Lab 4

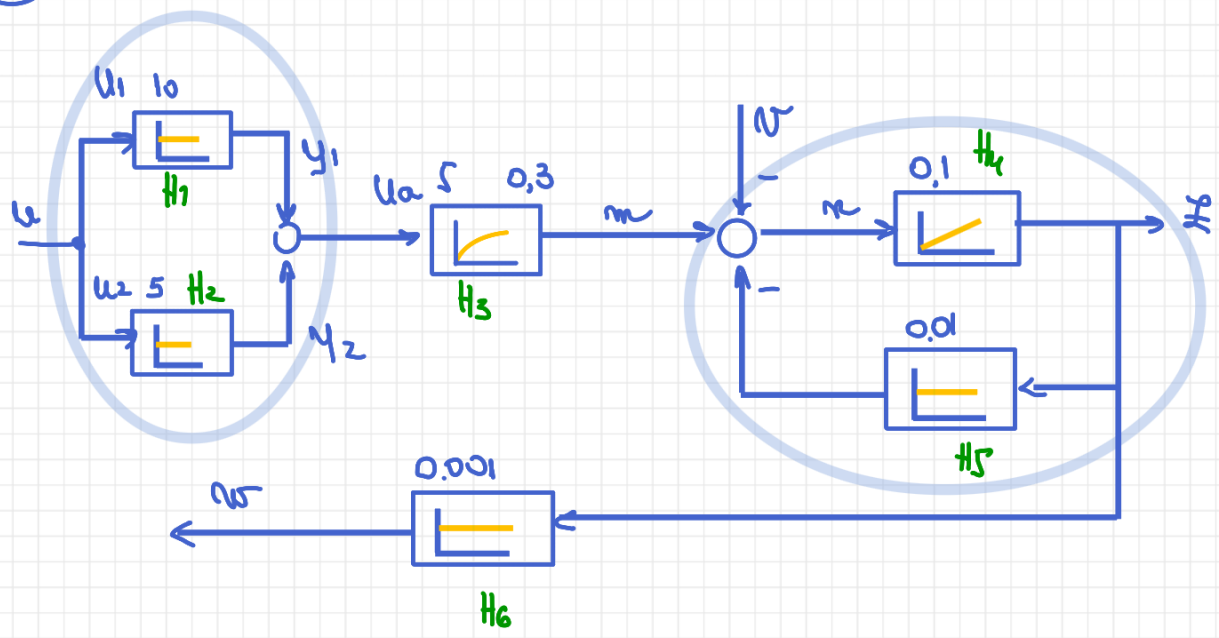
$$H_{wu}(s)\Big|_{v=0} = \frac{W(s)}{U(s)} \qquad 1.5p$$

