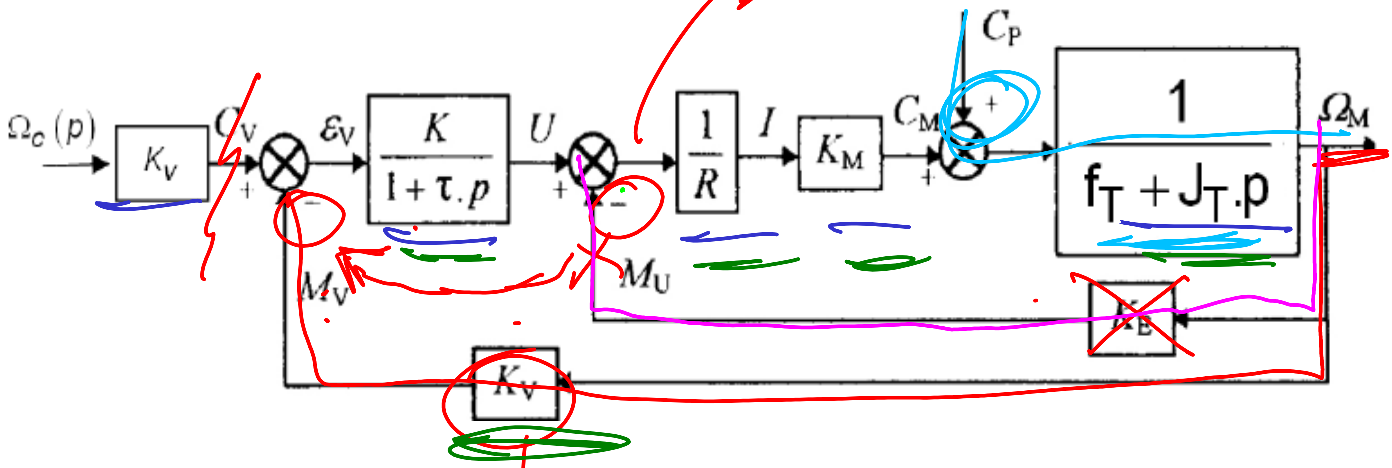
Révisions

Simplifier le schéma-bloc $= \Omega_m \left(K_V \dfrac{K}{1+\tau p} + K_E \right)$



Puis expression de $\Omega_m = f(\Omega_c, C_p)$

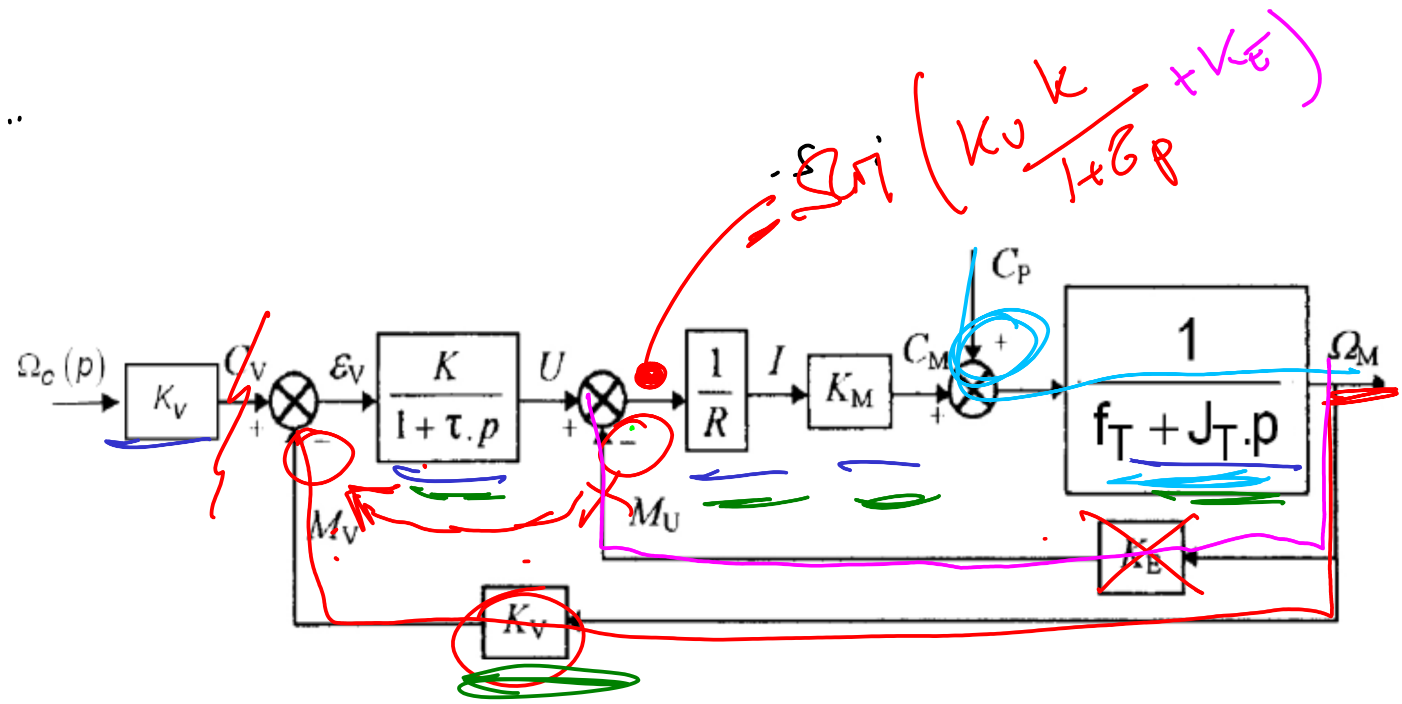
$$= H_1(p)\,\Omega_c(p) + H_2(p)\,C_p(p)$$

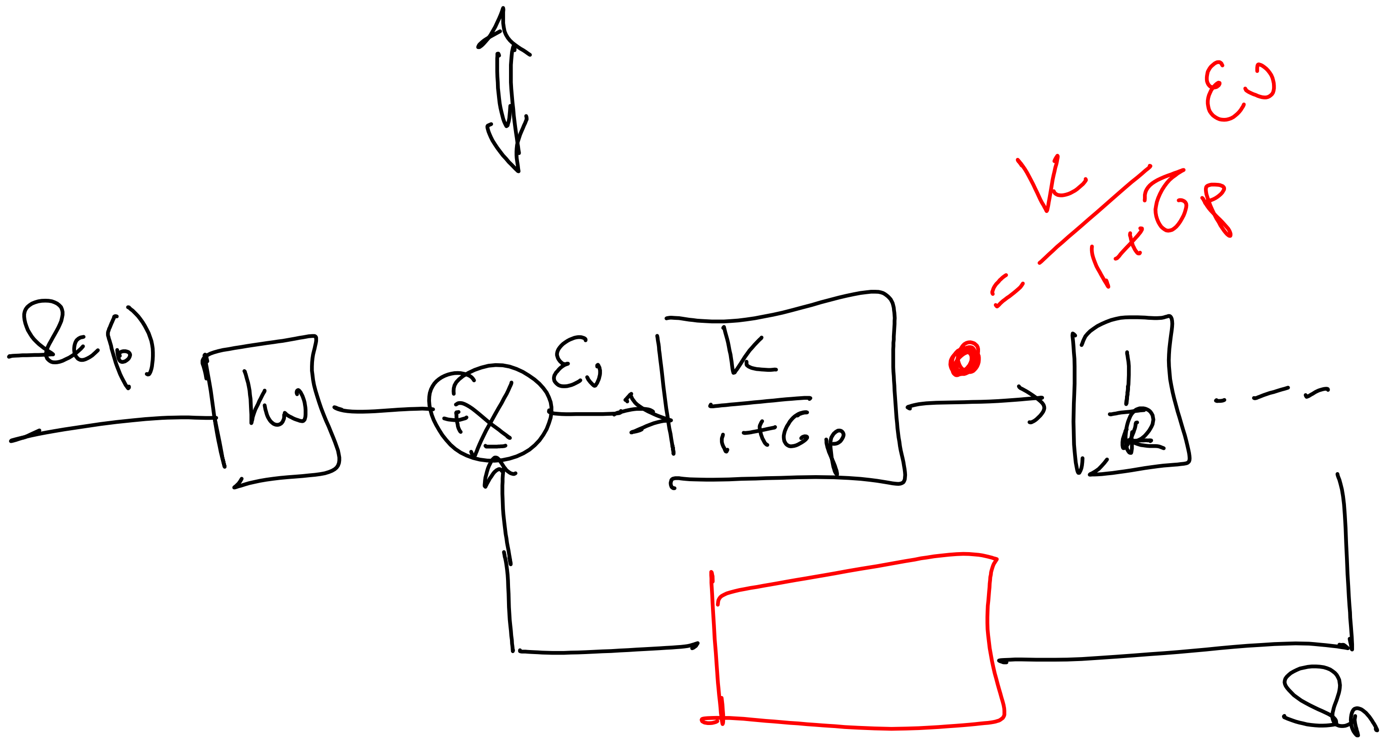
$$K_V + \frac{K_E(1+\tau p)}{K}$$

par formule de Black.

$$H_1(p) = \frac{\Omega_m(p)}{\Omega_c(p)} = \frac{K_V \dfrac{K K_m}{(1+\tau p) R (f_T + J_T p)}}{1 + \dfrac{K K_m \left(K_V + K_E(1+\tau p)/K \right)}{(1+\tau p) R (f_T + J_T p)}}$$

$$H_2(p) = \frac{\Omega_m(p)}{C_p(p)} = \frac{\dfrac{1}{f_T \cdot J_T p}}{1 + FTBO(p)}$$

