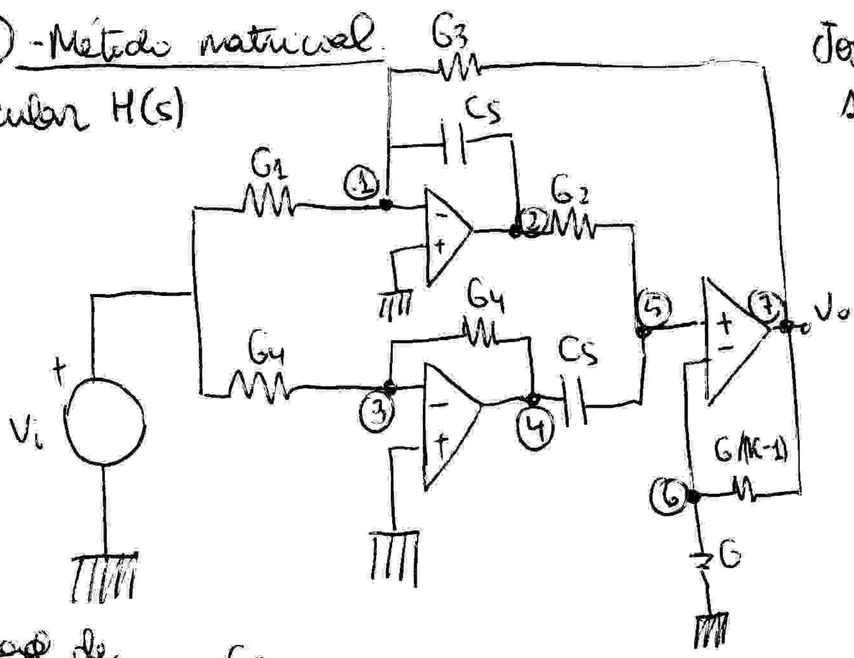
② - Método matricial

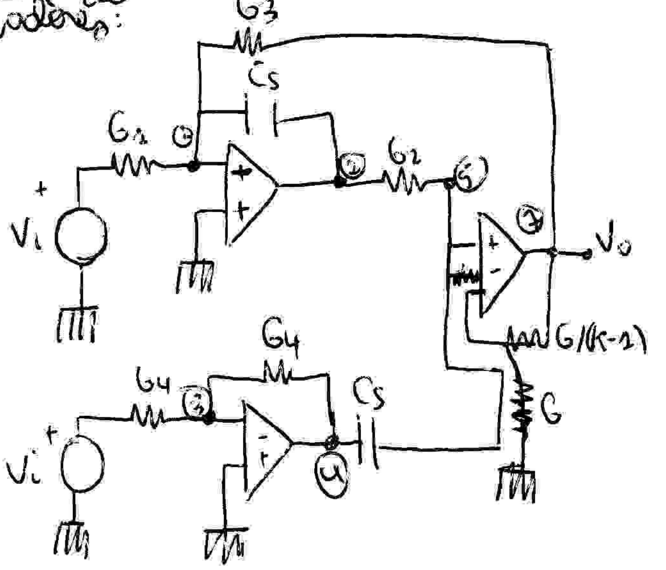
José Antonio Sáez Muñoz
1º Ingeniería Informática
FTC

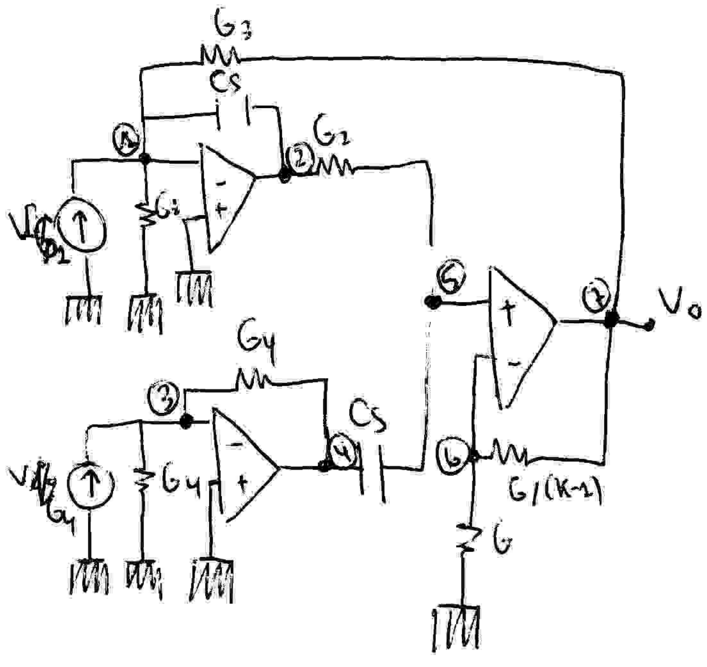
*) Calcular H(s)



Realimentación negativa.

