

$H_{Z-W}$

$$H_1 = \frac{1}{1+0.5S}$$

$$H_2 = 10$$

$$H_4 = \frac{0.08}{1+0.05S}$$

$$H_6 = \frac{1}{0.1S}$$

$$H_{RG} = \frac{5}{S}$$

$$H_3 = 15$$

$$H_5 = 0.8$$

$$H_7 = 0.02$$

- $H_2, H_3$  parallel  $\Rightarrow H_{23} = H_2 + H_3 = 25$

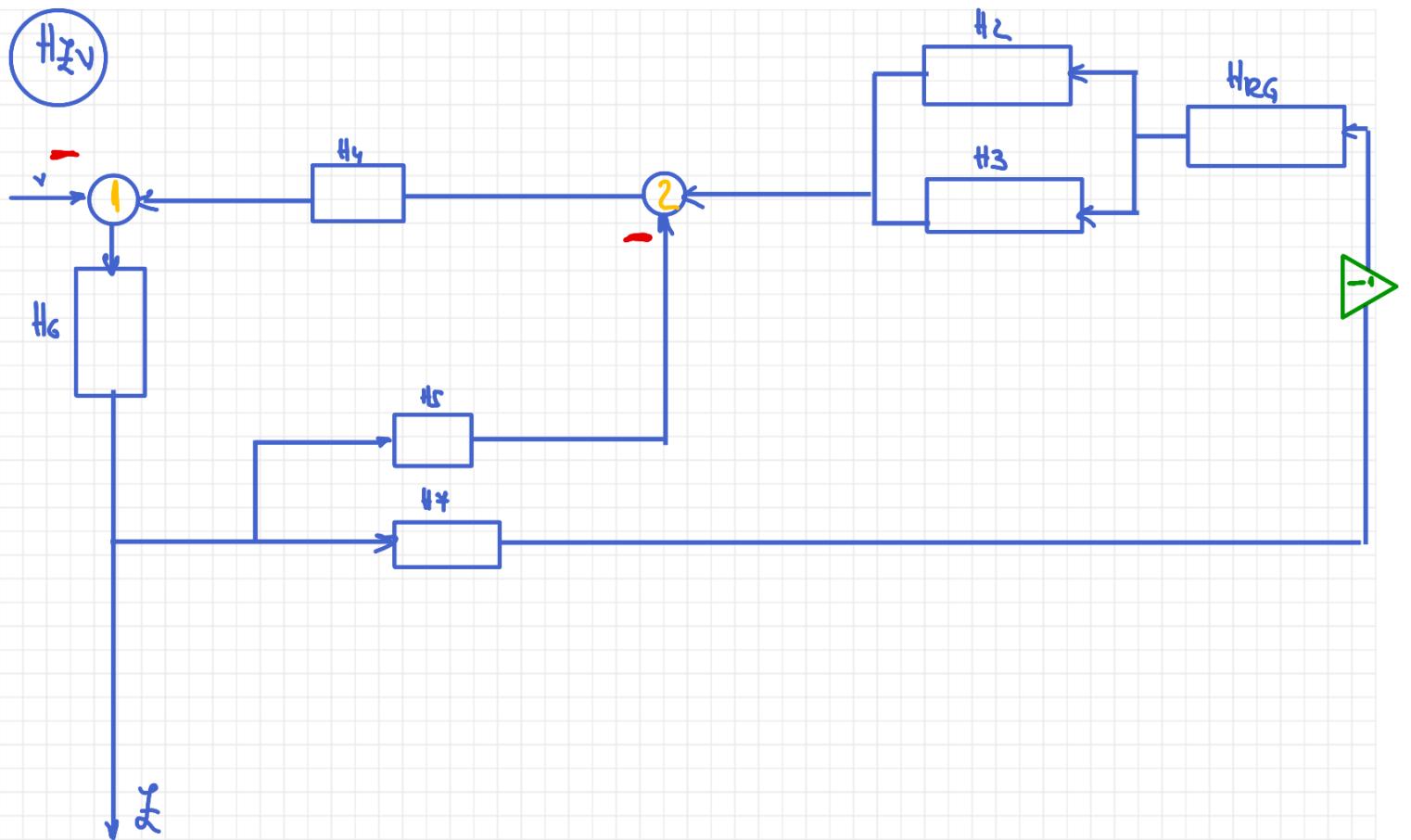
- $H_4, H_6$  series  $\Rightarrow H_{46} = H_4 \cdot H_6 = \frac{0.08}{(1+0.05S) \cdot 0.1S} = \frac{0.8}{S+0.05S^2}$

