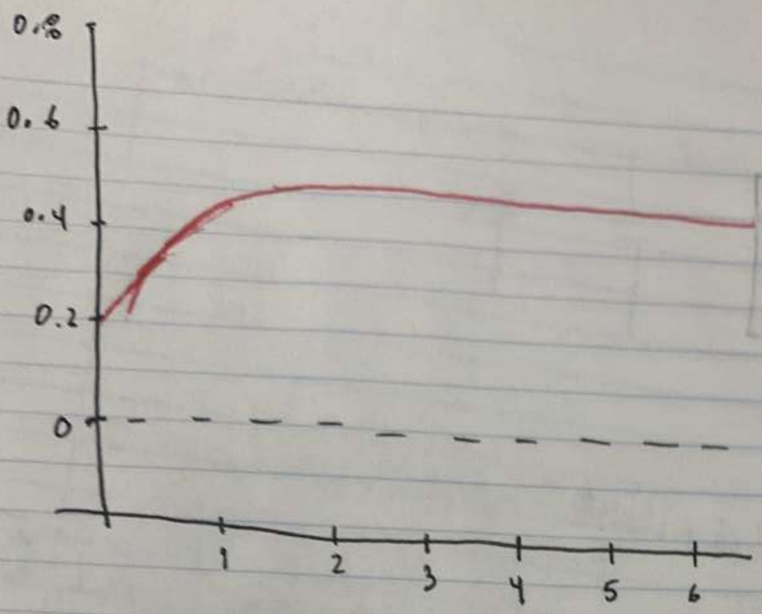
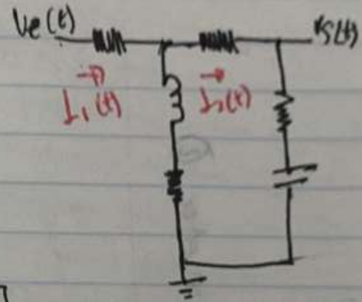




Ecuaciones principales

$$V_e(t) = R I_1(t) + L \frac{d[I_1(t) - I_2(t)]}{dt} + R[I_1(t) - I_2(t)]$$

$$L \frac{d[I_1(t) - I_2(t)]}{dt} + R[I_1(t) - I_2(t)] = R I_2(t) + R I_2(t) + \frac{1}{C}\int I_2(t)\,dt$$

$$V_s(t) = R I_2(t) + \frac{1}{C}\int I_2(t)\,dt$$

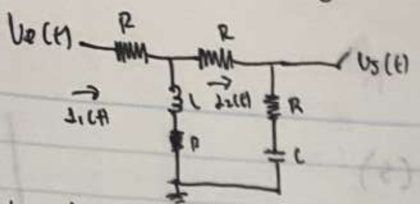
Modelo ecuaciones integrodiferenciales

$$I_1(t) = \left[V_e(t) - L \frac{d[I_1(t) - I_2(t)]}{dt} + R I_2(t)\right] \frac{1}{2R}$$

$$I_2(t) = \left[L \frac{d[I_1(t) - I_2(t)]}{dt} + R I_1(t) - \frac{1}{C}\int I_2(t)\,dt\right] \frac{1}{3R}$$

$$V_s(t) = R I_2(t) + \frac{1}{C}\int I_2(t)\,dt$$

Modelado



$$V_e(t) = R I_1(t) + L \frac{[i_1(t) - i_2(t)]}{dt} + R[I_1(t) - I_2(t)]$$

$$L \frac{d[I_1(t) - I_2(t)]}{dt} + R[I_1(t) - I_2(t)] = R I_2(t) + R I_2(t) + \frac{1}{C}\int I_2(t)\,dt$$

