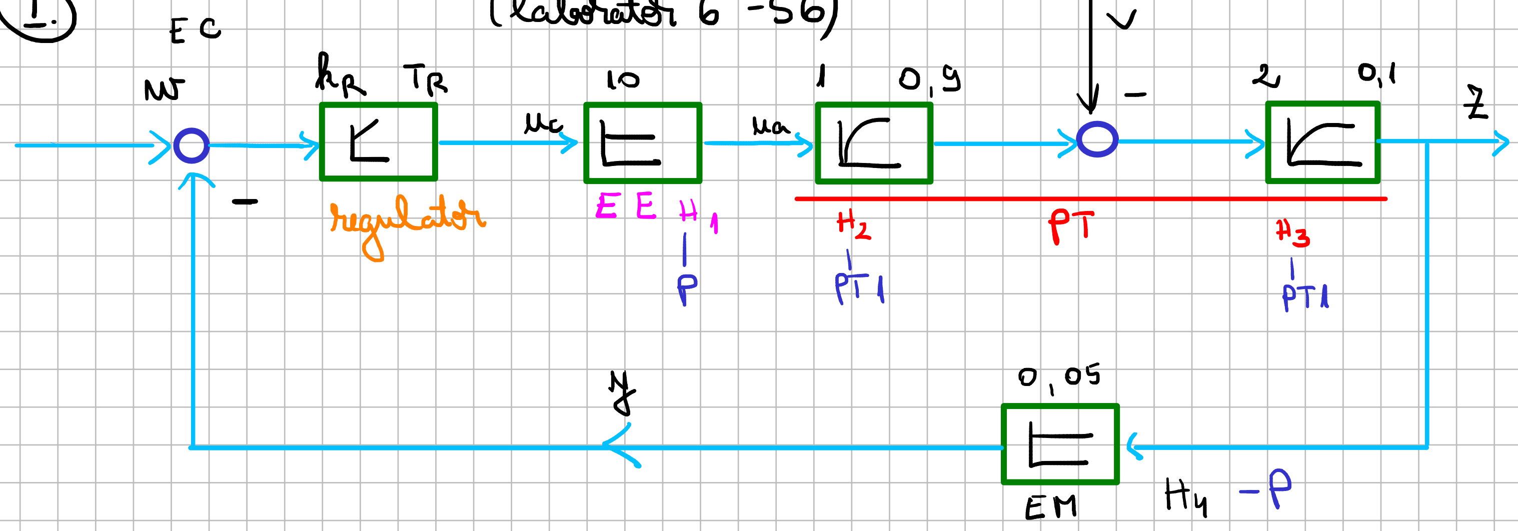
Teoria sistemelor 05.11.2024

(laborator 6 - S6)

I.



el de execuție > 0, supraunitar

$$H_{yu_c}(s)\Big|_{v=0} = H_1 H_2 H_3 H_4 = 10 \cdot \frac{1}{1+0{,}5s} \cdot \frac{2}{1+0{,}1 \cdot s} \cdot 0{,}05 = \frac{1}{(1+0{,}5s)(1+0{,}1s)}$$

y - ieșire

u_c - intrare

PT2 ~ avem un proporțional și 2 temporizări

$$H_{yu_c}(s)\Big|_{v=0} = \frac{k_{PC}}{(1+sT_1)(1+sT_2)}$$

$$\left.\begin{aligned} k_{PC} &= 1 \\ T_1 &= 0{,}5 \\ T_2 &= 0{,}1 \end{aligned}\right\} \Rightarrow \boxed{T_1 > T_2}$$

$$H_{RG-PI}(s) = \frac{k_r}{s}(1+sT_r) = \frac{5}{s}(1+0{,}5s)$$

$$k_r = \frac{1}{2 \cdot k_{PC} \cdot T_2} = \frac{1}{2 \cdot 1 \cdot 0{,}1} = 5$$

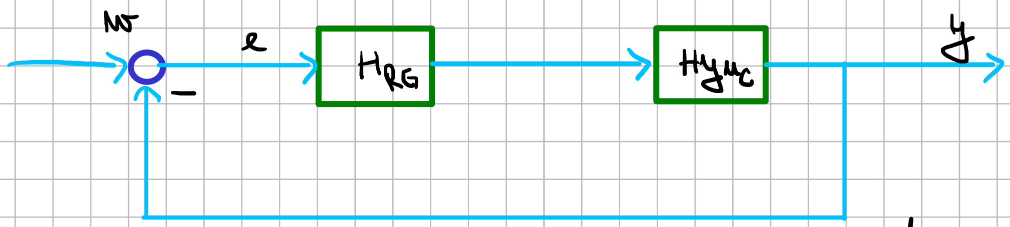
$T_r = T_1 = 0{,}5$ (constanta de timp mai mare)