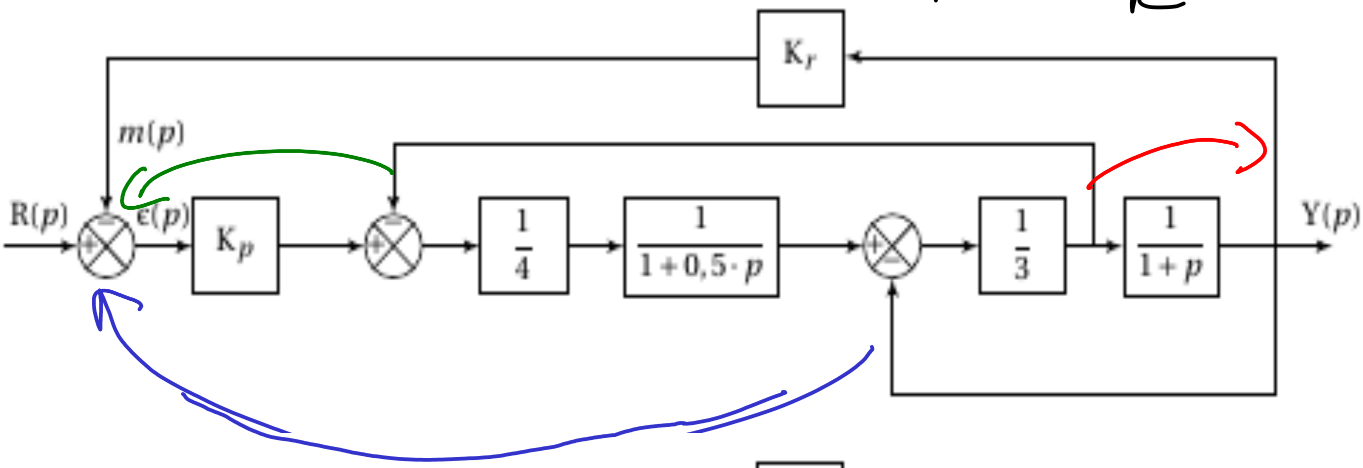


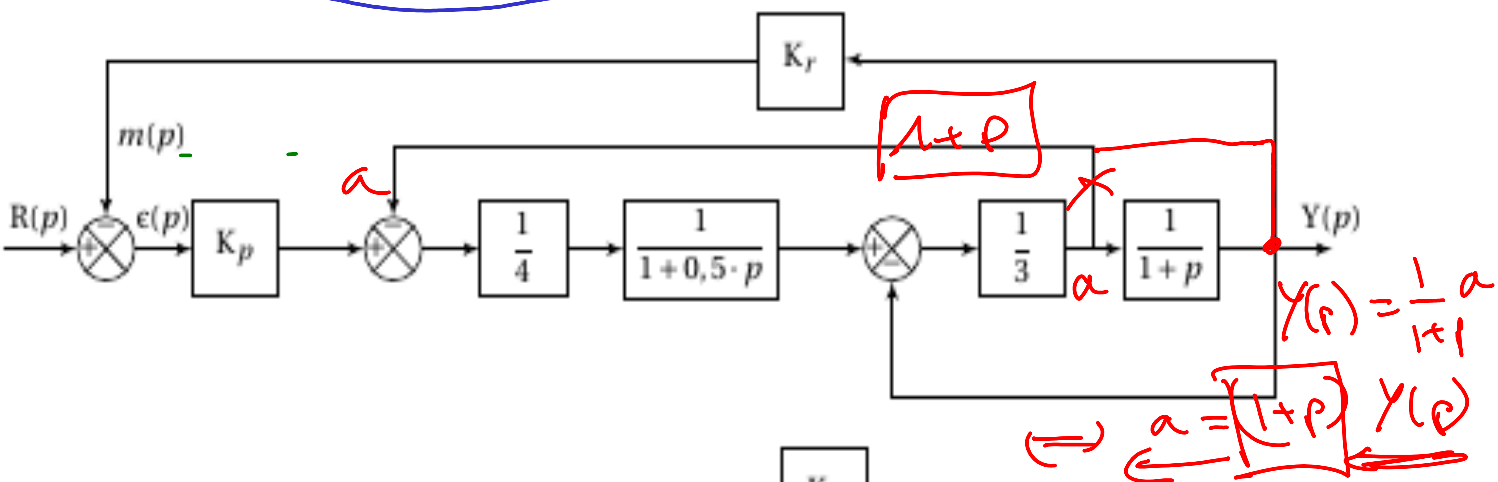


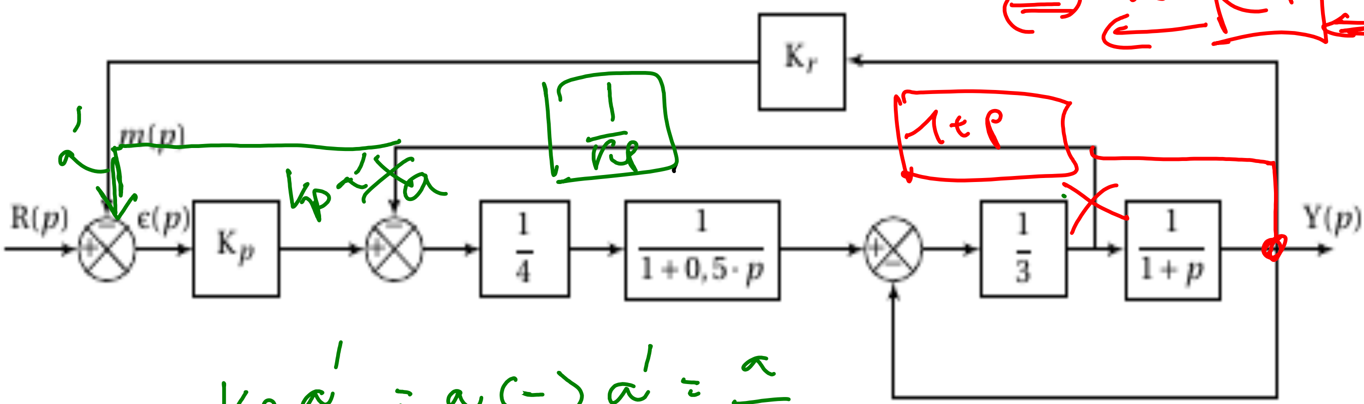
$$-\cancel{\Omega_n}\left(K_V \frac{K}{1+\tau p} + K_E\right) = \cancel{-}\,\cancel{\Omega_n}\,[\;]\cdot\frac{K}{1+\tau p}$$

$$\Leftrightarrow \cancel{\frac{K}{1+\tau p}}\left(K_V + \frac{K_E(1+\tau p)}{K}\right) = [\;]\,\cancel{\frac{K}{1+\tau p}}$$

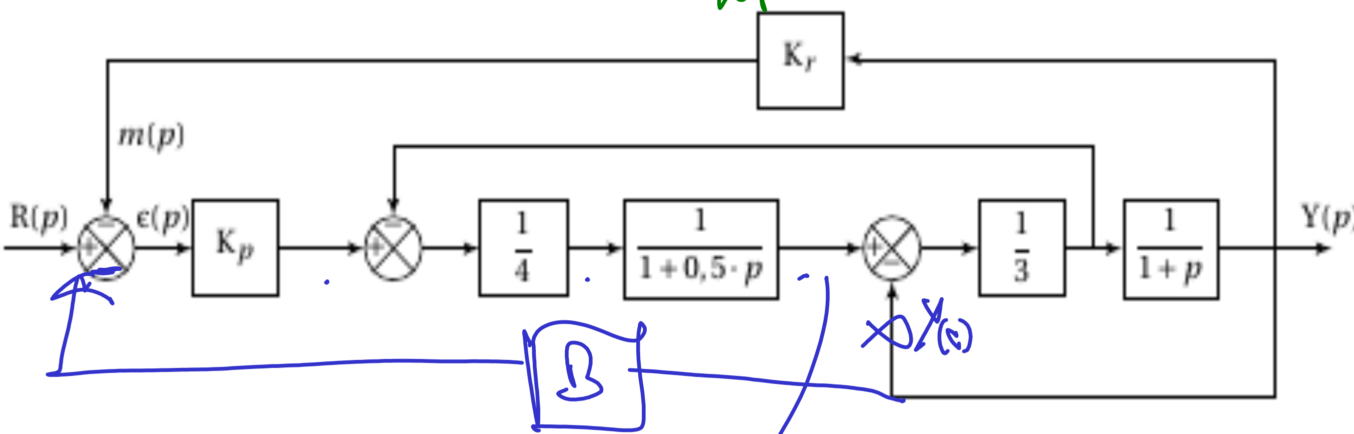
Simplifiez le schéma-blocs, puis $\frac{Y}{R}$?





