Correction DS de SI, MPSI 1, nov 25

Exo 1 1] $H(\tau) = \dfrac{7}{3(\tau+3)}$ $\quad E(\tau) = \dfrac{1}{\tau}$

$$S(\tau) = \frac{7}{3\tau(\tau+3)} = \frac{a}{\tau} + \frac{b}{\tau+3} \qquad a = \frac{7}{3} \qquad b = -\frac{7}{3}$$

$$S(\tau) = \frac{7}{3}\left(\frac{1}{\tau} + \frac{1}{\tau+3}\right) \Longrightarrow s(t) = \frac{7}{3}\left(1 - e^{-3t}\right) u(t)$$

Exo 2 $H(\tau) = \dfrac{3(\tau+7)}{\tau^2 + 14\tau + 65}$ $\quad E(\tau) = 1$

$$S(\tau) = \frac{3(\tau+7)}{(\tau+7)^2 + 16} \Longrightarrow s(t) = 3\, e^{-7t} \cos(4t)\cdot u(t)$$

Exo 2 1] H_1 : adaptateur ; H_2 : correcteur + carte puissance

H_3 : moteur ; H_4 : génératrice tachymétrique.

2] Schéma bloc BCC

3] $$H_3(\tau) = \frac{k_c}{(R+L\tau)J\tau + k_c k_e} = \frac{\dfrac{1}{k_e}}{\dfrac{RJ}{k_c k_e}\tau^2 + \dfrac{LJ}{k_c k_e}\tau + 1}$$

4]
$$H(\tau) = \frac{0{,}5\,a}{\tau(1+0{,}25\tau) + 0{,}5\,a} = \frac{1}{\dfrac{\tau^2}{2a} + \dfrac{2}{a}\tau + 1}$$

$$K = 1 \;;\; \omega_0 = \sqrt{2a} \qquad \frac{2z}{\omega_0} = \frac{2}{a} \Longrightarrow z = \sqrt{\frac{2}{a}}$$

1] Suite : il faut garder H_1 = gain de H_4

Exo 3 (Q1) Chaine de puissance...

(Q2) $\lambda(t) = \frac{1}{t} V(t)$ (5)

$$F(t) = \frac{1}{a_0 + a_1 t} \left[U_m(t) - a_2 V(t) \right] \Longrightarrow (1) \text{ et } (2)$$

$$V(t) = \frac{1}{m t} \left[F(t) - a_3 \frac{V(t)}{t} - a_4 V(t) \right] = \frac{1}{m t} \left[F(t) - \quad \right]$$

$$V(t) = \frac{1}{m t} \left[F(t) - \frac{a_3 + a_4 t}{t} \cdot V(t) \right] \Longrightarrow (3) \text{ et } (5)$$

(Q3) $$H_6 = \frac{V}{F} = \frac{\frac{1}{mt}}{1 + \frac{1}{mt} \frac{a_3 + a_4 t}{t}} = \frac{t}{m t^2 + a_4 t + a_3}$$

(Q4)

$$H_7 = \frac{\lambda}{U_m} = \frac{t}{(a_0 + a_1 t)(m t^2 + a_4 t + a_3) + a_2 t} \times \frac{1}{t}$$

$$H_7 = \frac{1}{a_1 m t^3 + (a_0 m + a_1 a_4) t^2 + (a_0 a_4 + a_1 a_3 + a_2) t + a_0 a_3}$$

(Q5) $$\lim_{t \to \infty} \lambda(t) = \frac{1}{a_0 a_3}$$

(Q6) $\theta(\infty) = 6 \cdot 10^{-6}$ rad $< 10 \times 10^{-6}$ rad.

$1{,}05 \times \theta(\infty) = 6{,}3 \cdot 10^{-6}$

$0{,}95 \times \theta(\infty) = 5{,}7 \cdot 10^{-6}$ $\Longrightarrow t_{5\%} = 7{,}2$ s

