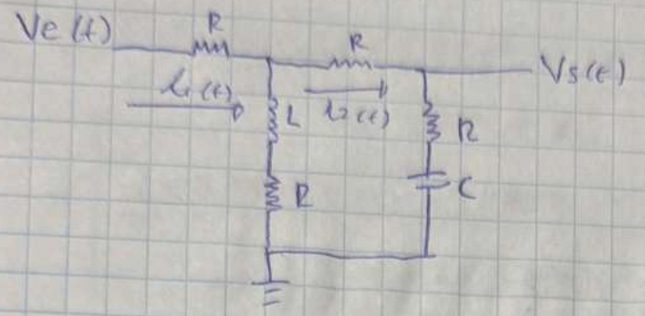


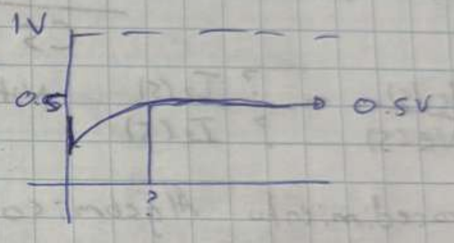
$L = 220\,mH$
$C = 10\,\mu F$
$R = 22\,k\Omega$

Ecuaciones principales

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

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

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



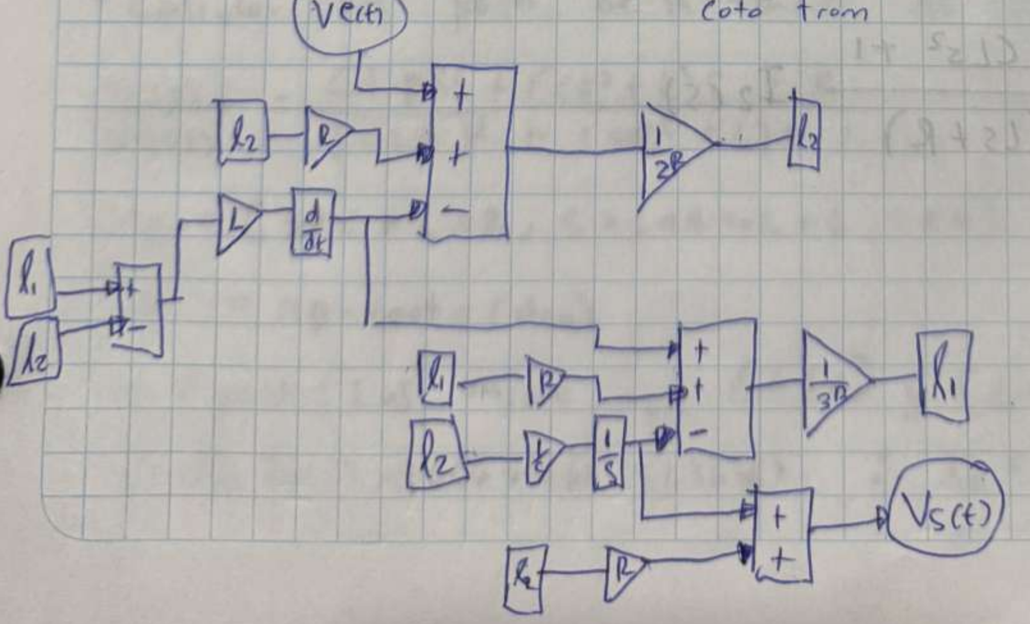
Modo de ecuaciones integro - diferencial

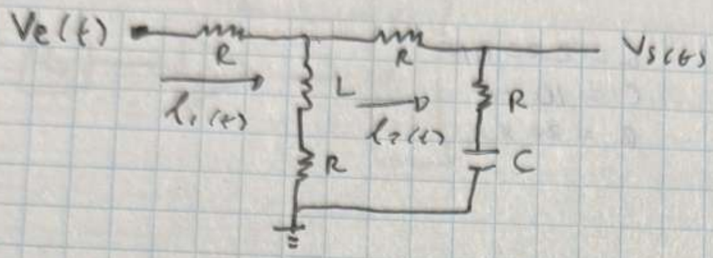
$$i_1(t) = \left[V_e(t) - L\frac{d[i_1(t) - i_2(t)]}{dt} + R i_2(t)\right]\frac{1}{2R}$$

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

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

coto from





Transformada de Laplace

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

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

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

$$\frac{Vs(s)}{Ve(s)} = \frac{?\ I_2(s)}{?\ I_2(s)}$$ Nota: No debe haber terminos negativos

Procedimiento Algebraico

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

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

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

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

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

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

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

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

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

$$- CL^2s^3 - 2CLRs^2 - CR^2s$$

$$3CLRs^2 + Ls + 5CR^2s + 2R$$

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

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

$R = 22\ k\Omega$
$C = 10\ \mu F$
$L = 220\ mH$

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

Estabilidad de lazo abierto

- Calcular los polos de la función de transferencia

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

```
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]}
```

$\therefore \lambda_1 = -166666666.3636363 \qquad \therefore \lambda_2 = -1.8181818214876033$

Error en estado estacionario

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

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

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

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

El sistema presenta una respuesta estable y sobe amortiguada