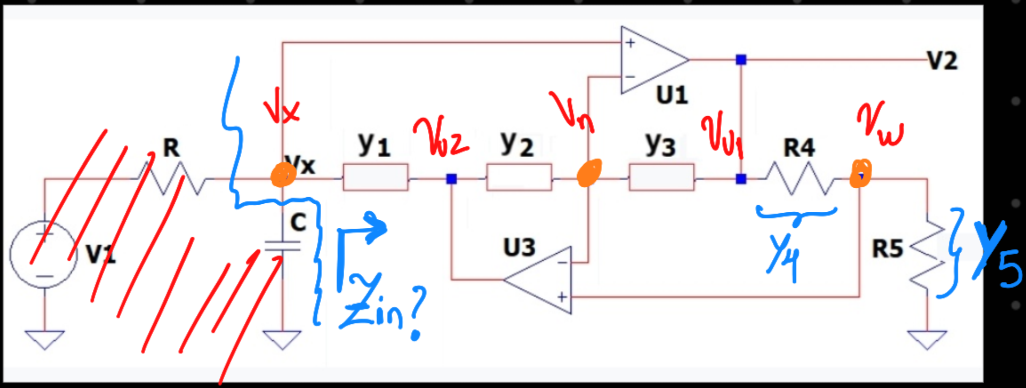


Análisis GIC de manera genérica

① $V_x \cdot Y_1 - V_{U2} Y_1 = I_{in}$

② $V_n (Y_2 + Y_3) - V_{U2} Y_2 - V_{U1} Y_3 = 0$

③ $V_w (Y_4 + Y_5) - V_{U1} Y_4 = 0$

Extras

$V_x = V_n = V_w$

$Z_{in} = \dfrac{V_{in}}{I_{in}}$

$V_{in} = V_x$

① $V_x \cdot Y_1 - V_{U2} Y_1 = I_{in}$

② $V_x (Y_2 + Y_3) - V_{U2} Y_2 - V_{U1} Y_3 = 0$

③ $V_x (Y_4 + Y_5) - V_{U1} Y_4 = 0$

→ Incognitas V_x ; V_{U2} ; V_{U1}

②' $V_{U2} = \dfrac{V_x (Y_2 + Y_3)}{Y_2} - V_{U1} \dfrac{Y_3}{Y_2}$

③' $V_{U1} = V_x \dfrac{(Y_4 + Y_5)}{Y_4}$

③' en ②'

④ $V_{U2} = V_x \left[\dfrac{(Y_2 + Y_3)}{Y_2} - \dfrac{Y_3 (Y_4 + Y_5)}{Y_2 Y_4} \right]$

(4) en (1)

$$Y_1\left\{V_x - V_x\frac{1}{Y_2}\overbrace{\left[(Y_2+Y_3) - \frac{Y_3(Y_4+Y_5)}{Y_4}\right]}^{\lambda}\right\} = I_{in}$$

$$Y_1\left\{V_x\left(1-\frac{\lambda}{Y_2}\right)\right\} = I_{in}$$

$$Z_{in} = \frac{V_x}{I_{in}} = \frac{1}{Y_1\left(1-\frac{\lambda}{Y_2}\right)} = \frac{\frac{Y_2}{Y_1}}{Y_2-\lambda}$$

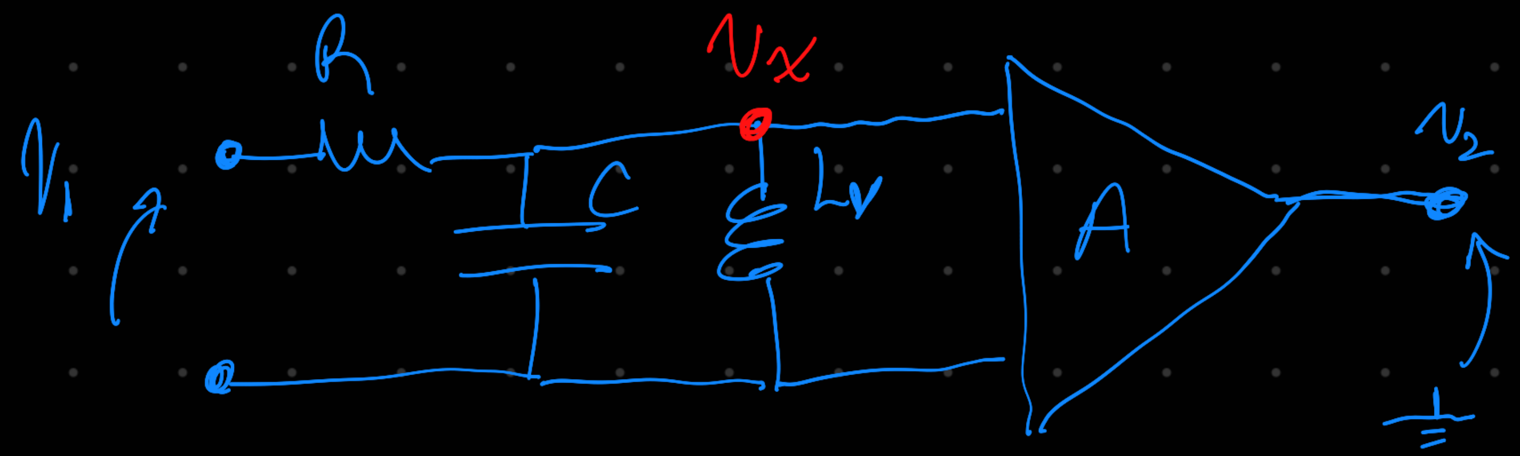
$$Z_{in} = \frac{\frac{Y_2}{Y_1}}{\frac{\cancel{Y_2Y_4} - \cancel{Y_4Y_2} - \cancel{Y_3Y_4} + \cancel{Y_3Y_4} + Y_3Y_5}{Y_4}} \Rightarrow \frac{Y_2Y_4}{Y_1Y_3Y_5}$$

