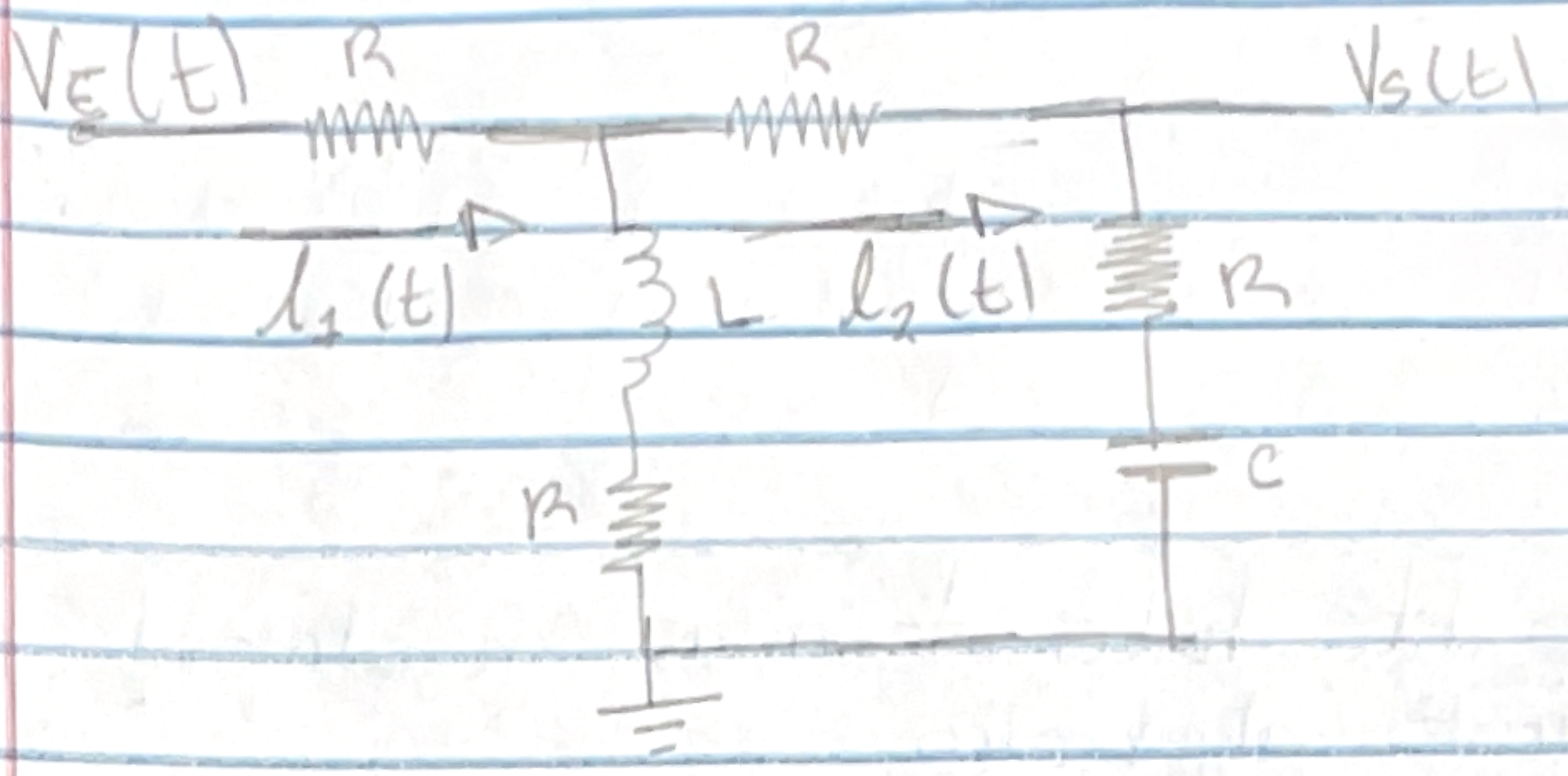


Ecuaciones parciales

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

$$L\frac{d[i_1(t) - i_2(t)]}{dt} + \underbrace{R[i_1(t) - i_2(t)]}_{R i_1(t) - R i_2(t)} = \underbrace{R i_2(t) + R i_2(t) + \ldots}_{2R i_1(t)}$$

