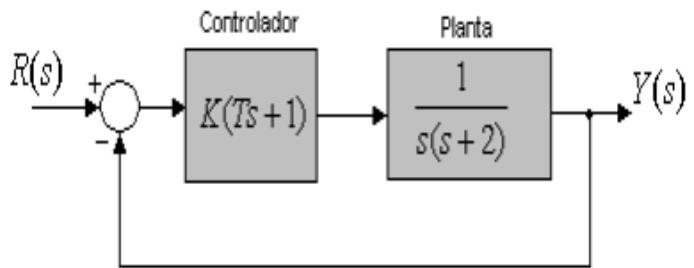
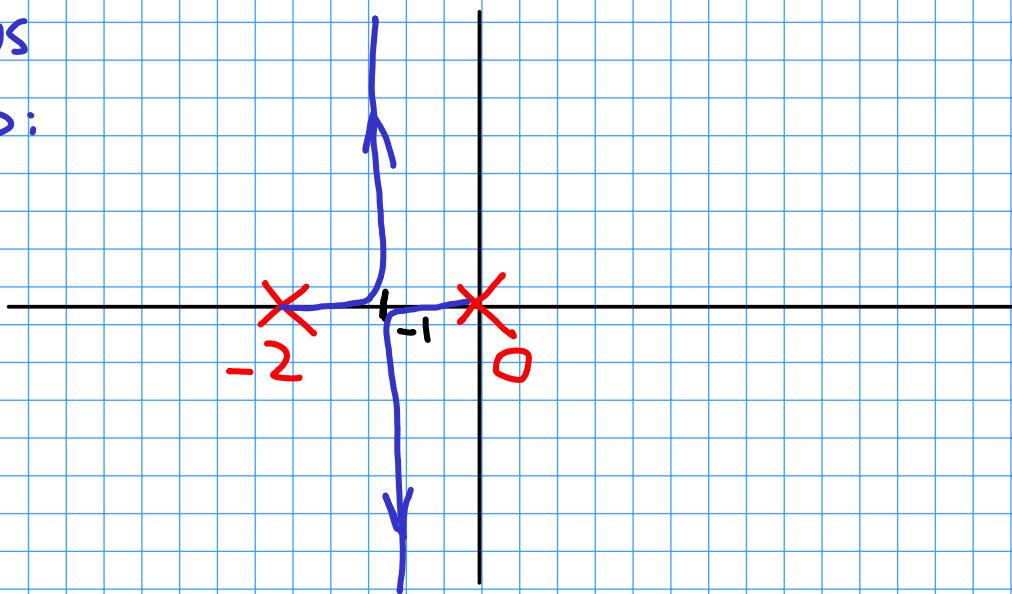


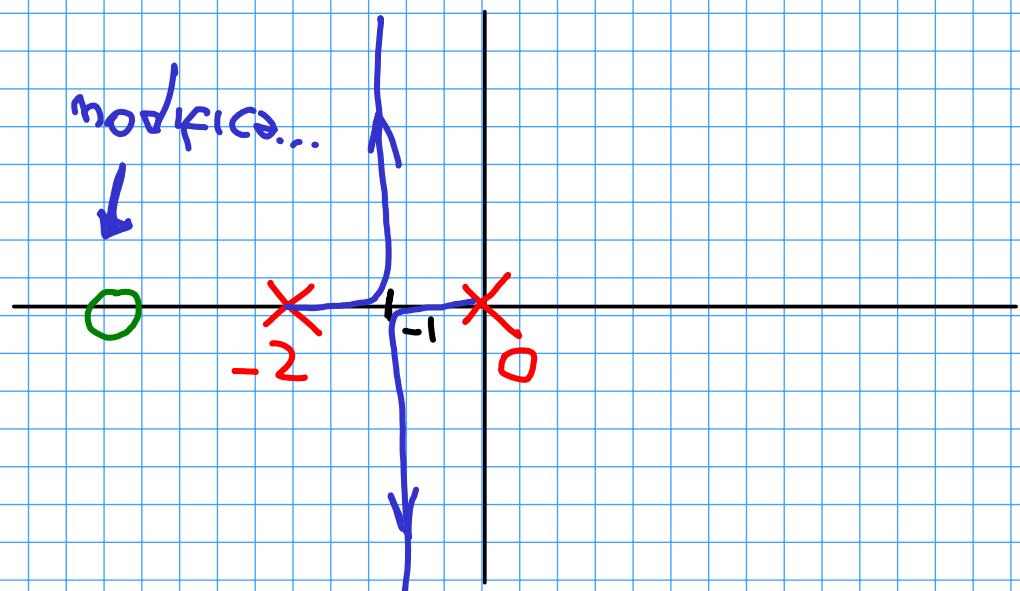
**Problema 2.** Para el sistema de control mostrado en la figura, determine la ganancia  $K$  y la constante de tiempo  $T$  del controlador  $G_c(s)$  para que los polos de lazo cerrado se localicen en  $s = -2 \pm j2$ .

