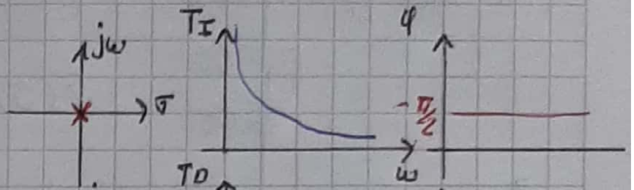
Clase teórica 7 (Videos)

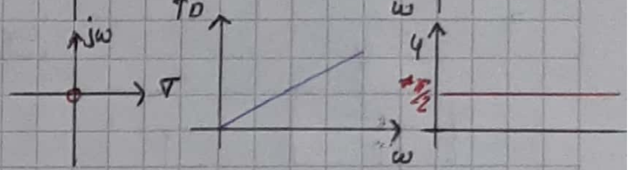
Funciones bilineales (Tabla 3.1) Cap 3 Sch

$$\boxed{T(s) = k\,\frac{s+z}{s+p}}$$

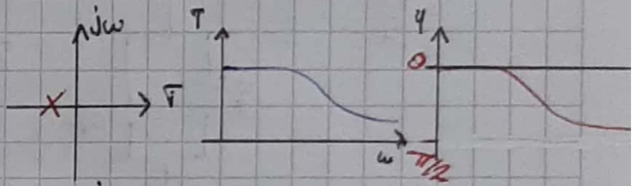
$T_I(s) = \dfrac{k}{s}$ integrador



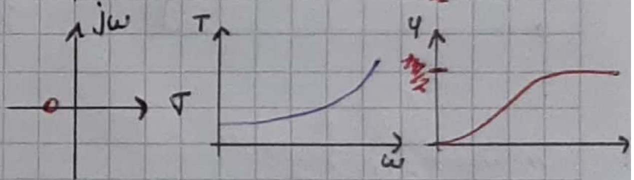
$T_D(s) = sk$ derivador (cero en el origen)



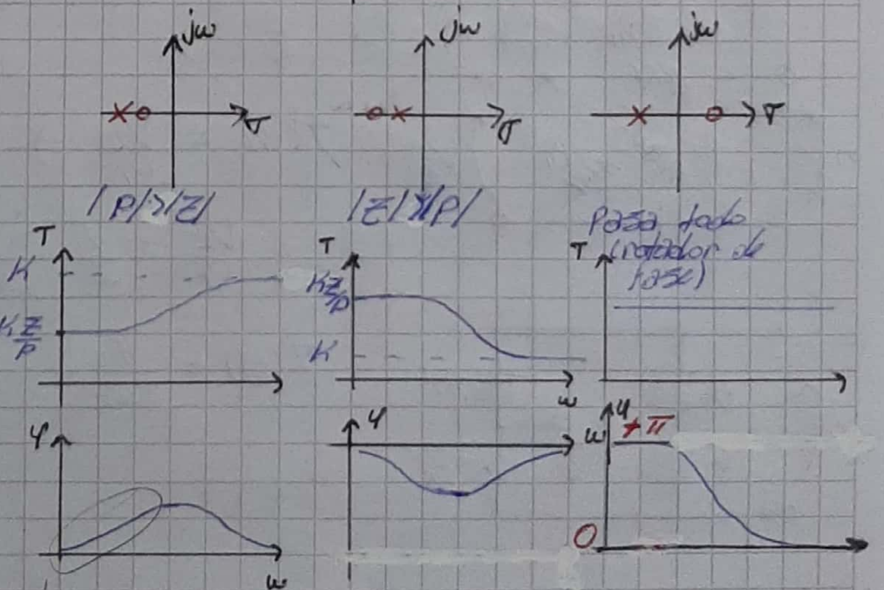
$T(s) = \dfrac{\quad}{s+p}$ integrador real



