Controlador Integral $\rightarrow \dfrac{k_I}{s} \;=\; \dfrac{1}{\tau_i\, s}$

$$\boxed{\dfrac{k_I}{s}} \longrightarrow \boxed{\dfrac{40}{4s+1}}$$

Sistema $\rightarrow \dfrac{40}{4s+1}$

$$\longrightarrow \dfrac{40\,k_I}{s(4s+1)} = \dfrac{\cancel{4}\,(10k_I)}{\cancel{4}s(s+0,25)}$$

$$\Rightarrow \dfrac{10k_I}{s(s+0,25)}$$

$$\text{FTCF} = \dfrac{G}{1+GH} = \dfrac{\dfrac{10k_I}{s^2+0,25s}}{1+\dfrac{10k_I}{s^2+0,25s}} = \dfrac{10k_I}{s^2+\dfrac{1}{4}s+10k_I}$$

$$\left\{\begin{array}{l} W_o^2 = 10k_I \\[2mm] 2\xi W_o = \dfrac{1}{4} \end{array}\right. \;\;\overset{c=1}{\Longrightarrow}\;\; \left\{\begin{array}{l} k_I = \dfrac{W_o^2}{10} \\[2mm] W_o = \dfrac{0,25}{2\xi} \end{array}\right. \;\;\overset{c=1}{\Longrightarrow}\;\; \left\{ k_I = \dfrac{\left(\dfrac{0,25}{2\xi}\right)^2}{10} \right. \quad - \text{Para } \xi = \dfrac{\sqrt{2}}{2} \rightarrow k_I = \dfrac{1}{320}$$
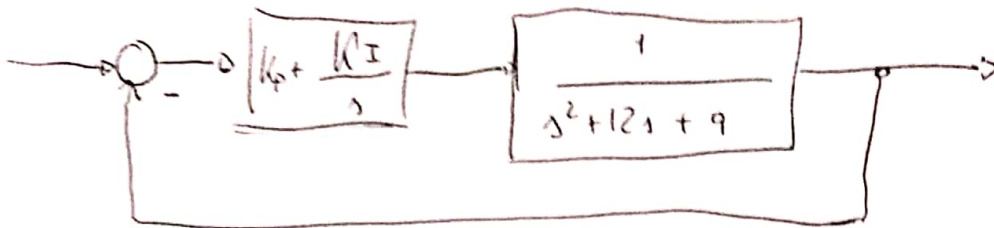
$$K_p + \frac{K_I}{s} = \frac{K_p s + K_I}{s} = \frac{K_I \left(\frac{K_p s}{K_I} + 1 \right)}{s}$$

$$s^2 + 12s + 9 = 0 \iff s = -11,20 \quad V \; s = -0,80$$

$$\frac{1}{s^2+12s+9} = \frac{1}{(s+11,20)(s+0,8)} = \frac{1}{(11,2 \times 0,8)(1,25s+1)(0,09s+1)} =$$

$$\frac{K_I \left(\frac{K_{ps}}{K_I} + 1 \right)}{s} \bullet \frac{1}{8,96(1,25s+1)(0,09s+1)} =$$

$$= \frac{K_I}{s} \bullet \frac{1}{8,96(0,09s+1)} = \frac{K_I}{s} \bullet \frac{0,112}{(0,09s+1)} = \frac{0,112\, K_I}{s(0,09s+1)}$$

$$\frac{K_I}{K_p} = 1,25$$

FTCF

$$\hookrightarrow \frac{\frac{0,112\, K_I}{s(0,09s+1)}}{1 + \frac{0,112\, K_I}{s(0,09s+1)}} = \frac{0,112 K_I}{0,09 s^2 + s + 0,112 K_I} = \frac{1,24\, K_I}{s^2 + 11,1s + 1,24 K_I}$$

$$\begin{cases} K_I = \frac{W_o^2}{0,112} \\ 2\mathcal{E} W_o = 11,1 \end{cases} \quad \begin{cases} K_I = \frac{W_o^2}{1,24} \\ 2\mathcal{E} W_o = 11,1 \end{cases} \Rightarrow \begin{cases} K_I = \frac{W_o^2}{1,24} \\ W_o = \frac{11,1}{2\mathcal{E}} \end{cases}$$

Para $\mathcal{E} = \frac{\sqrt{2}}{2}$	Para $\mathcal{E} = 0,1$	Para $\mathcal{E} = 4$
$W_o = 7,85$	$W_o = 55,5$	$W_o = 1,375$
$K_I = 49,68$	$K_I = 2484,07$	$K_I = 1,52$
$K_p = 39,744$	$K_p = 1987,26$	$K_p = 1,216$