$$H_{uv}(s)\Big|_{u=0} = \frac{U(s)}{V(s)} \qquad 1.5p$$

$$H_{yu}\Big|_{v=0} = \frac{Y(s)}{U(s)}$$

$$H_{yv}\Big|_{u=0} = \frac{Y(s)}{V(s)}$$

A



$H_1 = 10$ $\quad H_4 = \frac{1}{5 \cdot 10} = \frac{1}{10s}$

$H_2 = 5$ $\quad H_5 = 0,01$

$H_3 = \frac{5}{1+0,3s}$ $\quad H_6 = 0,001$

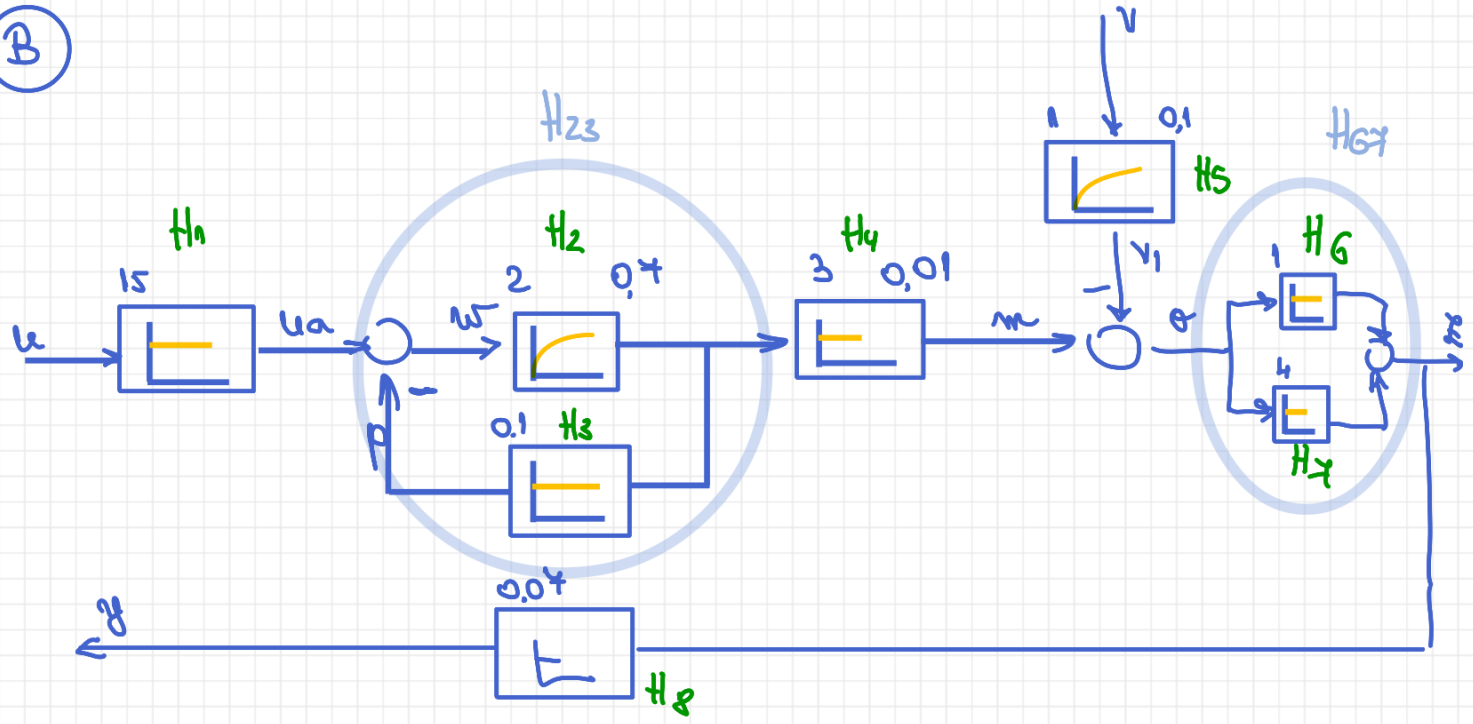
- H_1, H_2 paralel $\Rightarrow H_{12} = H_1 + H_2 = 15$.
- H_4, H_5 reactie $\Rightarrow H_{45} = \frac{H_4}{1+H_4H_5} = \frac{\frac{1}{10s}}{1+\frac{1}{10s}\cdot 0,01} = \frac{\frac{1}{10s}}{\frac{1}{10s}(10s+0,01)} = \frac{1}{10s+0,01}$
- H_{12}, H_3, H_{45}, H_6 serie $\Rightarrow H_{wu} = H_{12} \cdot H_3 H_{45} \cdot H_6 =$

$$= 15 \cdot \frac{5}{1+0,3s} \cdot \frac{1}{10s+0,01} \cdot 0,001 =$$

$$= \frac{0,075}{(1+0,3s)(10s+0,01)} = \boxed{\frac{7,5}{300s^2 + 1000,3s + 1}}$$

- H_{45}, H_6 serie $\Rightarrow H_{wv} = -\frac{1}{10s+0,01} \cdot 0,001 = \boxed{\frac{-0,1}{1000s+1}}$

(B)



$H_1 = 15$ $\quad H_4 = \frac{3}{1+0,01s}$ $\quad H_6 = 1$ $\quad H_8 = 0,07$

$H_2 = \frac{2}{1+0,7s}$ $\quad H_5 = \frac{1}{1+0,1s}$ $\quad H_7 = 4$

$H_3 = 0,1$

H_2, H_3 : reactie: $H_{23} = \frac{H_2}{1+H_2H_3} = \frac{\frac{2}{1+0,7s}}{1+\frac{2}{1+0,7s}\cdot 0,1} = \frac{2}{1+0,7s+0,2} =$

$= \frac{20}{12+7s}$

H_6, H_7 : paralel : $H_{67} = H_6 + H_7 = 1+4 = 5$.

• $u \to y$: $H_1, H_{23}, H_4, H_{67}, H_8$ serie $\Rightarrow H = H_1 \cdot H_{23} \cdot H_4 \cdot H_{67} \cdot H_8 =$

$= 15 \cdot \frac{20}{12+7s} \cdot \frac{3}{1+0,01s} \cdot 5 \cdot 0,07 =$

$= \frac{15 \cdot 20 \cdot 3 \cdot 5 \cdot 0,07}{(12+7s)(1+0,01s)} = \frac{315}{0,07s^2 + 7,07s + 12} = \boxed{\frac{26,25}{5,83 \cdot 10^{-3} s^2 + 0,589s + 1}}$

• $v \to y$: H_5, H_{6Y}, H_8 serie $\Rightarrow$ $H_{yv} = -H_5 \cdot H_{6Y} \cdot H_8 = -\frac{5 \cdot 0{,}07}{1+0{,}15} =$

$= -\frac{0{,}35}{1+0{,}15} = \frac{-0{,}35}{0{,}15+1}$