Funciones bilineales:

Son del tipo: $T(s) = k\dfrac{s+z}{s+p}$ $\quad p \geq 0$

Hay distintas posibilidades

Integrador

$T_I(s) = \dfrac{k}{s}$

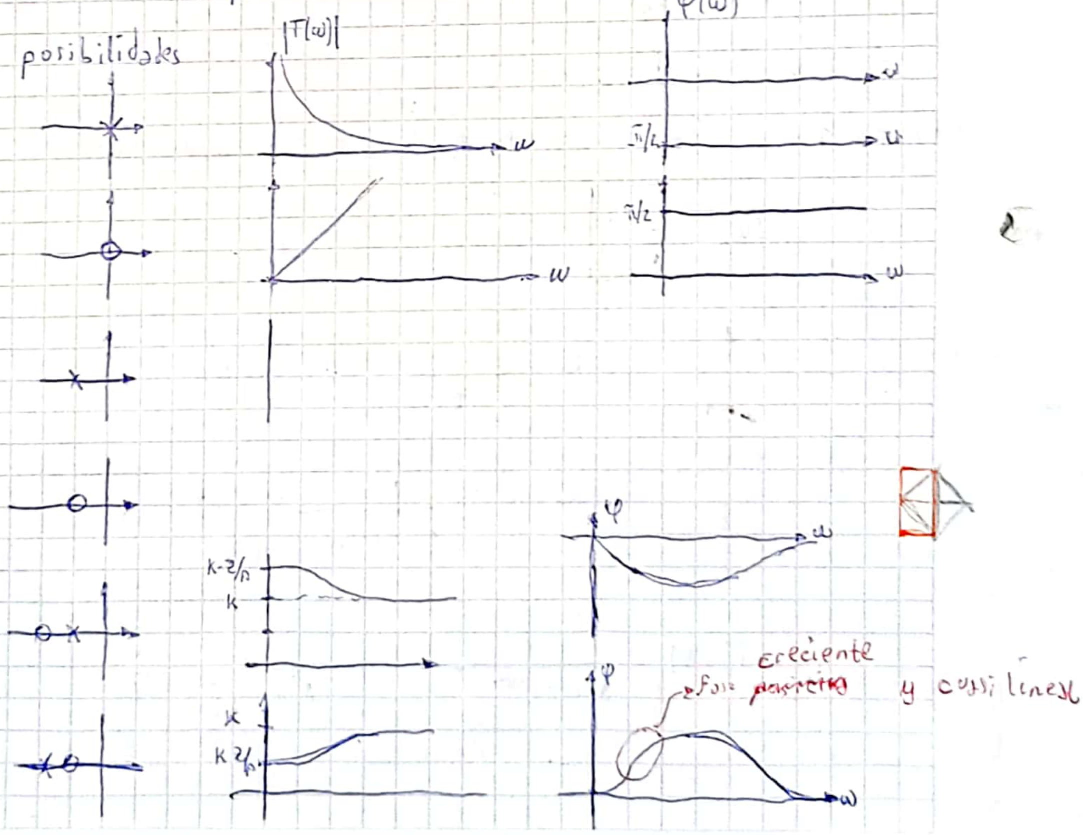
Derivador

$T_D(s) = ks$

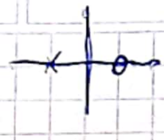
$T(s) = \dfrac{k}{s+p}$

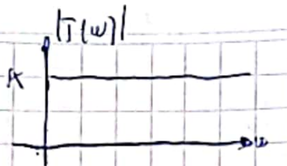
$T(s) = k(s+z)$

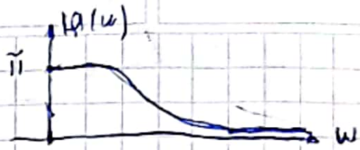
$T(s) = k\dfrac{s+z}{s+p}$



$T(s) = K \dfrac{s+z}{s+p}$

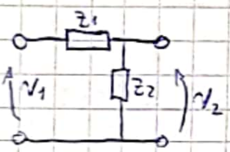




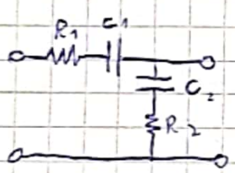


Implementaciones pasivos

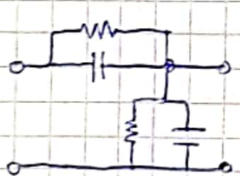
$T(s) = \overset{\leq 1}{K} \dfrac{s+z}{s+p}$



