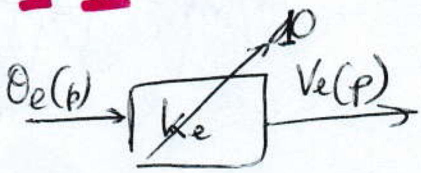
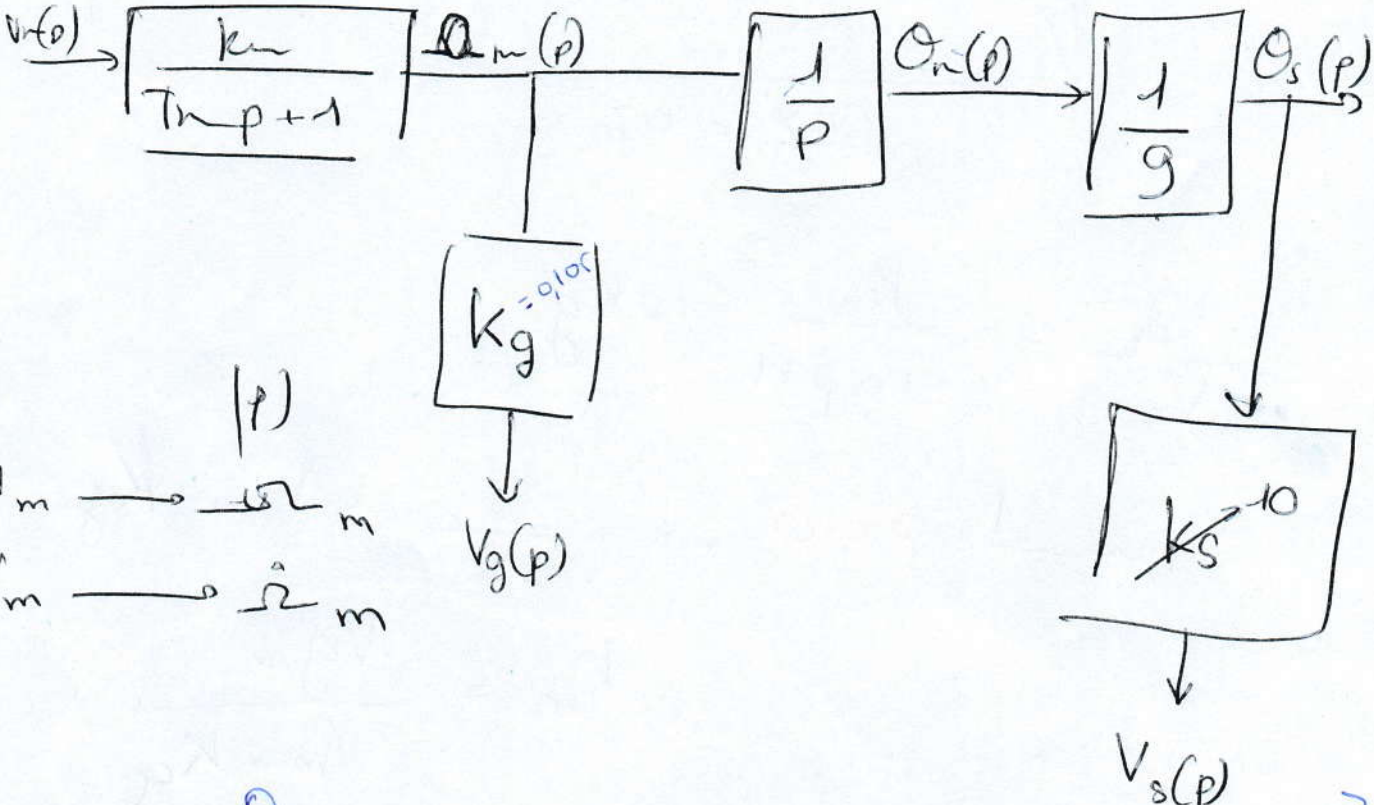
III - 1 schema bloc



$p \quad \frac{1}{p}$



(t) (p)

$W_m \longrightarrow \Omega_m$

$V_m \longrightarrow \dot{\Omega}_m$

$$\frac{\theta_s}{\theta_m} = \frac{1}{g} \Rightarrow \theta_s = \frac{\theta_m}{g}$$

$$V_m(p) \cdot (K_m) = \Omega_m(p) = T_m \dot{\omega}_m(t) + \omega_n(t)$$

$$T_m \ddot{\theta}_m(t) + \dot{\theta}_m(t) = K_m V_m(t) \qquad \dot{\theta}_m(t)$$