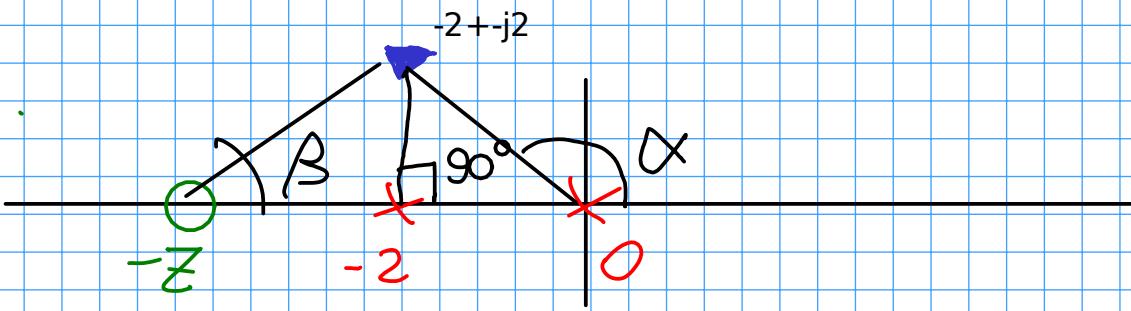


rlocus  
de  $G$ :



modifico...





Criterio de Fosc:

$$q = N - M - 1 \\ = 2 - 1 - 1 \\ = 0$$

$$\sum \text{ang} - 2\pi q = \pm 180^\circ (2q + 1)$$

$$\beta - (90^\circ + 135^\circ) = -180^\circ \\ \underline{\beta = 45^\circ}$$

Si el cero aporta  $45^\circ$  debe ubicarse en  $z=-4$

Criterio de Magnitud:

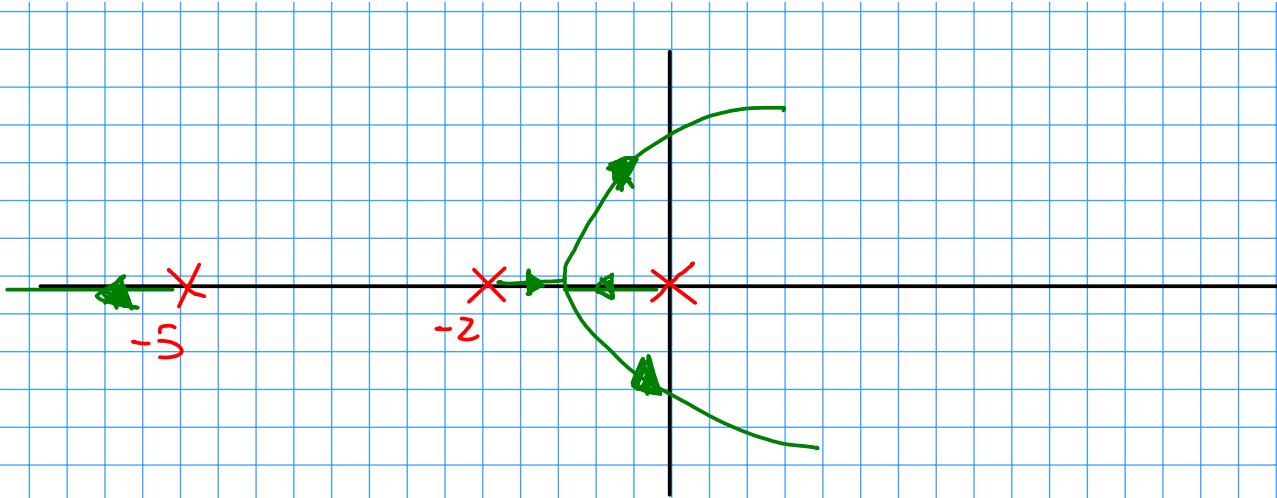
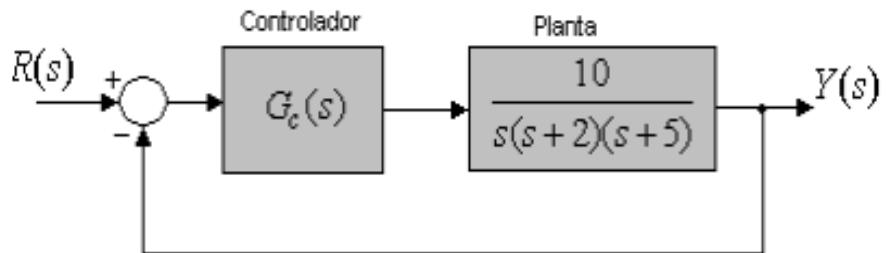
$$G \cdot H = \left| K T \left( s + 1/T \right) \cdot \frac{1}{s(s+2)} \right| = 1$$

$$\underline{T = 1/4}$$

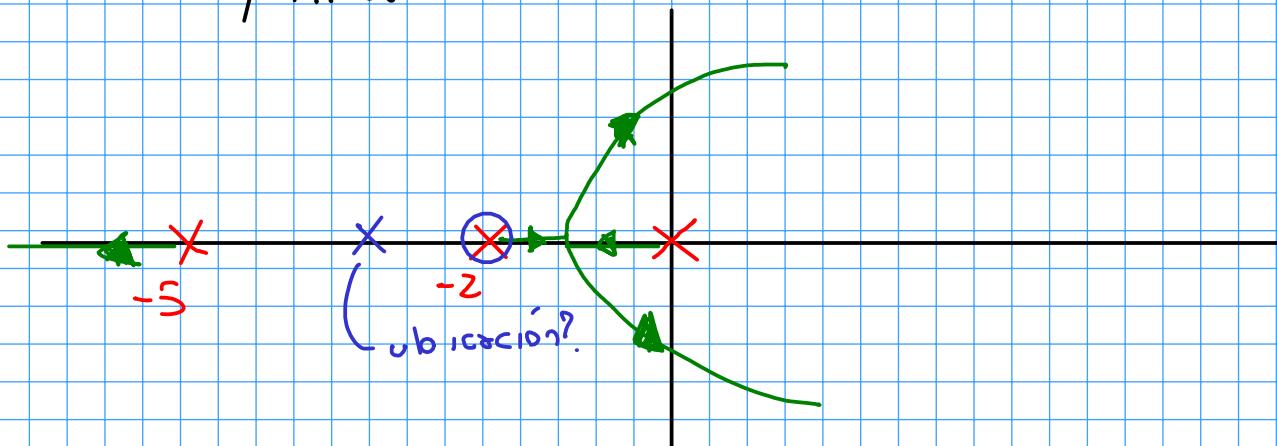
$$\left| \frac{K \left( \frac{1}{4} \right) \left( s + 4 \right)}{s(s+2)} \right| = \frac{|K| \sqrt{2^2 + 2^2}}{\frac{1}{4} \sqrt{2^2 + 2^2} \cdot 2} = 1$$

