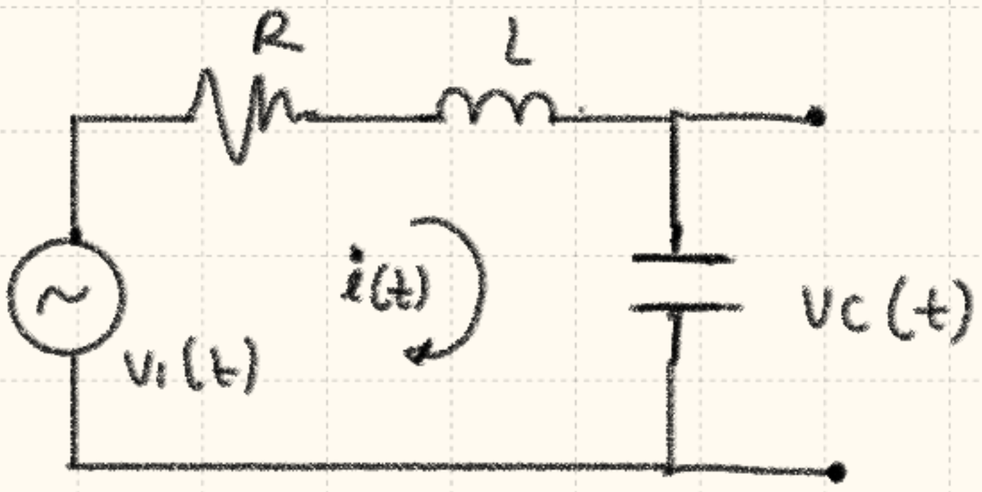
2.12 RLC (serie)



- $R = V_R(t) = R\,i(t)$
- $L = V_L(t) = L\,\frac{di(t)}{dt}$
- $C = V_C(t) = \frac{1}{C}\int i(t)\,dt = y(t)$

$$\hookrightarrow i(t) = C\cdot\frac{dv_C(t)}{dt} = \frac{C\,dy(t)}{dt}$$

en la malla

$$x(t) = V_R(t) + V_L(t) + V_C(t)$$

sustituyo $= x(t) = R\,i(t) + L\,\frac{di(t)}{dt} + y(t)$

$$x(t) = RC\,\frac{dy(t)}{dt} + LC\,\frac{d^2y(t)}{dt^2} + y(t)$$

$$\Rightarrow x(t) = LC\,\frac{d^2y(t)}{dt^2} + RC\,\frac{dy(t)}{dt} + y(t)$$

paso a laplace (con las condiciones iniciales)

- $\mathcal{L}\{y'(t)\} = sY(s) - y(0^+)$

$$\mathcal{L}\{y''(t)\} = s^2Y(s) - sy(0^+ \quad - y'(0^+$$

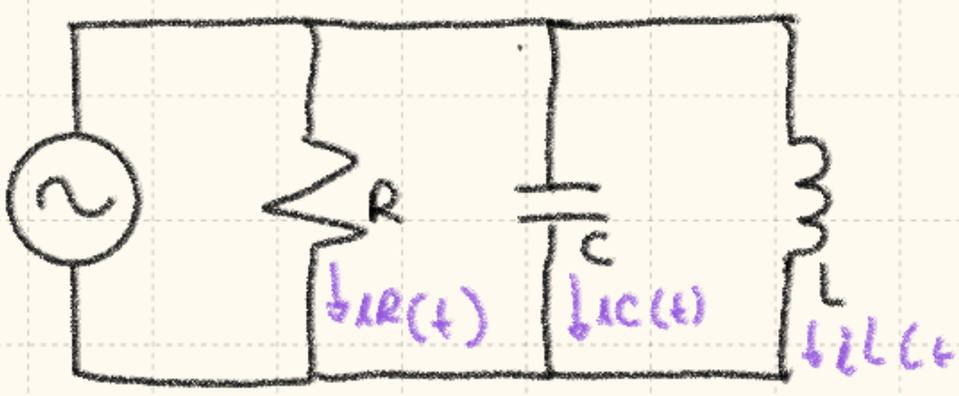
$$\Rightarrow LC\left(s^2Y - s\ (0^+) - y'(0^+)\right) + RC\,(sY - y(0^+)) + Y = X(s)$$

$$(LCs^2 + RCs + 1)\,Y(s) = X(s) + LC(sy(0^+) + y'(0^+)) + RC\,y(0^+)$$

$$\Rightarrow Y(s) = \frac{1}{LCs^2+RCs+1} X(s) + \frac{LC(sy(0^+) + y'(0^+)) + RCy(0^+)}{LCs^2+RCs+1}$$

$$\Rightarrow \underset{\text{serie}}{H(s)} = \frac{Y(s)}{X(s)} = \frac{1}{LCs^2+RCs+1}$$

RLC (Paralelo).



$R = iR(t) = \frac{V(t)}{R}$

$C = iC(t) = C\frac{dv(t)}{dt}$

$L = V(t) = L\frac{diL}{dt} = L\frac{dy(t)}{dt} \Rightarrow V(t) = L\frac{dy}{dt}$

Entrada de la corriente: $x(t) = i_{in}(t) = iR(t) + iL(t) + iC(t)$

sustituyo $\Rightarrow x(t) = \frac{V(t)}{R} + y(t) + C\frac{dv(t)}{dt}$

$\Rightarrow V(t) = L\frac{dy}{dt} \Rightarrow x(t) = \frac{L}{R}\frac{dy}{dt} + y(t) + C\frac{d}{dt}\left(L\frac{dy}{dt}\right)$

$x(t) = CL\frac{d^2y}{dt^2} + \frac{L}{R}\frac{dy}{dt} + y(t)$

$$\Rightarrow EDO = LC\frac{d^2y(t)}{dt^2} + \frac{L}{R}\frac{dy(t)}{dt} + y(t) = x(t$$

- En laplace.

$$LC(s^2Y - sy(0^+) - y'(0^+)) + \frac{L}{R}(sY - y(0^+)) + Y = X(s)$$

$$= (LCs^2 + \frac{L}{R}s + 1)\,Y(s) = X(s) + LC(sy(0^+) + y'(0^+)) + \frac{L}{R}y(0^+)$$

$$\Rightarrow Y(s) = \frac{1}{LCs^2 + \frac{L}{R}s + 1}X(s) + \frac{LC(sy(0^+) + y'(0^+)) + \frac{L}{R}y(0^+)}{LCs^2 + \frac{L}{R}s + 1}$$

$$H(s) = \frac{Y(s)}{X(s)} = \frac{1}{LCs^2 + \frac{L}{R}s + 1}$$

paralelo