# Tarea Semanal 6

1) Filtro Pasa-Altos, máxima planicidad en banda de paso.

$f_c = 300\,Hz$; Cero de transmisión en $100\,Hz$.

- Prototipo pasabajos:

2do orden + 1er orden

$$T_1(s) = \frac{s^2 + 3^2}{s^2 + \sqrt{2}\,s + 1}$$ → Del gráfico, cero en $f = 3$ → Butter $n = 2$, $f = 1$ por gráfico

$$T_2(s) = \frac{1}{s+1}$$ → sección de 1er orden pasabajos $f_c = 1$

$$T(s) = T_1(s) \cdot T_2(s) = \frac{s^2 + 3^2}{(s^2 + \sqrt{2}\,s + 1)} \cdot \frac{1}{s+1} \cdot \underbrace{\frac{1}{9}}_{\to \frac{1}{w_z^2/w_0^2}}$$

- Transformación LP a HP:

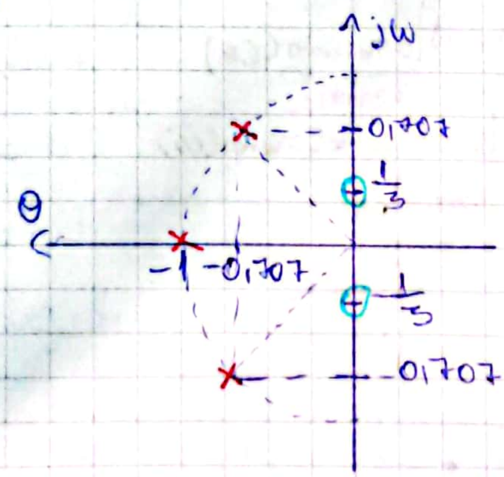
$$K_{HP} = 1/s$$

$$T_{HP}(s) = T\left(\frac{1}{s}\right) = \frac{\frac{1}{s^2} + 3^2}{\frac{1}{s^2} + \sqrt{2}\,\frac{1}{s} + 1} \cdot \frac{1}{\frac{1}{s} + 1} \cdot \frac{1}{9}$$

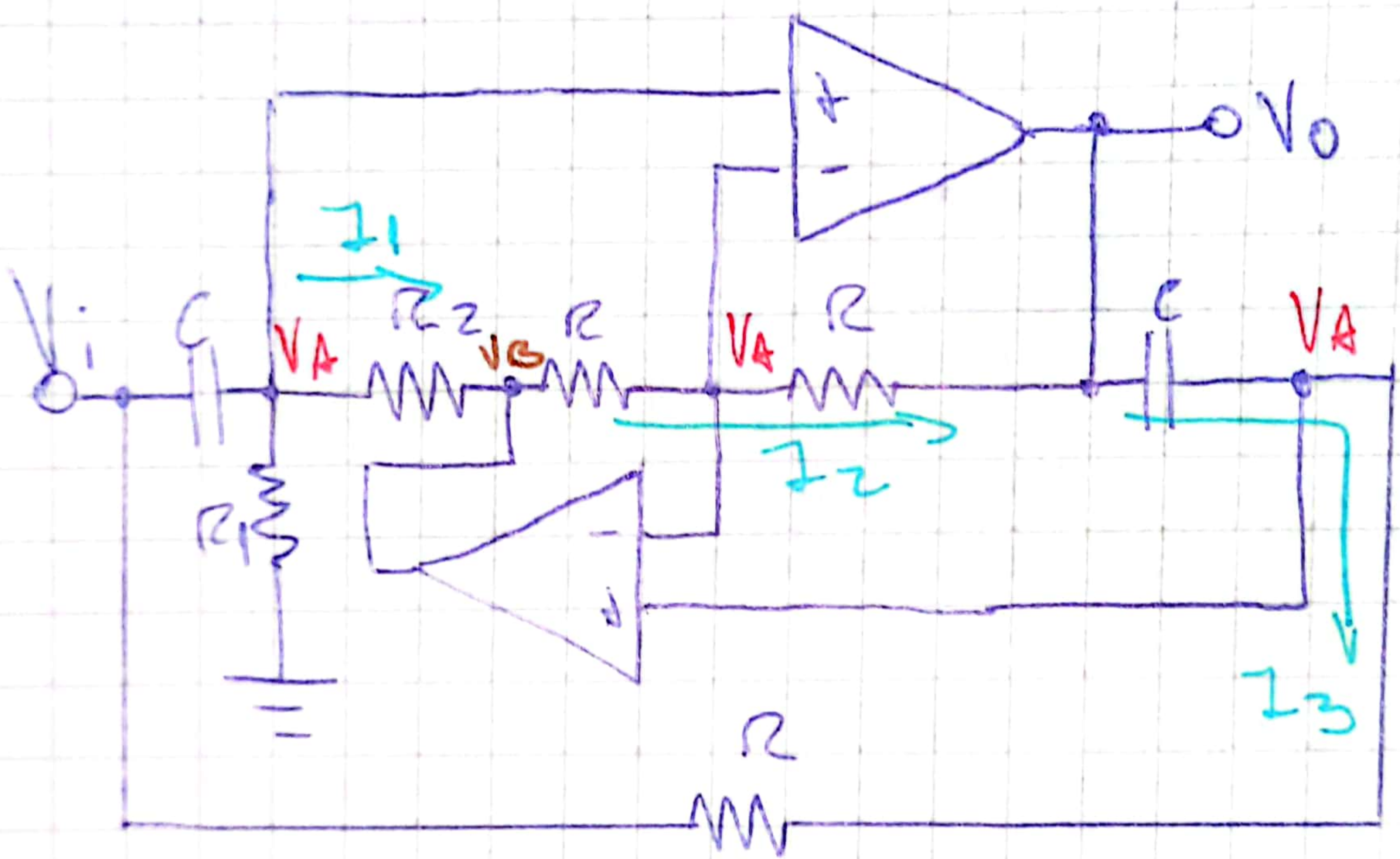
$$T_{HP}(s) = \frac{\frac{1 + 3^2 \cdot s^2}{\cancel{s^2}}}{\frac{1 + \sqrt{2}\,s + s^2}{\cancel{s^2}}} \cdot \frac{1}{\frac{1+s}{s}} \cdot \frac{1}{9} = \frac{9s^2 + 1}{s^2 + \sqrt{2}\,s + 1} \cdot \frac{s}{s+1} \cdot \frac{1}{9}$$

