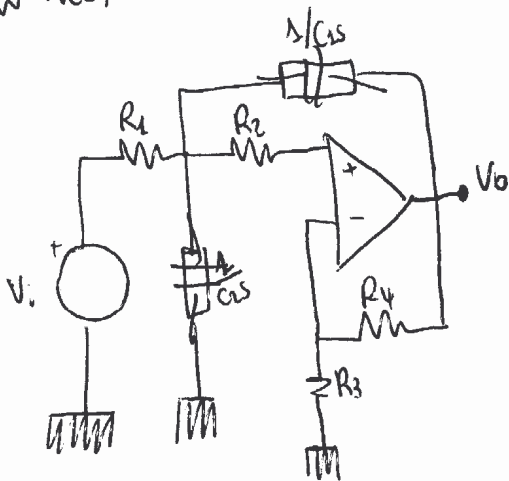


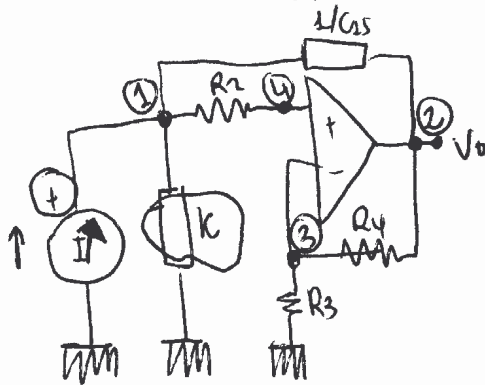
① - Método matricial.

* Calcular $H(s)$

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Realimentación negativa.



$$K = Z_{eq} = \frac{R_1}{R_2 Cs + 1}$$

$$\begin{pmatrix} \frac{1}{K} & \frac{1}{R_2} + Cs & -Cs & 0 \\ -Cs & Cs + \frac{1}{R_4} & -\frac{1}{R_4} & 0 \\ 0 & -\frac{1}{R_4} & \frac{1}{R_4} + \frac{1}{R_3} & 0 \\ -\frac{1}{R_2} & 0 & 0 & \frac{1}{R_2} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{pmatrix} = \begin{pmatrix} V_i/R_1 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

$V_2 \rightarrow$ salida

$V_3 = V_4$

$$A = \begin{pmatrix} \frac{1}{K} + \frac{1}{R_2} + Cs & -Cs & \frac{1}{R_2} \\ 0 & -\frac{1}{R_4} & \frac{R_3 + R_4}{R_3 R_4} \\ -\frac{1}{R_2} & 0 & \frac{1}{R_2} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix} = \begin{pmatrix} V_i/R_1 \\ 0 \\ 0 \end{pmatrix}$$

$$V_2 = \frac{\begin{vmatrix} \frac{1}{k} + \frac{1}{R_2} + C_{15} & \sqrt{C_1/R_1} & -1/R_2 \\ 0 & 0 & \frac{R_3+R_4}{R_3 R_4} \\ -\frac{1}{R_2} & 0 & 1/R_2 \end{vmatrix}}{\det(A)}$$

$$V_2 = \frac{\frac{V_i}{R_1} \frac{R_3+R_4}{R_3 R_4} \cdot \frac{-1}{R_2}}{\left(\frac{1}{k} + \frac{1}{R_2} + C_{15}\right) \left(\frac{-1}{R_1 R_2}\right) + \frac{C_{15}(R_3+R_4)}{R_2 R_3 R_4} + \frac{1}{R_2^2 R_4}} = \frac{-V_i (R_3+R_4)}{R_1 R_2 R_3 R_4} = \frac{-1}{k R_1 R_2} + \frac{1}{R_2^2 R_4} - \frac{C_{15}}{R_1 R_2} + \frac{C_{15}(R_3+R_4)}{R_2 R_3 R_4} + \frac{1}{R_2^2 R_4}$$

$$V_2 = \frac{\frac{-V_i R_3 - V_i R_4}{R_1 R_2 R_3 R_4}}{\frac{-1}{R_1 R_4 R_2} - \frac{C_{15}}{R_1 R_2} + \frac{C_{15} R_3 + C_{15} R_4}{R_2 R_3 R_4}} = \frac{\frac{-V_i R_3 - V_i R_4}{R_1 R_2 R_3 R_4}}{\frac{-R_1 C_{15} - 1}{R_1 R_4 R_2} - \frac{C_{15}}{R_2 R_4} + \frac{C_{15} R_3 + C_{15} R_4}{R_2 R_3 R_4}}$$

$$V_0 = V_2 = \frac{\frac{-V_i R_3 - V_i R_4}{R_1 R_2 R_3 R_4}}{\frac{-R_1 C_{15} R_3 - R_3 - C_{15} R_1 R_3 + C_{15} R_3 R_1 + C_{15} R_4 R_1}{R_1 R_2 R_3 R_4}} = \frac{-V_i (R_3 + R_4)}{-R_1 C_{15} R_3 - R_3 + C_{15} R_4 R_1}$$

$$\frac{V_0}{V_i} = \frac{R_3 + R_4}{R_1 C_{15} R_3 + R_3 - C_{15} R_4 R_1}$$

esta bien