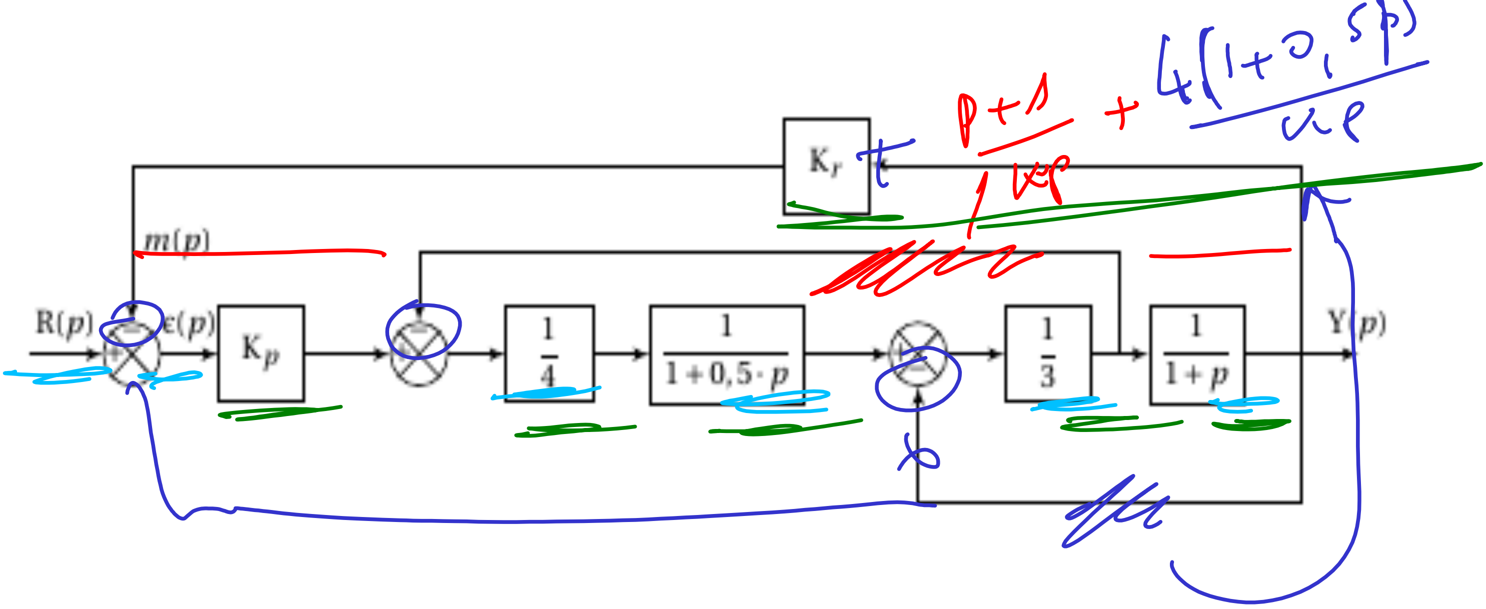


$K_p a' = a \Leftrightarrow a' = \frac{a}{K_p}$



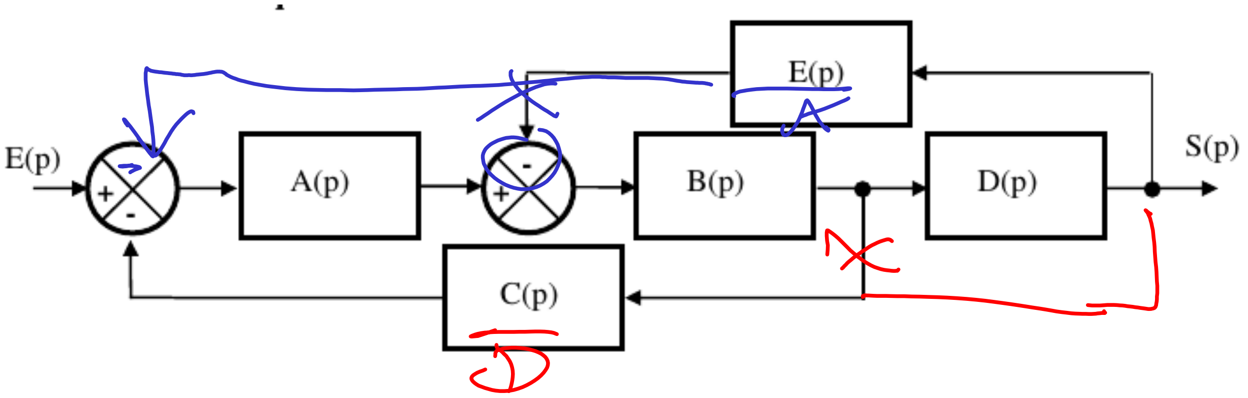
$B = \frac{4(1+0,5p)}{K_p}$

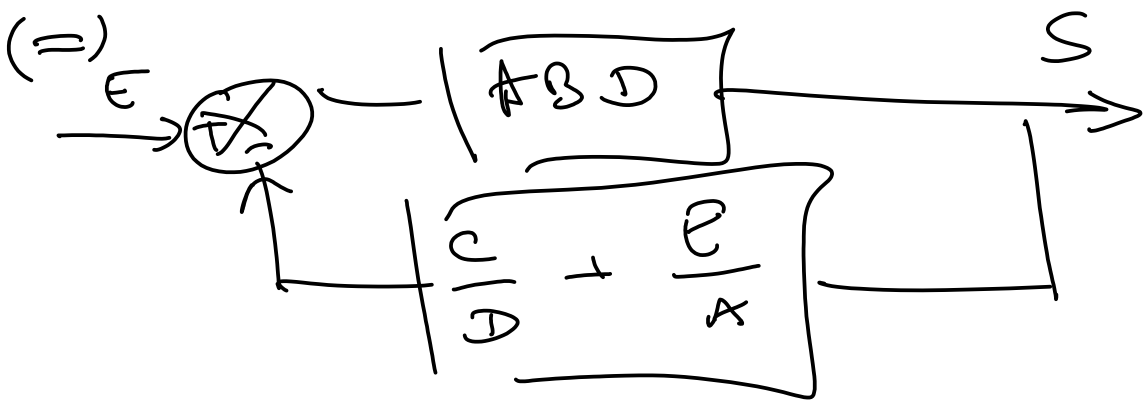
$\Leftrightarrow Y(p) \cdot B\, K_p \cdot \frac{1}{4} \cdot \frac{1}{1+0,5\,p} = Y(p)$



$$\frac{Y(p)}{R(p)} = \frac{\dfrac{Kp}{4\cdot(1+0,5p)\,3\,(1+p)}}{1+\dfrac{Kp}{4(1+0,5p)3(1+p)}\left(Kr+\dfrac{p+1}{Kp}+\dfrac{4(1+0,5p)}{Kp}\right)}$$

Simplifiez le schéma-blocs, puis $\frac{S}{E}$?

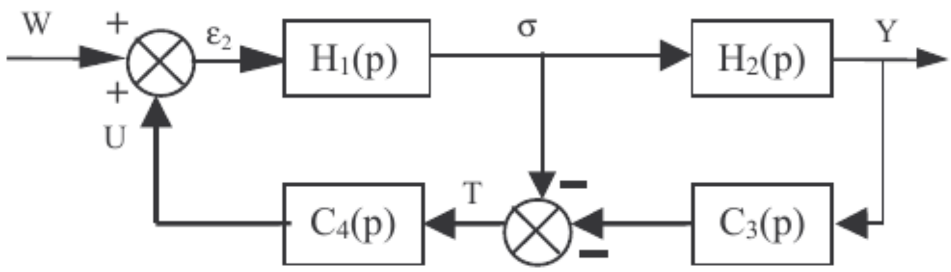




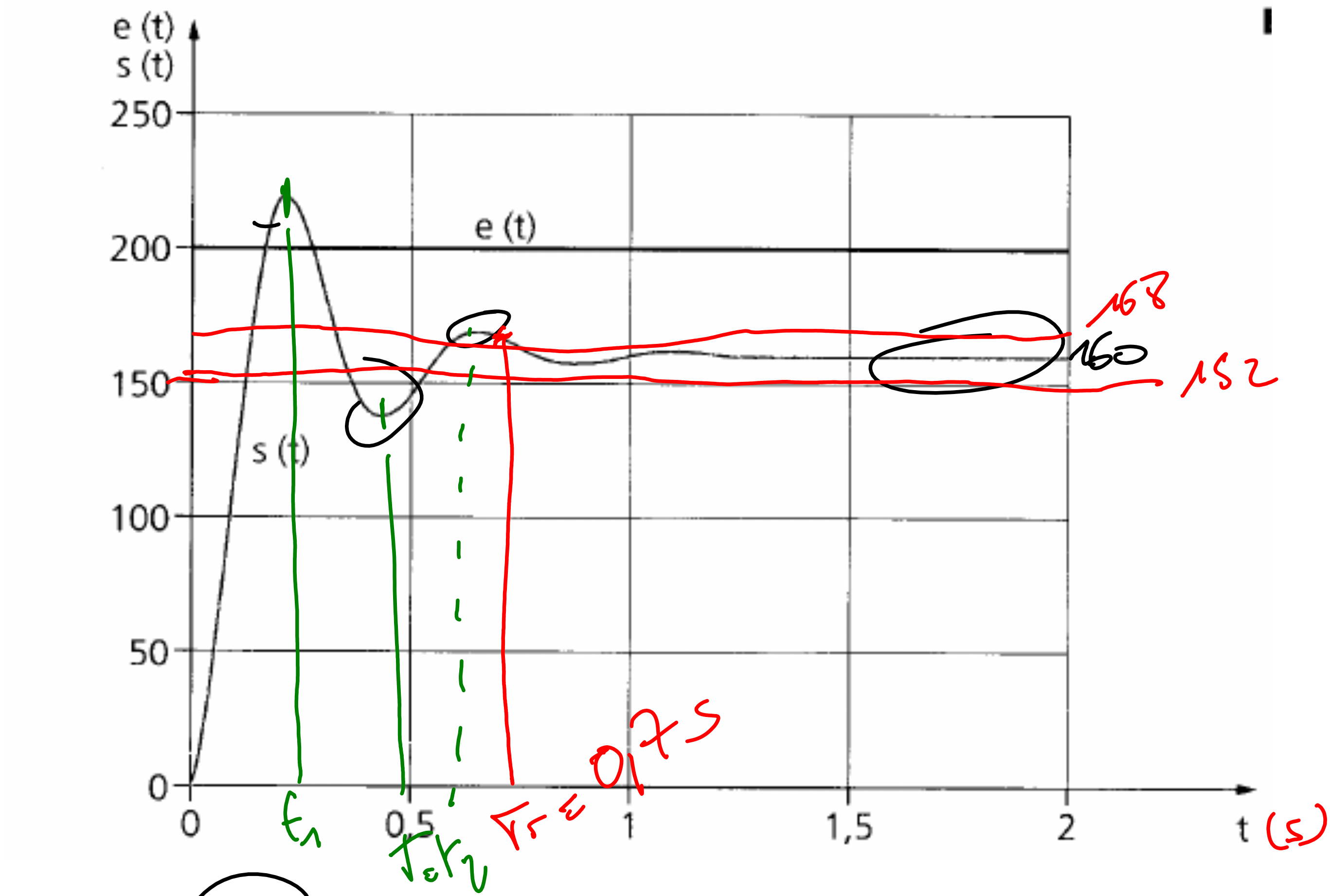
$$\frac{S}{E} = \frac{ABD}{1 + ABD\left(\frac{C}{D} + \frac{E}{A}\right)}$$

$$= \frac{ABD}{1 + ABC + BDE}$$

Simplifiez le schéma-blocs, puis $\frac{Y}{W}$?



Identification $\xrightarrow{E(p)} \boxed{H(p)} \xrightarrow{S(p)}$, $H(p)$?



