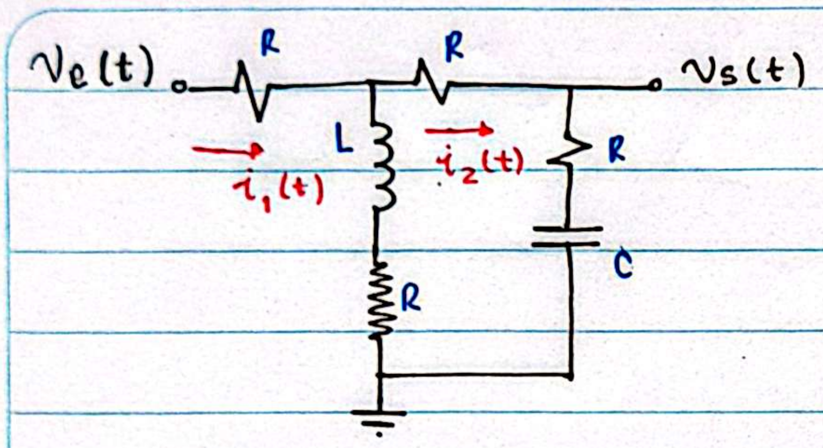
Práctica no. 1 23-Septiembre



Ecuaciones principales

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

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

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

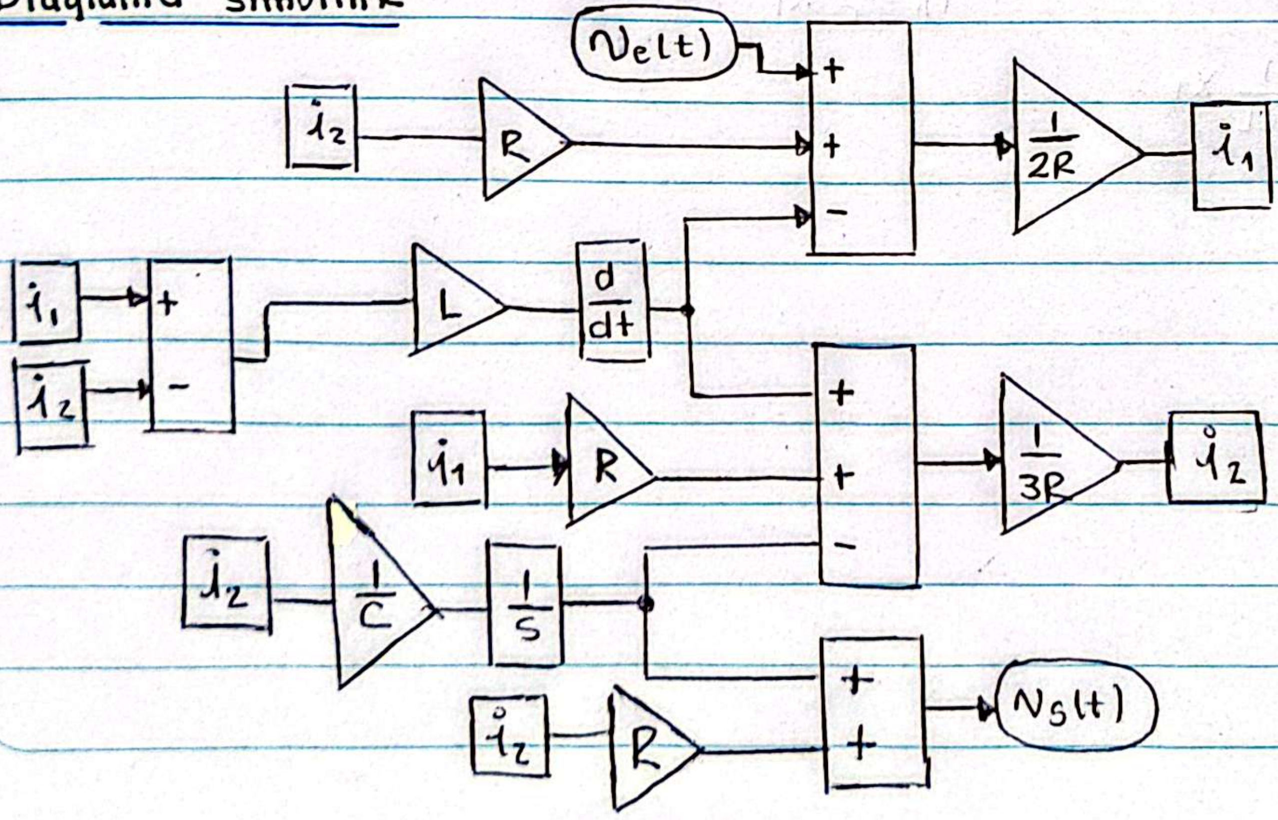
Modelo de ecuaciones integro-diferenciales

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

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

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

Diagrama simulink



Escaneado con CamScanner

26-Septiembre

Transformada de Laplace

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

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

$$V_s(s) = RI_2(s) + \frac{I_2(s)}{CS}$$

Procedimiento algebraico

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

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

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

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

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

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

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

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

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

$$= \frac{\cancel{CL^2S^3} + 3CLRS^2 + LS + \cancel{2CLRS^2} + 6CR^2S + 2R - \cancel{CL^2S^3} - \cancel{2CLS^2R} - CSR^2}{CS(LS + R)}$$

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

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

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

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

Función de Transferencia

Escaneado con CamScanner

Estabilidad en lazo abierto. 02-Octubre

∘ Calcular los polos de la función de transferencia

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

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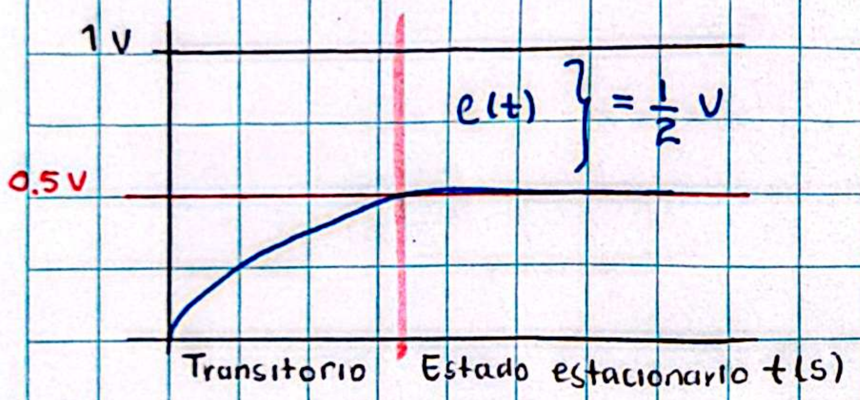
raíces

$\boxed{\begin{array}{l} L[0] = -1666662.368 \\ L[1] = -25.788 \end{array}}$

El sistema presenta una respuesta estable y sobreamortiguada



$V_e(t) = 1V$

$V_s(t) = \frac{1}{s}$

Error en estado estacionario

$$e(s) = \lim_{s \to 0} sV_e(s)\left[1 - \frac{V_s(s)}{V_e(s)}\right] = \lim_{s \to 0} s * \frac{1}{s}\left[1 - \frac{CLRs^2 + (CR^2+L)s + R}{3CLRs^2 + (5CR^2+L)s + 2R}\right]$$

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

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