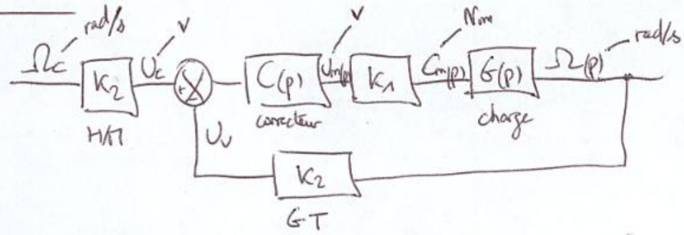
CORRIGE Robot de piscine

Exercice 2:

Q1:



Q2: $G(p) = \dfrac{9025}{1{,}69 + p}$

$\omega = \dfrac{\pi N}{30}$

$1 tr/min = \dfrac{\pi}{30}$ rad/s

$K_2 = \dfrac{6}{1000} = \dfrac{6}{104{,}66}$ V/rad/s

$H/M = K_2$ car pour $\Omega(p) = \Omega_c(p) \Leftrightarrow \varepsilon = 0$

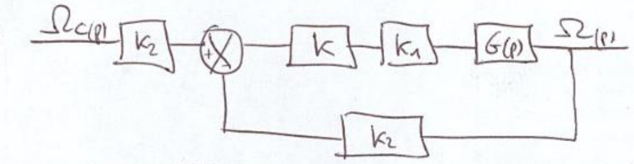
$\Leftrightarrow \Omega_c \cdot G_{H/M} - K_2 \Omega_p = 0$

$\Rightarrow G_{H/M} = K_2$

$K_1 = 0{,}2$ Nm/V

On a $C(p) = K$

Q3 :



* $FTBO = K_2 K K_1 G(p)$

* $H(p) = \dfrac{\Omega(p)}{\Omega_c(p)} = \dfrac{K_2 K K_1 G(p)}{1 + K_2 K_1 K G(p)}$

* $H(p) = \dfrac{K K_1 K_2 \cdot 9025}{1{,}69 + p + K K_1 K_2 9025} = \dfrac{K K_1 K_2 9025}{p} \cdot \dfrac{1}{1 + \frac{1{,}69}{p} + \frac{K K_1 K_2 \cdot 9025}{p}}$

ordre 1
classe 1
($K_s = K K_1 K_2 \cdot 9025$)

* $H(p) = \dfrac{K K_1 K_2\, 9025 / 1{,}69 + K K_1 K_2 \cdot 9025}{1 + \dfrac{p}{1{,}69 + K K_1 K_2 \cdot 9025}} \Leftrightarrow H(p) = \dfrac{K}{1 + \tau p}$ avec $K_s = \dfrac{K K_1 K_2 \cdot 9025}{1{,}69 + K K_1 K_2 \cdot 9025}$, $\tau = \dfrac{1}{1{,}69 + K K_1 K_2 \cdot 9025}$

* A.N: $K_s = K \cdot 0{,}2 \cdot \dfrac{6}{104{,}66} \cdot 9025 / 1{,}69 + K \cdot 0{,}2 \cdot \dfrac{6}{104{,}66} \cdot 9025$

$K_s = \dfrac{103{,}47 K}{1{,}69 + 103{,}47 K}$

$\tau = \dfrac{1}{1{,}69 + 103{,}47 K}$

On donne $E_r(\%) = 100 \times \frac{E_r(+\infty)}{E_0}$

Q4 : 1er ordre $\Rightarrow t_{r5\%} \simeq 3\tau$

pour $k = 0{,}1$: $t_{r5\%} = 3/_{1{,}69+103{,}47k} = \frac{3}{1{,}69+10{,}34} \approx 0{,}25\,s$

$k = 1$: $t_{r5\%} = 3/_{1{,}69+103{,}47} \approx 0{,}028\,s$

pour $k=0{,}1$; $K = \frac{103{,}47 \times 0{,}1}{1{,}69 + 103{,}47 \times 0{,}1} \simeq 0{,}86 \Rightarrow E_r(\%) = 14\%$

$k=1$; $K = \frac{103{,}47}{1{,}69+103{,}47} \simeq 0{,}98 \Rightarrow E_r(\%) = 2\%$

Q5 : $H(p) = \frac{K}{1+\tau p}$ avec $k=0{,}1$: $K = 0{,}86$; $\tau \simeq 0{,}083$; $k=1$: $K=0{,}98$; $\tau \simeq 0{,}0095$

$H(p) = \frac{S(p)}{E(p)} \Rightarrow S(p) = \frac{1}{p} \cdot \frac{K}{1+\tau p}$