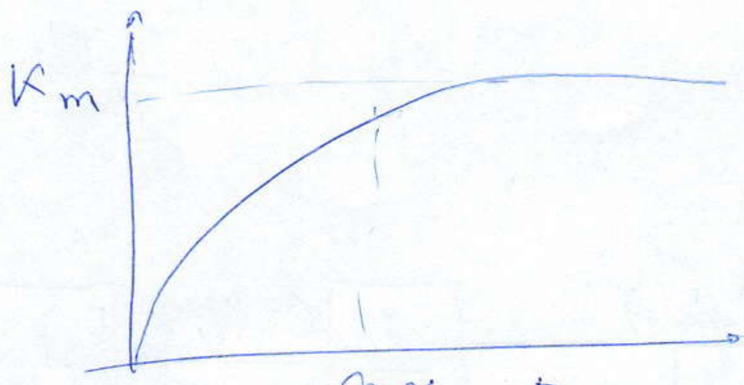
$$T_m p + 1 = K_m p_m$$

$$T_m \dot{\omega}_m(t) + \omega_m(t) = K_m V_m(t)$$

(1) $$\frac{\omega_m(t)(T_m + 1)}{v_m(t)} = K_m \qquad \cancel{\omega_m(t)(T_m} \qquad T_m \quad \frac{\omega_m(t)}{V_m(t)} = \frac{K_m}{T_m + 1}$$

Rep indicielle 1er Ordre.

$$\cancel{V_m = \frac{K_g \cdot V_m}{V_g}}$$



63% = τ_m

$$\frac{V_{\cancel{g}}}{V_m} = \frac{K_m}{T_m p + 1} \cdot K_g$$

Quand **p=0** $\Rightarrow$ $\frac{V_g}{V_m} = K_m \cdot \cancel{K}_g$

$$K_m = \frac{V_g}{V_m \cdot K_g}$$

III-2

$$\frac{\theta_s(p)}{\theta_e(p)} = \left(V_m(p) \cdot \frac{K_m}{T_m p + 1}\right)\left(\frac{1}{p} \cdot \frac{1}{g}\right)$$

$\theta_e = K_e \cdot V_e(p)$

$\theta_s = \frac{1}{g} \cdot \theta_m(t) = V_s / K_s$

$\theta_e(p) K_e$

$K_1 (V_e - \underbrace{V_s(t)})$

$\theta_s \cdot K_s$

~~$\theta_e K_e$~~

$$\theta_s(p) = \frac{1}{g} \cdot \frac{1}{p} \cdot \left(\frac{K_m}{T_m p + 1} \cdot V_m\right)$$

2

$$\theta_s(p) = \frac{1}{gp} \cdot \left(\frac{K_m}{T_m p + 1} \left(K_1 \left(\theta_e(p) K_e - \theta_s K_s \right) \right) \right)$$

$$\theta_s(p) \left(1 + \frac{1}{gp} \frac{K_m K_1 K_s}{(T_m p + 1)} \right) = \frac{1}{gp} \cdot \left(\frac{K_m \cdot K_1 \cdot K_e}{T_m p + 1} \right) \cdot \theta_e(p)$$

$$\frac{\theta_s(p)}{\theta_e(p)} = \frac{\dfrac{K_m \cdot K_1 \cdot K_e}{gp(T_m p + 1)}}{1 + \dfrac{K_m K_s K_1}{gp(T_m p + 1)}}$$

$$= \frac{\dfrac{K_m \cdot K_1 \cdot K_e}{\cancel{T_m g p^2 + g p}}}{\dfrac{g T_m p^2 + g p + K_m K_s K_1}{\cancel{g T_m p^2 + g p}}}$$

$V_m =$

$V_g = 2{,}36V$

Inputs

5VCC

$f = 0{,}2$ Hz

$T_{m_{63\%}} = 336$ ms

$= 0{,}336$ s

$$\boxed{TF = \frac{K_m \cdot K_1 \cdot K_e}{g T_m p^2 + g p + K_m K_s K_1}}$$

$V_m = 4$

$V_g = 2{,}36$

$K_g = 0{,}105$

$K_m = 5{,}619$

$T_m = 0{,}336$

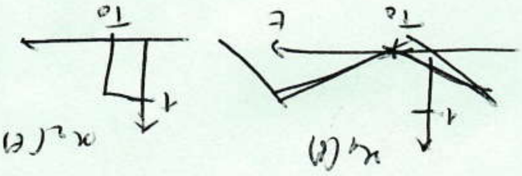
experiment alement

3

III.3 ⑥

Tracer diag Bode

bode(T)
margin(T)



$$\boxed{gT_m p^2 + gp + K_m K_s K_1}$$

p^2	gT_m	$K_m K_s K_1$
p^1	g	0
p^0	$K_m K_s K_1$	0
	0	

$$b = -\frac{1}{a_{n-1}} = -\frac{1}{g}$$

$$b_m = -\frac{1}{g}\det\begin{bmatrix} gT_m & K_m K_s K_1 \\ g & 0 \end{bmatrix} = \frac{1}{g}\left(gT_m \times 0 - g K_m K_s K_1\right)$$