$$\frac{K}{1 + \frac{23}{100}p + \frac{p^2}{100^2}}$$

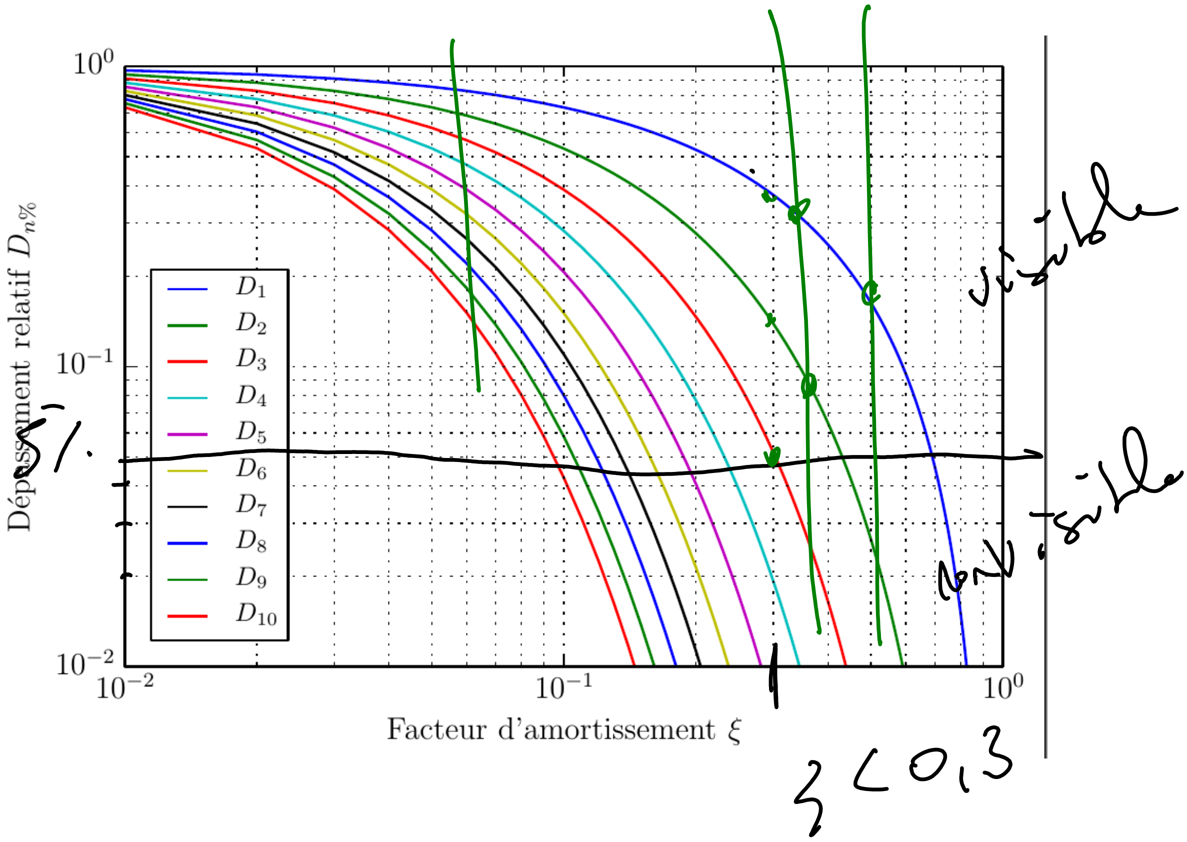
, $\xi < 1$ dépassements visibles

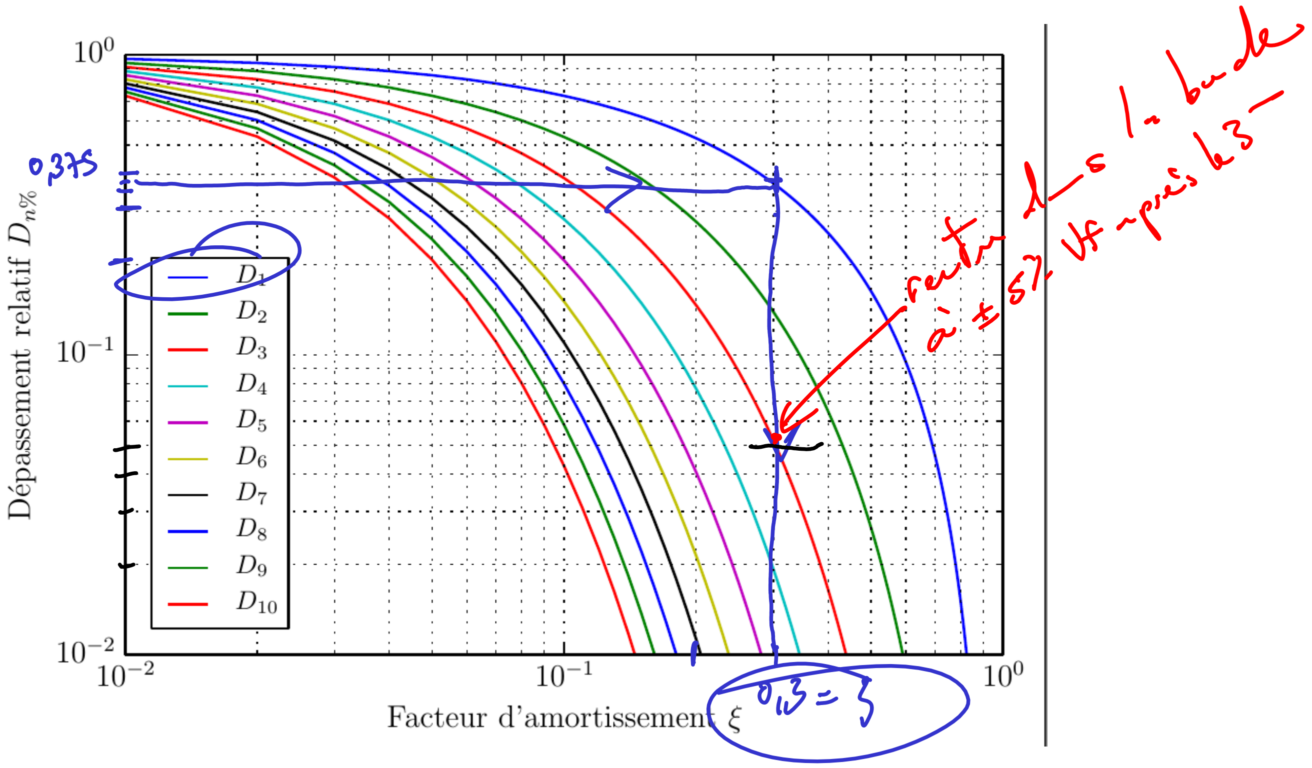
$\xi < 0,3$

$\hookrightarrow \xi$

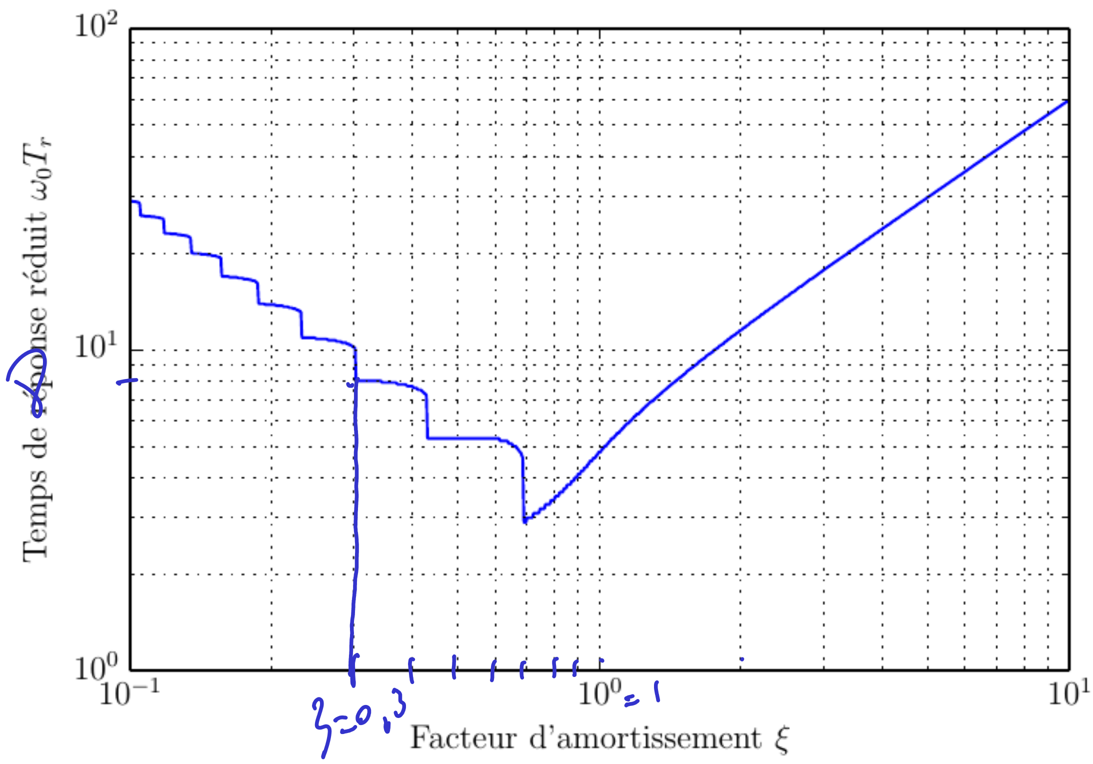
VF : $K = \frac{160}{200} = \frac{4}{5} = 0,8$

$D_1\% = \frac{220 - 160}{160} = \frac{6}{16} \simeq 37,5\%$


Dépassement relatif $D_{n\%}$
Facteur d'amortissement ξ
D_1
D_2
D_3
D_4
D_5
D_6
D_7
D_8
D_9
D_{10}
5%
visible
non visible
$\xi < 0{,}3$


Dépassement relatif $D_{n\%}$
Facteur d'amortissement ξ
D_1
D_2
D_3
D_4
D_5
D_6
D_7
D_8
D_9
D_{10}
0,375
$0{,}3 = \xi$

$$\boxed{\xi = 0{,}3}$$



$\omega_0 T_r = 8$

$T_r = 0,7$

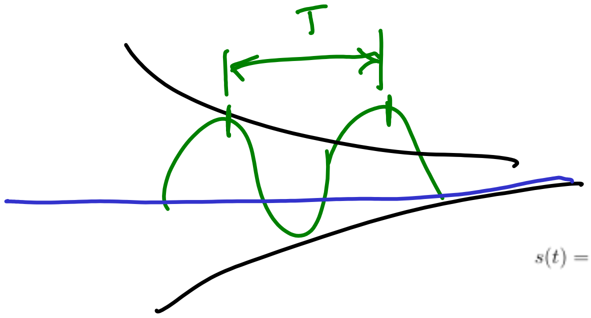
$\omega_0 = \frac{8}{0,7} \simeq 12 \text{ rad.s}^{-1}$

$$\frac{2\pi}{T} = \omega = \omega_0\sqrt{1-\xi^2}$$

$$t_1 = \frac{T}{2}, \quad t_k = k\frac{T}{2} = \frac{k\pi}{\omega_0\sqrt{1-\xi^2}}$$

$$t_1 = 0,33\,s \rightarrow \omega_0 = \frac{\pi}{t_1\sqrt{1-\xi^2}} = \frac{\pi}{0,33\sqrt{0,91}}$$