- $H_{46}, H_5$  reactie  $\Rightarrow H_{\Delta} = \frac{H_{46}}{1+H_5 \cdot H_{46}} = \frac{0.8}{S(1+0.05S)} \cdot \frac{1}{1+0.8 \cdot \frac{0.8}{S(1+0.05S)}} = \frac{0.8}{S(1+0.05S)} \cdot \frac{S(1+0.05S)}{S(1+0.05S)+0.64} = \frac{0.8}{S(1+0.05S)+0.64}$

- $H_1, H_{RG}, H_{23}, H_{\Delta}$  series  $\Rightarrow H_{Z-W} = H_1 \cdot H_{RG} \cdot H_{23} \cdot H_{\Delta} =$

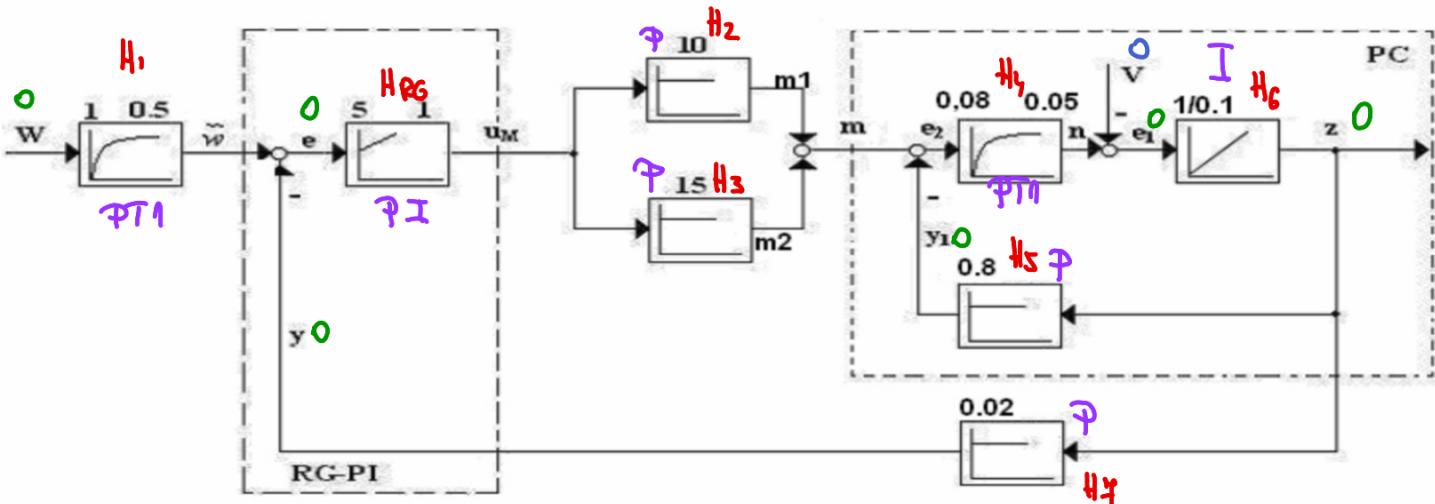
$$= \frac{1}{1+0.5S} \cdot \frac{5}{S} \cdot 25 \cdot \frac{0.8}{S(1+0.05S)+0.64} =$$

$$= \frac{100}{(S+0.5S^2)(S+0.05S^2+0.64)} = \frac{100}{0.025S^4 + 0.555^3 + 1.32S^2 + 0.64S}$$



b)

