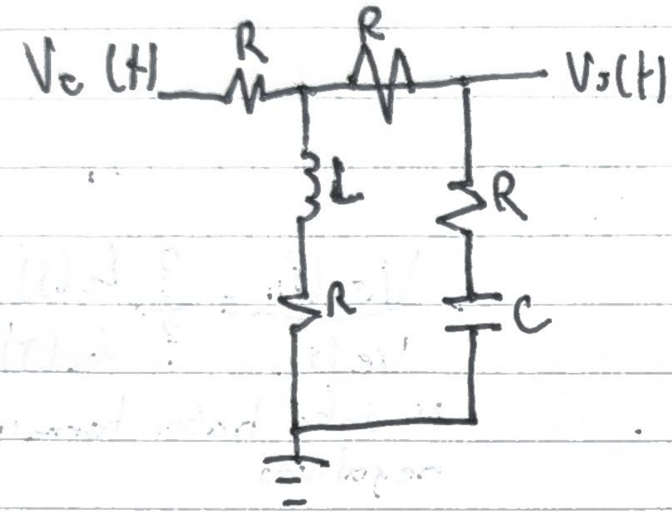


Ec principales

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

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

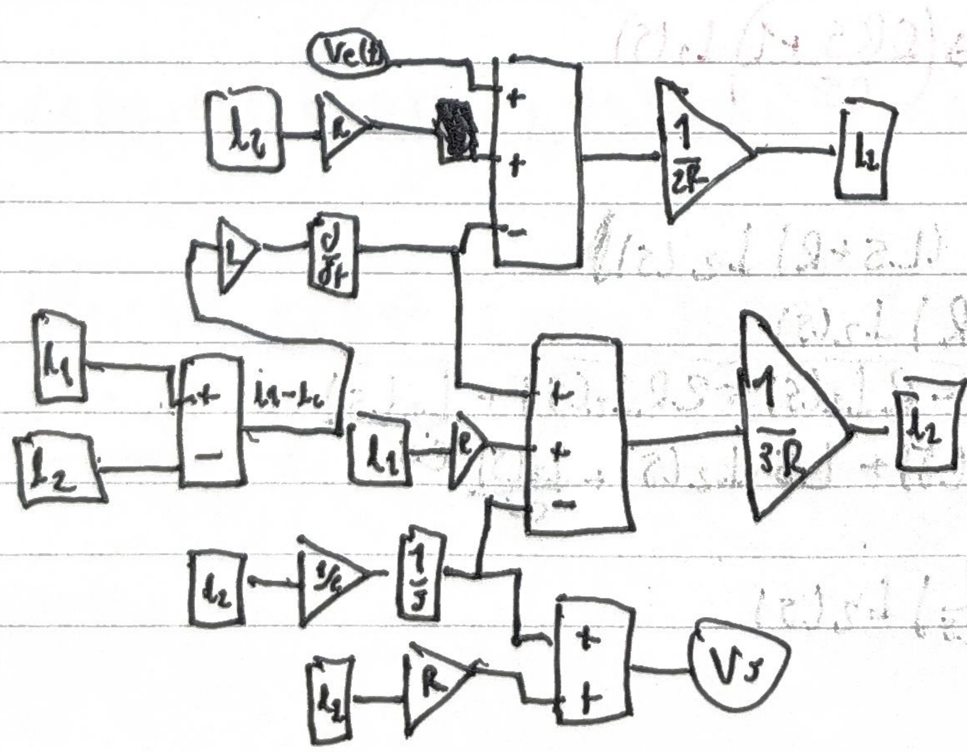
$$V_s(t) = R i_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

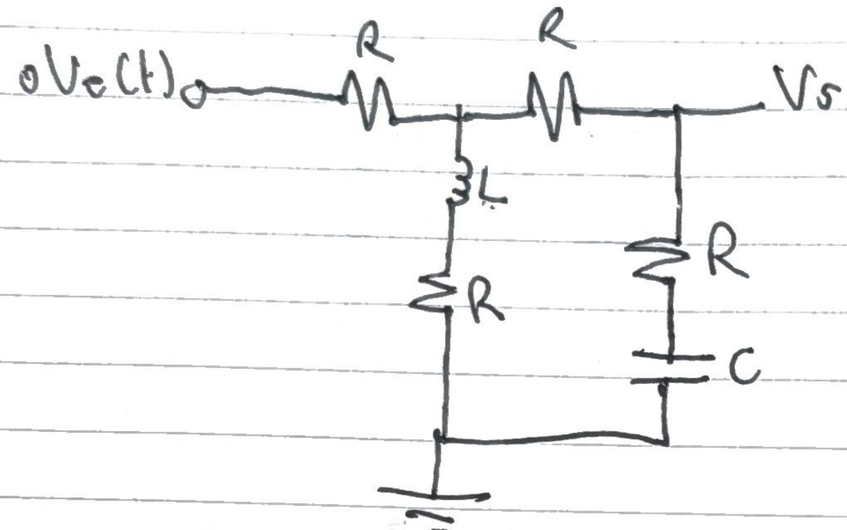
Modelo de ecuaciones integrodiferenciales

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

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

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





$$\frac{V_S(s)}{V_e(s)} = \frac{?\; I_2(s)}{?\; I_2(s)}$$

· No debe haber terminos negativos

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

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

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

Transformada de Laplace

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

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

$$V_s(s) = R I_2(s) + \frac{I_2(s)}{Cs} \rightarrow \left(\frac{CRs+1}{Cs}\right) I_2(s)$$

Procedimiento algebráico

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

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

$$Ls I_1(s) - Ls I_2(s) + R I_1(s) - R I_2(s) = 2R I_2(s) + \frac{I_2(s)}{Cs}$$

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

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

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

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

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

$$\cancel{CL^2S^3} + 3LCS^2R + LS + \cancel{2RCLS^2} + 6CR^2S + 2R$$

$$-\cancel{CL^2S^3} - \cancel{2CLRS^2} - \cancel{CR^2S} \qquad +5CR^2S$$

$$3CLRS^2 + LS + 5CR^2S + 2R$$

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

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

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

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

$R = 4.7K$
$L = 300E-6$
$C = 33E-6$

Estabilidad de lazo abierto

Calcular los polos de la función de transferencia

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

El sistema presenta una respuesta estable y sobreamortiguada

Error estacionario estacionario

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

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

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

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