$$Z_{in} = \frac{\frac{1}{Z_2Z_4}}{\frac{1}{Z_1Z_3Z_5}} \Rightarrow \frac{Z_1Z_3Z_5}{Z_2Z_4}$$

Caso de estudio

para poder "ver" un inductor en derivación Y_2 debe ser un capacitor ya que Y_4 es un resistor en el circuito de estudio.

Por lo tanto, reemplazo con todo resistores menos Y_2 y el circuito queda de la siguiente manera



$$\frac{V_2}{V_1} = \frac{V_x}{V_1} \cdot \frac{V_2}{V_x}$$

$\frac{V_2}{V_x}$ sale de la ecuación (3)

$$(3) \quad V_2 = V_x \frac{(Y_4 + Y_5)}{Y_4} \Longrightarrow \frac{V_2}{V_x} = \frac{Y_4 + Y_5}{Y_4}$$

$$y\, sL_v = Z_{GIC} = \frac{Z_1 Z_3 Z_5}{Z_2 Z_4} \Rightarrow \frac{R_1 R_3 R_5}{\frac{1}{sC_2} R_4}$$

$$sL_v = sC_2 \frac{R_1 R_3 R_5}{R_4} \quad \therefore L_v = C_2 \frac{R_1 R_3 R_5}{R_4}$$

Ahora analizo el RLC

$$\frac{V_x}{V_{in}} = \frac{\left(sC + \frac{1}{sL}\right)^{-1}}{\left(sC + \frac{1}{sL}\right)^{-1} + R} = \frac{\frac{sL}{\cancel{s^2LC+1}}}{\frac{sL + (s^2LC+1)R}{\cancel{s^2LC+1}}}$$

$$\frac{V_x}{V_{in}} = \frac{sL}{sL + s^2LCR + R} = \frac{\frac{s}{RC}}{s^2 + s\frac{1}{RC} + \frac{1}{LC}}$$

$$H(s) = \frac{s\frac{w_0}{Q}}{s^2 + s\frac{w_0}{Q} + w_0^2}$$

Se multiplica $H(s) \cdot \frac{v_2}{v_x}$:

$$\Rightarrow H(s) = \frac{s\frac{w_0}{Q}}{s^2 + s\frac{w_0}{Q} + w_0^2} \cdot \frac{Y_4 + Y_5}{Y_4}$$

$\rightarrow Q = 20 \quad f_0 = 10K \quad w_0 = 2\pi\, 10K$

Para simplificar $Y_4 = Y_5$

$$w_0^2 = \frac{1}{LC} \; ; \; L_V = C_2 \frac{R_1 R_3 \cancel{R_5}}{\cancel{R_4}}$$

$$w_0^2 = \frac{1}{C_2 C R_1 R_3} = (2\pi\, 10K)^2$$

Si $C_2 = C \wedge R_1 = R_3$

$$\frac{1}{R_1 C} = w_0 \rightarrow R_1 = \frac{1}{w_0 C}$$

$$w_0 = \frac{1}{\sqrt{LC}} = \frac{Q}{RC} \Rightarrow \sqrt{\frac{C}{L}} = \frac{Q}{R}$$

$$\frac{Q^2}{R^2} = \frac{C}{L} = \frac{\cancel{C}}{\cancel{C_2} R_1 R_3}$$

$$\frac{Q^{\cancel{2}}}{R^{\cancel{2}}} = \frac{1}{R_1^{\cancel{2}}}$$

$$R = Q R_1$$

$$R_1 = \frac{1}{W_0 C}$$

$$R_1 = R_3$$

$$C = C_2$$

$$R = Q R_1$$

$$R_4 = R_5$$