w	v	e	u	y	y <sub>1</sub>	e <sub>2</sub>	y <sub>2</sub>	n	e <sub>1</sub>	m	m <sub>1</sub>	m <sub>2</sub>	z			
I	0	0	0	0	0	0	0	0	0	0	0	0	0		(1)	
II	3	0	0	4,8	3	120	0	0	0	120	48	72	150		(2)	
III	6	0	0	9,6	6	240	0	0	0	240	96	144	300		(3)	
IV	6	5	0	12,1	6	240	62,5	0	5	0	302,5	121	181,5	300		(4)
V	6	10	0	14,6	6	240	125	0	10	0	365	146	219	300		(5)



$$\text{I. } w_{\infty} = 0, v_{\infty} = 0$$

$$e_{\infty} = 0 \quad (\text{PI})$$

$$\text{dor } e_{\infty} - w_{\infty} - y_{\infty} \Rightarrow y_{\infty} = w_{\infty} - e_{\infty} = 0.$$

$$\text{H}_7: y_{\infty} = 0,02 \cdot z_{\infty} \Rightarrow z_{\infty} = 0.$$

$$\text{H}_5: y_{1,\infty} = 0,8 \cdot z_{\infty} \Rightarrow y_{1,\infty} = 0.$$

$$\text{H}_6: \text{define: } z=0 \Rightarrow e_{1,\infty} = 0 \quad (\text{I})$$

$$\text{dor } e_{1,\infty} = m_{\infty} - v_{\infty} \Rightarrow m_{\infty} = 0.$$

$$\text{H}_4: e_{2,\infty} = e_{1,\infty} \cdot 0,08 \Rightarrow e_{2,\infty} = 0.$$

$$\text{dor } e_{2,\infty} = m_{\infty} - y_{1,\infty} \Rightarrow m_{\infty} = 0.$$

$$m_{1,\infty} = 10 \cdot u_{M,\infty}$$

$$m_{2,\infty} = 15 \cdot u_{M,\infty}$$

$$m_{1,\infty} + m_{2,\infty} = M_{\infty} = 0.$$

$$\left. \begin{array}{l} \\ \\ \end{array} \right\} \Rightarrow 2u_{M,\infty} = 0 \Rightarrow u_{M,\infty} = 0 \Rightarrow m_{\infty} = 0 \\ m_{2,\infty} = 0.$$

$$\text{II. } w_{\infty} = 3, v_{\infty} = 0$$

$$e_{\infty} = 0 \text{ (PI)}$$

$$\text{dor } e_{\infty} - w_{\infty} - y_{\infty} \Rightarrow y_{\infty} = w_{\infty} - e_{\infty} = 3.$$

$$\text{H7: } y_{\infty} = 0,02 \cdot z_{\infty} \Rightarrow z_{\infty} = \frac{3}{0,02} = 150.$$

$$\text{H5: } y_{1,\infty} = 0,8 \cdot z_{\infty} \Rightarrow y_{1,\infty} = 120.$$

$$\text{H6: define: } \begin{cases} z = 150 \\ 0 \end{cases} \Rightarrow e_{1,\infty} = 0 \text{ (I)}$$

$$\text{dor } e_{1,\infty} = m_{\infty} - v_{\infty} \Rightarrow m_{\infty} = 0$$

$$\text{H4: } e_{2,\infty} = e_{1,\infty} \cdot 0,08 \Rightarrow e_{2,\infty} = 0.$$

$$\text{dor } e_{2,\infty} = m_{\infty} - y_{1,\infty} \Rightarrow m_{\infty} = 120.$$

$$m_{1,\infty} = 10 \cdot u_{M,\infty}$$

$$m_{2,\infty} = 15 \cdot u_{M,\infty}$$

$$m_{1,\infty} + m_{2,\infty} = m_{\infty} = 120.$$

$$\Rightarrow 25u_{M,\infty} = 120 \Rightarrow u_{M,\infty} = 4,8.$$

$$\Rightarrow m_{1,\infty} = 48, m_{2,\infty} = 72.$$

$$\text{III. } w_{\infty} = 6, v_{\infty} = 0$$

$$e_{\infty} = 0 \text{ (PI)}$$

$$\text{dor } e_{\infty} - w_{\infty} - y_{\infty} \Rightarrow y_{\infty} = w_{\infty} - e_{\infty} = 6.$$

