tesis 7/4/2009

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1c)

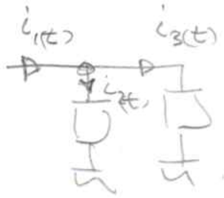
$$v = L \frac{d}{dt} i_{(t)} = L s\, i_{(s)}$$

$$i_{(t)} = C \frac{d}{d(t)} v_{(t)} = C s\, v_{(s)}$$

$$v_i = \frac{1}{C} \int_0^T i_{1(t)}\, dt + R\, i_{2(t)}$$

$$v_o = R\, i_{3(t)}$$

$$v_o' = \frac{1}{C} \int_0^T i_{3(t)}\, dt + R i_{3(t)}$$




$$i_{2(t)} = i_{1(t)} - i_{3(t)}$$

$$i_{1(s)} = i_{2(s)} + i_{3(s)}$$

$\therefore$

truth
$$\begin{cases} v_{i(s)} = \frac{1}{C} \frac{i_{1(s)}}{s} + R\, i_{2(s)} \\ v_{o(s)} = R\, i_{3(s)} \\ v_{o(s)}' = \frac{1}{C} \cdot \frac{i_{3(s)}}{s} + R \cdot i_{3(s)} \end{cases}$$

$$i_{3(s)} = \frac{v_{o(s)}}{R}$$

$$v_{i(s)} = \frac{1}{C} \frac{i_{1(s)}}{s} + \frac{1}{C} \frac{i_{3(s)}}{s} + v_{o(s)}$$

$$v_{i(s)} = \frac{1}{C} \frac{i_{1(s)}}{s} + \frac{1}{C} \frac{\frac{v_{o(s)}}{R}}{s} + v_{o(s)}$$

$$= \frac{1}{Cs} i_{1(s)} + \frac{v_{o(s)}}{RCs} + v_{o(s)}$$

$$i_{1(s)} = \left[ v_{i(s)} - \left( \frac{v_{o(s)}}{RsC} + v_{o(s)} \right) \right] C \cdot s$$

$$= v_{i(s)} C \cdot s - \frac{v_{o(s)}}{R} - v_{o(s)} C \cdot s$$

$$\therefore v_{i(s)} = v_{i(s)} - \frac{v_{o(s)}}{RCs} - v_{o(s)} + \frac{v_{o(s)}}{RCs} + v_{o(s)}$$

$$= v_{i(s)} + v_{o(s)} \left( -\frac{1}{RCs} - 1 + \frac{1}{RCs} + 1 \right)$$

1 c)

$$\begin{cases} 0 = -v_i + \frac{1}{C}\int i_1 + R(i_1 - i_2) \\ 0 = \frac{1}{C}\int i_2 + R i_2 + R(i_2 - i_1) \end{cases}$$

$$\begin{cases} v_i = \frac{1}{sC} I_1 + R I_1 - R I_2 \\ 0 = \frac{1}{sC} I_2 + R I_2 + R I_2 - R I_1 \end{cases} \qquad \begin{cases} \\ 0 = \frac{1}{sC} I_2 + 2 R I_2 - R I_1 \end{cases}$$

$$\begin{pmatrix} v_i \\ 0 \end{pmatrix} = \begin{bmatrix} \frac{1}{sC} + R & -R \\ -R & \frac{1}{sC} + 2R \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$V_0 = R \; I_2$$

$$I_2 = \frac{\begin{bmatrix} \frac{1}{sC} + R & v_i \\ -R & 0 \end{bmatrix}}{\begin{bmatrix} \frac{1}{sC} + R & -R \\ -R & \frac{1}{sC} + 2R \end{bmatrix}} = \frac{v_i \cdot R}{\left(\frac{1}{sC} + R\right)\left(\frac{1}{sC} + 2R\right) - R^2}$$

$$\frac{V_o}{V_i} = \frac{R^2}{\left(\frac{1}{sC}\right)^2 + \frac{2R}{sC} + \frac{R}{sC} + \cancel{2}R^2 - \cancel{R^2}} \; \frac{(sC)^2}{(sC)^2}$$

$$= \frac{(sCR)^2}{1 + 2sCR + sCR + (sCR)^2}$$

$$= \frac{(sCR)^2}{(sCR)^2 + 3sCR + 1}$$