CMC-12 Eric Guerra Ribeiro Lista 9

1- $G(j\omega) = \dfrac{10(j\omega-1)}{(j\omega+2)(j\omega+3)}$

$|G(j\omega)| = \dfrac{5}{3}, \omega = 0$ $\qquad |G(j\omega)| \to 0, \omega \to \infty$

$\angle G(j\omega) = -180°, \omega = 0$ $\qquad \angle G(j\omega) \to -90°, \omega \to \infty$

$$G(j\omega) = \frac{10(j\omega-1)(j\omega-2)(j\omega-3)}{(\omega^2+4)(\omega^2+9)} = \frac{10}{(\omega^2+4)(\omega^2+9)}((j\omega)^3 - 6(j\omega)^2 + 11j\omega - 6$$

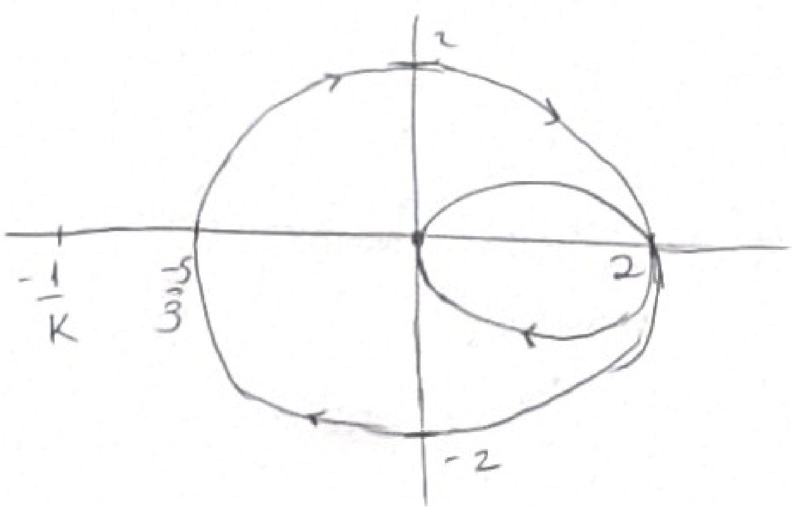
$$G(j\omega) = \frac{10}{(\omega^2+4)(\omega^2+9)}\left(6(\omega^2-1) + j(11-\omega^2)\omega\right)$$

Real: $(11-\omega^2)\omega = 0 \Rightarrow \omega = 0$ ou $\omega = \sqrt{11}$

$G(j\omega) = -\dfrac{5}{3}$ $\qquad G(j\omega) = \dfrac{\cancel{10}}{\cancel{15\cdot 20}\ 2}(6\cdot 10) = 2$

Imaginário puro: $6(\omega^2-1) = 0 \Rightarrow \omega = 1$

$$G(j\omega) = \frac{\cancel{10}\cdot j\cdot 10}{5\cdot \cancel{10}} = 2j$$



Estabilidade

$-\dfrac{1}{K} < -\dfrac{5}{3}$

$K < \dfrac{3}{5} \Rightarrow$ límite: $K = \dfrac{3}{5}$

2-

$$G(s) = \frac{10}{(s+5)(s-2)} \Rightarrow G(j\omega) = \frac{10}{(j\omega+5)(j\omega-2)}$$

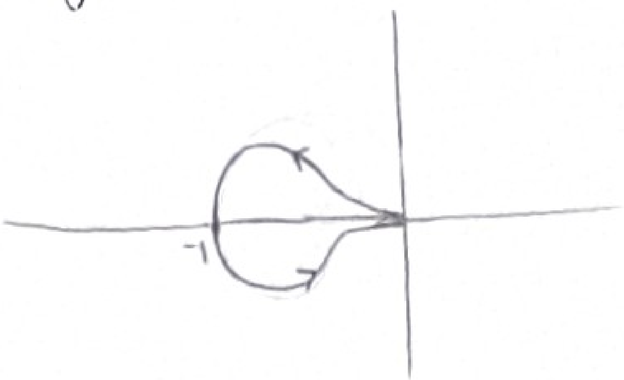
$|G(j\omega)| = 1, \ \omega = 0$ $\qquad |G(j\omega)| \to 0, \ \omega \to \infty$

$\angle G(j\omega) = -180°, \ \omega = 0$ $\qquad \angle G(j\omega) \to -180°, \ \omega \to \infty$

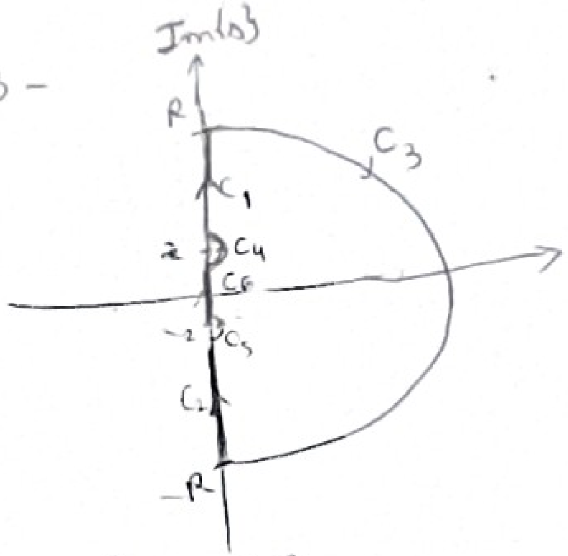
$$G(j\omega) = \frac{10\,(j\omega-5)(j\omega+2)}{(\omega^2+5)(\omega^2+2)} = \frac{-10}{(\omega^2+5)(\omega^2+2)}\left((10+\omega^2)+3j\omega\right)$$

Real : $\omega = 0$

Imaginário puro : $10+\omega^2 = 0 \Rightarrow$ Não cruza



3-



$$G(s) = \frac{1}{(s+1)(s^2+4)}, \quad s = x + yj$$

$$G(x,y) = \frac{1}{(x+1+yj)(x^2+4-y^2+2xyj)}$$

$$G(x,y) = \frac{(x+1-yj)(x^2+4-y^2-2xyj)}{((x+1)^2+y^2)((x^2+4-y^2)^2+4x^2y^2)}$$

$$G(x,y) = \underbrace{\frac{(x+1)(x^2-y^2+4)-2xy^2}{((x+1)^2+y^2)((x^2-y^2+4)^2+4x^2y^2)}}_{X(x,y)} - \underbrace{\frac{y(x^2-y^2+4)+2xy(x+1)}{((x+1)^2+y^2)((x^2-y^2+4)^2+4x^2y^2)}}_{Y(x,y)}$$

C_1: $x = 0$, $y = 2+r : 10^{-3} : R$

C_2: $x = 0$, $y = -R : 10^{-3} : -2-r$

C_3: $x = R\cos\theta$, $y = R\,\text{sen}\,\theta$, $\theta = \frac{\pi}{2} : -10^{-3} : -\frac{\pi}{2}$

C_4: $x = r\cos\theta$, $y = 2+r\,\text{sen}\,\theta$, $\theta = -\frac{\pi}{2} : 10^{-3} : \frac{\pi}{2}$

C_6: $x = 0$, $y = -2+r : 10^{-3} : 2+r$

C_5: $x = r\cos\theta$, $y = -2+r\,\text{sen}\,\theta$, $\theta = -\frac{\pi}{2} : 10^{-3} : \frac{\pi}{2}$