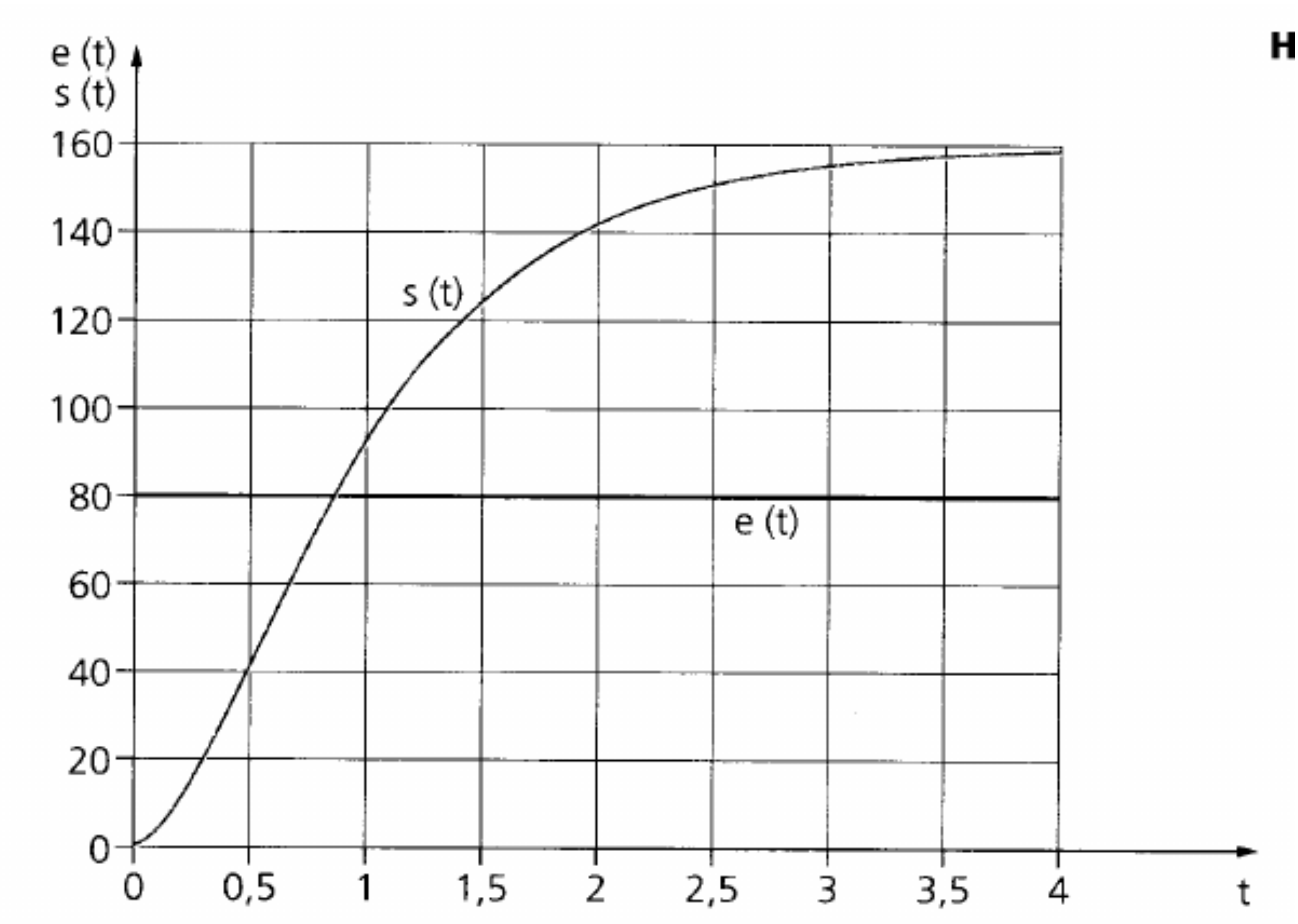
$\simeq 10 \text{ rad.s}^{-1}$



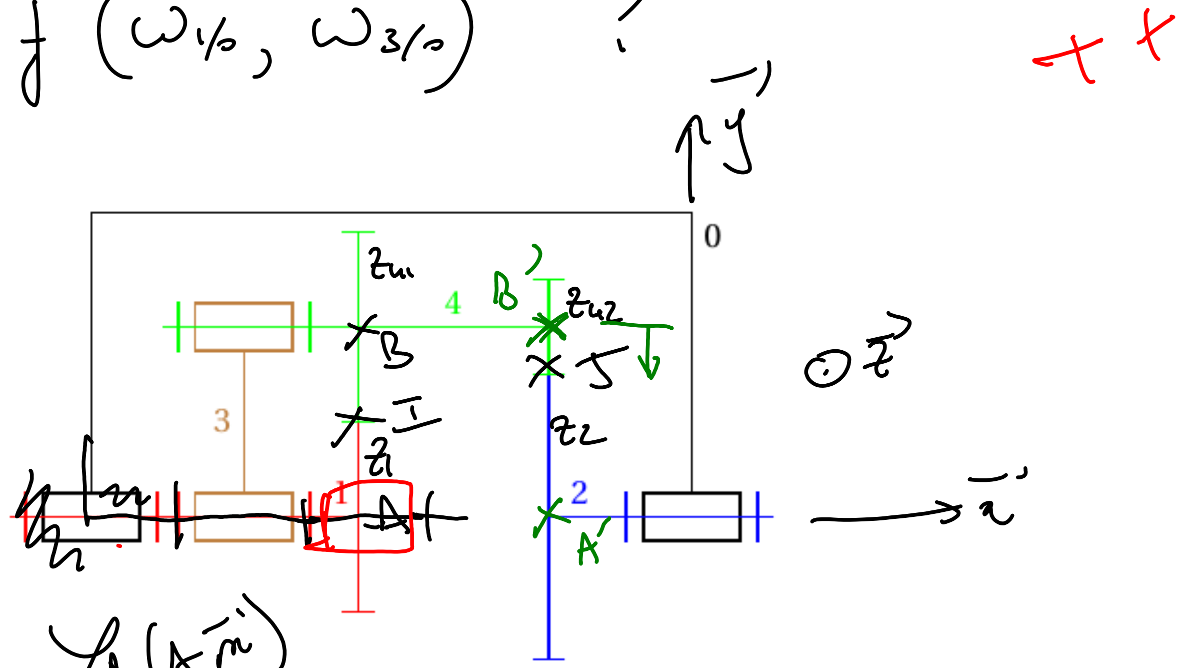
e^{-at}

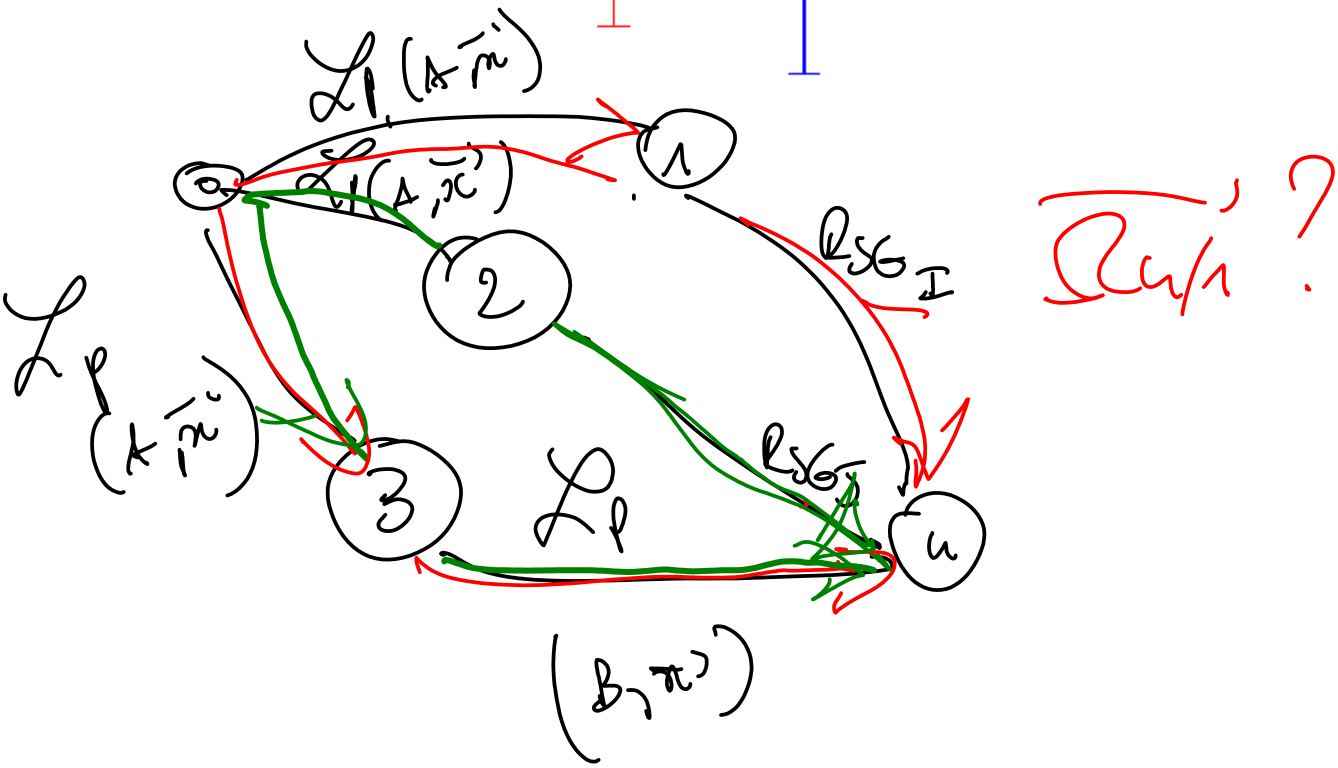
$$s(t) = K\,e_0\left[1 - \exp(-\xi\omega_0 t)\left(\cos\left(\omega_0 t\sqrt{1-\xi^2}\right) + \frac{\xi}{\sqrt{1-\xi^2}}\sin\left(\omega_0 t\sqrt{1-\xi^2}\right)\right)\right]u(t)$$

Identification $\xrightarrow{E(p)} \boxed{H(p)} \xrightarrow{S(p)}$, $H(p)$?



$\omega_{2/0} = f(\omega_{1/0}, \omega_{3/0})$?





