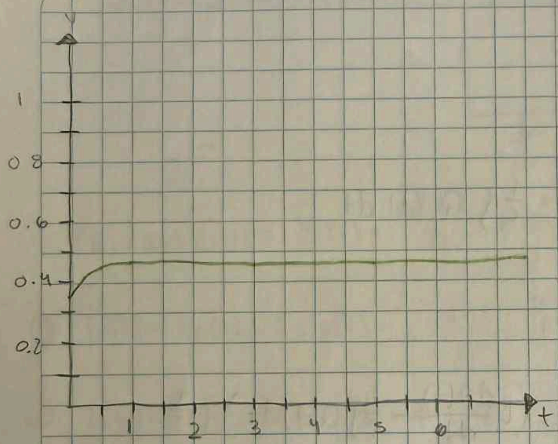
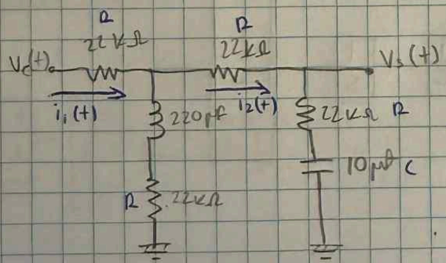
Practica #1





*** Ecuaciones principales**

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

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

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

23-Sep-25

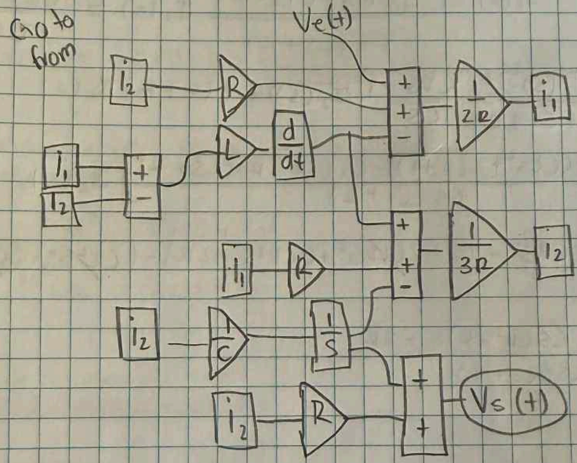
Modelo de ecuaciones integro-diferenciales

Despeje de EC. Principales

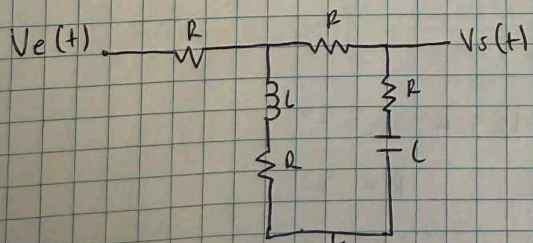
$$i_1(t) = \left[Ve(t) - L\frac{d[i_1(t) - i_2(t)]}{dt} + R i_2(t) \right] \frac{1}{2R}$$

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

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



26-09-25



función de transferencia

$$\frac{Vs(s)}{Ve(s)} = \frac{?}{?}\ \frac{I_2(s)}{I_2(s)}$$

Transformada de la place

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

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

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

26/sep/25

Nota:
no debe de haber terminos negativos!

→ Procedimiento algebraico

→ $V_e(s) = (R + Ls + R) I_1(s) - (Ls + R) I_2(s)$
$= (Ls + 2R) I_1(s) - (Ls + R) I_2(s)$

→ $LsI_1(s) - LsI_2(s) + RI_1(s) - RI_2(s) = 2RI_2(s) + \frac{I_2(s)}{Cs}$

$LsI_1(s) + RI_1(s) = 3RI_2(s) + LsI_2(s) + \frac{I_2(s)}{Cs}$

$(Ls+R) I_1(s) = (3R + Ls + \frac{1}{Cs}) I_2(s)$

$I_1(s) = \frac{3CRs + CLs^2 + 1}{Cs(Ls+R)} I_2(s) = \frac{CLs^2 + 3CRs + 1}{Cs(Ls+R)} I_2(s)$

→ $Ve(s) = \frac{(Ls+2R)(CLs^2 + 3CRs + 1)}{Cs(Ls+R)} I_2(s) - (Ls+R) I_2(s)$

$Ve(s) = \left[\frac{(Ls+2R)(CLs^2+3CRs+1) - Cs(Ls+R)(Ls+R)}{Cs(Ls+R)}\right] I_2(s)$

$(\cancel{CL^2s^3} + 3CLRs^2 + Ls + 2\cancel{CLRs^2} + 6CR^2s + 2R) - (\cancel{CL^2s^3} - 2\cancel{CLRs^2} - CR^2s)$

$Ve(s) = \frac{3CLRs^2 + (5CR^2 + L)s + 2R}{Cs(Ls+R)}$

$Vs(s) = \dfrac{\frac{CRs+1}{Cs} I_2(s)}{\frac{3CLRs^2 + (5CR^2+L)s + 2R}{Cs(Ls+R)} I_2(s)}$

$Vs(s) = (CRs+1)(Ls+R) = CLRs^2 + CR^2s + Ls + R$

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

$R = 22$

$C = 22$

$L = 2$

02-oct-25

Estabilidad en lazo abierto

Calcular los polos de la función de transferencia

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

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den = [3*C*L*R, 5*C*R**2+L, 2*R]
L = np.Roots(den)
fprint: las raíces {L[0]} y {L[1]}
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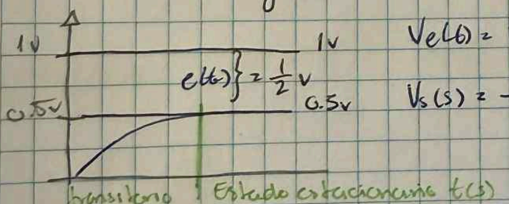
$\lambda_1 = -166666666.36363$

$\lambda_2 = -1.81818182148$

El sistema presenta una respuesta estable y sobreamortiguada.



$Ve(t) = 1V$

$Vs(s) = \frac{1}{S}$

Error en estado estacionario

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

$$= \lim_{s \to 0} s \cdot \frac{1}{s}\left[1 - \frac{CLRS^2 + (CR^2+L)s + R}{3CLRS^2 + (5CR^2+L)s + 2R}\right]$$

$$= \frac{R}{2R}$$

$e(t) = \frac{1}{2} V$