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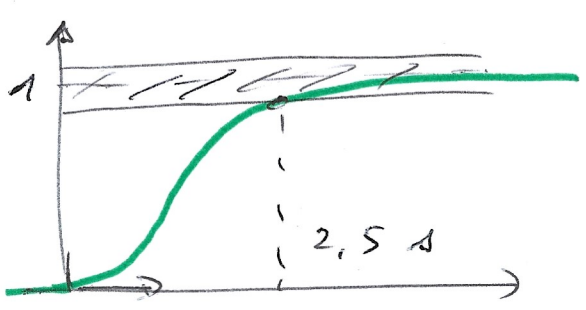
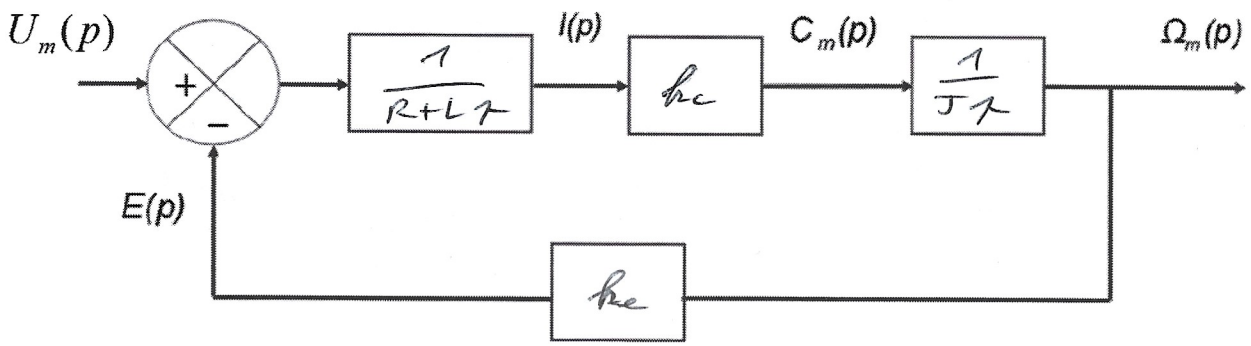
Exo 2 5] $\xi = 1 \Rightarrow a = 2$; $\omega_0 = 4$; $t_{5\%} = \frac{5}{2} = 2{,}5$ s