$$\frac{g \times K_m K_s K_1 - \cancel{gT_m \times 0}}{g} = K_m K_s K_1$$

III 3 ⑤

→ système stable si $K_m K_s K_1 > 0$

Critère de Routh ✓
car même signe et non nul (1re colonne)

p^2	gT_m	$K_m K_s K_1$
p^1	g	0
p^0	$K_m K_s K_1$	0

→ $=10>0$

$5{,}619>0$

$$b_{n-1} = \cancel{\frac{g \times 0 - \ldots \times 0}{\ldots}}$$

$$c_m = \cancel{\frac{K_m K_s K_1 \times 0 - 0 \times \ldots}{\ldots}}$$

④

Exercice 3

(8) Matlab

(1) $M^4 - 4M^2 + 4I = 0$

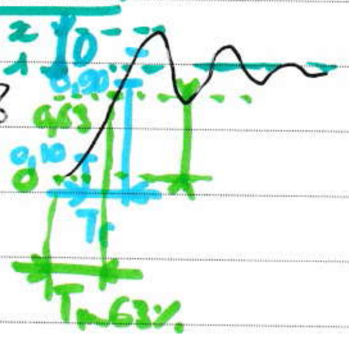
$K_1 = 1$

$T_{m\,63\%} = 0,36 \Rightarrow A = 0,78$

$D = 0,31$

$T_r = 0,32$

D = 1 - x



$k_1 = 2,7$

$T_{m\,63\%}\ 0,186$

$D = 0,51$

$T_r = 0,114$

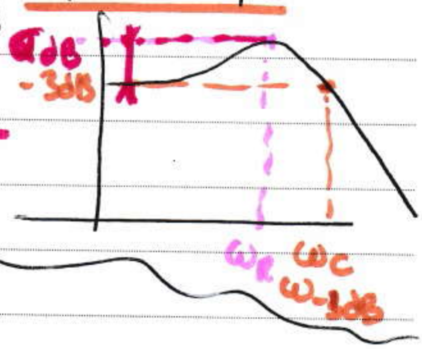
(12) $k = 2,7$ $\omega_R = 6,76$ rad/s $\quad k = 1$ $\omega_R = 3,76$ rad/s

pulsation de ~~résonnance~~ coupure $k = 2,7$ $\omega_c = 10,7$ rad/s

$k = 1$ $\omega_c = 6,13$ rad/s

ω_{-3dB}

coef de surtension



$k = 2,7$ $Q_{dB} = G_{dB}(6,76) - G_{dB}(0) = 7,73$

$k = 1$ $Q_{dB} = G_{dB}(3,76) - G_{dB}(0) = 3,76$

TP2

(1) (raison) ⇒ voir photo Tableau

(2) $M\varphi$ ⇒ rajoute un pole et un zero

$\boxed{k \cdot \frac{1 + a\tau p}{1 + \tau p}}$ car on a augmenté trop k

(bien que cela ~~rejet~~ réduise l'erreur de vitesse) la réponse sera trop rapide et le système physique n'aura pas le temps de régir à la commande

⑧ $k =$

$a =$

$\tau =$

quest ⑤

$M\varphi_{act} = 23,7°$ $M\varphi_{désirée} = 45°$

tjs ⇒ $\alpha = 1,2$

$$\Delta\varphi_{max} = \alpha(45 - 23,7)$$
$$= 25,56$$

$$a = \frac{1 + \sin(25,56)}{1 - \sin(25,56)} = 2,42$$

$$\omega_{max} = \frac{1}{\tau \cdot \sqrt{a}} \Rightarrow \tau = \frac{1}{\omega_{max} \cdot \sqrt{a}}$$

$\omega_{max} =$ 6,82 $\tau = 0,6435$

$$k = K_1 = 2,7$$

$C = \frac{\tau}{R_1}$ avec $C =$

$R_1 = \frac{R_2}{a-1} = \frac{\tau}{C} = \frac{0,}{1}$

$R_2 =$

0,55

quest ⑥ $P_m = 41,7$ deg.

⑦ Déduire de a et τ les valeurs des résistances R_1 R_2 et du condensateur C

$$\frac{1 + a\tau p}{1 + \tau p} \Leftrightarrow \frac{1 + (R_1 + R_2)Cp}{1 + R_1 Cp}$$

$$\frac{R_1 C + R_2 C}{R_1 C}$$

soit $\left\{\begin{array}{l} a\tau = (R_1 + R_2)C = R_1C + R_2C \\ \tau = R_1 C = \end{array}\right.$ donc $\left\{\begin{array}{l} a = \\ \tau = R_1 Cp \end{array}\right.$

soit $1 + \frac{R_2}{R_1}$

$a\tau = (R_1 + R_2) C_E$

$\tau = R_1 C$

1nF sur la maquette

$\frac{6435}{0^{-6}} = 643500\,\Omega \approx 64\,k\Omega$

$\frac{R_1}{a-1} = \frac{643500}{2{,}42-1} = 453169\,\Omega \approx 45\,k\Omega$