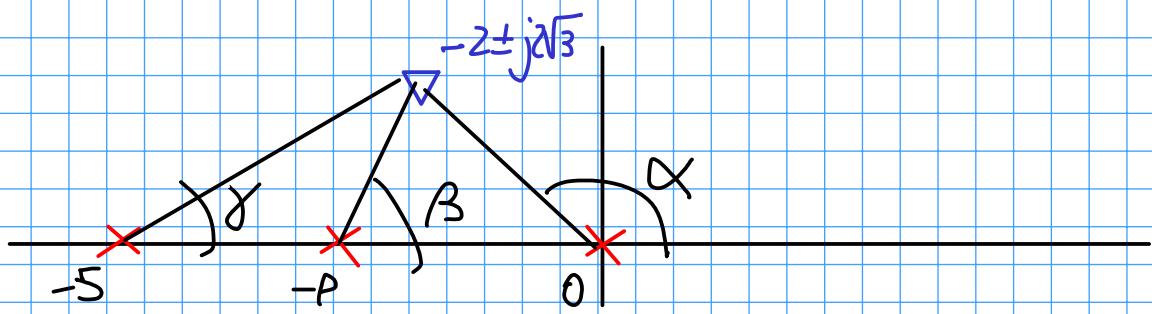
$$\underline{K = 8}$$

**Problema 5.** Considérese el sistema de control mostrado en la figura. Diseñe un compensador para que la constante de error estático de velocidad, sea  $K_v = 50 \text{ seg}^{-1}$  y los polos dominantes de lazo cerrado se localicen en  $s = -2 \pm j2\sqrt{3}$ .



Adelanto/Atraso:





Criterio de Fase:

$$\alpha + \beta + \gamma = \pm 180^\circ$$

$$\alpha = \operatorname{arccotg} \left( \frac{2\sqrt{3}}{2} \right) = 120^\circ$$

$$\gamma = \operatorname{arccotg} \left( \frac{2\sqrt{3}}{5-2} \right) = 49,1^\circ$$

$$\beta \approx 10,9$$

$$= \operatorname{arccotg} \left( \frac{2\sqrt{3}}{P-2} \right)$$

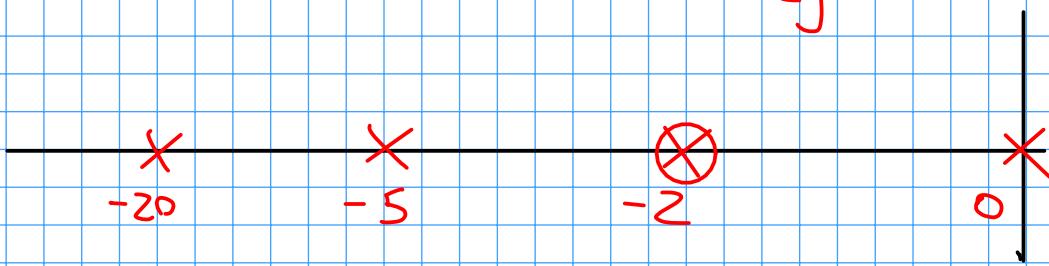
$$\tan(10,9) = \frac{2\sqrt{3}}{P-2}$$

$$P = 2 + \frac{2\sqrt{3}}{\tan(10,9)}$$

$$\underline{P = 19,98}$$

$$\underbrace{s+2}_{s+20} \quad \text{Real 1}$$

$$\nabla -2 + j 2\sqrt{3}$$



$$\left| \frac{k_c \cdot 10}{\sqrt{18^2 + (2\sqrt{3})^2} \cdot \sqrt{3^2 + (2\sqrt{3})^2}} \right| = 1$$

$$k_c = \frac{18,33 \cdot 4,58 \cdot 4}{10}$$

$$\underline{k_c = 33,58}$$

$$k_v = \lim_{s \rightarrow 0} \cancel{s} \frac{33,58 \cdot 10 \cancel{(s+2)}}{\cancel{(s)} \cancel{(s+s)} \cancel{(s+20)} \cancel{(s+2)}}$$

