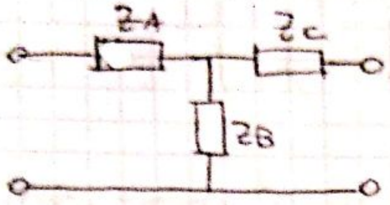
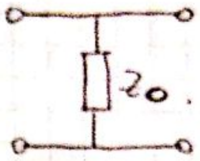
TSB

Busco los parámetros T de estos dos circuitos



①



②

$$A_1 = \frac{V_1}{V_2}\Big|_{I_2=0} = \left(\frac{Z_B}{Z_A+Z_B}\right)^{-1} = \frac{Z_A+Z_B}{Z_B}$$

$$B_1 = \frac{V_1}{-I_2}\Big|_{V_2=0} = \left(\frac{I_2}{V_1}\right)^{-1}(-1) = \left(\frac{Z_C /\!/ Z_B}{Z_A + Z_C /\!/ Z_B}\right)^{-1} Z_C$$

$$B_1 = \frac{Z_A + Z_C /\!/ Z_B}{Z_C /\!/ Z_B} \cdot Z_C$$

$$C_1 = \frac{I_1}{V_2}\Big|_{I_2=0} = \left(\frac{V_2}{I_1}\right)\Big|_{I_2=0}^{-1} = \left(\frac{I_1 \cdot (\ldots Z_B)}{I_1}\right)^{-1}$$

$$\boxed{C_1 = \frac{1}{Z_B}}$$

$$D_1 = -\frac{I_1}{I_2}\Big|_{V_2=0} = -\left(\frac{I_2}{I_1}\right)\Big|_{V_2=0}^{-1} = -\left(\frac{I_1 \cdot (Z_C /\!/ Z_B)}{I_1 \cdot Z_C}\right)^{-1}$$

$$\boxed{D_1 = \frac{-Z_B}{Z_C + Z_B}}$$

$A_2 = 1 \qquad B_2 = 0$

$C_2 = Y_0 \qquad D_2 = 1.$

$$T = T_A . T_B = \begin{pmatrix} A_1 + B_1 . Y_0 & B_1 \\ C_1 + D_1 Y_0 & D_1 \end{pmatrix}$$

De esta matriz sólo necesito el primer elemento.

$$A_1 + D_1 Y_0 = \frac{Z_A + Z_B}{Z_B} + Y_0 Z_C \frac{(Z_A + Z_C // Z_B)}{Z_C // Z_B}$$

$$= \frac{Z_A + Z_B}{Z_B} + Y_0 \cancel{Z_C} \frac{\left(Z_A + \frac{Z_C . Z_B}{Z_A + Z_B}\right)}{\frac{\cancel{Z_C} Z_B}{Z_C + Z_B}}$$

$$= \frac{Z_A + Z_B}{Z_B} + Y_0 (Z_C + Z_B)\left(\frac{Z_A}{Z_B} + \frac{Z_C}{Z_C + Z_B}\right)$$

$Z_A = S . \frac{3}{2} \qquad Z_B = \frac{1}{S\frac{4}{3}} \qquad Z_C = \frac{1}{2} S \qquad Z_0 = 1 = Y_0$

$$\therefore A = \frac{S\frac{3}{2} + \frac{1}{S} \cdot \frac{3}{4}}{\frac{3}{4S}} + \left(\frac{1}{2}S + \frac{3}{4S}\right)\left(\frac{S\frac{3}{2}}{\frac{3}{4S}} + \frac{\frac{1}{2}S}{\frac{3}{4S} + \frac{1}{2}S}\right)$$

$$A = \frac{s^2 \frac{3}{2} + \frac{3}{4}}{\frac{3}{4}} + \left(\frac{1}{2}s^2 + \frac{3}{4}\right)\left(\frac{s\frac{3}{2}}{\frac{3}{4}} + \frac{\frac{1}{2}s}{\frac{3}{4} + \frac{1}{2}s^2}\right)$$

$$A = \frac{4}{3}\left(s^2 \frac{3}{2} + \frac{3}{4}\right) + \left(\frac{1}{2}s^2 + \frac{3}{4}\right)\left(2s + \frac{s}{\frac{3}{2} + s^2}\right)$$

$$A = (2s^2 + 1) + \frac{1}{2}\cancel{\left(s^2 + \frac{3}{2}\right)}\left(\frac{2\,3s + 2s^3 + s}{\cancel{\frac{3}{2} + s^2}}\right)$$

$$A = (2s^2 + 1) + s^3 + 2s = s^3 + 2s^2 + 2s + 1 .$$

$$\therefore \frac{V_o}{V_i} = A^{-1} = \frac{1}{s^3 + 2s^2 + 2s + 1}$$

$\hookrightarrow$ Butterworth de 3er orden.