$$\text{H7: } y_{\infty} = 0,02 \cdot z_{\infty} \Rightarrow z_{\infty} = \frac{6}{0,02} = 300.$$

$$\text{H5: } y_{1,\infty} = 0,8 \cdot z_{\infty} \Rightarrow y_{1,\infty} = 240.$$

$$\text{H6: define: } \begin{cases} z = 300 \\ 0 \end{cases} \Rightarrow e_{1,\infty} = 0 \text{ (I)}$$

$$\text{dor } e_{1,\infty} = m_{\infty} - v_{\infty} \Rightarrow m_{\infty} = 0$$

$$\text{H4: } e_{2,\infty} = e_{1,\infty} \cdot 0,08 \Rightarrow e_{2,\infty} = 0.$$

$$\text{dor } e_{2,\infty} = m_{\infty} - y_{1,\infty} \Rightarrow m_{\infty} = 240.$$

$$m_{1,\infty} = 10 \cdot u_{M,\infty}$$

$$m_{2,\infty} = 15 \cdot u_{M,\infty}$$

$$m_{1,\infty} + m_{2,\infty} = m_{\infty} = 240.$$

$$\Rightarrow 25u_{M,\infty} = 240 \Rightarrow u_{M,\infty} = 9,6 \Rightarrow$$

$$\Rightarrow m_{1,\infty} = 96, m_{2,\infty} = 144.$$

IV.  $w_{\infty} = 6$ ,  $v_{\infty} = 5$ .

$$e_{\infty} = 0 \text{ (PI)}$$

$$\text{dor } e_{\infty} - w_{\infty} - y_{\infty} \Rightarrow y_{\infty} = w_{\infty} - e_{\infty} = 6.$$

$$H_7: y_{\infty} = 0,02 \cdot I_{\infty} \Rightarrow I_{\infty} = \frac{6}{0,02} = 300.$$

$$H_5: y_{1,\infty} = 0,8 \cdot I_{\infty} \Rightarrow y_{1,\infty} = 240.$$

$$H_6: \text{define: } \begin{matrix} I \\ \infty \end{matrix} - 300 \Rightarrow e_{1,\infty} = 0 \text{ (I)}$$

$$\text{dor } e_{1,\infty} = m_{\infty} - v_{\infty} \Rightarrow m_{\infty} = 5.$$

$$H_4: m_{\infty} = e_{2,\infty} \cdot 0,08 \Rightarrow e_{2,\infty} = \frac{5}{0,08} = 62,5$$

$$\text{dor } e_{2,\infty} = m_{\infty} - y_{1,\infty} \Rightarrow m_{\infty} = 302,5$$

$$m_{1,\infty} = 10 \cdot u_{M,\infty}$$

$$m_{2,\infty} = 15 \cdot u_{M,\infty}$$

$$m_{1,\infty} + m_{2,\infty} = m_{\infty} = 302,5$$

$$\Rightarrow 25u_{M,\infty} = 302,5 \Rightarrow u_{M,\infty} = 12,1$$

$$\Rightarrow m_{1,\infty} = 121, m_{2,\infty} = 181,5$$

V.  $w_{\infty} = 6$ ,  $v_{\infty} = 10$ .

$$e_{\infty} = 0 \text{ (PI)}$$

$$\text{dor } e_{\infty} - w_{\infty} - y_{\infty} \Rightarrow y_{\infty} = w_{\infty} - e_{\infty} = 6.$$

$$H_7: y_{\infty} = 0,02 \cdot I_{\infty} \Rightarrow I_{\infty} = \frac{6}{0,02} = 300.$$

$$H_5: y_{1,\infty} = 0,8 \cdot I_{\infty} \Rightarrow y_{1,\infty} = 240.$$

$$H_6: \text{define: } \begin{matrix} I \\ \infty \end{matrix} - 300 \Rightarrow e_{1,\infty} = 0 \text{ (I)}$$

