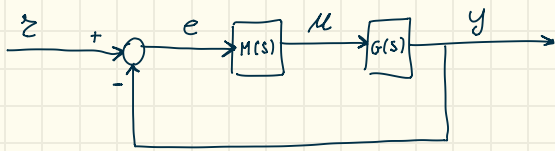


ES 1



$$H(s) = \frac{s+1}{s}$$

$$G(s) = \frac{3}{s+2}$$

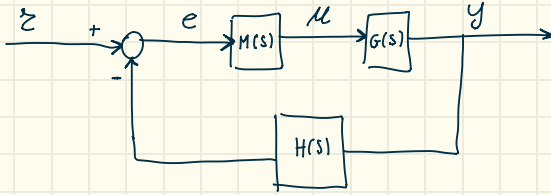
$$T_{Z \rightarrow \mu} = \frac{M(s)}{1 + G(s)M(s)} = \frac{\frac{s+1}{s}}{1 + \frac{3(s+1)}{s(s+2)}} = \frac{\frac{s+1}{s}}{\frac{s(s+2) + 3(s+1)}{s(s+2)}} = \frac{\frac{s+1}{s}}{\frac{s^2+2s+3s+3}{s(s+2)}} = \frac{\frac{s+1}{s}}{\frac{s^2+5s+3}{s(s+2)}} = \frac{s+1}{s^2+5s+3} = \frac{(s+1)(s+2)}{s^2+5s+3}$$

Stabile?

$$\begin{array}{c|cc} s^2 & 1 & 3 \\ s^1 & 5 & 0 \\ s^0 & 3 & \end{array}$$

Positivi \rightarrow A. STABILE

ES 2:



$$G(s) = \frac{0.5}{s+1}$$

$$M(s) = 2 \frac{s+0.4}{s}$$

$$H(s) = 0.1 \frac{s+10}{s+1}$$

$$T_{Z \rightarrow y} = \frac{M(s)G(s)}{1 + H(s) \cdot M(s) \cdot G(s)}$$

$$M(s) \cdot G(s) = 2 \frac{0.5(s+0.4)}{s(s+1)} = \frac{s+0.4}{s(s+1)} \cdot 0.1 \frac{s+10}{s+1} = 0.1 \frac{(s+0.4)(s+10)}{s(s+1)^2}$$

$$= \frac{\frac{s+0.4}{s(s+1)}}{1 + 0.1 \frac{(s+0.4)(s+10)}{s(s+1)^2}} = \frac{\frac{s+0.4}{s(s+1)^2}}{\frac{s(s+1)^2 + 0.1(s+0.4)(s+10)}{s(s+1)^2}} = \frac{s+0.4}{s(s^2+2s+1) + 0.1(s^2+14s+40)}$$

$$s^3 + 2s^2 + s + 0.1s^2 + 1.4s + 4 = s^3 + 2.1s^2 + 2.4s + 4 \quad \text{A. STABILE?}$$

ALTRO CRITERIO STABILITA'

Moltiplico tutti i coefficienti in 's'; se questo prodotto è maggiore del termine noto allora il sistema è stabile.

NON
CONFERMATO

$$\begin{array}{c|cc} s^3 & 1 & 2.4 \\ s^2 & 2.1 & 4 \\ s^1 & 0.4 & 0 \\ s^0 & 0.4 & \end{array}$$

A. STABILE ✓

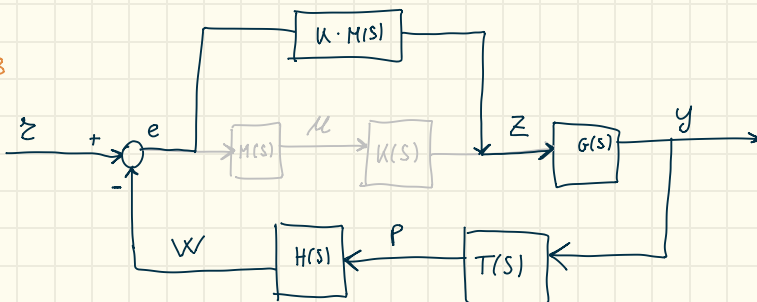
$$\frac{2.1 \cdot 2.4 - 4}{2.1} = 0.49$$

$$\frac{0.4 \cdot 0.4 - 0}{0.4} = 0.4$$

$$s^3 + 2.1s^2 + 2.4s + 4$$

$$1 \cdot 2.1 \cdot 2.4 \stackrel{?}{>} 0.4 \quad \text{TRUE} \rightarrow \text{A.S.}$$

ES 3



$$G = \frac{0.5}{s+2}$$

$$M = 2 \cdot \frac{s+0.5}{s}$$

$$K = 0.5$$

$$H = 0.1 \frac{s+8}{s+0.8}$$

$$T = \frac{2}{s+5}$$

$$V_{Z \rightarrow Z} = \frac{0.5 M(s)}{1 + G \cdot T \cdot H \cdot K \cdot M}$$