Multiplicidad de generadores:





$$
\begin{pmatrix}
G_1+C_S+G_3 & -C_S & 0 & 0 & 0 & 0 & -G_3 \\
-C_S & C_S+G_2 & 0 & 0 & -G_2 & 0 & 0 \\
0 & 0 & 2G_4 & -G_4 & 0 & 0 & 0 \\
0 & 0 & -G_4 & G_4+C_S & -C_S & 0 & 0 \\
0 & -G_2 & 0 & -C_S & G_2+C_S & 0 & 0 \\
0 & 0 & 0 & 0 & \cancel{\frac{G}{K-1}+G} & \frac{G}{K-1}+G & \frac{-G}{K-1} \\
-G_3 & 0 & 0 & 0 & 0 & \frac{-G}{K-1} & G_3+\frac{G}{K-1}
\end{pmatrix}
\begin{pmatrix} \cancel{V_1} \\ V_2 \\ \cancel{V_3} \\ V_4 \\ V_5 \\ \cancel{V_6} \\ V_7 \end{pmatrix}
=
\begin{pmatrix} V_1G_1 \\ \cancel{0} \\ V_1G_4 \\ \cancel{0} \\ 0 \\ 0 \\ \cancel{0} \end{pmatrix}
$$

$V_1 = 0$

$V_3 = 0$

Nodo salida $\rightarrow V_2$

Nodo salida $\rightarrow V_4$

Nodo salida $\rightarrow V_7$

$V_5 = V_6$

$$
A = \begin{pmatrix}
-C_S & 0 & 0 & -G_3 \\
0 & -G_4 & 0 & 0 \\
-G_2 & -C_S & G_2+C_S & 0 \\
0 & 0 & \frac{G}{K-1}+G & \frac{-G}{K-1}
\end{pmatrix}
\begin{pmatrix} V_2 \\ V_4 \\ V_5 \\ V_7 \end{pmatrix}
=
\begin{pmatrix} V_1G_1 \\ V_1G_4 \\ 0 \\ 0 \end{pmatrix}
$$

$$V_7 = \frac{\begin{vmatrix} -Cs & 0 & 0 & V_iG_1 \\ 0 & -G_4 & 0 & V_iG_4 \\ -G_2 & -Cs & G_2+Cs & 0 \\ 0 & 0 & \frac{G}{K-1}+G & 0 \end{vmatrix} = \det(B)}{\det(A)}$$

$$|A| = \begin{vmatrix} -Cs & 0 & 0 & -G_3 \\ 0 & -G_4 & 0 & 0 \\ -G_2 & -Cs & G_2+Cs & 0 \\ 0 & 0 & \frac{G}{K-1}+G & \frac{-G}{K-1} \end{vmatrix}$$

$$|A| = (-G_4)\cdot A_{22} = -G_4\cdot(-1)^{2+2}\begin{vmatrix} -Cs & 0 & -G_3 \\ -G_2 & G_2+Cs & 0 \\ 0 & \frac{G}{K-1}+G & -\frac{G}{K-1} \end{vmatrix} = -G_4\left(\left(-CsG_2 - C^2s^2\right)\left(-\frac{G}{K-1}\right) + G_2G_3\left(\frac{G}{K-1}+G\right)\right)$$

$$|A| = -G_4\left(\frac{CsG_2G}{K-1} + \frac{C^2s^2G}{K-1} + \frac{G_2G_3G}{K-1} + GG_2G_3\right)$$

$$|B| = \left(\frac{G}{K-1}+G\right)A_{43} = \left(\frac{G}{K-1}+G\right)(-1)\begin{vmatrix} -Cs & 0 & V_iG_1 \\ 0 & -G_4 & V_iG_4 \\ -G_2 & -Cs & 0 \end{vmatrix} = \left(\frac{G}{K-1}+G\right)(-1)\left(-G_2G_4V_iG_1 + C^2s^2V_iG_4\right)$$

$$V_o = V_7 = \frac{\left(\frac{G}{K-1}+G\right)\left(G_2G_4V_iG_1 + C^2s^2V_iG_4\right)}{G_4\left(\frac{CsG_2G}{K-1} + \frac{C^2s^2G}{K-1} + \frac{G_2G_3G}{K-1} + GG_2G_3\right)}$$

$$V_0 = \frac{\left(\frac{G}{K-1} + \frac{G(K-1)}{K-1}\right)\left(G_2 G_4 V_i G_1 + C^2 s^2 V_i G_4\right)}{G_4\left(\frac{CsG_2G + C^2s^2G + G_2G_3G + GG_2G_3(K-1)}{K-1}\right)}$$

$$V_0 = \frac{\left(\frac{G + G(K-1)}{\cancel{(K-1)}}\right)\left(G_2 \cancel{G_4} V_i G_1 + C^2 s^2 V_i \cancel{G_4}\right)\cancel{(K-1)}}{\cancel{G_4} CsG_2G + \cancel{G_4}C^2s^2G + G_2G_3G\cancel{G_4} + GG_2G_3\cancel{G_4}(K-1)}$$

$$V_0 = \frac{\cancel{G}\cdot(\cancel{1}+K-\cancel{1})(G_2V_iG_1 + C^2s^2V_i)}{CsG_2\cancel{G} + C^2s^2\cancel{G} + G_2G_3\cancel{G} + \cancel{G}G_2G_3(K-1)} = \frac{G_2V_iG_1K + C^2s^2V_iK}{CsG_2 + C^2s^2 + \cancel{G_2G_3} + G_2G_3K - \cancel{G_2G_3}}$$

$$V_0 = \frac{G_2V_iG_1K + C^2s^2V_iK}{CsG_2 + C^2s^2 + G_2G_3K} = V_i\left(\frac{G_2G_1K + C^2s^2K}{CsG_2 + C^2s^2 + G_2G_3K}\right)$$

$$\boxed{\frac{V_0}{V_i} = \frac{G_2G_1K + C^2s^2K}{CsG_2 + C^2s^2 + G_2G_3K}}$$

Seguro que está bien !