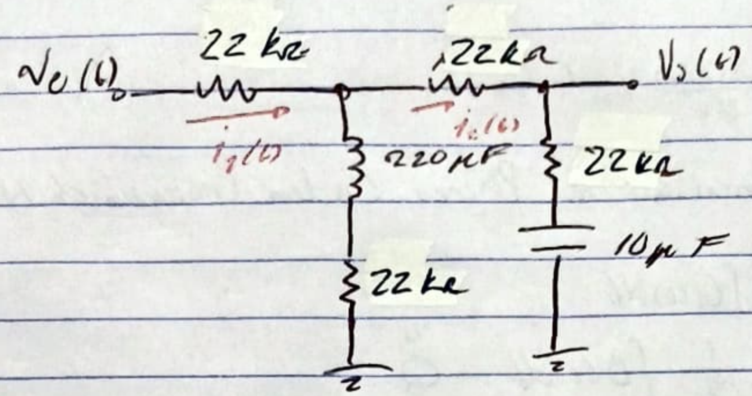
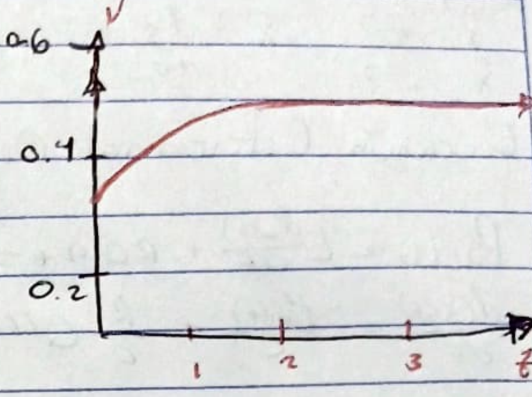
Practica 1.

23/Sep/2025





Ecuaciones Principales

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

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

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

Modelo de ecuaciones integro-diferenciales.

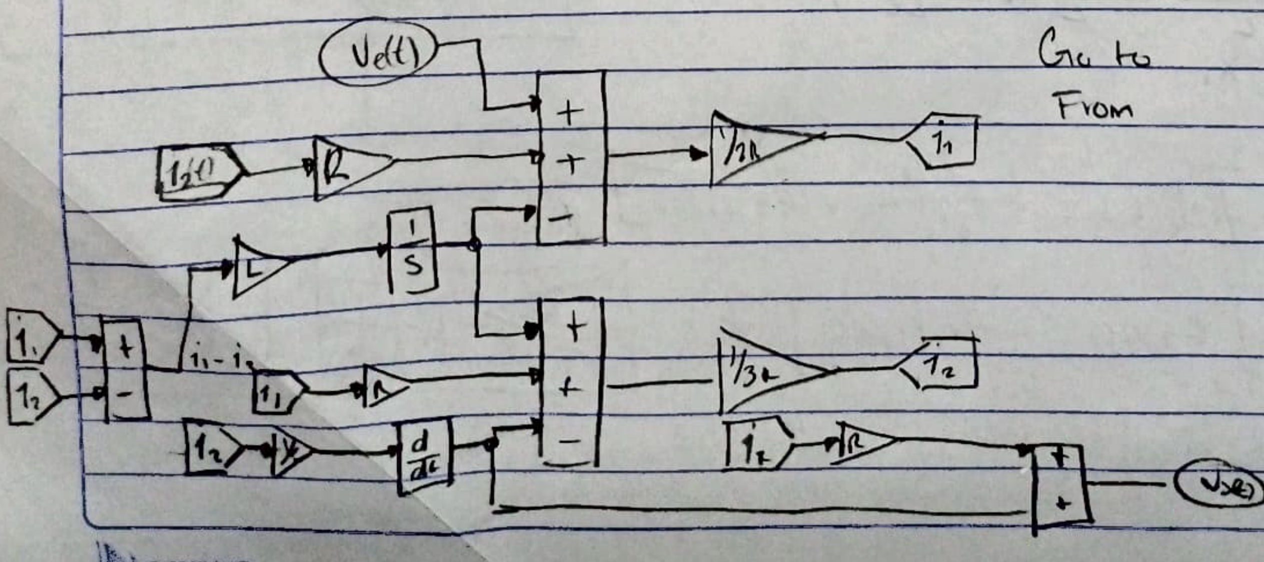
$$V_e(t) = 2R\, i_1(t) - R\, i_2(t) + L\frac{d[i_1(t)-i_2(t)]}{dt}$$