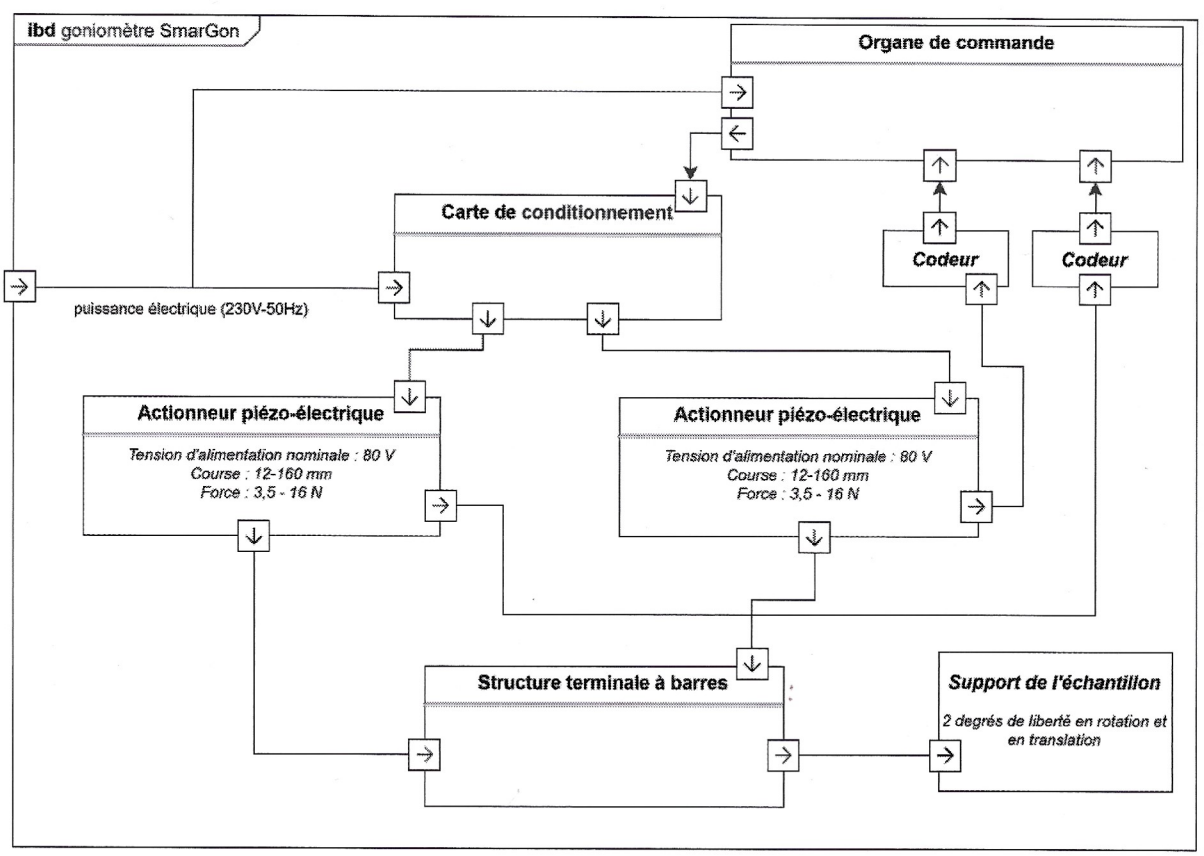


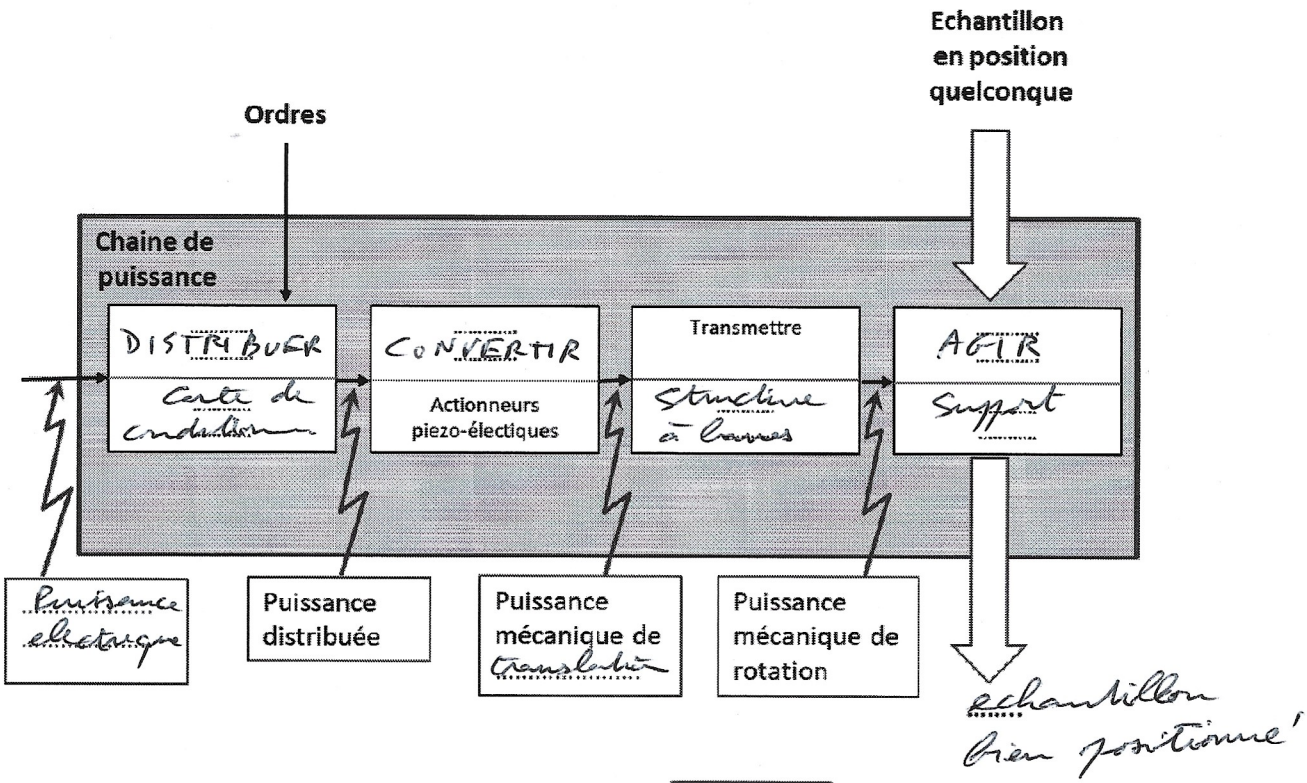
DS MPSI1, novembre 2025, document réponses