$T(s) = k\,(s+z)$ derivador real



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



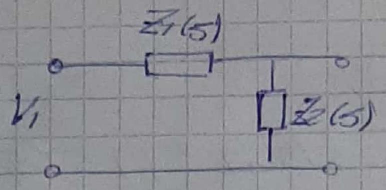
en este BW el retardo de grupo es cte

$$D = \frac{d\varphi}{d\omega}$$

Implementaciones pasivas

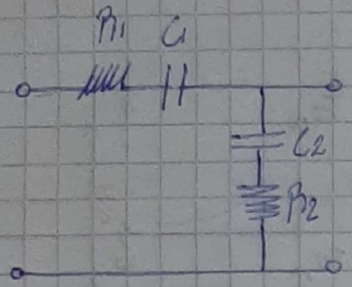
$$T(s) = K \cdot \frac{s+Z}{s+P}$$

$K < 1$



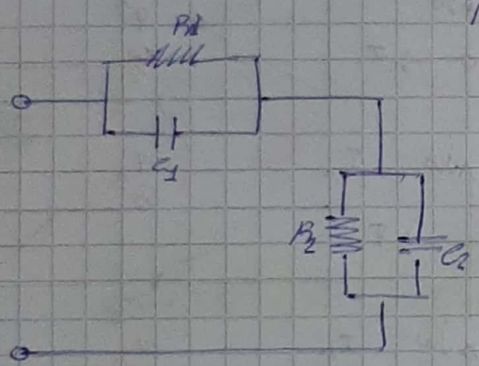
Solo con un Tipo de componente reactivo
RL ó RC

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



$$T(s) = \frac{R_2 + 1/sC_2}{R_1+R_2+1/sC_1+1/sC_2}$$

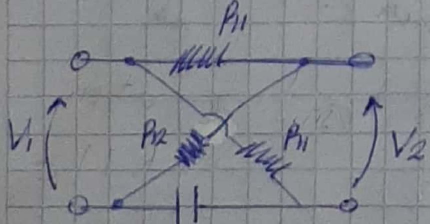
$$T(s) = \frac{R_2}{R_1+R_2} \cdot \frac{s+1/C_2R_2}{s+\frac{C_1+C_2}{C_1C_2(R_1+R_2)}}$$



$$T(s) = \frac{G_1+sC_1}{G_1+G_2+sC_1+sC_2}$$

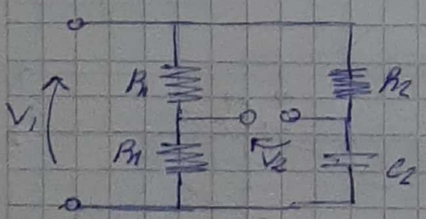
$$T(s) = \underbrace{\frac{C_1}{C_1+C_2}}_{K} \cdot \frac{s+\overbrace{G_1/C_1}^{Z}}{s+\underbrace{\frac{G_1+G_2}{C_1+C_2}}_{P}}$$

Circuito Lattice



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

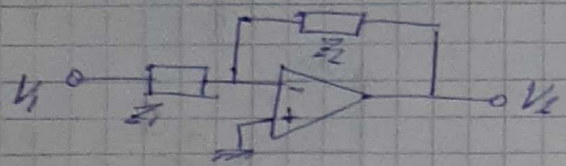
$$\frac{V_2}{V_1} = \frac{1}{2} - \frac{G_2}{G_2+sC} = \frac{sC_2-G_2}{2(sC+G_2)}$$



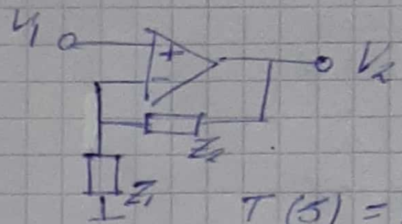
$$T(s) = \frac{1}{2} \cdot \frac{s-G_2/C_2}{s+G_2/C_2}$$

