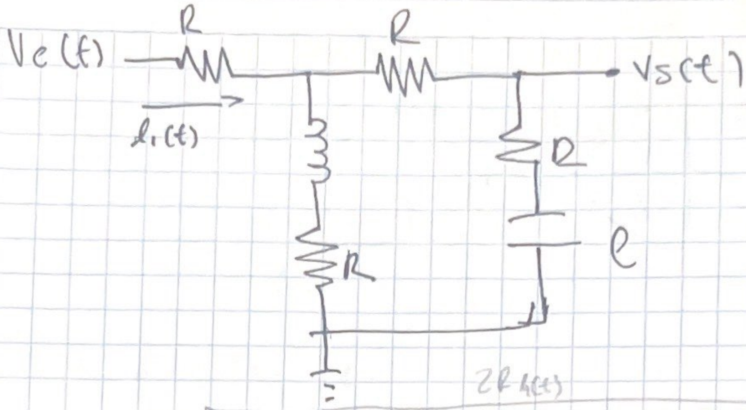


$$Ve(t) = \overbrace{R\, i_1(t) + \frac{L\, d(i_1(t) - i_2 d(t))]}{dt} + R[i_1(t) - i_2(t)]}^{2R\, i_1(t)}$$

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

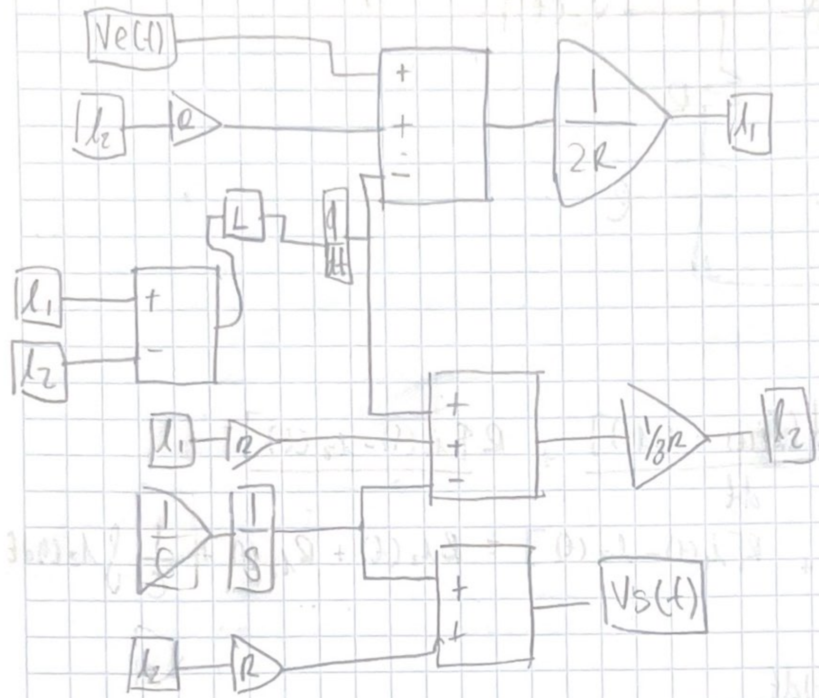
$$Vs(t) = R\, i_2(t) + \frac{1}{C}\int i_2(t)\,dt$$

Modelo de ecuaciones integro-diferenciales

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

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

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



Ve(t)
R
1
2R
L
d/dt
+
-
1/3R
1/C
1/s
Vs(t)

Función de transferencia $\frac{V_o}{V_S}$

Nunca habrá resultados negativo

Transformada laplace

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

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

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

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

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

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

$$V_e(S) = (R + Ls + R)\,I_1(S) - (Ls + R)\,I_2(S)$$

$$= (Ls + 2R)\,I_1(S) - (Ls + R)\,I_2(S)$$

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

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

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

$$I_1(S) = \frac{(3RCS + CLS^2 + 1)\,I_2(S)}{CR(LS + R)}$$

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

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

$$V_{e(s)} = CL^2S^3 + 3CRLS^2 + LS + 2CLRS^2 + 6CR^2S + 2R - CL^2S^3 - 2LCRS^2 - CSR^2$$

$$\underbrace{6CR^2S - CSR^2}_{5CR^2S}$$

$$V_{e(s)} = \frac{3CRLS^2 + LS + 5CR^2S + 2R}{CS(LS+R)} I_{2(s)}$$

$$V_{s(s)} = R I_{2(s)} + \frac{I_{2(s)}}{CS} = \left(\frac{RCS+1}{CS}\right) I_{2(s)}$$

$$V_{s(s)} = \frac{RCS+1}{CS} I_{2(s)}$$

$$\frac{V_{s(s)}}{V_{e(s)}} = \frac{RCS+1 \cdot \cancel{I_{2(s)}}}{\cancel{CS}} \cdot \frac{\cancel{CS}(LS+R)}{(3CRLS^2+LS+5CR^2S+2R)\cancel{I_{2(s)}}}$$

$$\frac{V_{s(s)}}{V_{e(s)}} = \frac{(RLCS^2 + R^2CS + LS + R)}{3CRLS^2 + LS + 5CR^2S + 2R} = \frac{RLCS^2 + (CR^2+L)S + R}{3CRLS^2 + (5CR^2+L)S + 2R}$$

Estabilidad en lazo abierto

· Calcular los polos de la función de transferencia

$$\frac{Vs(s)}{Ve(s)} = \frac{CLRS^2 + (CR^2+L)S + R}{3CLRS^2 + (5CR^2+L)S + 2R}$$ raíces del denominador

Error en estado estacionario con escalón unitario 1V

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

$$ve(t) = 1V$$

$$Ve(s) = \frac{1}{S}$$

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

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

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