RSG I : $\vec{V}_{I,4/1} = \vec{0}$

par composition des vitesses au point I, on a :

$$\vec{V}_{I,4/1} = \vec{V}_{I,4/3} + \underbrace{\vec{V}_{I,3/0} - \vec{V}_{I,1/0}}_{\vec{V}_{I,3/1}}$$

Avec par changement de point :

$$\overrightarrow{V_{F,4/3}} = \cancel{\overrightarrow{V_{B,4/3}}} + \overrightarrow{\Omega_{4/3}} \wedge \overrightarrow{BI}$$

$$= \omega_{43}\,\vec{x}' \wedge -R_{41}\,\vec{y}'$$

$$= -R_{41}\,\omega_{43}\,\vec{z}'$$

$$\overrightarrow{V_{I,3/0}} = \cancel{\overrightarrow{V_{A,3/0}}} + \overrightarrow{\Omega_{3/0}} \wedge \overrightarrow{AI}$$

$$= \omega_{30}\,\vec{x}' \wedge R_1\,\vec{y}'$$

$$= \omega_{30}\,R_1\,\vec{z}'$$

$$\overrightarrow{V_{I,1/0}} = \omega_{10}\,R_1\,\vec{z}' \qquad (3 \to 1)$$

d'où : $/\vec{z}' : 0 = -R_{41}\,\omega_{43} + (\omega_{30} - \omega_{10})\,R_1$

RSG en J $\quad \overrightarrow{V_{J,4/2}} = \vec{0}$

Par composition des vitesses au point J, on a :

$$\overrightarrow{V_{J,4/2}} = \overrightarrow{V_{J,4/3}} + \overrightarrow{V_{J,3/0}} - \overrightarrow{V_{J,2/0}}$$

$\overrightarrow{V_{J,3/2}}$

Avec par changement de point B' tel que $\overrightarrow{B'J} \cdot \vec{x}' = 0$

$$\overrightarrow{V_{J,4/3}} = \cancel{\overrightarrow{V_{B',4/3}}} + \overrightarrow{\Omega_{4/3}} \wedge \overrightarrow{B'J}$$

$$= \omega_{43}\, \vec{x}' \wedge -R_{42}\, \vec{y}'$$

$$= -\omega_{43}\, R_{42}\, \vec{z}$$

$$\overrightarrow{V_{J,3/0}} = \overrightarrow{V_{A',3/0}} + \overrightarrow{\Omega_{3/0}} \wedge \overrightarrow{A'J}$$

$$= \omega_{30}\, \vec{x}' \wedge R_2\, \vec{y}'$$

$$= \omega_{30}\, R_2\, \vec{z}'$$

$$\overrightarrow{V_{J,1/0}} = \omega_{20}\, R_2\, \vec{z}' \qquad (3 \to 2)$$

d'où $/\vec{z}$: $0 = -\omega_{43} R_{42} + (\omega_{30} - \omega_{20})\, R_2$

$$\begin{cases} 0 = -R_{u1}\,\omega_{u3} + (\underline{\omega_{30}} - \underline{\omega_{10}})\,R_1 \\ 0 = -\omega_{u3}\,R_{u2} + (\underline{\omega_{30}} - \underline{\omega_{20}})\,R_2 \end{cases}$$

$$\Leftrightarrow \begin{cases} \omega_{u3} = (\omega_{30} - \omega_{10})\,\dfrac{R_1}{R_{u1}} \\ \omega_{u3} = (\omega_{30} - \omega_{20})\,\dfrac{R_2}{R_{u2}} \end{cases}$$

$$\Leftrightarrow \begin{cases} - - - \\ \end{cases}$$

$L_2 \leftarrow L_2 - L_1$

$$(E)\quad 0 = (\omega_{30} - \omega_{20})\,\frac{R_2}{R_{u2}} - (\omega_{30} - \omega_{10})\,\frac{R_1}{R_{u1}}$$

R engrenage, R_2, R_{u2} $\Rightarrow \dfrac{R_2}{R_{u2}} = \dfrac{\cancel{m}\,z_2}{\cancel{m}\,z_{u2}}$

$d = m z$

$$(E) \Leftrightarrow \omega_{20} = \frac{z_{u2}}{z_2}\left(\omega_{10}\,\frac{z_1}{z_{u1}} + \omega_{30}\left(\frac{z_2}{z_{u2}} - \frac{z_1}{z_{u1}}\right)\right)$$

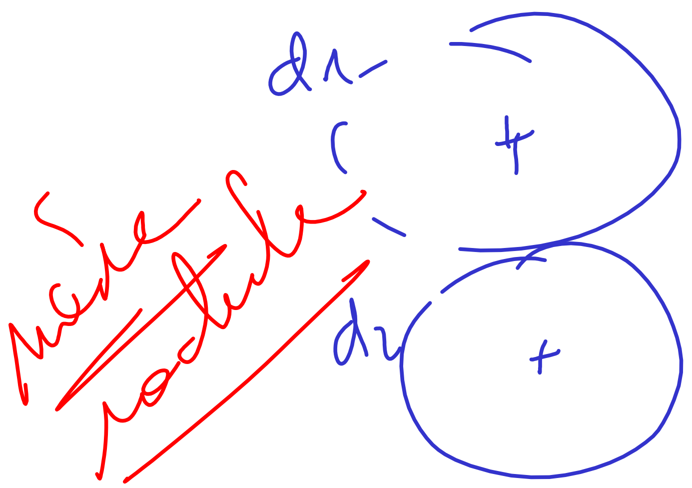
$$\Leftrightarrow \boxed{\omega_{20} = \omega_{10}\,\lambda + \omega_{30}(1 - \lambda) \qquad \lambda = z_1 z_{u2} / (z_2 z_{u1})}$$

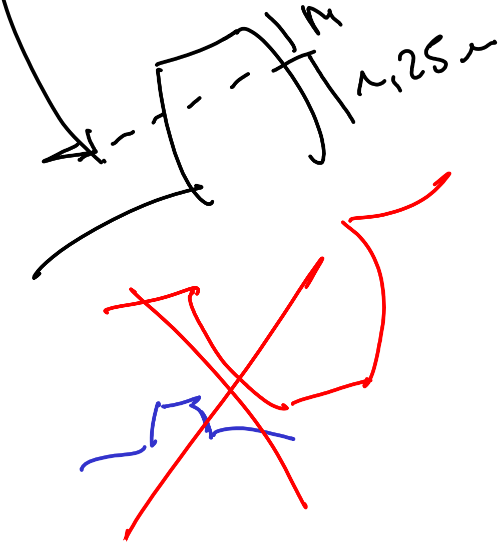
diamètre primitif (mm)

$d = m \cdot z$ — nb de dents

module (mm/dent)

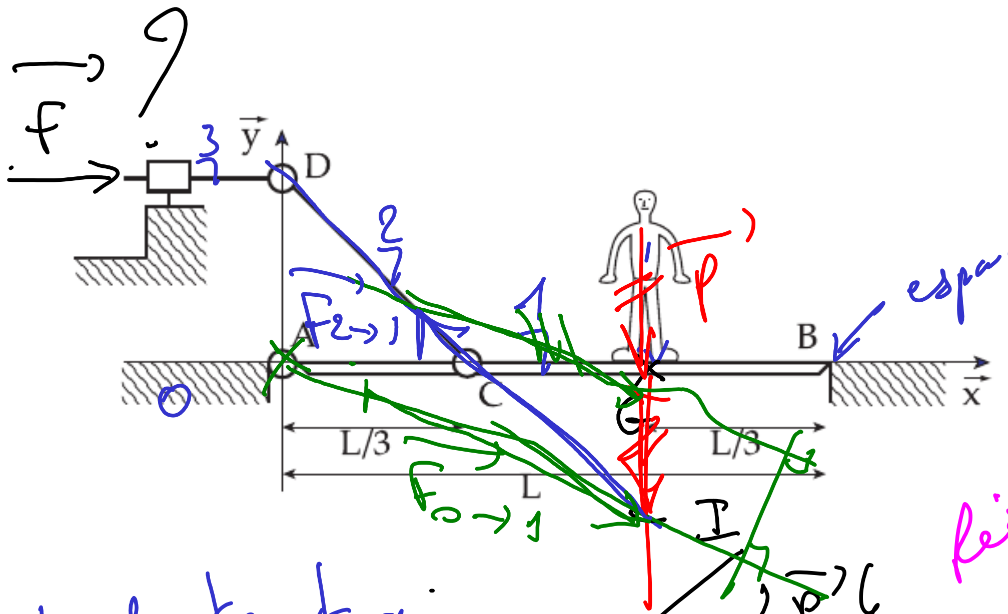
caractéristique de taille





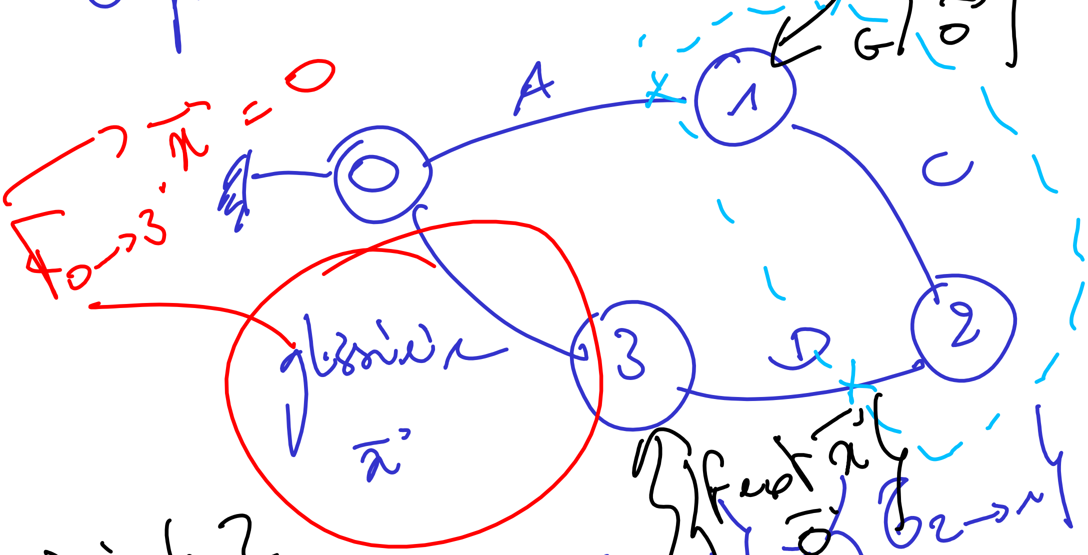
$$\frac{d_1}{d_2} = \frac{m z_1}{m z_2} = \frac{z_1}{z_2}$$

$$r_i = \frac{d_i}{2}, \quad i \in [\![1,2]\!]$$



Résolution plan

Graphe de structure :



1) isole 2

Axe central $\{G_{3\to2}\}$ est la droite (DC).