$T(s) = \dfrac{V_2(s)}{V_1(s)} = \dfrac{Z_2}{Z_1+Z_2} = \dfrac{Y_1}{Y_1+Y_2}$



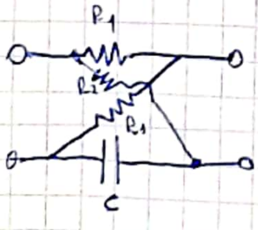
$\dfrac{R_2 + 1/sC_2}{R_2 + 1/sC_2 + R_1 + 1/sC_1}$



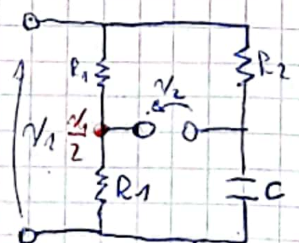
$\dfrac{G_1 + sC_1}{G_1 + sC_1 + G_2 + sC_2} = \dfrac{C_1(s + G_1/C_1)}{C_1+C_2\left(s + \frac{G_1+G_2}{C_1+C_2}\right)}$

Con ~~pasivos~~ este tipo de pasivos Nunca vamos a llegar a tener coeficientes negativos y por ende zeros en el semiplano derecho

Lattice



$\equiv$

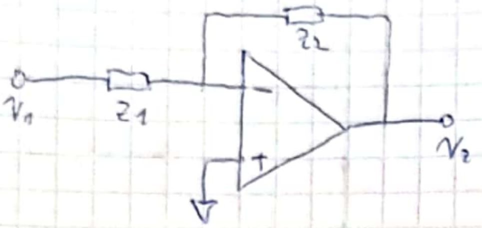


$T(s) = \dfrac{V_2}{V_1} \Rightarrow \dfrac{V_1}{2} - \dfrac{G_2}{G_2+sC} V_1 = V_2 \Rightarrow \dfrac{V_2}{V_1} = \dfrac{1}{2} \cdot \dfrac{G_2 + sC - 2G_2}{G_2 + sC}$

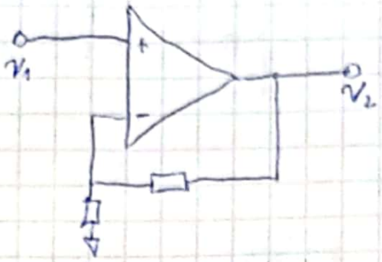
$T(s) = \dfrac{1}{2} \cdot \dfrac{sC - G_2}{sC + G_2} = \dfrac{1}{2} \dfrac{s - G_2/C}{s + G_2/C}$

Escaneado con CamScanner

Implementaciones activas



$$T_I(s) = -\frac{Z_2}{Z_1}$$



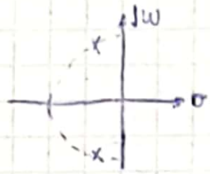
$$T_{NI}(s) = \frac{Z_1 + Z_2}{Z_1}$$

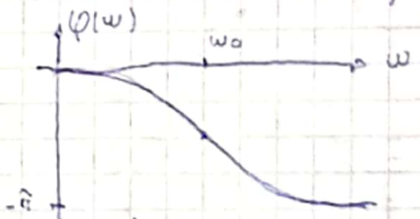
Transferencias bicuadráticas

$$T(s) = \frac{s^2 + s\frac{\omega_z}{Q_z} + \omega_z^2}{s^2 + s\,\omega_0/Q + \omega_0^2} \cdot K$$

