



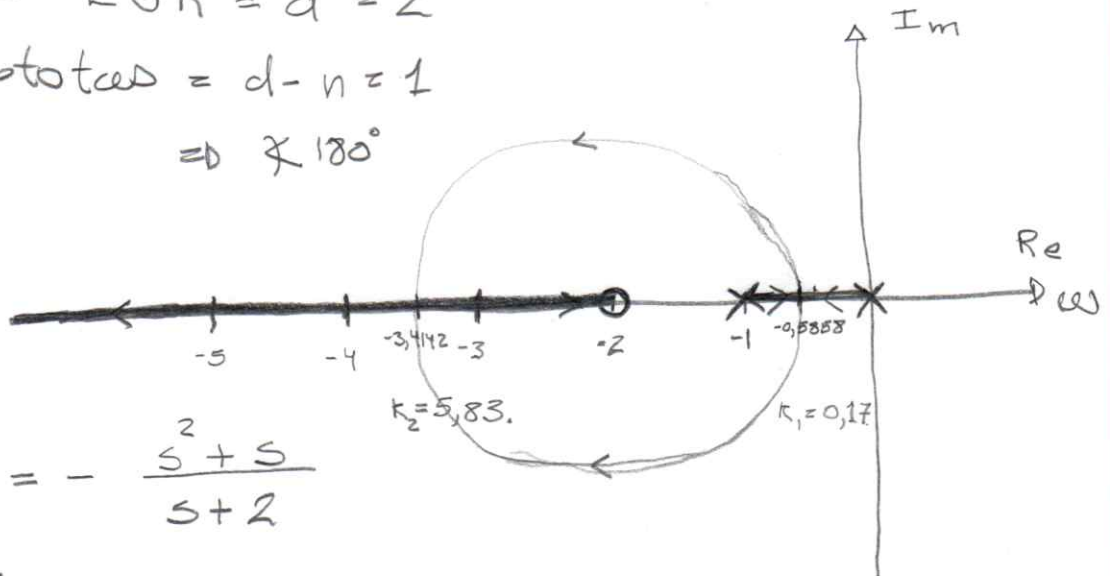
$$G(s) \cdot H(s) = -1 \Leftrightarrow K \frac{s+2}{s(s+1)} = -1.$$

Zeros $s = -2$ ($n=1$)

Polos $s = 0$
 $s = -1$ ($d=2$)

RAMOS LGR = $d = 2$

Assimptotas = $d - n = 1$
 $\Rightarrow \angle 180^\circ$



$$K = - \frac{s^2 + s}{s + 2}$$

$$\frac{dK}{ds} = 0 \Leftrightarrow - \frac{(2s+1)(s+2) - (s^2+s) \cdot 1}{(s+2)^2} = 0$$

$$\begin{cases} s_1 = -0,5858 \\ s_2 = -3,4142 \end{cases}$$

NOTA!
 "começa nos polos e acaba no zero ou no infinito."

$$\left. \begin{matrix} s^2 + s + Ks + 2K \\ s = j\omega \end{matrix} \right| = 0$$

$$-\omega^2 + j\omega + jK\omega + 2K = 0$$

$$\begin{cases} -\omega^2 + 2K = 0 \\ \omega + K\omega = 0 \end{cases} \Big|_{\omega=0} \Rightarrow \begin{cases} K = 0 \\ \omega = 0 \end{cases} \vee \begin{cases} K = -1 \end{cases}$$

intersecção eixo imaginário $K=0 \wedge \omega=0$

$$\frac{K}{(s+1)(0,1s+1)(s^2+6s+18)} = -1$$

$$\begin{cases} s+1=0 \\ s=-1 \end{cases}$$

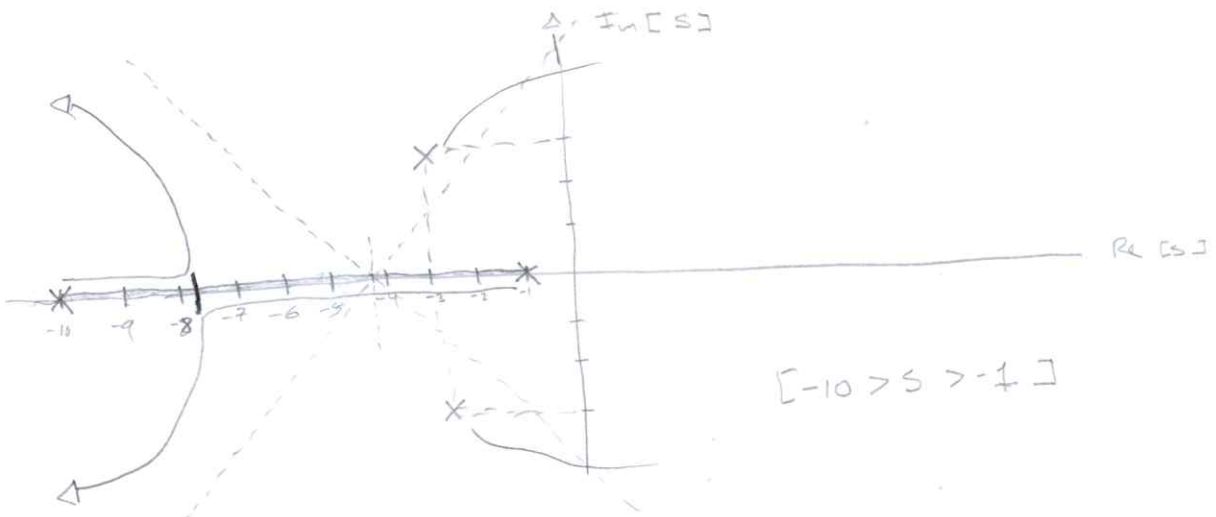
$$\begin{cases} 0,1s+1=0 \\ 0,1s=-1 \\ s=\frac{-1}{0,1} = -10 \end{cases}$$

Branches = 4

Asymptotes = 4

Angles = $45^\circ; 135^\circ; 225^\circ; 315^\circ$

$$\sigma = -4,25$$



$$(0,1s^2 + s + 0,1s + 1)(s^2 + 6s + 18) + K = 0$$

$$(0,1s^2 + 1,1s + 1)(s^2 + 6s + 18) + K = 0$$

$$0,1s^4 + 0,6s^3 + 1,8s^2 + 1,1s^3 + 6,6s^2 + 19,8s + s^2 + 6s + 18$$

$$(0,1s^4 + 1,7s^3 + 9,4s^2 + 25,8s + 18) + K = 0$$

$$f(0,4s^3 + 5,1s^2 + 18,8s + 25,8) = K' \quad | \quad K' = 0$$

$$\begin{cases} s_1 = -7,768 \\ s_2 = -2 \pm 1,45j \end{cases}$$

$$D(s) = 0 \quad | \quad s = -7,768$$

$$K = 4,79$$

$$0,1\omega^4 - 1,7j\omega^3 - 9,4\omega^2 + 25,8j\omega + 18 + K = 0 \quad | \quad s = j\omega$$

$$\begin{aligned} \text{Re} \begin{cases} 0,1\omega^4 - 9,4\omega^2 + 18 + K = 0 \\ 25,8\omega - 1,7\omega^3 = 0 \end{cases} & \begin{cases} K = -18 \\ \omega = 0 \end{cases} \quad \vee \quad \begin{cases} \omega^2 = \frac{25,8}{1,7} \\ \omega = \pm 3,89 \end{cases} \end{aligned}$$