TS6

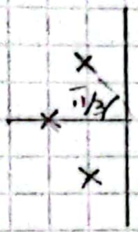
1) Hp: $\omega_0 = 300$ Cero en $\omega_m = 100$ Hz Normalizo $\omega_0 = 1$ $\omega_m = \frac{1}{3}$

Prototipo Pasa Bajos: $\omega_m = 3$ $K = 1$

Es un elimina Banda que se comporta como LP para que en altas frecuencias la magnitud siga bajando por lo que si quiero que se comporte como EB y baje eso, el denominador será de 3er orden $T(s) = \frac{s^2 + \omega_m^2}{s^3 + a s^2 + b s + c^2}$ $\omega_m = 3$

EB + LP 1er orden: $\frac{s^2 + \omega_m^2}{s^2 + \frac{\omega_p}{Q} s + \omega_p^2} \cdot \frac{1}{s + \omega_p}$

MP orden 3 $2\cos\frac{\pi}{3} = \frac{\omega_p}{Q_p} = 1 \rightarrow$ Denominador: $s^2 + s + 1$

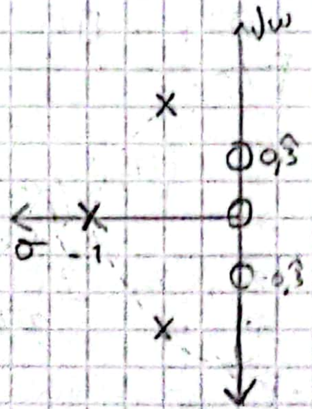


$(s^2 + s + 1)(s + 1) = s^3 + 2s^2 + 2s + 1$

$T(s) = \frac{s^2 + 3^2}{(s^2 + s + 1)(s + 1)} = \frac{(s^2 + 3^2)}{(s^3 + 2s^2 + 2s + 1)}$

Convierto a Pasa altos

$$\frac{\left(\frac{1}{s^2} + 9\right)}{\frac{1}{s^3} + \frac{2}{s^2} + \frac{2}{s} + 1} = \frac{\frac{1}{s^2}\left(1 + 9s^2\right)}{\frac{1}{s^3}\left(1 + 2s + 2s^2 + s^3\right)}$$

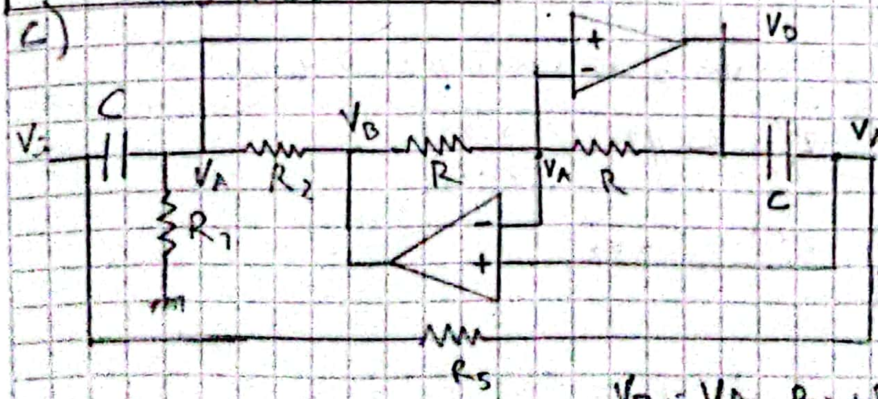


$T(s) = \frac{9s\,(s^2 + 1/3^2)}{s^3 + 2s^2 + 2s + 1}$ $\lim_{s \to \infty} T(s) = 9$

Como yo quiero que en ∞ tienda a 0, debo tomar un valor de $K = \frac{1}{9}$

$$\boxed{T(s) = \frac{s^3 + s\,\frac{1}{3^2}}{s^3 + 2s^2 + 2s + 1}}$$

c)



$I_{C_1} = I_{R_1} + I_{R_2}$

$(V_i - V_A)sC = \frac{V_A}{R_1} + \frac{V_A - V_B}{R_2}$

$V_i sC - V_A sC = \frac{V_A}{R_1} + \frac{V_A}{R_2} - \frac{V_B}{R_2}$

$\frac{V_B}{R_2} = V_A\left(\frac{1}{R_1} + \frac{1}{R_2} + sC\right) - V_i sC$

$V_B = V_A \frac{R_2 + R_1 + R_2 R_1 sC}{R_1} - V_i sC R_2$

NOTA

$\frac{V_B - V_A}{R} = \frac{V_A - V_O}{R} \rightarrow V_A - V_i = V_A - V_O \rightarrow V_O = 2V_A - V_B$

