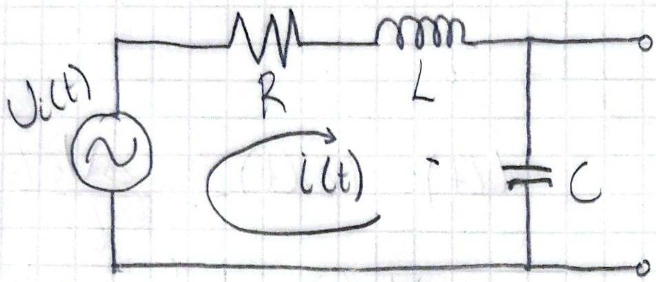
EJERCICIO $2^{do}$ Parcial - Bonificación

Circuito RLC

Demostrar que RLC en serie es Lineal.




Sea $U_i(t) = LC \frac{d^2}{dt^2} V_c(t) + RC \frac{d}{dt} V_c(t) + V_c(t)$

$V_c(t) = f(U_i(t); R, L, C)$

$U_i(t) = a_1 V_1(t) + a_2 V_2(t)$

$y(t) =$

$\hat{y}(t)$

① Para $x_i(t) = V_{c1}(t)$ (I)

$x_i(t) = LC \frac{d^2}{dt^2} V_{c1}(t) + RC \frac{d}{dt} V_{c1}(t) + V_{c1}(t)$

② Cuando $x_{ii}(t) = V_{c2}(t)$ (II)

$x_{ii}(t) = LC \frac{d^2}{dt^2} V_{c2}(t) + RC \frac{d}{dt} V_{c2}(t) + V_{c2}(t)$

$\therefore \quad a_i x_i(t) + a_{ii} x_{ii}(t)$

$a_i V_{c1}(t) + a_{ii} V_{c2}(t)$

$a_i x_i(t) + a_{ii} x_{ii}(t) = LC \frac{d^2}{dt^2} (a_i V_{c1}(t) + a_{ii} V_{c2}(t)$

$+ RC (a_i V_{c1}(t) \ldots + a_{ii} V_{c2}(t) + (a_i V_{c1}(t) + a_{ii} V_{c2}(t))$

- Propiedad de linealidad de la derivada

$= a_i LC \frac{d^2}{dt^2} V_{c1}(t) + a_{ii} LC \frac{d^2}{dt^2} V_{c2}(t) + a_i RC \frac{d}{dt} V_{c1}(t)$

$$+a_{ii}RC\frac{d}{dt}V_{C2}(t)+a_iV_{C1}(t)+a_{ii}V_{C2}(t)$$

- Ahora aplicando factorización tenemos:

$$=a_i\left(LC\frac{d^2}{dt^2}V_{C1}(t)+RC\frac{d}{dt}V_{C1}(t)+a_iV_{C1}(t)\right)+$$

$$+a_{ii}\left(LC\frac{d^2}{dt^2}V_{C2}(t)+RC\frac{d}{dt}V_{C2}(t)+a_{ii}V_{C2}(t)\right)$$

$$=a_ix_i(t)+a_{ii}x_{ii}(t)$$

$$\therefore \boxed{a_ix_i(t)+a_{ii}x_{ii}(t)=a_iV_{C1}(t)+a_{ii}x_{ii}(t)}$$

El sistema cumple con la prop. de linealidad

$y(t)=$

$y(t)$

Si $V_i(t)=x_i(t)\longrightarrow V_c(t)=V_{C1}(t)$

$V_i(t)=x_{ii}(t)\longrightarrow V_c(t)=V_{C2}(t)$

Por lo tanto el circuito RLC es lineal

de modo que:

$$\boxed{V_i(t)=a_ix_i(t)+a_{ii}x_{ii}(t) \quad \Big| \quad V_c(t)=a_iV_{C1}(t)+a_{ii}V_{C2}(t)}$$