2) isole 3 $\vec{P}$

(CD)

× A

Axe central de $\{G_{0\to1}\}$: (AI)

Stratégie :

1) isole les solides soumis à 2 glisseurs

2) — ∅ — syst. 2 —

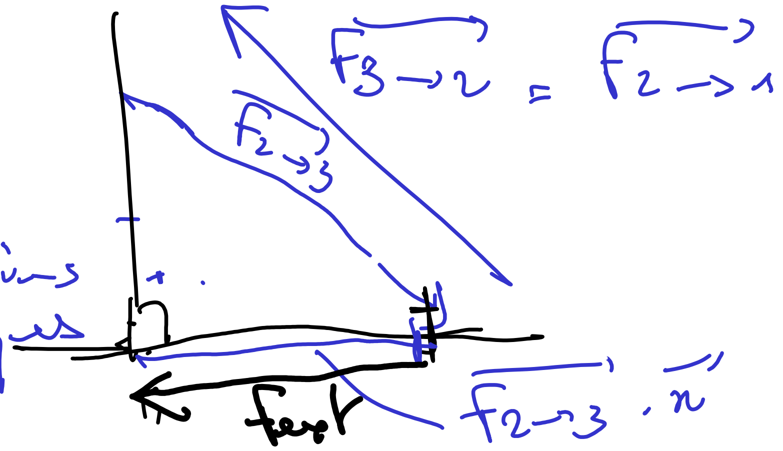
3) — solides 3 —

4) — système {1,2} 3 —

3) On isole 3. éq de résultante selon $\vec{x}$:

$$\cancel{\vec{F}_{0\to3}\cdot\vec{x}} + \vec{F}_{2\to3}\cdot\vec{x} + F_{ext} = 0$$

nulle car glissière



$\{\mathcal{G}_{0\to3}\}$ est un glisseur en D

cs : On isole 3.

3 soumis à :

	Axe central
$\{\mathcal{G}_{2\to3}\}$	(DC)
$\{\mathcal{G}_{ext\to3}\}$	$(D, \vec{x})$
$\{\mathcal{G}_{0\to3}\}$	(D)

$\vec{M}_{D,2\to3} = \vec{0}$

$\vec{M}_{D,ext\to3} = \vec{0}$

$\Rightarrow \vec{M}_{D,0\to3} = \vec{0}$

3 sommes à 3AN:

$\{\mathcal{C}_{2\to3}\}$ (C, D)

$\{\mathcal{C}_{ext\to3}\}$ $(D, \vec{x}')$

$\{\mathcal{C}_{v\to3}\}$

glisser en D

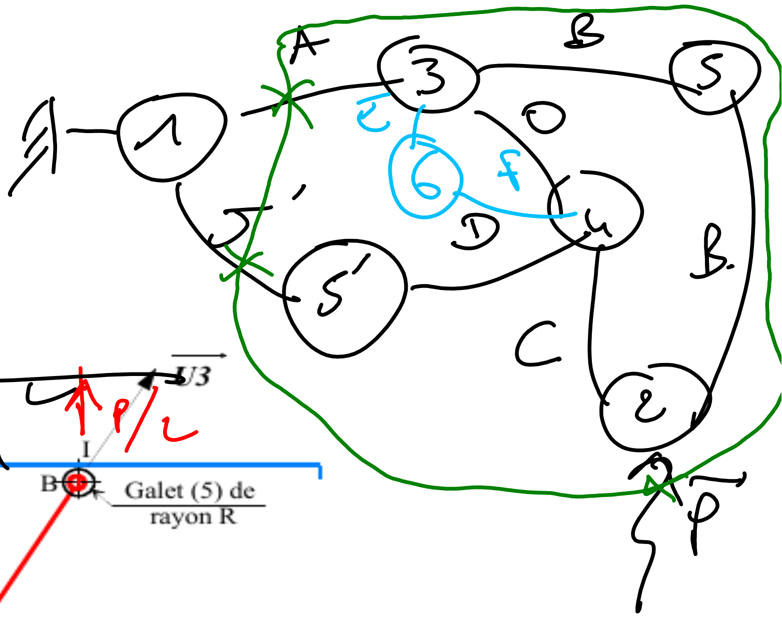
Si $\vec{F}_{O\to3} \neq \vec{0}$

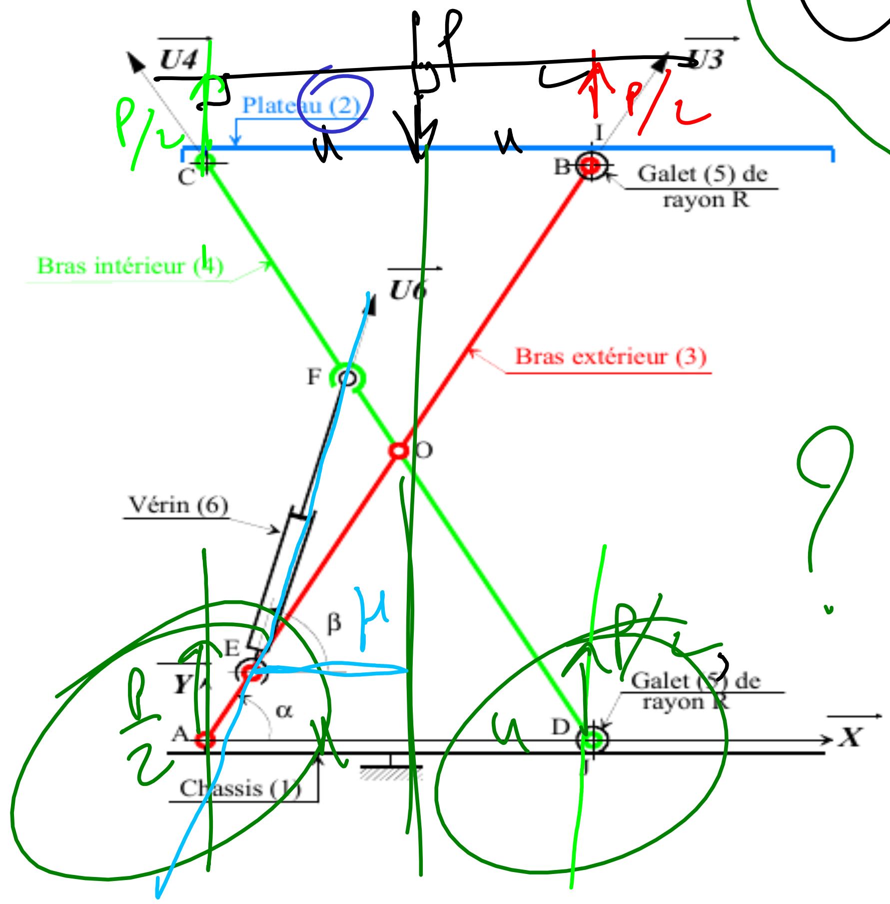
eq. du moment en D:

$$\cancel{\vec{\Gamma}_{D,2\to3}} + \cancel{\vec{\Gamma}_{D,ext\to3}} + \underbrace{\vec{\Gamma}_{D,v\to3}} = \vec{0}$$

table élévatrice

$\vec{F}_{6\to4}$?





stratégie (analytique)

1) isole les galets 5 et 5', soumis à 2 glisseurs,

⇒ axe central $\{\mathcal{T}_{5\to2}\} : (I, \vec{y})$

$\{\mathcal{T}_{5'\to4}\} : (J, \vec{y})$

isole 6 . . .

2) isole 2. Par symétrie ⟶ $\vec{R}\cdot\vec{y}$ et $\vec{M_C}$

3) isole {2, 3, 4, 5, 5', 6} soumis à 3 glisseurs

2 les axes centraux $\{G_{0\to 5'}\}$ et $\{G_{ext\to 2}\}$ sont parallèles

donc $\{G_{0\to 4}\}$ est la droite $(A, \vec{y})$,

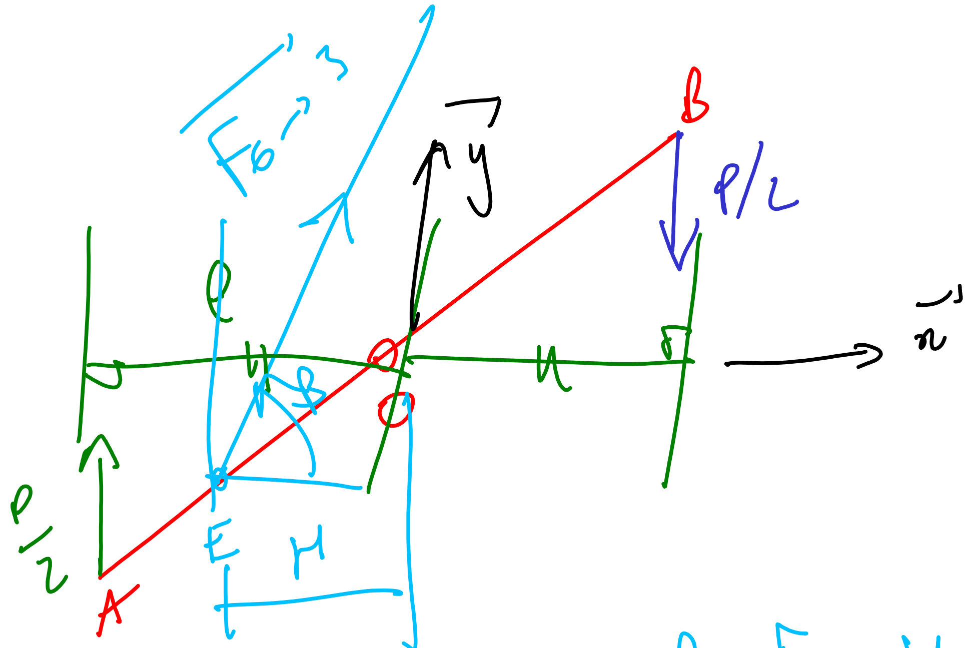
par symétrie on obtient :

$$\overrightarrow{F_{0\to 4}} = \frac{P}{2}\vec{y}$$

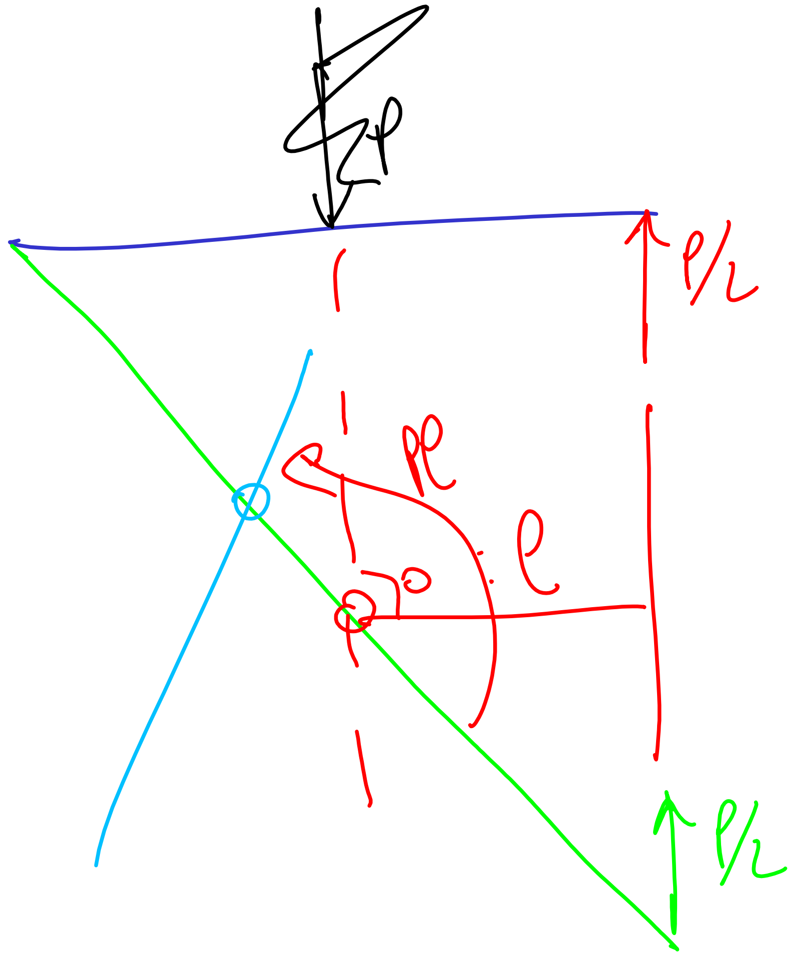
$$\overrightarrow{F_{0\to 5'}} = \overrightarrow{F_{5'\to 3}} = \frac{P}{2}\vec{y}$$