$$\text{dor } e_{1,\infty} = m_{\infty} - v_{\infty} \Rightarrow m_{\infty} = 10.$$

$$H_4: m_{\infty} = e_{2,\infty} \cdot 0,08 \Rightarrow e_{2,\infty} = 125.$$

$$\text{dor } e_{2,\infty} = m_{\infty} - y_{1,\infty} \Rightarrow m_{\infty} = 365$$

$$m_{1,\infty} = 10 \cdot u_{M,\infty}$$

$$m_{2,\infty} = 15 \cdot u_{M,\infty}$$

$$m_{1,\infty} + m_{2,\infty} = m_{\infty} = 365$$

$$\Rightarrow 25u_{M,\infty} = 0 \Rightarrow u_{M,\infty} = 14,6$$

$$\Rightarrow m_{1,\infty} = 146, m_{2,\infty} = 219$$

c)

$$\underline{z}_{\infty} = 250, \quad v_{\infty} = 10.$$

$$e_{1\infty} = 0.$$

$$\text{dor } e_{1\infty} = m - v_{\infty} \Rightarrow m_{\infty} = 10.$$

$$\text{Hg: } y = 0.02 \cdot \underline{z} \Rightarrow y = 5.$$

$$\text{Hg: } y_1 = 0.8 \cdot \underline{z} \Rightarrow y_1 = 200$$

$$\text{Hg: } m_{\infty} = 0.8 \cdot e_{2\infty} \Rightarrow e_{2\infty} = 125.$$

$$\text{dor } e_{2\infty} = m_{\infty} - y_{1\infty} \Rightarrow$$

$$\Rightarrow m_{\infty} = 325.$$

$$m_{1\infty} = 10 \cdot u_m$$

$$m_{2\infty} = 15 \cdot u_m$$

$$m_{1\infty} + m_{2\infty} = m_{\infty}$$

$$\begin{cases} \Rightarrow 25 u_m = 325 \Rightarrow \\ \Rightarrow u_m = 13 \Rightarrow \\ \Rightarrow m_{1\infty} = 130, \\ m_{2\infty} = 195. \end{cases}$$

$$e_{\infty} = 0 \text{ (PI)}$$

$$\text{dor } e_{\infty} = w_{\infty} - y_{\infty} \Rightarrow w_{\infty} = 5.$$

$$\underline{z}_{\infty} = 350, \quad v_{\infty} = 15.$$

$$e_{1\infty} = 0.$$

$$\text{dor } e_{1\infty} = m - v_{\infty} \Rightarrow m_{\infty} = 15.$$

$$\text{Hg: } y = 0.02 \cdot \underline{z} \Rightarrow y = 4.5$$

$$\text{Hg: } y_1 = 0.8 \cdot \underline{z} \Rightarrow y_1 = 280$$

$$\text{Hg: } m_{\infty} = 0.8 \cdot e_{2\infty} \Rightarrow e_{2\infty} = 187.5$$

$$\text{dor } e_{2\infty} = m_{\infty} - y_{1\infty} \Rightarrow$$

$$\Rightarrow m_{\infty} = 467.5$$

$$m_{1\infty} = 10 \cdot u_m$$

$$m_{2\infty} = 15 \cdot u_m$$

$$m_{1\infty} + m_{2\infty} = 467.5$$

$$\begin{cases} \Rightarrow 25 u_m = 467.5 \Rightarrow \\ \Rightarrow u_m = 18.7 \Rightarrow \\ \Rightarrow m_{1\infty} = 187 \\ m_{2\infty} = 280.5 \end{cases}$$

$$e_{\infty} = 0 \text{ (PI)}$$

$$\text{dor } e_{\infty} = w_{\infty} - y_{\infty} \Rightarrow w_{\infty} = 4.5$$

w	v	e	u	y	$y_1$	$e_2$	$y_2$	n	$e_1$	m	$m_1$	$m_2$	z			
5	10	0	13	5	200	125	0	10	0	325	130	195	250			(1)
4.5	15	0	18.7	4.5	280	187.5	0	15	0	467.5	187	280.5	350			(2)