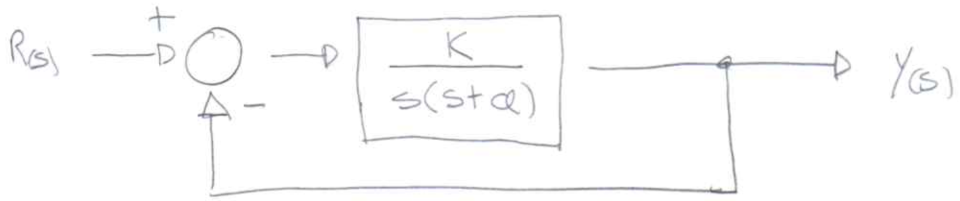
Analise no dominio dos tempos.

13.



$$b = 1 \Rightarrow \lim_{s \to 0} \cancel{s} \cdot \frac{K}{\cancel{s}(s+a)} \Rightarrow \lim_{s \to 0} \frac{K}{a\left(\frac{s}{a}+1\right)}$$

$$K_v = \frac{K}{a}$$

$$e_{ss} = \frac{a}{K} = 0{,}01$$

<u>sobreelongação máx</u> - $M_p = 0{,}1$

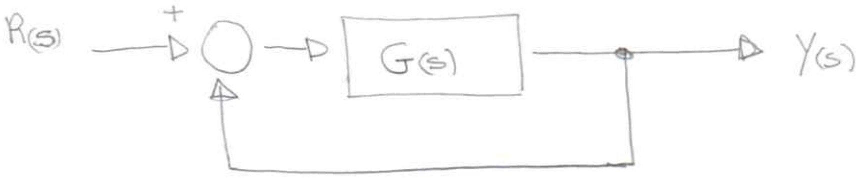
$$\xi = 0{,}591$$

$$FTMF = \frac{K}{s(s+a)+K} = \frac{K}{s^2+as+K}$$

$$a = 2\xi\omega_n$$
$$K = \omega_n^2$$

$$\begin{cases} a = 0{,}01K \\ 2 \times 0{,}591 \times \sqrt{K} = a \end{cases} \Rightarrow \begin{cases} K = 13971 \\ a = 139{,}7 \end{cases}$$

13)



$K = ?$
$a = ?$
$e_{ss} = 1\%$
$M_p = 10\%$

$$G(s) = \frac{K}{s(s+a)}$$

↳ type 1 system (one pole in origin)

⇒ Since the system is a type 1 system the steady-state error has finite values for an unit <u>Ramp</u> input:

$$\boxed{e_{ss} = \frac{1}{K_v}}$$

$$\boxed{K_v = \lim_{s \to 0} s\, G(s)} = \lim_{s \to 0} s \cdot \frac{K}{s(s+a)} = \lim_{s \to 0} \frac{K}{s+a} = \frac{K}{a}$$

$$e_{ss} = \frac{a}{K} \quad (1)$$

⇒ closed-loop transfer function:

$$\frac{Y(s)}{R(s)} = \frac{G(s)}{1+G(s)} = \frac{\frac{K}{s(s+a)}}{1+\frac{K}{s(s+a)}} = \frac{K}{s(s+a)+K}$$

$$\frac{Y(s)}{R(s)} = \frac{K}{s^2+as+K}$$

Note:
T.F of 2^d order system
$$\frac{Y(s)}{R(s)} = \frac{\omega_n^2}{s^2+2\xi\omega_n s+\omega_n^2}$$

$$\begin{cases} K = \omega_n^2 \\ a = 2\xi\omega_n \end{cases} \Leftrightarrow \begin{cases} \omega_n = \sqrt{K} \\ a = 2\xi\sqrt{K} \end{cases} \quad (2)$$

- From the specification of M_p:

$$M_p = e^{-\pi\xi/\sqrt{1-\xi^2}} \Leftrightarrow 0{,}1 = e^{-\pi\xi/\sqrt{1-\xi^2}} \Leftrightarrow \xi = 0{,}591$$

Equation (1) and (2):

$$\begin{cases} a = 0{,}01K \\ a = 2\xi\sqrt{K} \end{cases} \Leftrightarrow \begin{cases} K = 13971 \\ a = 139{,}7 \end{cases}$$