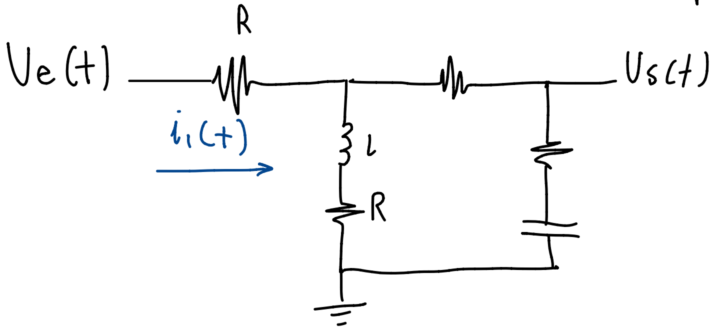
$C = 100 \times 10^{-6}$ $\quad L = 2.2 \times 10^{-3}$

$R = 1 \times 10^{3}\,\Omega$

23-Sep-25



Ecuaciones principales

$2Ri_1(t)$ $\quad Ri(t - Ri_2(t)$

$$V_e(t) = Ri_1(t) + L\frac{d[i_1(t) - i_2(t)]}{dt} + R[i_1(t) - i_2(t)]$$

$$L\frac{d[i_1(t) - i_2(t)]}{dt} + R[i_1(t) - i_2(t)] = Ri_2(t) + Ri_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

$Ri_1(t) - Ri_2(t)$ $\quad 3Ri_2(t)$

$$V_s(t) = Ri_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

despejar las dependientes desde donde no se int ni deriva

$$i_1(t) = \left[V_e(t) - L\frac{d[i_1(t) - i_2(t)]}{dt} + Ri_2(t)\right]\frac{1}{2R}$$

$$i_2(t) = \left[L\frac{d[i_1(t) - i_2(t)}{dt} + Ri_1(t) - \frac{1}{C}\int i_2(t)\,dt\right]\frac{1}{3R}$$

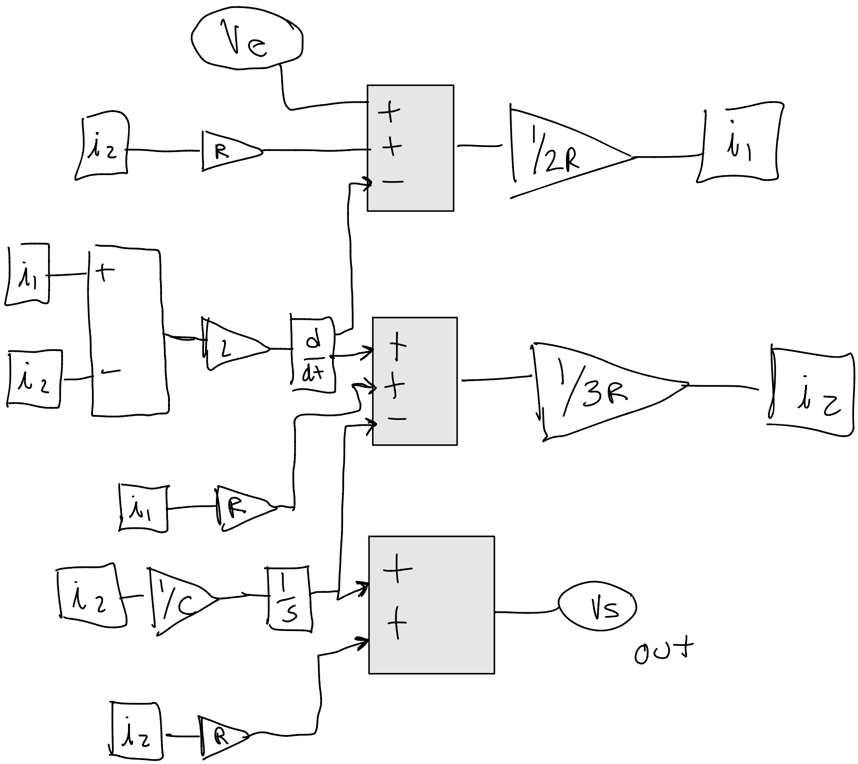
$$V_s(t) = Ri_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

Modelo de ec. integro-diferenciales

in

Voltaje E.

goto from



Con las ecuaciónes principales continuaremos.

Transformada de Laplace

pasamos de dominio del t^{iempo} a dominio de "s"

①

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

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

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

②

$$LS\left[I_1(s) - I_2(s)\right] + R\left[I_1(s) - I_2(s)\right] = 2R I_2(s) + \frac{I_2(s)}{Cs}$$

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

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

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

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

ahora el V_s

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

$$= \frac{CRS+1}{Cs}\, I_2(s)$$

Termina laplace y empieza el algebraico

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

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

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

$5CR^2S$

$$= \frac{\cancel{2CLRS^2} + \cancel{6CR^2S} + 2R + \cancel{CL^2S^3} + 3CLRS^2 + CS \cancel{- CL^2S^3} \cancel{- CLRS^2} \cancel{- CLRS^2} \cancel{- CR^2S}}{CS\,(LS+R)}\, I_2(s)$$

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

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

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

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

Con nuestros valores de R C L

Error en estado estacionario [escalón unitario]

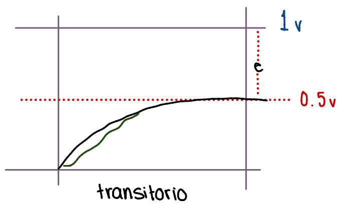
$$e(s) = \lim_{s\to\emptyset} s\,Ve(s)\left[1 - \frac{Vs(s)}{Ve(s)}\right]$$

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

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

$$= \frac{1}{2}V$$

Bosquejo ↴



Estabilidad en lazo abierto

- Cálculo de raices del denominador [Polos]

$$3CLRS^2 + (5CR^2+L)S + 2R = \emptyset$$

Con base en las raíces, se concluye que el sistema es estable con una respuesta Sobreamortiguada.

den = [3*C*L*R, 5*C*R**2+L, 2*R]

$\lambda_1 = -4.4642857\,13 \times 10^7$

$\lambda_2 = -7.843137257 \times 10^{-2}$

$\lambda_1 = -7.57575091 \times 10^5$

$\lambda_2 = -4.00000352$