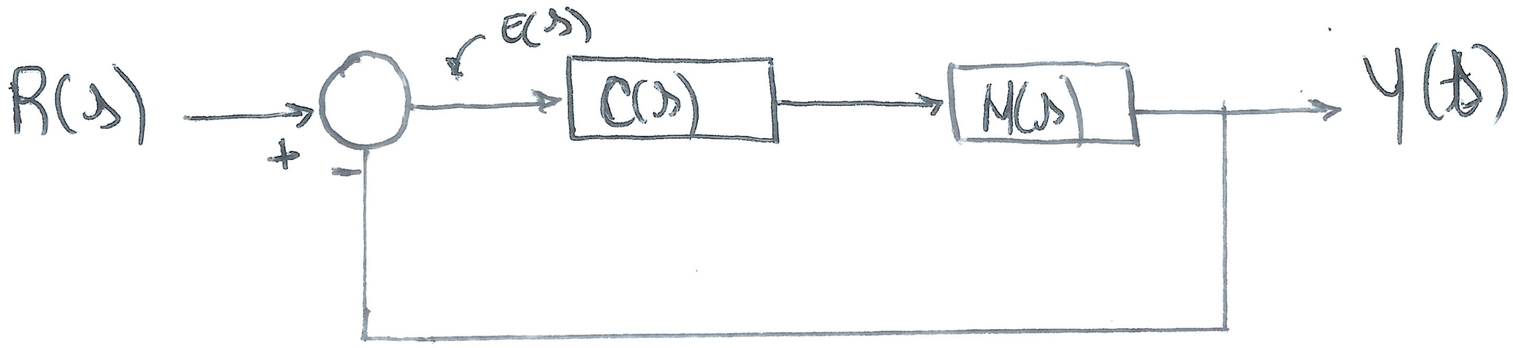

$$E(s) = R(s) - Y(s)$$

$$E(s).(C(s).G(s)) = Y(s)$$

$$(R(s) - Y(s)).C(s).G(s) = Y(s)$$

$$R(s).C(s).G(s) = Y(s)(C(s).G(s) + 1)$$

$$\frac{Y(s)}{R(s)} = \frac{C(s).G(s)}{1 + C(s).G(s)}$$

1.1) $T(s) = \dfrac{C(s).M(s)}{1 + C(s).M(s)} = \dfrac{K\left(1+\frac{1}{s}\right).\left(\frac{-6s-60}{0,16s^2-10}\right)}{\underbrace{1 + K\left(\underbrace{1+\frac{1}{s}}_{\frac{s+1}{s}}\right).\left(\frac{-6s-60}{0,16s^2-10}\right)}_{\text{DEM}}}$

$$\text{DEM} = \frac{s(0,16s^2-10) + K((s+1)(-6s-60))}{s(0,16s^2-10)}$$

$$\text{NUM} = \frac{K(s+1)(-6s-60)}{s(0,16s^2-10)}$$

$$T(s) = \frac{K(s+1)(-6s-60)}{s(0,16s^2-10) + (K(s+1)(-6s-60))} = \frac{\frac{K(s+1)(-6s-60)}{s(0,16s^2-10)}}{\frac{s(0,16s^2-10) + K(s+1)(-6s-60)}{s(0,16s^2-10)}} = \frac{(s+1)(6s+60)}{s(0,16s^2-10) + (s+1)(6s+60)}$$

$$T(s) = \frac{6s^2+60s+6s+60}{0,16s^3-10s+6s^2+60s+6s+60} = \frac{6s^2+66s+60}{0,16s^3+6s^2+56s+60}$$

Bibo ESTÁVEL

Calculo do erro em regime permanente

→ $R(s)$ → ENTRADA

ENTRADA DEGRAU

$$y(\infty) = \lim_{s \to 0} s \cdot \frac{1}{s} \left(1 - \left(\frac{6s^2 + 66s + 60}{0{,}6s^3 + 6s^2 + 56s + 60} \right) \right) =$$

$$y(\infty) = \left(1 - \frac{60}{60} \right) = 0$$

ERRO DE REGIME PERMANENTE = 0

ENTRADA RAMPA

$$y(\infty) = \lim_{s \to 0} s \cdot \frac{1}{s^2} \left(1 - \left(\frac{6s^2 + 66s + 60}{0{,}6s^3 + 6s^2 + 56s + 60} \right) \right)$$

$$y(\infty) = \lim_{s \to 0} s \cdot \frac{1}{s^2} \left(\frac{0{,}6s^3 + 6s^2 + 56s + 60 - 6s^2 - 66s - 60}{0{,}6s^3 + 6s^2 + 56s + 60} \right)$$

$$y(\infty) = \lim_{s \to 0} \frac{1}{s} \left(\frac{0{,}6s^3 - 10s}{0{,}6s^3 + 6s^2 + 56s + 60} \right)$$

$$y(\infty) = \underbrace{\lim_{s \to 0}} \left(\frac{0{,}6s^2 - 10}{0{,}6s^3 + 6s^2 + 56s + 60} \right) = \frac{-10}{60} = \frac{-1}{6}$$

ERRO DE REGIME PERMANENTE $= \frac{-1}{6}$