Avem SRA după regulator

$$H_{RG-PI}(s) = \frac{k_R}{s\cdot T_R}\cdot(1+s\cdot T_R)$$

$$k_r = \frac{k_R}{T_r} \Rightarrow k_R = k_r\cdot T_r = 5\cdot 0,5 = 2,5$$

II.



$$H_0 = H_{RG}\cdot H_{PC} = \frac{5}{s}(1+0,5s)\cdot\frac{1}{(1+0,5s)(1+0,1s)}$$

!!! Nu se fac simplificari -> putem avea sistem instabil

$$H_w(s) = \frac{H_0}{1+H_0} = \frac{\frac{5(1+0,5s)}{s(1+0,5s)(1+0,1s)}}{\boxed{1+\frac{5(1+0,5s)}{s(1+0,5s)(1+0,1s)}}}$$

ec. caracteristică

$$\Rightarrow \Delta(s) = 1+H_0 = 1+H_{RG}\cdot H_{PC} = 0$$

$$\Delta(s) = \frac{s(1+0,5s)(1+0,1s)+5(1+0,5s)}{s(1+0,5s)(1+0,1s)} = 0$$

$$\Delta(s) = \underbrace{0,05}_{a_3>0}s^3 + \underbrace{0,6}_{a_2>0}s^2 + \underbrace{3,5}_{a_1>0}s + \underbrace{5}_{a_0>0}$$

! toți coef >0

$\Rightarrow$ putem continua căci sistemul este stabil

n = putere max $\Delta(s)$

pt. $n = 3$

$$H = \begin{bmatrix} a_2 & a_0 & 0 \\ a_3 & a_1 & 0 \\ 0 & a_2 & a_0 \end{bmatrix}$$

Pentru cazul nostru:

$$H = \begin{bmatrix} 0,6 & 5 & 0 \\ 0,05 & 3,5 & 0 \\ 0 & 0,6 & 5 \end{bmatrix}$$

! Determinanții + minorii - strict pozitivi

$H_1 = 0,6 > 0$

$$H_2 = \begin{vmatrix} 0,6 & 5 \\ 0,05 & 3,5 \end{vmatrix} = 2,1 - 0,25 = 1,85 > 0$$

$H_3 = 10,5 - 1,25 = 9,25 > 0$

$\Rightarrow$ SRA - stabil

2/6 ~ laborator 3

$$\Delta(s) = s^3 + 3k s^2 + (k+2) s + 4$$

$a_3 = 1$	$a_2 = 3k$	$a_1 = k+2$	$a_0 = 4$
>0	$3k > 0$	$k+2 > 0$	>0
	$k > 0$	$k > -2$	

$\Rightarrow k \in (0, \infty)$

Ne formăm matricea H

$$H_3 = \begin{bmatrix} 3k & 4 & 0 \\ 1 & k+2 & 0 \\ 0 & 3k & 4 \end{bmatrix}$$

$\delta_1 = 3k > 0 \Rightarrow k > 0$

$$b_2 = 3k(k+2) - 4 = 3k^2 + 6k - 4$$

$$\Delta = 36 + 48 = 84$$

$$k_{1,2} = \frac{-6 \pm 2\sqrt{21}}{6}$$

k		k_1		0		k_2	
f	$++$	0	$--$			0	$+++$

$$\Rightarrow k \in \left(\frac{-6+2\sqrt{21}}{6}, \infty\right)$$

$$b_3 = 12k(k+2) - 16 = 4(3k^2 + 6k - 4)$$

$$\Rightarrow k \in \left(\frac{-6+2\sqrt{21}}{6}, \infty\right)$$

Pentru $n=2$

$$\Delta_2(s) = a_2 \cdot s^2 + a_1 \cdot s + a_0$$

$$H_2 = \begin{bmatrix} a_1 & 0 \\ a_2 & a_0 \end{bmatrix}$$

Pentru $n=4$

$$\Delta_4(s) = a_4 s^4 + a_3 s^3 + a_2 s^2 + a_1 \cdot s + a_0$$

$$H_4 = \begin{bmatrix} a_3 & a_1 & 0 & 0 \\ a_4 & a_2 & a_0 & 0 \\ 0 & a_3 & a_1 & 0 \\ 0 & a_4 & a_2 & a_0 \end{bmatrix}$$