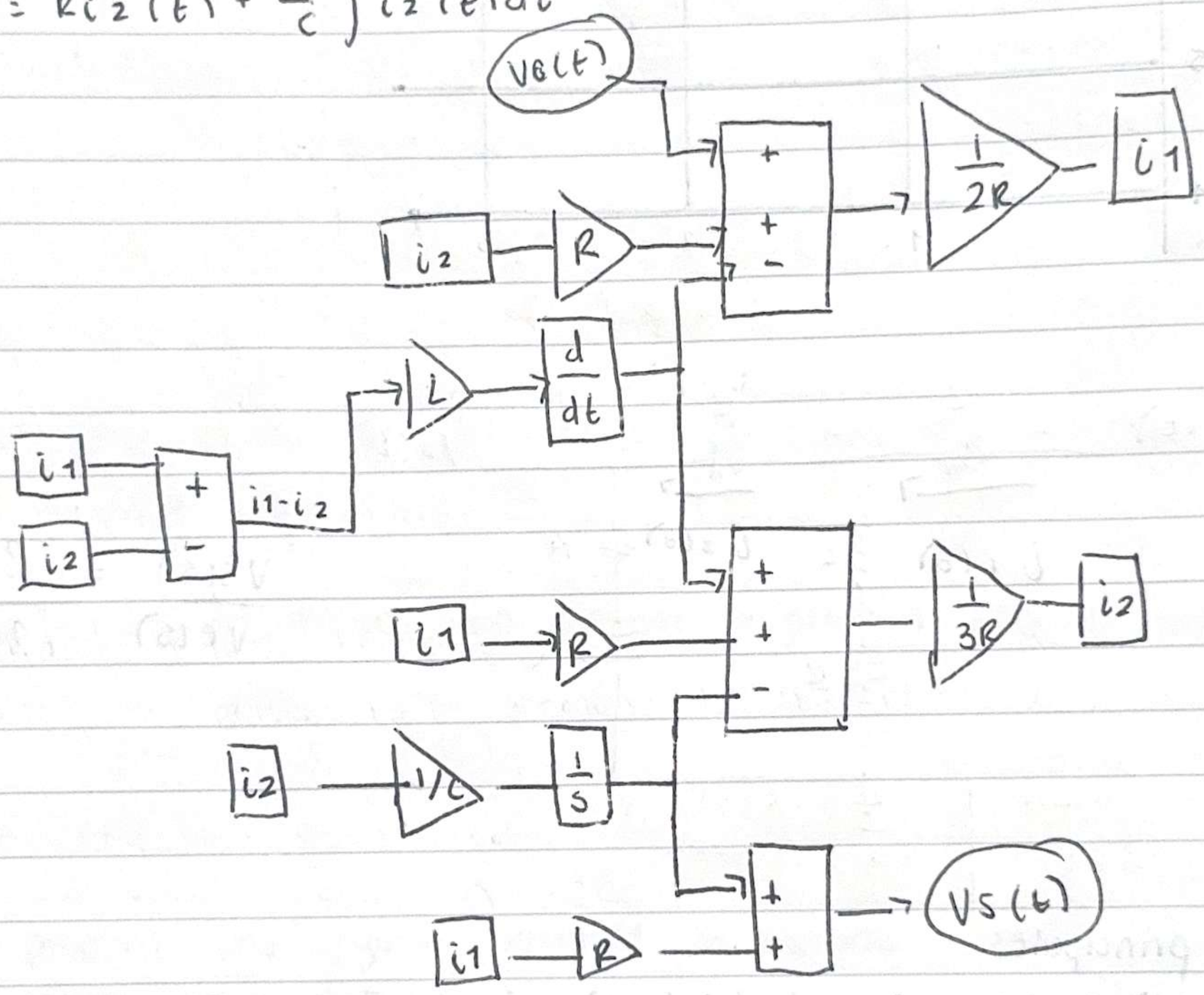
23/09/25

Modelo de ecuaciones integro - diferenciales

$$i_1(t) = \left[V_e(t) - L \frac{d[i_1(t) - i_2(t)]}{dt} + R i_2(t) \right] \frac{1}{2R}$$

$$i_2(t) = \left[L \frac{d[i_1(t) - i_2(t)]}{dt} + R i_1(t) - \frac{1}{C} \int i_2(t)\,dt \right] \frac{1}{3R}$$

$$V_S(t) = R i_2(t) + \frac{1}{C} \int i_2(t)\,dt$$



Nota: ¡No debe haber términos negativos!.