$$\underline{k_v = 3,35}$$

agregar 0 + a red con

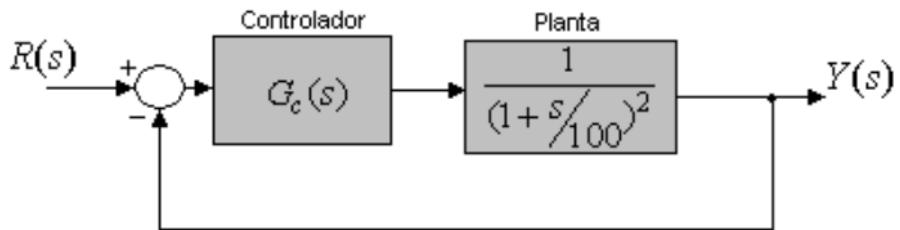
$$\frac{Z_C}{Z_P} = \frac{S_0}{3,35} = 14,92$$

$$z_c = 0,1$$

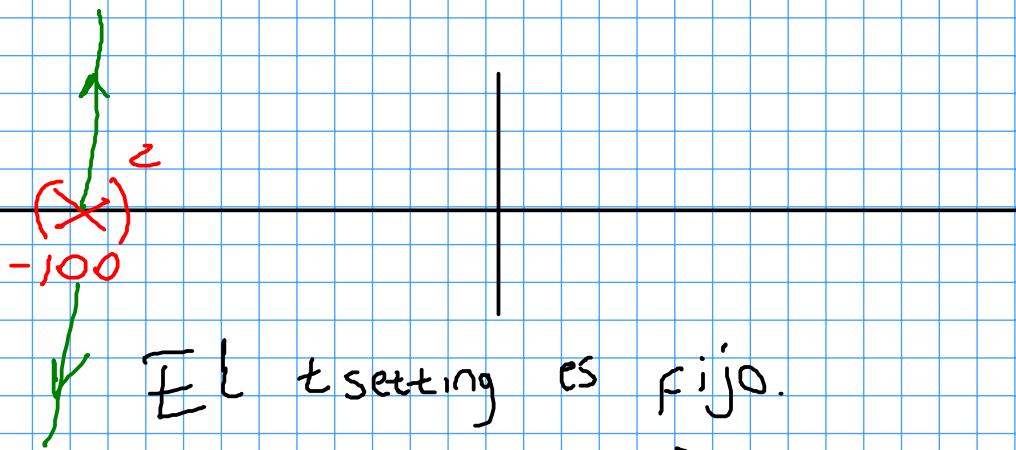
$$z_p = \frac{0,1}{14,92} = 0,0067$$

$$G_C = 33,58 \cdot \frac{(s+0,1)}{(s+0,0067)} \cdot \frac{(s+2)}{(s+20)}$$

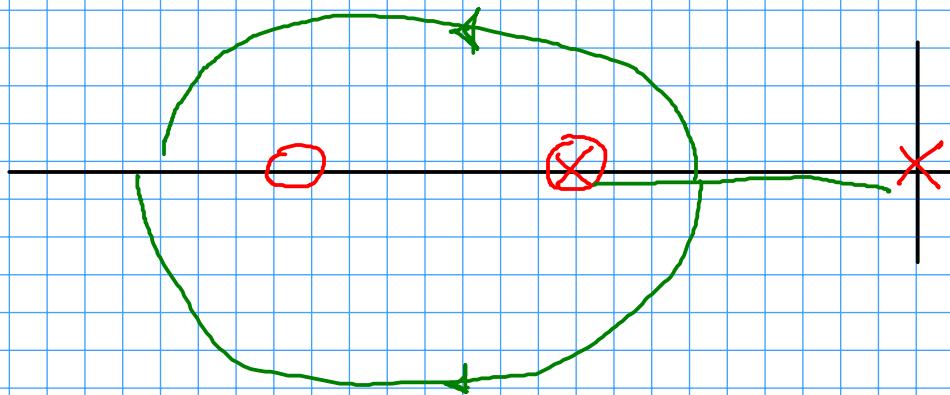
**Problema 10.** Considérese el sistema de control mostrado en la figura. Diseñese un controlador para tener a lazo cerrado una respuesta determinada por  $K_v = 100$  y un tiempo de establecimiento de 0.008 seg.



