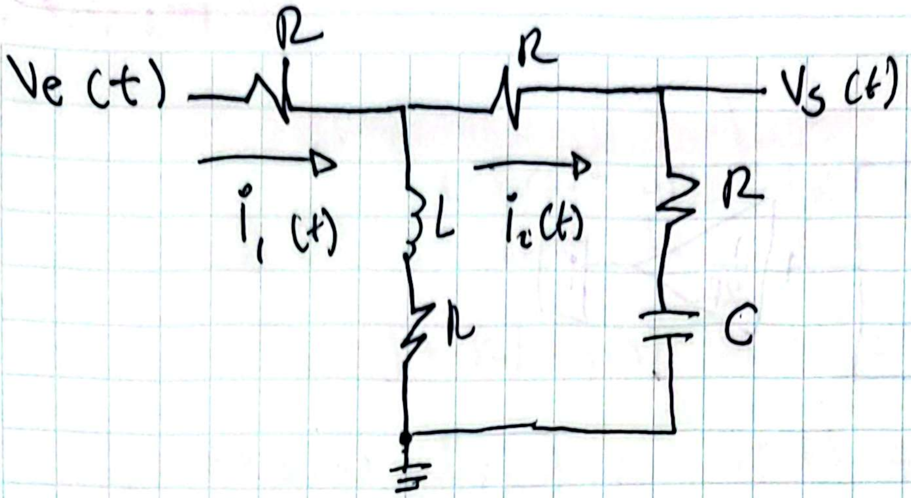
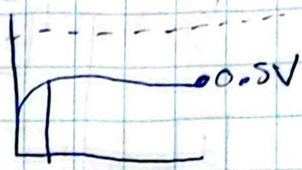
U2
Modelado

23-09-25



R = 4700 Ω
L = 2.2 mili H
C = 100 μF



Ecuaciones Principales → Analisis de mallas

$\cancel{Ve(t) = R i_2(t) + L\, d[i_1 + t] +}$

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

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

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

Modelo de ecuaciones Integro diferenciales

Donde no se este Integrando ni derivando.

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

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

$$Vs(t) = R i_1(t) + \frac{1}{C}\int i_2(t)\, dt$$

26-09-25

(Te) Transformada de Laplace

$$LsI_1(s) - LsI_2(s) + RI_1(s) - RI_2(s)$$

$$Ve(s) = RI_1(s) + Ls[I_1(s) - I_2(s)] + R[I_1(s) - I_2(s)]$$

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

$$Vs(s) = RI_2(s) + \frac{I_2(s)}{Cs} = \boxed{\frac{CRs+1}{Cs} + I_2(s)}$$

Procedimiento algebraico

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

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

$$LsI_1(s) - LsI_2(s) + RI_1(s) - RI_2(s) = 2RI_2(s) + \frac{I_2(s)}{Cs}$$

$$LsI_1 + RI_1(s) = 3RI_2(s) + LsI_2(s) + \frac{I_2(s)}{Cs}$$

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

$$I_1(s) = \frac{3CRs + CLs^2 + 1}{Cs(Ls + R)}I_2(s) = \frac{CLs^2 + 3CRs + 1}{Cs(Ls + R)}I_2(s)$$

$$Ve(s) = \frac{(Ls + 2R)(CLs^2 + 3CRs + 1)}{Cs(Ls + R)}I_1(s) - (Ls + R)I_2(s)$$

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

Mult.

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

$$\boxed{-\cancel{CL^2s^3} - 2CLRs^2 - CR^2s}$$

$$5CR^2s$$

→ ...

Modelado PF

29-09-25

R = 4.7K
C = 100nF
L = 2,2mH

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

$$\frac{CRs+1}{Cs} I_2(s) = V_s(s)$$ Salida

∴

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

Ley de la tortilla

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

ningun termino es 0

$$\frac{V_s(s)}{V_e(s)} = \frac{CLRs^2 + (CR^2+L)s + R}{3CLRs^2 + Cs(CR^2+1)s + 2R}$$

Funcion de transf.

mm [(100E-6)*(2.2E-3)*(4.7E3), (100E-6)*(4.7E3)^2

+ 2.2E-3, 4.7E3]

Estabilidad en lazo abierto

Modelado
2-10-25
U2

Componentes:

- $R = 4700 = 4{,}7 \times 10^3$
- $C = 100 \times 10^{-6}$
- $L = 2{,}2 \times 10^{-3}$ Henrys

*Calcular los polos de la función de transferencia

Server:

```
-> den = [3*C*L*R, 5*C*R**2+L, 2*R]
-> L = n.roots(den)
print: Las raices son
{L[0]} y {L[1]}
```

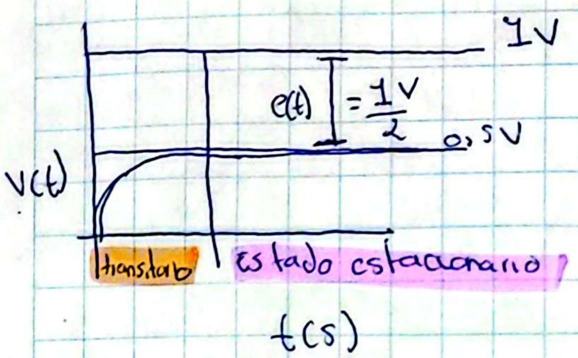
$$\frac{V_s(s)}{V_e(s)} = \frac{CLRs^2 + (CR^2+L)s + R}{3CLRs^2 + (5CR^2+L)s + 2R}$$

Sobre amortiguada

$\lambda_1 = -356060.9187620543$

$\lambda_2 = -0.85106386$

>>> El sistema presenta una respuesta estable y sobre amortiguada.



- $V_e(t) = 1\,V$
- $V_e(s) = \frac{1}{s}$

- Error en estado estacionario

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

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

$$= R/2R$$

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