26/09/25

$Ve(t)$

Transformada de Laplace

$$Ve(s) = RI_1(s) + LS[I_2(s) - I_2(s)] + R[I_1(s) - I_2(s)]$$

$$LS[I_1(s) - I_2(s)] + R[I_1(s) - I_2(s)] = RI_2(s) + RI_2(s) + \frac{I_2(s)}{CS}$$

$$Vs(s) = RI_2(s) + \frac{I_2(s)}{CS} = \frac{CRS+1}{CS} I_2(s)$$

Procedimiento algebraico

$$Ve(s) = (R + LS + R) I_1(s) - (LS+R) I_2(s)$$
$$= (LS + 2R) I_1(s) - (LS+R) I_2(s)$$

$$LSI_1(s) - LSI_2(s) + RI_1(s) - RI_2(s) = 2RI_2(s) + \frac{I_2(s)}{CS}$$

$$LSI_1(s) + RI_1(s) = 3RI_2(s) + LSI_2(s) + \frac{I_2(s)}{CS}$$

$$(LS+R) I_1(s) = (3R + LS + 1/CS) I_2(s)$$

$$I_1(s) = \frac{3CRS + CLS^2 + 1}{CS(LS+R)} \quad I_2(s) = \frac{CLS^2 + 3CRS + 1}{CS(LS+R)} I_2(s)$$

$$Ve(s) = \frac{(LS+2R)(CLS^2 + 3CRS + 1)}{CS(LS+R)} I_2(s) - (LS+R) I_2(s)$$

$$L^3S^2 + 2LRS + R^2$$

$$= \left[\frac{(LS+2R)(CLS^2+3CRS+1) - CS(LS+R)(LS+R)}{CS(LS+R)}\right] I_2(s)$$

$R = 4.7 \times 10^{-3}$

$L = 680 \times 10^{-6}$

$C = 47 \times 10^{-6}$

$+ \quad CL^2S^3 + 3CLRS^2 + LS + 2CLRS^2 + 6CR^2S + 2R$

$- \quad -CL^2S^3 - 2CLR^2 - CR^2S \rightarrow 5CR^2S$

$$Ve(s) = 3CLS^2 + (5CR^2 + L)S + 2R$$

$$\frac{CRS+1}{CS} \; I_2(s)$$

$$Vs(s) = \frac{}{3CLRS^2 + (5CR^2 + L)S + 2R} \; I_2(s)$$

$$CS(LS+R)$$

$$(CRS+1)(LS+R) = CLRS^2 + CR^2S + LS + R$$

$$\frac{Vs(s)}{Ve(s)} = \frac{CLRS^2 + (CR^2 + L)S + R}{3CLRS^2 + (5CR^2 + L)S + 2R}$$

$num = [(47 \times 10^{-6}) * (680 \times 10^{-6}) *$

Estabilidad en lazo abierto

- calcular los polos de la función de transferencia

$$Vs(s) = \frac{CLR^5 + (CR^2 + L)S + R}{3CLRS^2 + (5CR^2 + L)S + 2R}$$

L = np.roots(den)

fprint: Las raices son {L[0]} y {L[1]}

$\lambda_1 = -11519607.541$

$\lambda_2 = -1.8107$

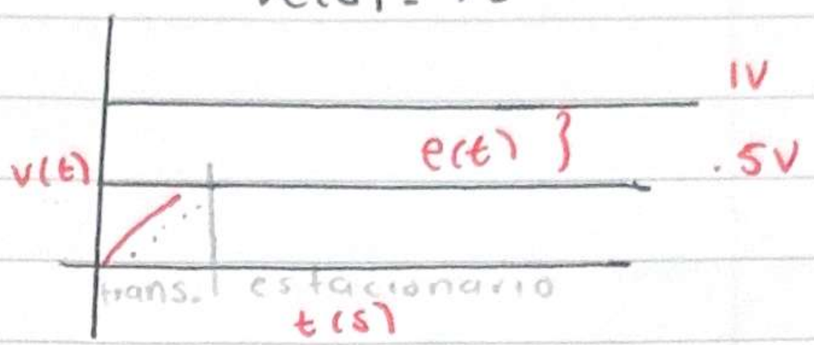
Sobreamortiguada

Error en estado estacionario

$$e(s) = \lim_{s \to 0} \; s\, ve(s) \left[1 - \frac{VS(s)}{ve(s)} \right]$$

$ve(t) = 1V$

$ve(s) = 1/2$



$$= \lim_{s \to 0} \; s \cdot \frac{1}{s} \left[1 - \frac{CLRS^2 + (CR^2 + L)\, s + R}{3\, CLRS^2 + (SCR^2 + L)\, s + 2R} \right]$$

$$= \frac{R}{2R} \qquad e(t) = 1/2\, V$$