Los ceros se colocan donde uno quiere

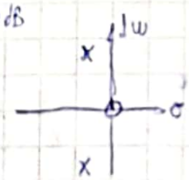
$$T_{LP}(s) = \frac{\omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2} K$$

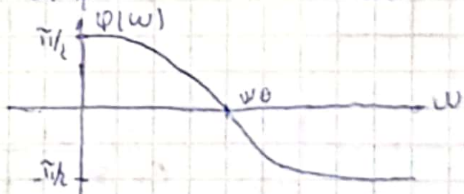




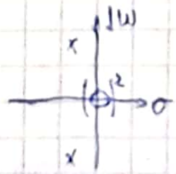
para que sea de 0dB

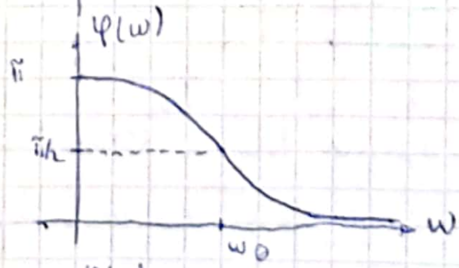
$$T_{BP}(s) = K \cdot \frac{s\,\omega_0/Q}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$



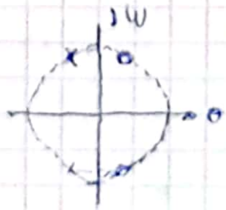


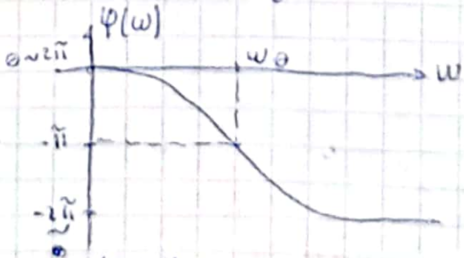
$$T_{HP}(s) = K \frac{s^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$

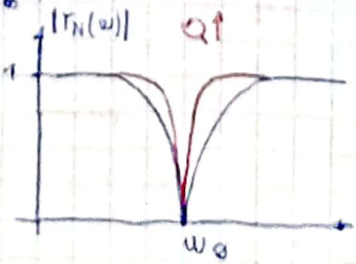




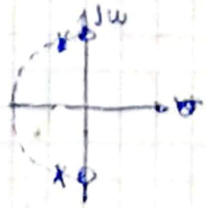
$$T_{AP}(s) = K \frac{s^2 - s\frac{\omega_0}{Q} + \omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$

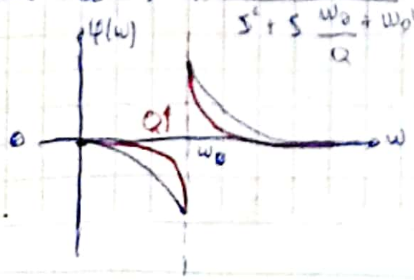






$$T_N(s) = T_{BE}(s) = K \frac{s^2 + \omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$

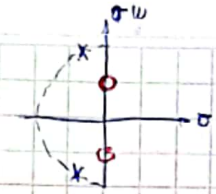


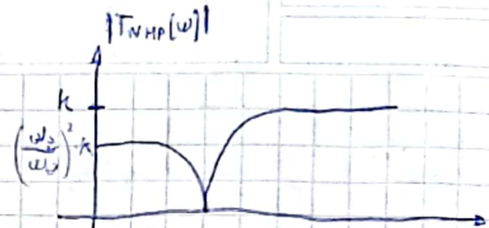


Escaneado con CamScanner

$\omega_z < \omega_0$

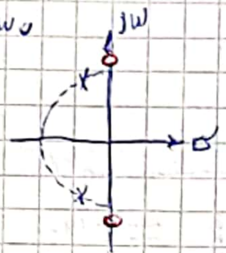
$$T_{NHP}(s) = k\,\frac{s^2 + \omega_z^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$