$$3R i_2(t)$$

$$\frac{1}{C}\int i_2(t)\,dt$$

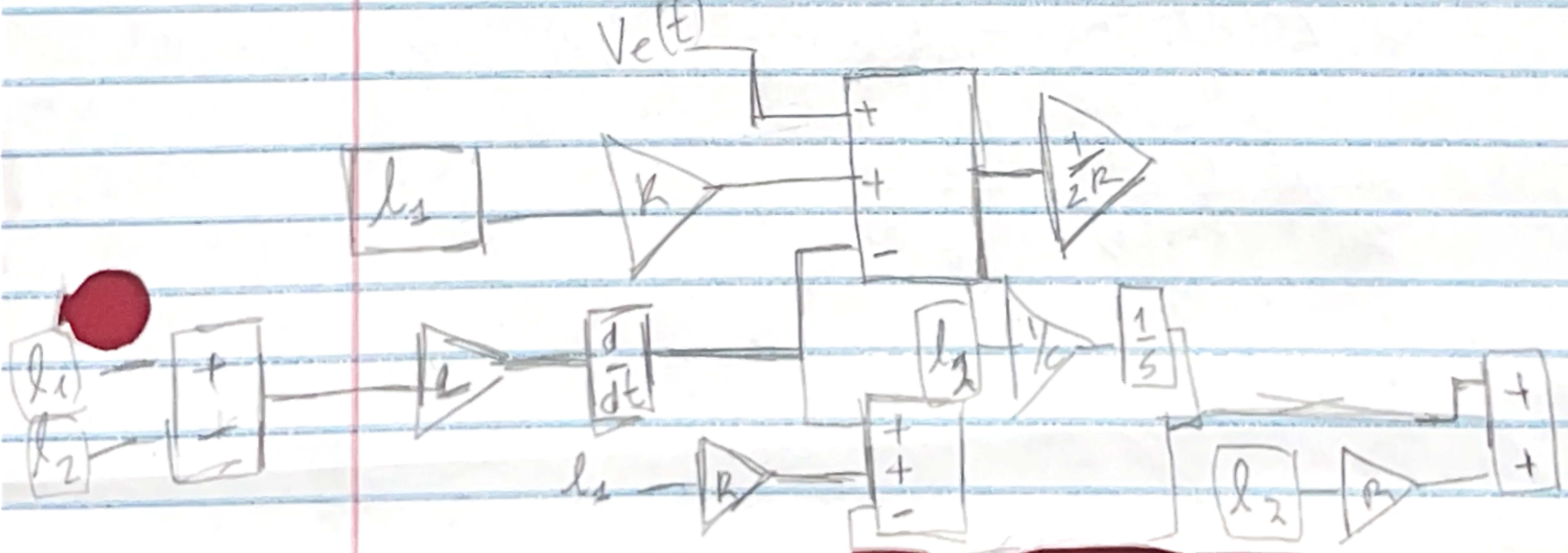
$$V_s(t) = R i_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

Modelo de ecuaciones integro-diferenciales

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

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

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



470×10^{-6}

4.7×10^{3}

6.8 mh

Transformada de laplace.

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

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

$V_s(S) = R I_2(S) + \frac{I_2(S)}{CS} = \frac{CRS+1}{CS} I_2(S)$

Nota: ¡No debe haber términos negativos!

Procedimiento algebraico.

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

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

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

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

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

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

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

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

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

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

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

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

Estabilidad en lazo abierto
Calcular los polos de la función de transferencia.

Error en estado estacionario.

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

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

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

El sistema presenta un estado estable y sobreamortiguado

$\lambda_1 = -1{,}151{,}960.754$
$\lambda_2 = -0.181$