Se pide un  $K_v$ , hay que aumentar el tipo:  
polo en el origen  $\rightarrow$  PID



Con un polo en el origen y un cero en -100



$$k_v = ?$$

$$k_v = \lim_{s \rightarrow 0} \frac{s \cdot k_c (s+z_1)(s+z_2)}{(1+s/100)^c}$$

$$k_v = k_c \cdot z_1 \cdot z_2$$

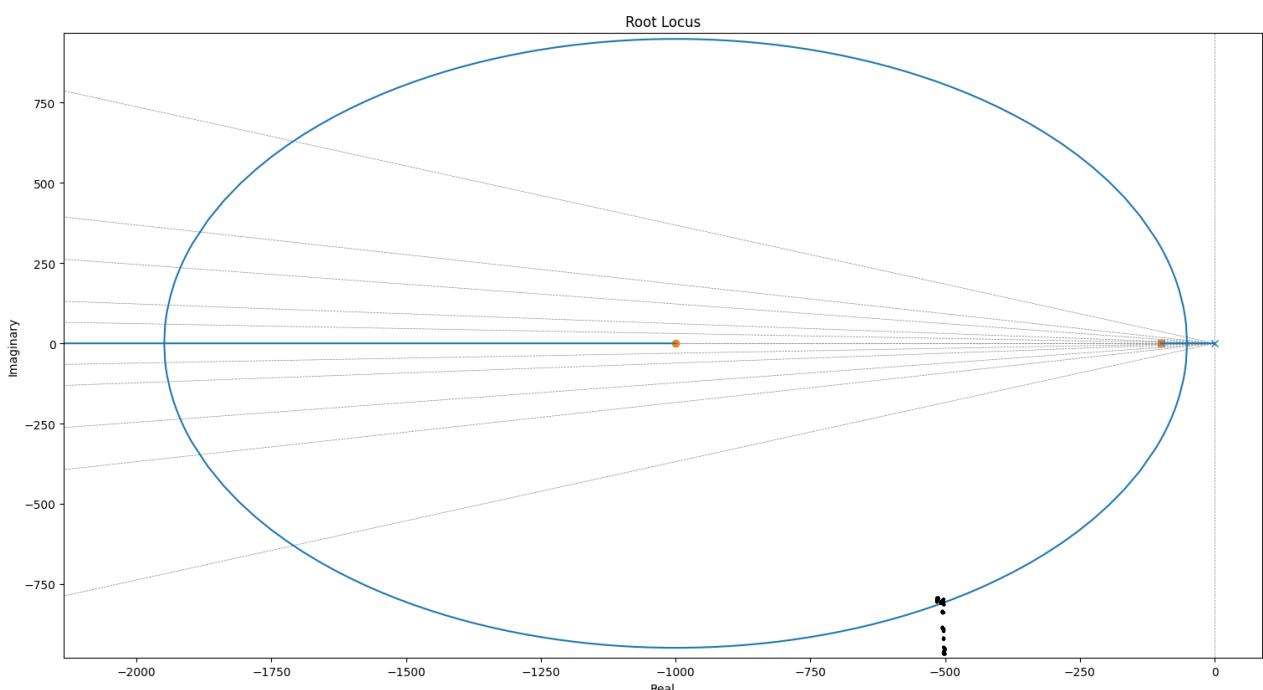
$$k_v \geq 100, \text{ como } z_1 = 100$$