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

$$L\frac{d[i_1(t)-i_2(t)]}{dt} + R\, i_1(t) - R\, i_2(t) = 2R\, i_2(t) + \frac{1}{C}\int i_2\,dt$$

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

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



Goto

From

Nota: ¡No terminos negativos!

Transformada de Laplace $V_s(s)/V_e(s) = ?\,I_1(s) / ?\,I_2(s)$

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

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

$V_s(s) = R I_2(s) + \frac{I_2(s)}{SC}$

Procedimiento Algebraico.

$V_e(s) = (R + LS + R) I_1(s) - (LS + R) I_2(s)$

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

$LS I_1(s) - LS I_2(s) + R I_1(s) - R I_2(s) = 2R I_2(s) + \frac{I_2(s)}{CS}$

$LS I_1(s) + R I_1(s) = 3R I_2(s) + LS I_2(s) + \frac{I_2(s)}{CS}$

$(LS + R) I_1(s) = (3R + LS + \frac{1}{CS}) I_2(s)$

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

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

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

$L^2S^2 + 2LSR + R^2$

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

$V_e(s) = \cancel{CL^2S^3} + 3CLRS^2 + LS + \cancel{2CLRS^2} + \overset{5}{\cancel{6}}CR^2S + 2R - \cancel{CS^3L^2} - \cancel{2CLS^2R} - \cancel{CR^2S}$

$V_e(s) = \left[\frac{3CLRS^2 + 5CR^2S + LS + 2R}{CS(LS + R)}\right] I_2(s)$

Función de Transferencia.

$$\frac{V_s(s)}{V_e(s)} = \frac{\frac{CRS + 1}{\cancel{CS}} \cancel{I_2(s)}}{\frac{3CLRS^2 + 5CR^2S + LS + 2R}{\cancel{CS}(LS + R)} \cancel{I_2(s)}}$$

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

$$\frac{V_s(s)}{V_e(s)} = \frac{CRLS^2 + (CR^2 + L)S + R}{3CLRS^2 + (5CR^2 + L)S + 2R}$$

Estabilidad en lazo abierto

- Calcular los polos de la función de transferencia

$$\frac{V_s(s)}{V_e(s)} = \frac{CLRS^2 + (CR^2+L)s + R}{3(LRS^2 + (5CR^2+L)s + 2R}$$

En ~~Python~~ Phyton?

```
den = [3*C*L*R, 5*C*R**2 + L, 2*R]
  L = np.roots (den)
→ fprint: Las raíces son {L[0]} y {L[1]}
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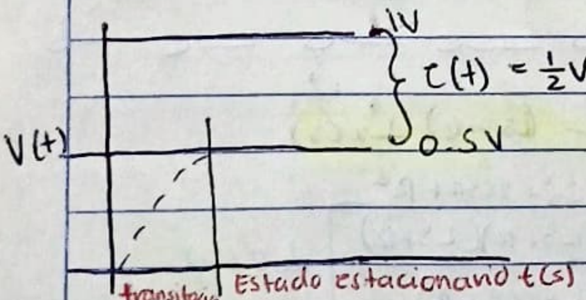
Muestra

$\lambda_1 = -166666666.3636363$

$\lambda_2 = -1.18$

El sistema presenta una respuesta estable y sobreamortiguada



Error en estado estacionario

$$e(s) = \lim_{s \to 0} sV_e(s)\left[1 - \frac{V_s(s)}{V_e(s)}\right]$$

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

$$e(s) = \frac{R}{2R}$$

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