$$T_{HP}(s) = \frac{s^2 + (1/3)^2}{s^2 + \sqrt{2}\,s + 1} \cdot \frac{s}{s+1}$$

- Polos y ceros



- Estructura segundo orden:



· Planteo nodos:

① $V_A \cdot (\$C + G_1 + G_2) - V_B \cdot G_2 - V_i \cdot \$C = 0$

② $V_A \cdot (G + G) - V_B \cdot G - V_0 \cdot G = 0$

③ $V_A \cdot (\$C + G) - V_0 \cdot \$C - V_i \cdot G = 0$

de ①: $V_A = (V_B \cdot G_2 + V_i \cdot \$C) \dfrac{1}{\$C + G_1 + G_2}$

en ②: $\dfrac{(V_B \cdot G_2 + V_i \cdot \$C)}{\$C + G_1 + G_2}(2G) - V_B \cdot G - V_0 \cdot G = 0$

de ①: $V_B = V_A \dfrac{(\$C + G_1 + G_2)}{G_2} - V_i \dfrac{\$C}{G_2}$

en ②: $V_A \cdot 2G - V_A \cdot \dfrac{(\$C + G_1 + G_2) \cdot G}{G_2} + V_i \dfrac{\$C \cdot G}{G_2} - V_0 \cdot G = 0$

$$V_A \left( 2G - \frac{(\$C + G_1 + G_2) G}{G_2} \right) = V_0 \cdot G - V_i \cdot \frac{\$C \cdot G}{G_2}$$

en ③: $\dfrac{\left[ V_0 \cdot G - V_i \cdot \dfrac{\$C \cdot G}{G_2} \right]}{\dots} (\$C + G) - V_0 \$C - V_i \cdot G = 0$

en ⑤ : $\dfrac{\left[V_o \cdot G - V_i \cdot \dfrac{sC \cdot G}{G_2}\right](sC+G)}{2G - \dfrac{(sC+G_1+G_2) \cdot G}{G_2}} - V_o\, sC - V_i\, G = 0$

$$\frac{2G \cdot G_2 - (sC+G_1+G_2)G}{G_2}$$

$$V_o\left(\frac{G \cdot G_2(sC+G)}{2G \cdot G_2-(sC+G_1+G_2)G} - sC\right) - V_i\left(\frac{sCG(sC+G)}{2G \cdot G_2-(sC+G_1+G_2)G} + G\right) = 0$$