tengo que proponer un valor de  $z_2$  y obtener  $k_c$  del rlocus

$$\text{elijo } z_2 = 1000;$$

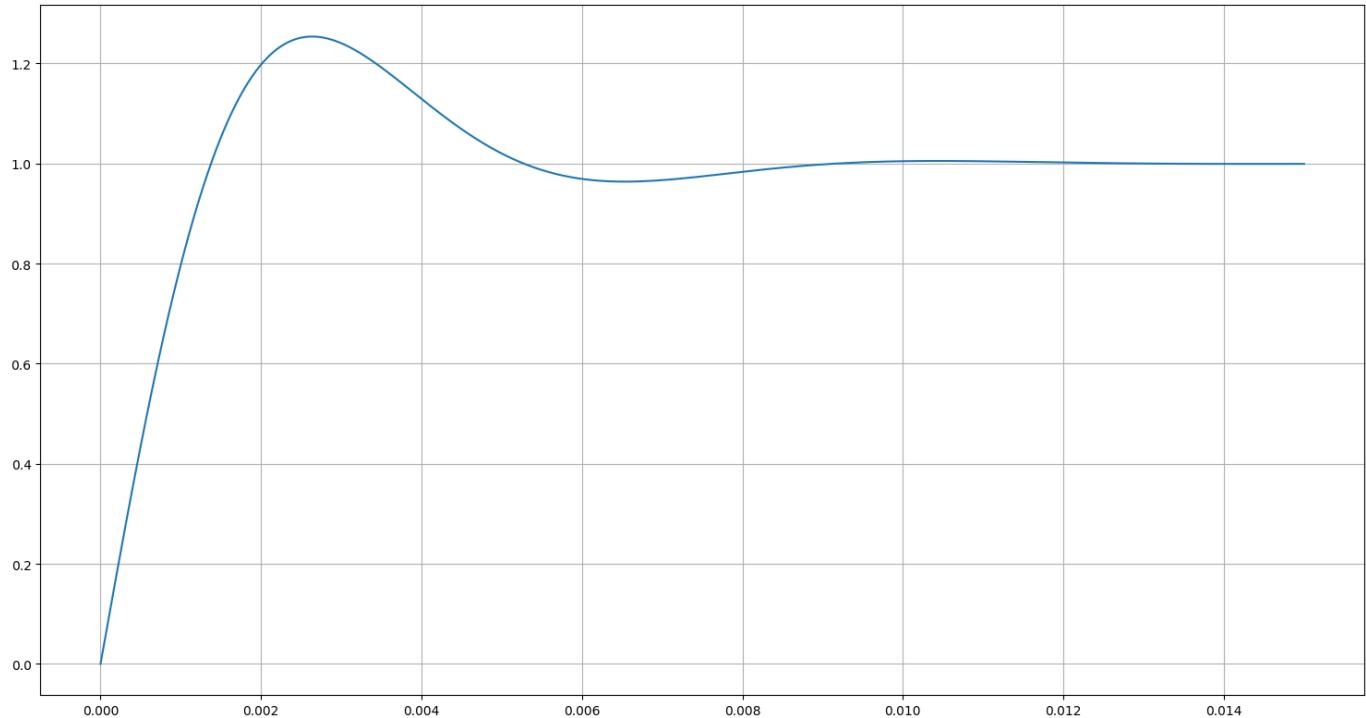
$$\frac{4}{\zeta w_n} = 0.008$$

$$\zeta w_n = 500$$



Con el rlocus nos da 0,09 de  $k_c$

$$k_v = 0,09 \cdot 1000 \cdot 100 = 9000$$



$$\frac{k_c \cdot (s + z_1)(s + z_2)}{s} = k_p + \frac{k_I}{s} + k_D s$$

$$\frac{k_c (s^2 + s(z_1+z_2) + z_1z_2)}{s} = \underbrace{k_c s}_{k_D} + \underbrace{k_c(z_1+z_2)}_{k_P} + \underbrace{\frac{k_c z_1 z_2}{s}}_{k_I}$$

$$k_D = 0,09$$

$$k_p = 99$$

$$k_I = 9000$$