NOTA

Implementaciones activas

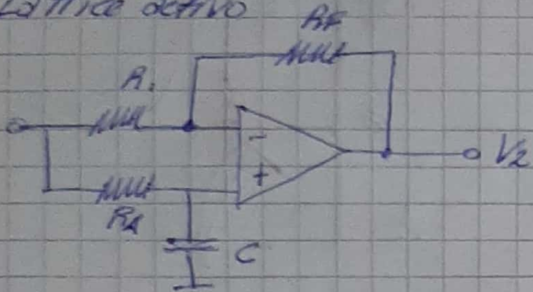


$$T(s) = -\frac{Z_2}{Z_1}$$



$$T(s) = 1 + \frac{Z_2}{Z_1}$$

Lattice activo



$$T(s) = -K \, \frac{s - \frac{1}{KCR_A}}{s + \frac{1}{CR_A}}$$

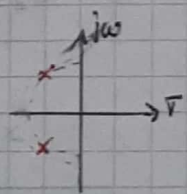
$$K = \frac{R_F}{R_1}$$

Funciones Bicuadráticas (Cap 5 Sch)

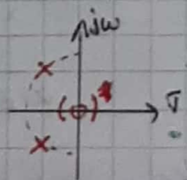
$$T(s) = \frac{s^2 + s\frac{\omega_Z}{Q_Z} + \omega_Z^2}{s^2 + s\frac{\omega_0}{Q_P} + \omega_0^2} \cdot K$$

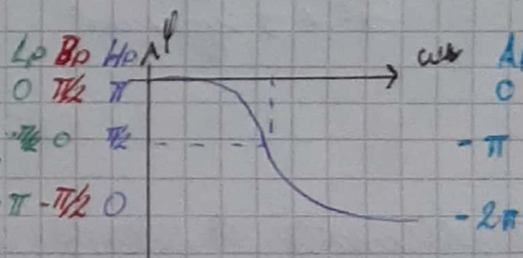
Fig 5.10 del Sch

- $T_{LP} = \dfrac{\omega_0^2 K}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$

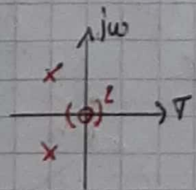


- $T_{BP} = \dfrac{s\frac{\omega_0}{Q} K}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$

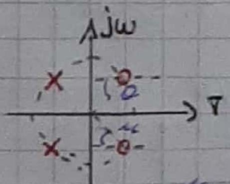




- $T_{HP} = \dfrac{s^2 K}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$



- $T_{AP} = \dfrac{s^2 - s\frac{\omega_0}{Q} + \omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$



$\varphi = \varphi_Z - \varphi_P$

$\pi + \theta$

$\pi - \mu$

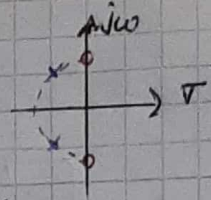
$\varphi_Z|_{\omega=0} \Rightarrow \mu = \theta \quad 2\pi$

$\omega \to \infty \quad \left.\begin{matrix} \theta/\theta_0 \to -\pi/2 \\ \mu/\mu_0 \to \pi/2 \end{matrix}\right\} \pi$

NOTA

~~Pasa Todo~~

- $T_{Notch} = T_{BE} = \dfrac{s^2 + \omega_0^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$

