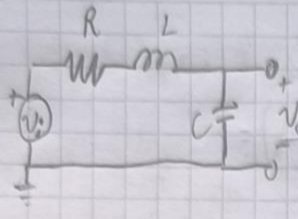

En t:

$$v_L(t) = L\,\frac{di_L(t)}{dt} \qquad i_L(t) = \frac{1}{L}\int_0^{\infty} v_L(\tau)\,d\tau + i_L(0^+)$$

$$v_c(t) = \frac{1}{C}\int_0^{\infty} i_c(\tau)\,d\tau + v_c(0^+) \qquad i_c(t) = C\,\frac{dv_c(t)}{dt}$$

$$v_R(t) = R\cdot i_R(t) \qquad i_R(t) = \frac{v_R(t)}{R} \qquad i_R(t) = i_c(t) = i_L(t) = i(t)$$

Ahora en s (Transformada de Laplace):

$V_R(s) = R\cdot I(s)$

$V_L(s) = sL\,I(s) - L\,i(0^+)$

$V_C(s) = \frac{1}{sC} I(s) + \frac{1}{s} v_c(0^+)$

$\mathcal{L}\{v_i(t)\} = V_i(s)$

Por LVK: $V_i(s) = V_R(s) + V_L(s) + V_c(s)$

$$V_i(s) = R\cdot I(s) + \left(sL\,I(s) - L\,i(0^+)\right) + \left(\frac{1}{sC} I(s) + \frac{1}{s} v_c(0^+)\right)$$

$$V_i(s) = \left(R + sL + \frac{1}{sC}\right) I(s) - L\,i(0^+) + \frac{1}{s} v_c(0^+)$$

Se despeja $I(s)$:

$$I(s) = \frac{sC}{LCs^2 + RCs + 1}\left[V_i(s) + L\,i(0^+) - \frac{v_c(0^+)}{s}\right]$$

$$I(s) = \frac{sC\,V_i(s)}{LCs^2 + RCs + 1} + \frac{sCL\,i(0^+)}{LCs^2 + RCs + 1} - \frac{C\,v_c(0^+)}{LCs^2 + RCs + 1}$$

Se tiene que $V_c(s) = Y(s)$, $v_c(t) = y(t)$, $X(s) = V_i(s)$, $x(t) = v_i(t)$

$$I(s) = \frac{sC\,X(s)}{LCs^2 + RCs + 1} + \frac{sCL\,i(0^+)}{LCs^2 + RCs + 1} - \frac{C\,v_c(0^+)}{LCs^2 + RCs + 1}$$

Se sabe que $Y(s) = V_c(s) = \frac{1}{sC} I(s) + \frac{1}{s} v_c(0^+)$

$$Y(s)=\frac{1}{sC}\left[\frac{sC\,X(s)}{LCs^2+RCs+1}+\frac{sCL\,i(0^+)}{LCs^2+RCs+1}-\frac{C\,v_c(0^+)}{LCs^2+RCs+1}\right]+\frac{v_c(0^+)}{s}$$

$$Y(s)=\frac{X(s)}{LCs^2+RCs+1}+\frac{L\,i(0^+)}{LCs^2+RCs+1}-\frac{v_c(0^+)}{s(LCs^2+RCs+1)}+\frac{v_c(0^+)}{s}$$

Se combinan los términos con $v_c(0^+)=y(0^+)$

$$Y(s)=\frac{X(s)}{LCs^2+RCs+1}+\frac{L\,i(0^+)}{LCs^2+RCs+1}+v_c(0^+)\left[\frac{1}{s}-\frac{1}{s(LCs^2+RCs+1)}\right]$$

$$Y(s)=\frac{X(s)}{LCs^2+RCs+1}+\frac{L\,i(0^+)}{LCs^2+RCs+1}+\frac{LCs+RC}{LCs^2+RCs+1}\,y(0^+)$$

$$Y(s)=\frac{X(s)}{LCs^2+RCs+1}+\frac{RC+LCs}{LCs^2+RCs+1}\,y(0^+)+\frac{L}{LCs^2+RCs+1}\,i_L(0^+)$$