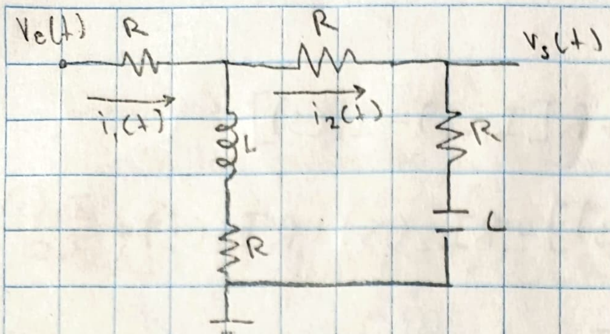


En la función final no debe haber términos negativos

Ecuaciones principales

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

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

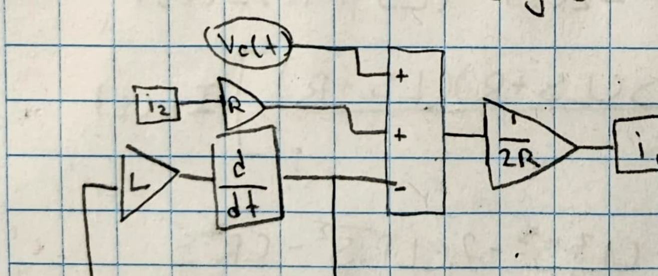
$$V_s(t) = R i_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

Modelo de ecuaciones integro-diferenciales

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

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

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



Transformada de Laplace

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

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

$$V_s(s) = RI_2(s) + \frac{I_2(s)}{CS} = \frac{CRS+1}{CS} I_2(s) \quad (3)$$

Procedimiento algebraico

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

$$= (LS + 2R)I_1(s) - (LS + R)I_2(s) \quad (1)$$

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

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

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

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

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

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

Mult:

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

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

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

función de transferencia

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

$C = 100 \times 10^{-6}$
$R = 1K$
$L = 68m$

Estabilidad en lazo abierto

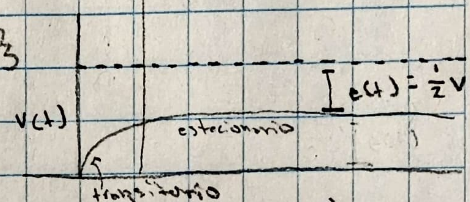
Calcular los polos de la función de transferencia

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

```
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]}
```

$\lambda_1 = -24509803.25490105$

$\lambda_2 = -4.000001088000205$



El sistema presenta una respuesta estable y sobreamortiguada

Error en estado estacionario

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

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

$$c(t) = \frac{1}{2} v$$

Va