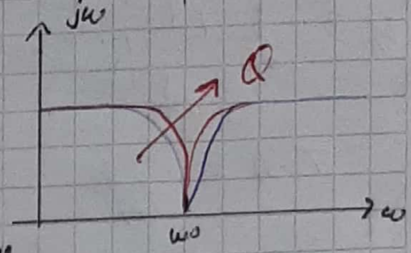


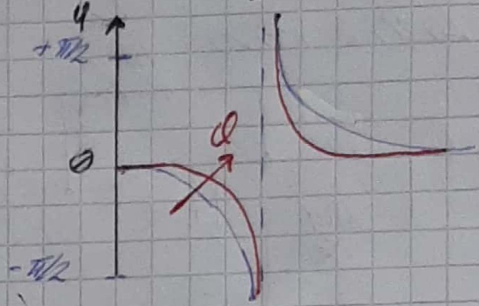
Fase

$\varphi_Z \rightarrow \omega < \omega_0 \quad \varphi_Z = 0$

$\searrow \omega > \omega_0 \quad \varphi_Z = +\pi$

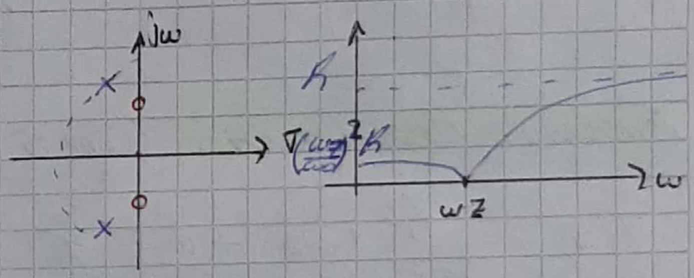
$\varphi_Z \quad +\pi \rightarrow -\pi$





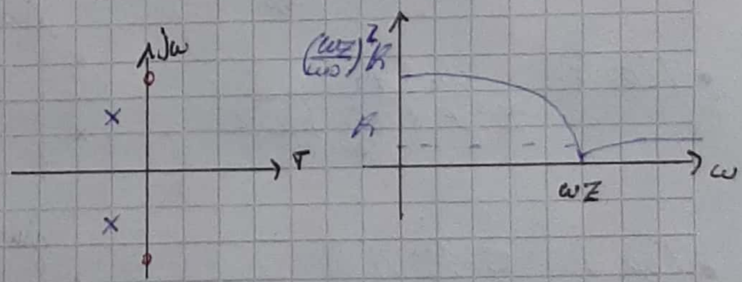
~~TNHP~~

- $T_{NHP} = \dfrac{s^2 + \omega_Z^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$



$\omega_Z < \omega_0$

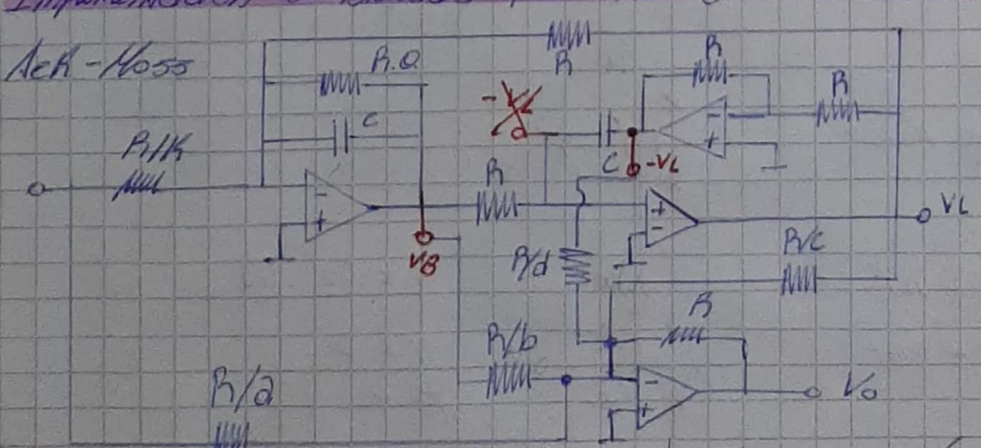
- $T_{NLP} = \dfrac{s^2 + \omega_Z^2}{s^2 + s\frac{\omega_0}{Q} + \omega_0^2}$



$\omega_Z > \omega_0$

Implementación de Bicuads por suma de Transferencias

Ack-Moss



↳ Suma pesada

NOTA

HOJA Nº 27

FECHA

$$\begin{cases} \dfrac{V_L}{V_i} = -\dfrac{K\omega_0^2}{s^2+s\frac{\omega_0}{Q}+\omega_0^2} = T_L(s) \\ \dfrac{V_B}{V_i} = -\dfrac{sKQ\left(\frac{\omega_0}{Q}\right)}{s^2+s\frac{\omega_0}{Q}+\omega_0^2} \end{cases}$$

$$T(s) = \frac{s^2+s\frac{\omega_z}{Q_z}+\omega_z^2}{s^2+s\frac{\omega_0}{Q}+\omega_0^2} = \frac{V_0}{V_i}$$