$\Rightarrow S(p) = \frac{K}{p(1+\tau p)} = \frac{A}{p} + \frac{B}{1+\tau p}$

$\times p$ et $p \to 0$: $A = K$

$\times (1+\tau p)$ et $p \to -\frac{1}{\tau}$: $B = \frac{K}{-\frac{1}{\tau}} = \frac{K}{-\frac{1}{\tau}} = -K\tau$

$\Rightarrow S(p) = \frac{K}{p} - \frac{K\tau}{1+\tau p} = \frac{K}{p} - \frac{K}{p+\frac{1}{\tau}}$

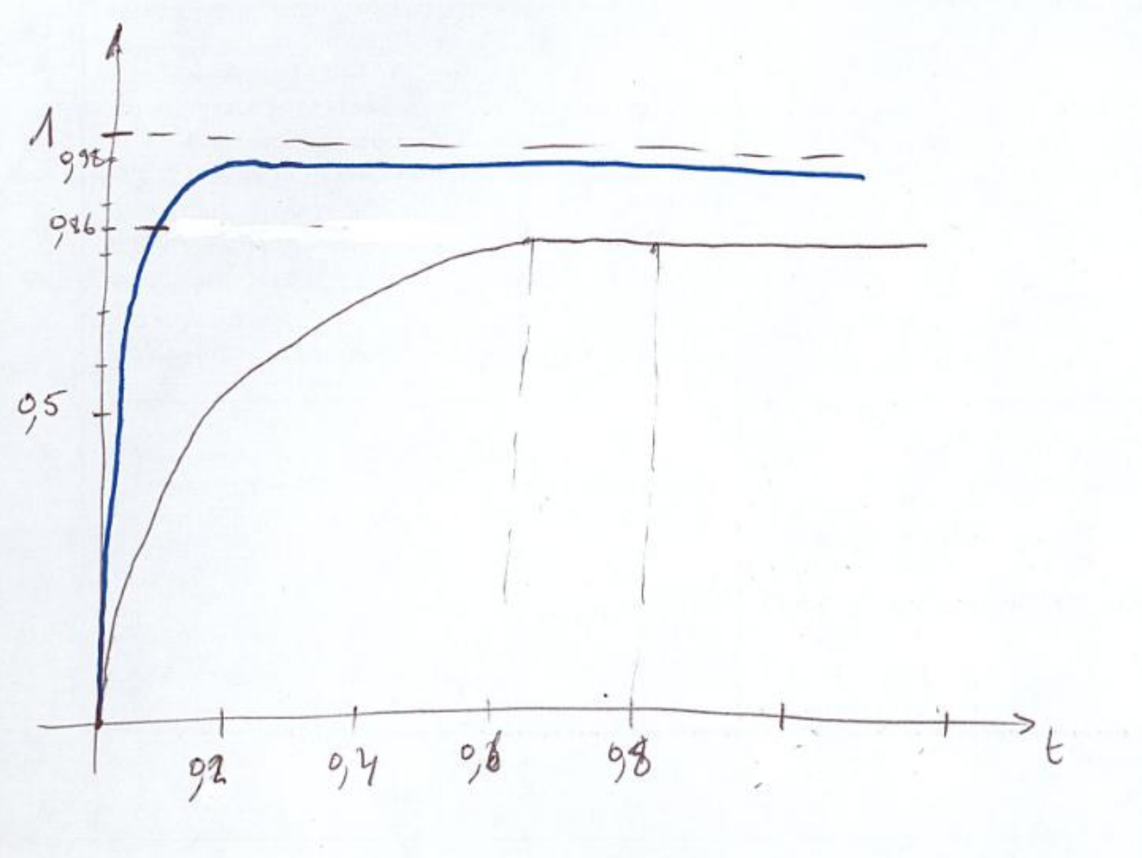
$\Rightarrow \boxed{S(t) = K.u(t) - K.e^{-t/\tau}u(t)}$ soit $\boxed{S(t) = K\left(1-e^{-t/\tau}\right)u(t)}$

$k=0{,}1$: $S(t) = 0{,}86\left(1-e^{-\frac{t}{0{,}083}}\right)$

$S(t) = 0{,}86\left(1-e^{-12t}\right)$

$k=1$: $S(t) = 0{,}98\left(1-e^{-\frac{t}{0{,}0095}}\right)$

$S(t) = 0{,}98\left(1-e^{-105t}\right)$



1
0,98
0,86
0,5
0,2
0,4
0,6
0,8
t