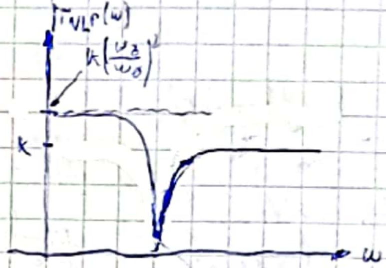




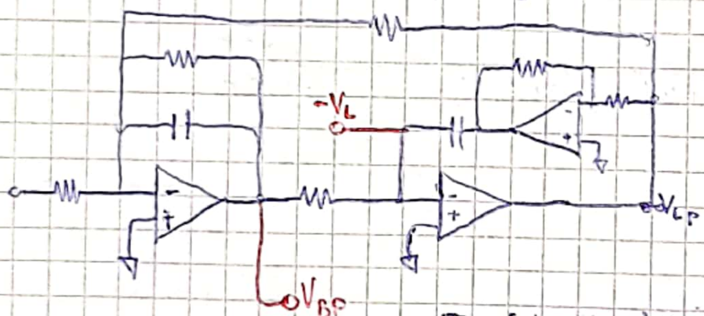
$\omega_z > \omega_0$

$$T_{NLP}(s) = k\,\frac{s^2 + \omega_z^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$





Implementación de los bicuads



$$T_{LN}(s) = k\,\frac{s^2 + \omega_z^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2} = \overbrace{\frac{s^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}}^{T_{HP}} + \overbrace{\frac{\omega_z^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}}^{T_{LP}}$$

$$V_0 = a \cdot V_1 + b \cdot V_B + c\,V_L + d\,(-V_L)$$

$$T_{Bicuad}(s) = \frac{V_0}{V_1} = a + b\,T_{BP} + c\,T_{LP} - d\,T_{LP}$$

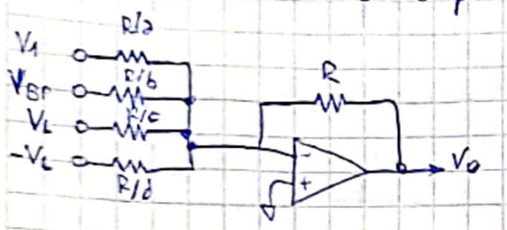
Q?

$$T_{Bicuad}(s) = \frac{a\left(s^2 + s\frac{\omega_0}{Q} + \omega_0^2\right) + b \cdot \left(-s k \cdot \frac{\omega_0}{Q}\right) + \omega_0^2 (d-c) k}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$

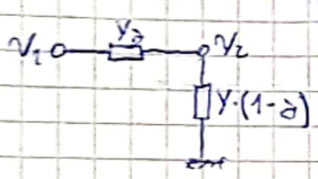
$$T(s) = \frac{s^2 \cdot a + s\frac{\omega_0}{Q} \cdot (a - b \cdot k) + \omega_0^2 \cdot (a + (d-c)k)}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$$

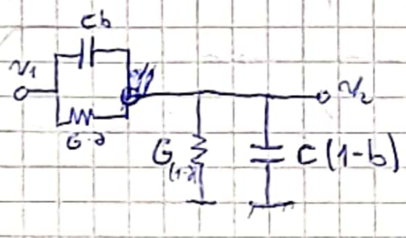
Sumando las salidas del Ack-Mos formamos cualquier bicuad deseada