$V_O = 2V_A - V_A\left(SCR_2 + \frac{R_2}{R_1} + 1\right) + V_i \; SCR_2 = V_A\left(1 - \frac{SCR_2R_1 + R_2}{R_1}\right) + V_i SCR_2$

$\frac{V_i - V_B}{R_S} = (V_A - V_B)SC \rightarrow V_i - V_A = V_A SCR_S - V_O SCR_S \quad \left(\frac{1}{SCR}\right)$

$\rightarrow V_A(2 + SCR_S) = V_i + V_O SCR_S \rightarrow V_A = \frac{V_i}{SCR_S + 1} + V_O \frac{SCR_S}{SCR_S + 1}$

$V_O = \frac{R_1 + SCR_2R_1 - R_2}{R_1}\left(V_i \frac{1}{SCR_S + 1} + V_O \frac{SCR_S}{SCR_S + 1}\right) + V_i\left(SCR_2\right)$

$V_O = V_i\left(\frac{R_1 - R_2 + SCR_2R_1}{(SCR_S + 1)R_1} + SCR_2\right) + V_O \frac{(R_1 - R_2 + SCR_2R_1)(SCR_S)}{(SCR_S + 1)R_1}$

$V_O\left(1 - \frac{-S^2C^2R_2R_1R_2 + SCR_S(R_1 - R_2)}{(SCR_S + 1)R_1}\right) = V_i \frac{R_1 - R_2 + SCR_2R_1 + SCR_2R_1(SCR_S + 1)}{(SCR_S + 1)R_1}$

$V_O = (SCR_S + 1)R_1 + S^2C^2R_SR_2R_1 + SCR_S(R_1 - R_2) = V_i \frac{R_1 - R_2 + S^2C^2R_2R_1R_S}{(SCR_S + 1)R_1}$

$\frac{V_O}{V_i} = \frac{S^2C^2R_2R_1R_S + (R_1 - R_2)}{S^2C^2R_1R_2R_S + SCR_S + R_1} = \frac{C^2R_2R_1R_S}{C^2R_1R_2R_S} \cdot \frac{S^2 + \frac{R_1 - R_2}{C^2R_2R_1R_S}}{S^2 + S\frac{1}{CR_1} + \frac{1}{C^2R_1R_2R_S}}$

$$T(s) = \frac{S^2 + \frac{R_1 - R_2}{C^2R_2R_1R_S}}{S^2 + S\frac{1}{CR_1} + \frac{1}{C^2R_2R_S}}$$

Directo: $T(s) = \frac{S^2 + (1)^2}{S^2 + S + 1} \cdot \frac{S}{S + 1}$

- Primer SOS: $\left[\frac{R_1 - R_2}{C^2R_2R_1R_S} = \frac{1}{3}\right] = \omega_n \left[\frac{1}{C^2R_2R_S} = 1\right] = \omega_p \quad \left[\frac{1}{CR_1} = \frac{\omega_p}{Q}\right]$

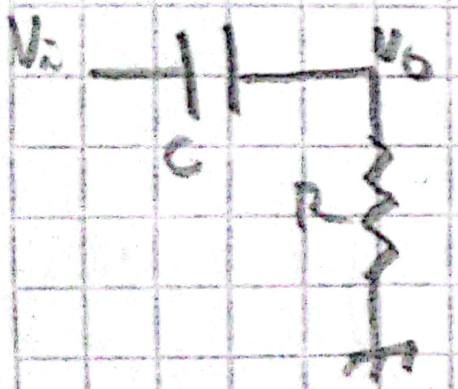
$\frac{R_1 - R_2}{R_1} = \frac{1}{9} \rightarrow R_1 - R_2 = \frac{R_1}{9} \rightarrow R_1 = \frac{9}{8}R_2$

$C^2 = \frac{1}{R_2R_S} \quad \frac{\cdot 8}{C 9R_2} = 1 \rightarrow C = \frac{8}{9}\frac{1}{R_2}$

$\rightarrow \left(\frac{8}{9R_2}\right)^2 = \frac{1}{R_2R_S} \rightarrow \frac{64}{81R_2^2} = \frac{1}{R_2R_S} \rightarrow R_2 = \frac{64}{81}R_S$

Adopto $R_S = 1 \rightarrow R_2 = \frac{64}{81} = 0{,}8 \rightarrow C = \frac{9}{8} = 1{,}125 \rightarrow R_1 = \frac{8}{9}$

Circuito RC: Pasa altas



$$(V_i - V_o)\,sC = \frac{V_o}{R} \rightarrow sCV_i = V_o\left(sC + \frac{1}{R}\right)$$

$$\rightarrow \frac{V_o}{V_i} = \frac{sCR}{sCR+1} \rightarrow \boxed{T(s) = \frac{s}{s + \frac{1}{RC}}}$$

$$\frac{1}{RC} = 1 \rightarrow \boxed{R = C = 1}$$