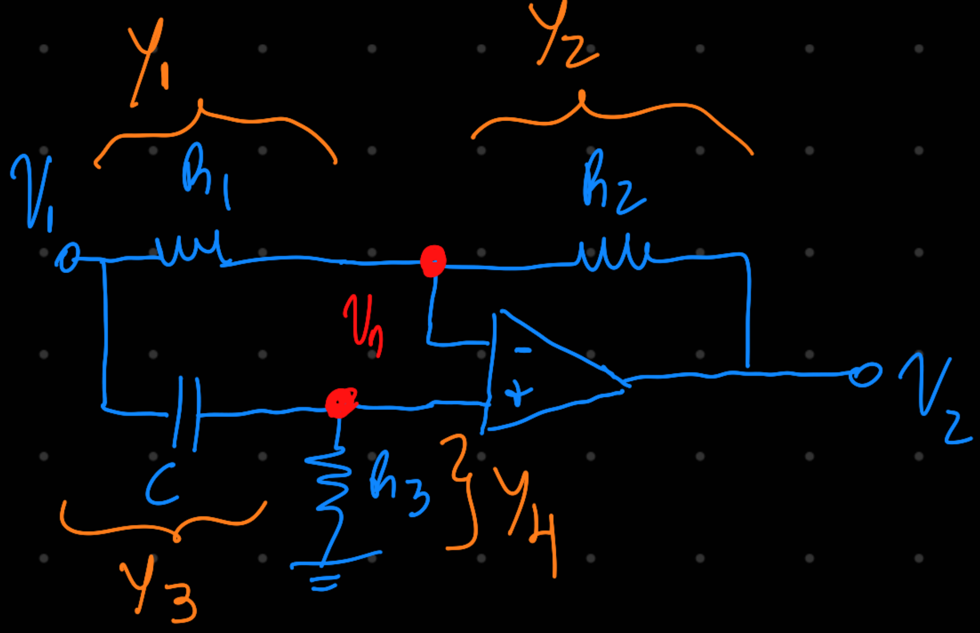


(1) $V_n(Y_4+Y_3)+V_1Y_3=0 \Rightarrow$ (3) $V_n=-\dfrac{V_1Y_3}{Y_4+Y_3}$

(2) $V_n(Y_1+Y_2)+V_1Y_1+V_2Y_2=0$

(3) en (2)

$$-\frac{V_1Y_3}{Y_3+Y_4}(Y_1+Y_2)+V_1Y_1+V_2Y_2=0$$

$$V_1\left(-\frac{Y_3(Y_1+Y_2)}{(Y_3+Y_4)}+Y_1\right)=-V_2Y_2$$

$$\frac{V_2}{V_1}=\frac{\cancel{Y_3Y_1}+Y_3Y_2-\cancel{Y_1Y_3}-Y_1Y_4}{Y_3Y_2+Y_4Y_2}$$

$$\frac{V_2}{V_1} = H(s) = \frac{Y_3 Y_2 - Y_1 Y_4}{Y_3 Y_2 + Y_4 Y_2}$$

transferencia genérica

Si $Y_3 = sC$; $Y_4 = G_3$; $Y_1 = G_1$; $Y_2 = G_2$

$$H(s) = \frac{sC\,G_2 - G_1 G_3}{sC\,G_2 + G_2 G_3} \cdot \frac{\frac{1}{CG_2}}{\frac{1}{CG_2}}$$

$$\longrightarrow \quad H(s) = \frac{s - \frac{G_1 G_3}{C G_2}}{s + \frac{G_3}{C}}$$

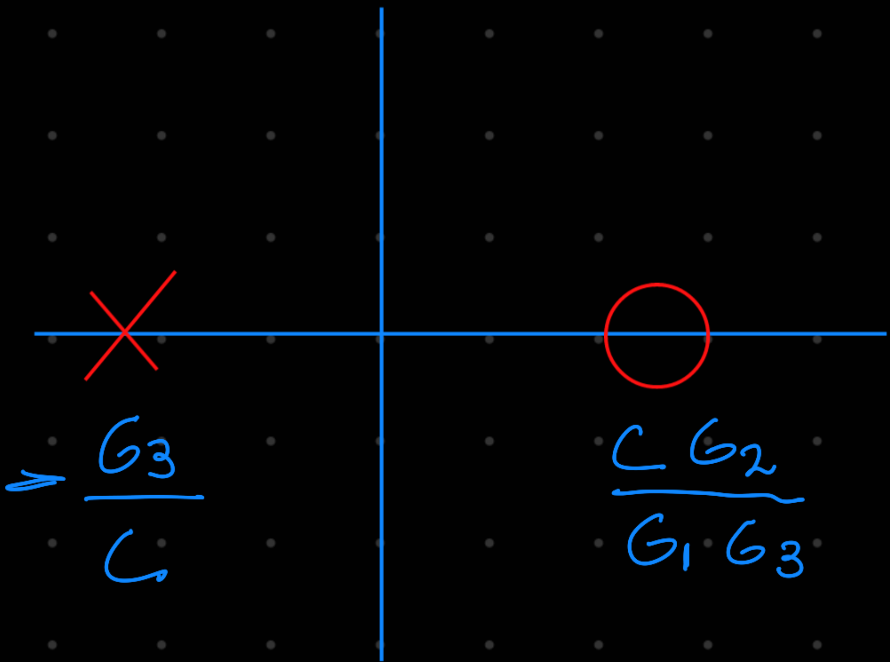
→ Modulo y fase

$$|H(j\omega)| = \frac{j\omega - \frac{G_1 G_3}{C G_2}}{j\omega + \frac{G_3}{C}} = \frac{\sqrt{\left(\frac{G_1 G_3}{C G_2}\right)^2 + \omega^2}}{\sqrt{\left(\frac{G_3}{C}\right)^2 + \omega^2}}$$

$$\angle H(jw) = \text{Arctg}\left(\frac{w}{-\frac{G_1 G_3}{C G_2}}\right) - \text{Arctg}\left(\frac{w}{\frac{G_3}{C}}\right)$$

$$\angle H(jw) = \text{Arctg}\left(\frac{w C G_2}{-G_1 G_3}\right) - \text{Arctg}\left(\frac{wC}{G_3}\right)$$

→ Diagrama de Polos y ceros



→ Caso de Estudio $R_1 = R_2$ → All Pass

$$H(s) = \frac{s - \frac{G_3}{C}}{s + \frac{G_3}{C}} \; ; \quad w_o = \frac{G_3}{C}$$

→ Se puede normalizar en frecuencia con $W_o = \frac{G_3}{C}$ → $s = s' \cdot w_o$

$$H(s') = \frac{s' - 1}{s' + 1} \; ,$$

Conviene que la norma de impedancia sea $R_3 == G_3$

→ Modulo y Fase

$$|H(jw)| = \frac{\sqrt{\left(\frac{\cancel{G_1} G_3}{C \cancel{G_2}}\right)^2 + w^2}}{\sqrt{\left(\frac{G_3}{C}\right)^2 + w^2}} = \cancel{1} \rightarrow 0dB$$

$$\angle H(jw) = \operatorname{Arctg}\left(\frac{w C \cancel{G_2}}{-\cancel{G_1} G_3}\right) - \operatorname{Arctg}\left(\frac{wC}{G_3}\right)$$

este menos hace que en $W=0$ $\angle = \pi$

$$= \operatorname{Arctg}\left(\frac{wC}{-G_3}\right) - \operatorname{Arctg}\left(\frac{wC}{G_3}\right)$$

→ Diagrama de Polos y ceros