$$\frac{V_o}{V_i} = \frac{\dfrac{sCG(sC+G)}{2G \cdot G_2-(sC+G_1+G_2)G} + G}{\dfrac{G \cdot G_2(sC+G)}{2G \cdot G_2-(sC+G_1+G_2) \cdot G} - sC} = \cancel{\frac{sCG + G \cdot [2G \cdot G_2-(sC+G_1+G_2)G]}{G \cdot G_2 - sC[2G \cdot G_2-(sC+G_1+G_2)G]}}$$

$$\cancel{\frac{V_o}{V_i} = sCG + 2G^2 \cdot G_2 - sCG^2 - G_1G^2 - G_2G^2}$$

$$\frac{V_o}{V_i} = \frac{s^2C^2G + \cancel{sCG^2} + 2G^2G_2 - (\cancel{sC}+G_1+G_2) \cdot G^2}{sCGG_2 + G^2 \cdot G_2 - sC \cdot 2G \cdot G_2 + sC(sC+G_1+G_2)G}$$

$$\frac{V_o}{V_i} = \frac{s^2C^2G + 2G^2G_2 - (G_1+G_2)G^2}{\cancel{sCGG_2} + G^2 \cdot G_2 - \cancel{sC2GG_2} + s^2C^2G + sCGG_1 + \cancel{sCGG_2}}$$

$$\frac{V_o}{V_i} = \frac{s^2C^2G + 2G^2G_2 - G_1G^2 - G_2G^2}{s^2C^2G + s \cdot C \cdot G \cdot G_1 + G^2 \cdot G_2}$$

$$T(s)=\frac{V_o}{V_i}=\frac{s^2C^2G+G^2(G_2-G_1)}{s^2C^2G+s.C.G.G_1+G^2.G_2}$$

$$T(s)=\frac{V_o}{V_i}=\frac{s^2+\frac{G^2(G_2-G_1)}{C^2G}}{s^2+s\frac{G_1}{C}+\frac{G^2G_2}{C^2G}}$$

$$T(s)=\frac{s^2+\frac{G.(G_2-G_1)}{C^2}}{s^2+s.\frac{G_1}{C}+\frac{G.G_2}{C^2}}$$

$$\frac{W_0}{Q}=\frac{G_1}{C} \qquad \frac{W_0}{Q}=\sqrt{2}\ ;\ W_0^2=1;\ W_z^2=\frac{1}{9}$$

$$W_0^2=\frac{G.G_2}{C^2} \qquad \frac{G.G_2}{C^2}=1\ ;\ \frac{G_1}{C}=\sqrt{2}\ ;\ \frac{G.(G_2-G_1)}{C^2}=\frac{1}{9}$$

$$W_z^2=\frac{G.(G_2-G_1)}{C^2} \qquad \Omega z=G$$

$$\frac{G_2}{C^2}=1\ ,\ \frac{G_1}{C}=\sqrt{2}\ ;\ \frac{G_2-G_1}{C^2}=\frac{1}{9}$$

$$G_2=C^2\ ;\ G_1=\sqrt{2}.C$$

$$\frac{C^2-\sqrt{2}C}{C^2}=\frac{1}{9}\Rightarrow\frac{8}{9}C^2-\sqrt{2}C=0$$

$$C=1,59$$

- Sin normalizar $\omega_0$ y $\omega_z$, $\Omega_z = G$

$$\frac{G \cdot G_2}{c^2} = \omega_0^2 \; ; \; \frac{G_1}{c} = \frac{\omega_0}{Q} \; ; \; \frac{G \cdot (G_2 - G_1)}{c^2} = \omega_z^2$$

$$G_2 = \omega_0^2 \cdot c^2 \; ; \; Q = \frac{\omega_0 \cdot c}{G_1} \; ; \; G_2 - G_1 = \omega_z^2 \cdot c^2$$

$$G_1 = \frac{\omega_0 \cdot c}{Q} \; ; \; \omega_0^2 c^2 - G_1 = \omega_z^2 c^2$$

$$G_1 = \omega_0^2 c^2 - \omega_z^2 c^2$$

$$G_1 = c^2 (\omega_0^2 - \omega_z^2)$$

$$\omega_0 > \omega_z$$

$$c^{\cancel{2}} \cdot (\omega_0^2 - \omega_z^2) = \frac{\omega_0 \cdot \cancel{c}}{Q}$$

$$c = \frac{\omega_0}{Q (\omega_0^2 - \omega_z^2)}$$