Transferencia pasabajo Notch

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

$$= \frac{s^2}{\dots} + \frac{\omega_z^2}{\dots}$$

$$HP + LP \cdot K$$

$$V_0 = -[aV_i + bV_B + cV_L + d(-V_L)]$$

$$T(s) = -[a + bT_{BP} + cT_{LP} + d(-T_{LP})]$$

Para formar una bicuadrática completa, sumo todas las salidas afectadas x ctes y luego le doy valores a esas ctes

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

$$T(s) = -\frac{s^2 a + s\frac{\omega_0}{Q}(a-bKQ)+a\omega_0^2 - K\omega_0^2 c + K\omega_0^2 d}{s^2+s\frac{\omega_0}{Q}+\omega_0^2}$$

$$\boxed{T(s) = -\frac{s^2 a + s\,\omega_0/Q\,(a-bKQ)+\omega_0^2[a+K(d-c)]}{s^2+s\frac{\omega_0}{Q}+\omega_0^2}}$$

EJemplo pasa banda

$$\begin{cases} a=0 & K/a=0 \\ K(d-c)=0 & \Rightarrow d=c \quad \text{osea } R/d = R/c \end{cases}$$

EJ. Notch

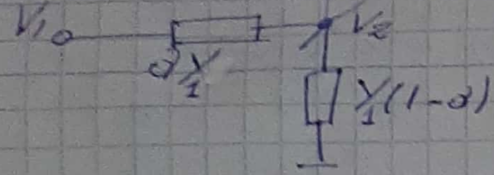
$$\begin{cases} a \neq 0 & \text{preferentemente } a=1 \\ 1-bKQ=0 & \Rightarrow b=\dfrac{1}{KQ} \end{cases}$$

NOTA

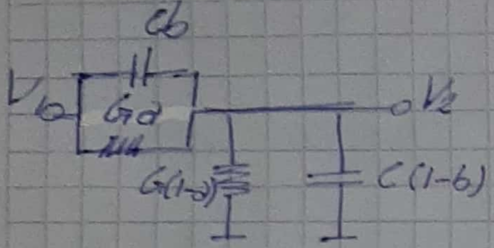
Voltage Feed Forward

Bilineal completa

Lift a component off ground



Es el mismo componente que se lo separó y se le pone una tensión en medio (V_2)