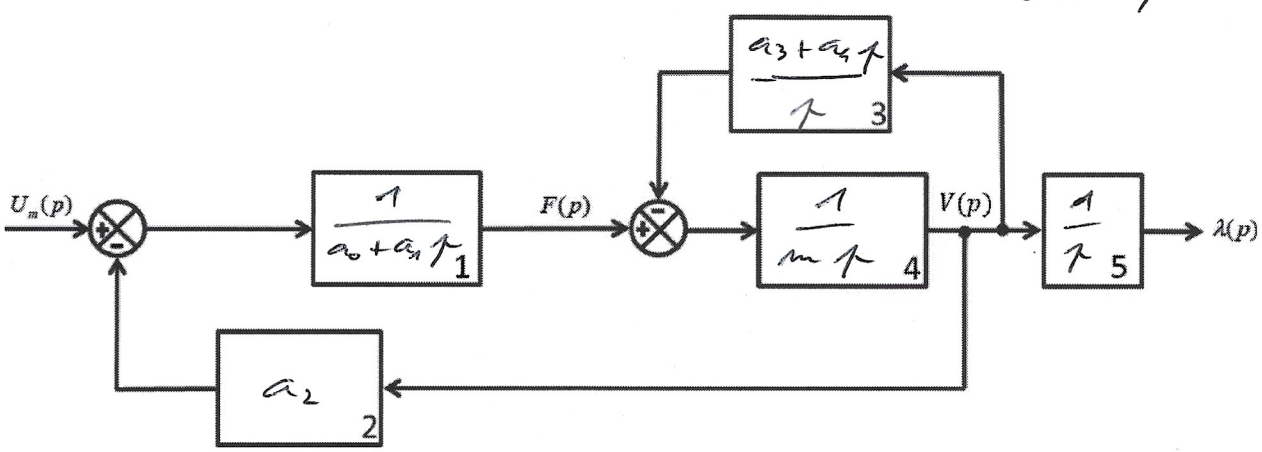
Exercice 2.

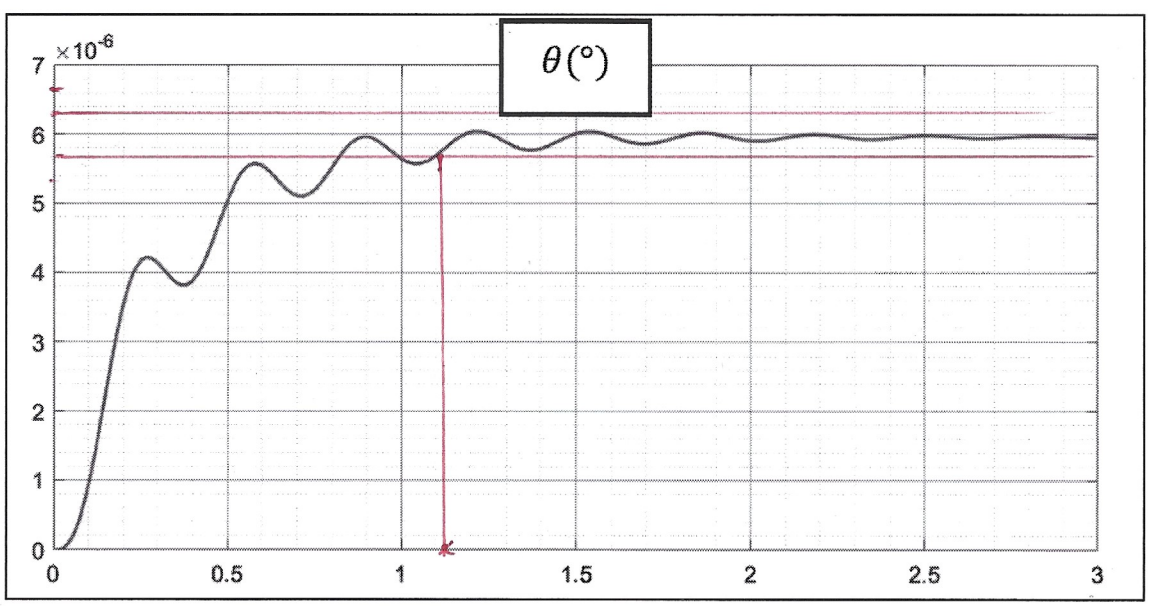


Exercice 3. Diagramme de blocs internes.




Echantillon en position quelconque
Ordres
Chaine de puissance
DISTRIBUER
Carte de commande
CONVERTIR
Actionneurs piezo-électiques
Transmettre
Structure à lames
AGIR
Support
Puissance électrique
Puissance distribuée
Puissance mécanique de translation
Puissance mécanique de rotation
échantillon bien positionné


$U_m(p)$
$\frac{1}{a_0 + a_1 p}$ 1
$F(p)$
$\frac{1}{m p}$ 4
$V(p)$
$\frac{1}{p}$ 5
$\lambda(p)$
a_2 2
$a_3 + a_4 p$ 3


$\theta(°)$
$\times 10^{-6}$
7
6
5
4
3
2
1
0
0
0.5
1
1.5
2
2.5
3
t (ms)

$t_{5\%} = 1,2\ s$