$$V_s(t) = \frac{1}{C}\int I_2(t)\,dt + R I_2(t)$$

Transformada laplace

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

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

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

Procedimiento Algebraico

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

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

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

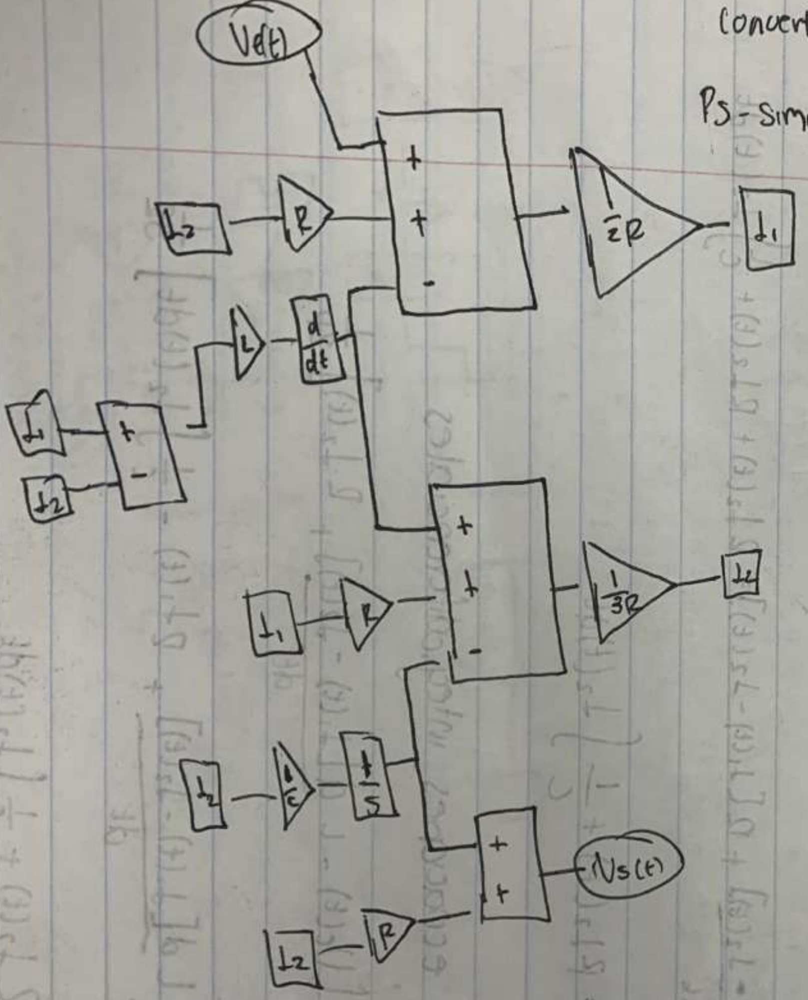
$$LS I_1(s) + R I_1(s) = 3R I_2(s) + LS I_2(s) + \frac{I_2(s)}{CS}$$

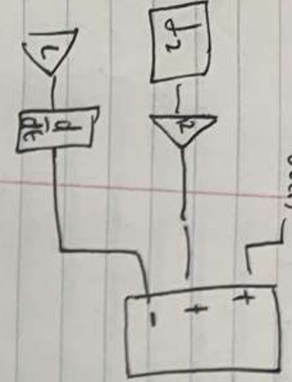
$$(LS + R) I_1(s) = \left(3R + LS + \frac{1}{CS}\right) I_2(s)$$

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

Simulink-PS converter ①

PS-Simulink converter ②





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

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

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

$$\cancel{CL^2s^3} + 3CLRs^2 + Ls + \cancel{2CLRs^2} + \overset{5}{\cancel{6}}CR^2s + 2R - \cancel{CL^2s^3} - \cancel{2CLRs^2} - \cancel{CR^2s}$$

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

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

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

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

$C = 22e^{-6}$

$R = 9e^{3}$

$L = 33e^{-3}$

Estabilidad en lazo abierto

• Calcular los polos de la función de transferencia

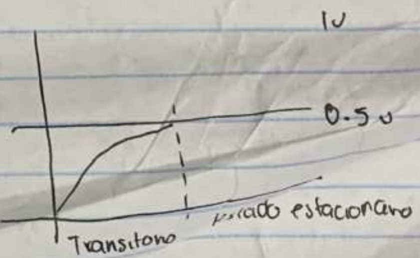
$$\frac{V_s(s)}{V_e(s)} = \frac{CLRs^2 + (CR^2+L)s + R}{3CLRs^2 + (5CR^2+L)s + 2R}$$

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

L = np.roots(den)

→ Fprint: Las raices son {L[0]} y {L[1]}

$\lambda_1 = -454545.117$
$\lambda_2 = -2.020$



Error en estado estacionario

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

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

$V_e(t) = 1$

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

$V_e(s) = \frac{1}{s}$

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