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

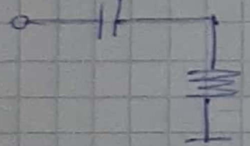
$$= \frac{Ga + sCb}{G + sC}$$

↳ los polos no varían

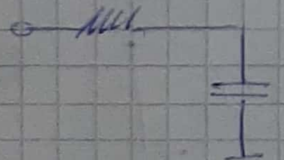
$0 \leq a, b \leq 1$

$$\frac{V_2}{V_1} = b \, \frac{s + \frac{Ga}{Cb}}{s + \frac{G}{C}}$$

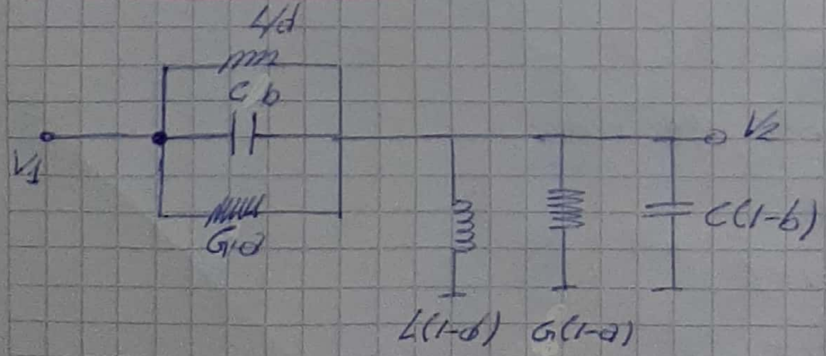
Si $a = 0$ y $b = 1$ <u>Pasa alto</u>



Si $a = 1$ y $b = 0$ <u>Pasa bajo</u>



Bicuadrática completa



$$T(s) = \frac{V_2}{V_1} = \frac{G.a + sCb + \frac{d}{sL}}{G + sC + \frac{1}{sL}} = \frac{sLGa + s^2LCb + d}{s^2 + sGL + \frac{1}{LC}}$$

NOTA

$$T(s) = \frac{\cancel{C}b\cancel{L}}{\cancel{C}\cancel{L}} \; \frac{s^2 + s\frac{Gd}{Cb} + \frac{1}{LC}\cdot\frac{d}{b}}{s^2 + s\,GL + 1/LC}$$

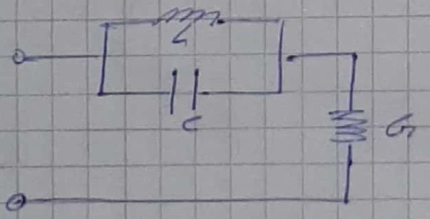
$$\left[T(s) = b \; \frac{s^2 + s\frac{Gd}{Cb} + \frac{1}{LC}\frac{d}{b}}{s^2 + s\frac{G}{C} + \frac{1}{LC}} \right]$$

EJ: Notch

$$T(s) = \frac{s^2 + \omega_z^2}{s^2 + s\,1/Q + 1}$$

$$\begin{cases} \frac{1}{LC} = 1 \\ d = 0 \\ \frac{d}{b} = \omega_z^2 = 1 \end{cases}$$

0dB en la banda de paso si $b = 1$ y $d = 1$
↳ pero esto sería un NOTCH puro sin componentes levantados de masa



EJ: Notch paso bajos

$$T(s) = \frac{s^2 + \omega_z^2}{s^2 + s\,1/Q + 1}$$

$\frac{1}{LC} = 1$

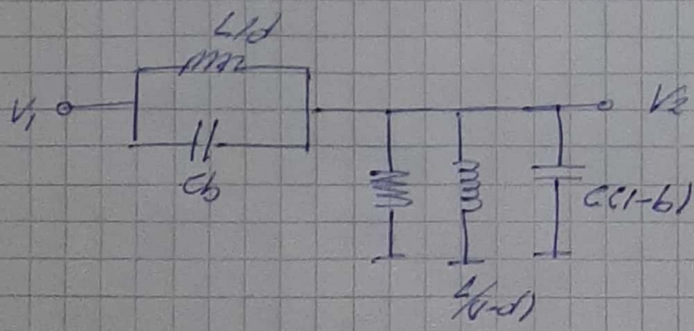
$d = 0$

$1 < \frac{d}{b} = \omega_z^2 \Rightarrow b < d$

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

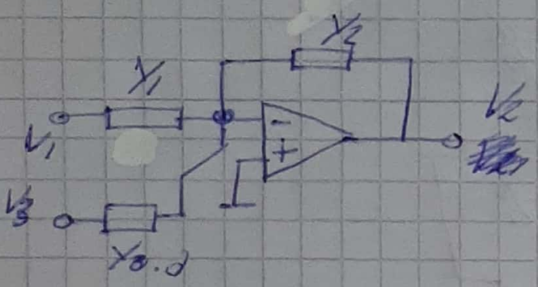
$T(s)\big|_{s\to\infty} = b$

$\begin{cases} d \leq 1 \\ b \leq 1 \end{cases}$



Levantar admitancias con circuitos activos

↳ se prealimentan las tierras virtuales



$$V_2 = -\frac{V_1 Y_1 + V_3 Y_{od}}{Y_2}$$

$$T(s) = -\frac{Y_1 + Y_{od}}{Y_2}$$

Siendo $V_1 = V_3$