Para hacer la suma pesada



Voltage FeedForward

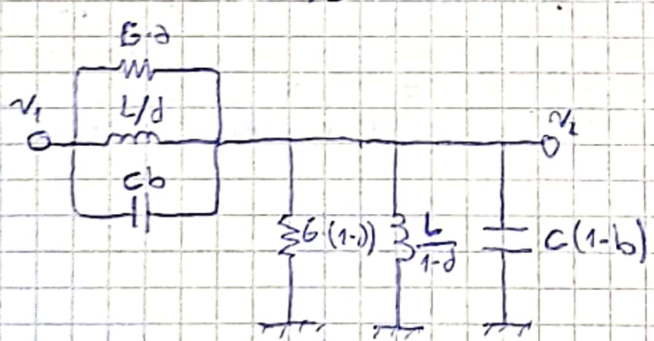




$0 \leq a, b \leq 1$

$$\frac{V_2}{V_1} = \frac{Ga + sCb}{Ga + sCb + G(1-a) + sC(1-b)} = \frac{Ga + sCb}{G + sC}$$

$$\frac{V_2}{V_1} = b \cdot \frac{s + \frac{G\cdot a}{bC}}{s + G/C}$$



$$\frac{V_2}{V_1} = \frac{Ga + sCb + \frac{d}{sL}}{G + sC + \frac{1}{sL}}$$

$$\frac{V_2}{V_1} = \frac{s^2LCb + sLGa + d}{s^2LC + sLG + 1} = b\,\frac{s^2 + s\frac{Ga}{Cb} + \frac{d}{LCb}}{s^2 + s\frac{G}{C} + \frac{1}{LC}}$$

Armamos funciones bilineales y bicuad positivas dividiendo las admitancias

Notch pasivo

$T_N(s) = \dfrac{s^2+\omega_z^2}{s^2+s\frac{\omega_0}{Q}+\omega_0^2} = \dfrac{s^2+\omega_z^2}{s^2+s\,1/Q+1}$; tengo que lograrlo con:

$$b\cdot\frac{s^2+s\frac{G\cdot a}{C\cdot b}+\frac{d}{LCb}}{s^2+s\frac{G}{C}+\frac{1}{LC}}$$

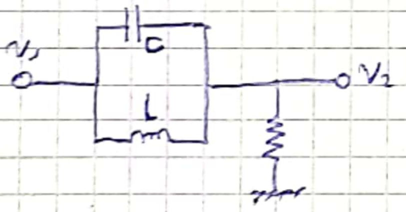
$\frac{1}{LC}=1$; $a=0$; $\frac{d}{b}=\omega_z^2$

para que sea de 0 dB: $\omega_z=\omega_0=1$

$\omega_z=1 \Rightarrow \frac{d}{b}=1 \Rightarrow d=b$

y $|T_N(\omega)|_{\omega=0}=1 \Rightarrow d=1 \Rightarrow b=1$

$a=0$; $d=1$; $b=1$

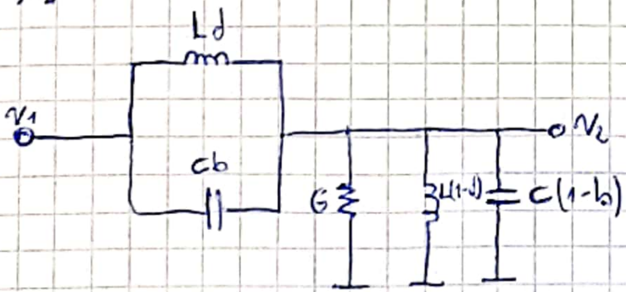


Notch pasabajo

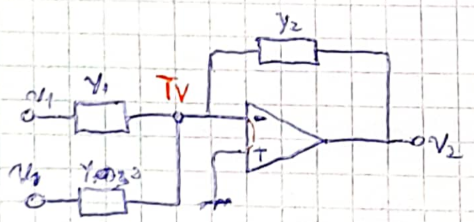
$a=0$; $\frac{d}{b}=\omega_z^2>1 \Rightarrow d>b$; $K<1 \rightarrow$ para ajustar sí o sí la ganancia en continua

$|T(s)|\big|_{s=0}=d$

$|T(s)|\big|_{\lim s\to\infty}=b$



Levantar admitancias de circuitos ~~pasivos~~ activos



$$T(s) = -\left(\frac{Y_1 + Y_a \cdot a}{Y_2}\right)$$