4) On isole 3 (ou 4) ; éq. moment en O

$$\overrightarrow{F_{6\to 3}} = F_{63}\,\overrightarrow{u_6}$$

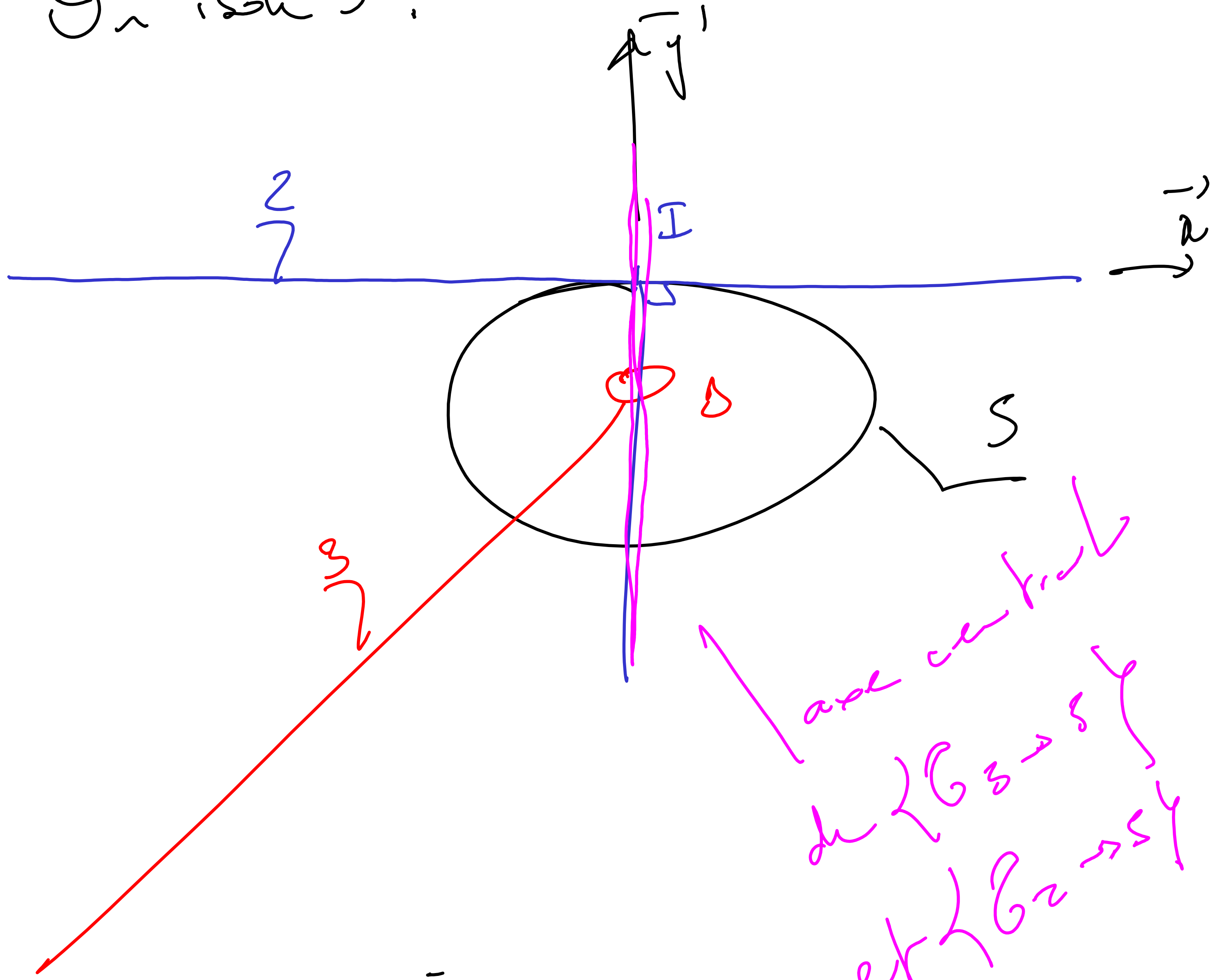


$$-P\ell - \sin\beta\, F_{63}\,\mu = 0$$



F_{zp}
$P/2$
P
$P/2$
ρ
ρ
ρ
ρ
$90°$

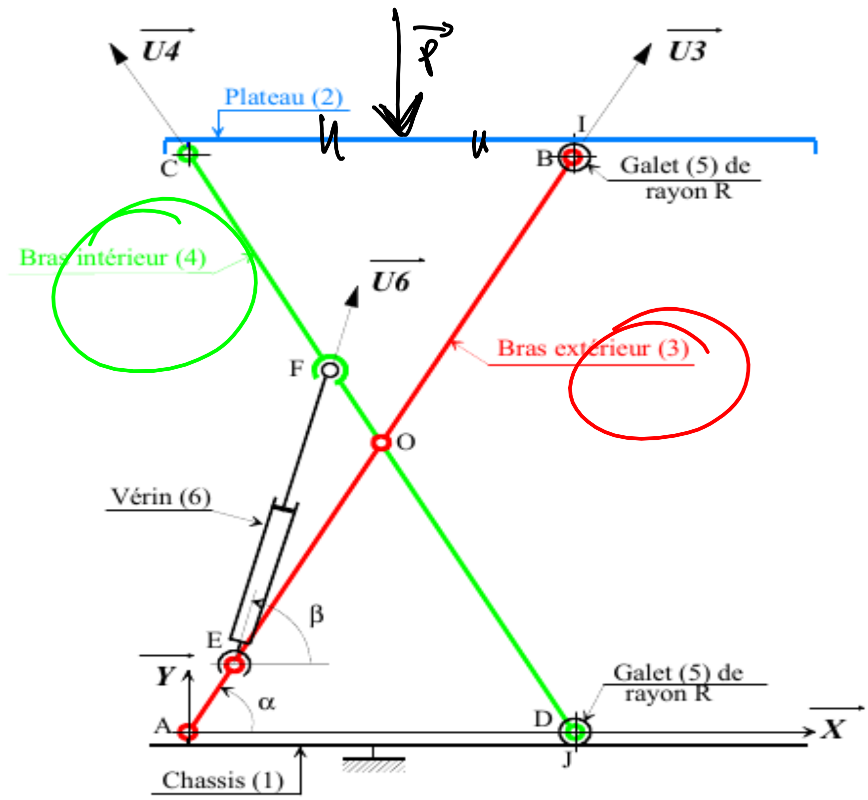
On isole S.



S soumis à :

- L sphère-plan de normale $(IB) = (I, \vec{y}')$ avec 2 (glisser)
- L pivot d'axe $(B, \vec{z})$ avec 3. (glisseur en B)

par th. d'un solide soumis à 2 glisseurs



1) solides soumis à 2 glisseurs : 5, 5'

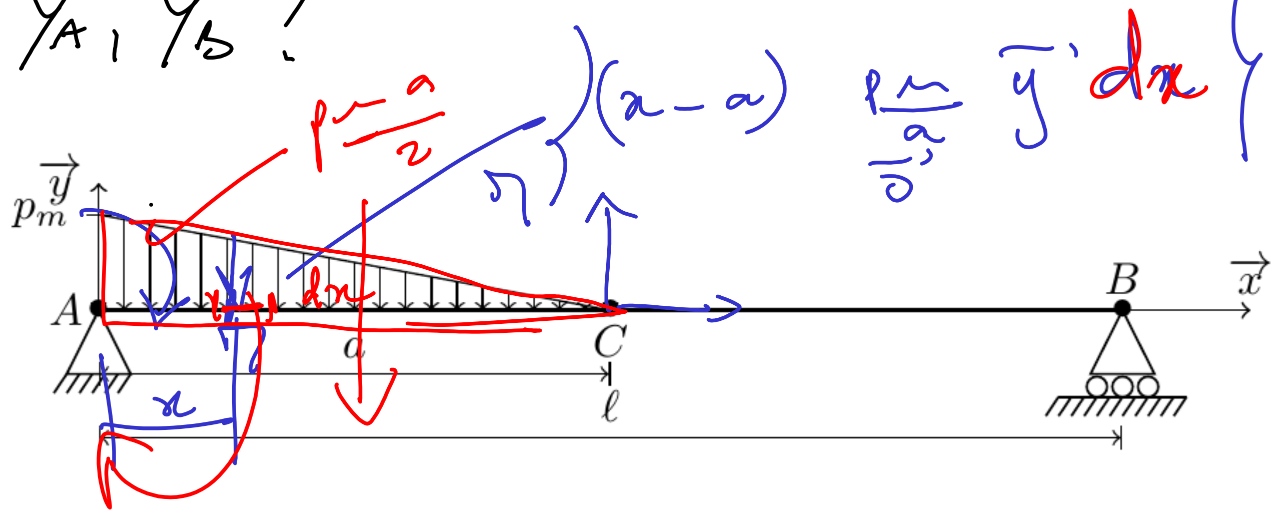
2) systèmes ——————— : 6

3) solides ——— 3 glisseurs : 2

4) systèmes ———————

{2, 3, 4, 5, 5', 6}

Y_A, Y_B ?



$$\vec{dM_A} = +\underbrace{x}_{>0}\underbrace{(x-a)}_{<0}\frac{p_m}{a}\,dx\,\vec{z}$$

$$\vec{R} = \int_0^a (x-a)\frac{p_m}{a}\,\vec{y}\,dx$$

$$= \left[\frac{(x-a)^2}{2}\right]_0^a \frac{p_m}{a}\,\vec{y}$$

$$= -p_m\frac{a}{2}\,\vec{y}$$

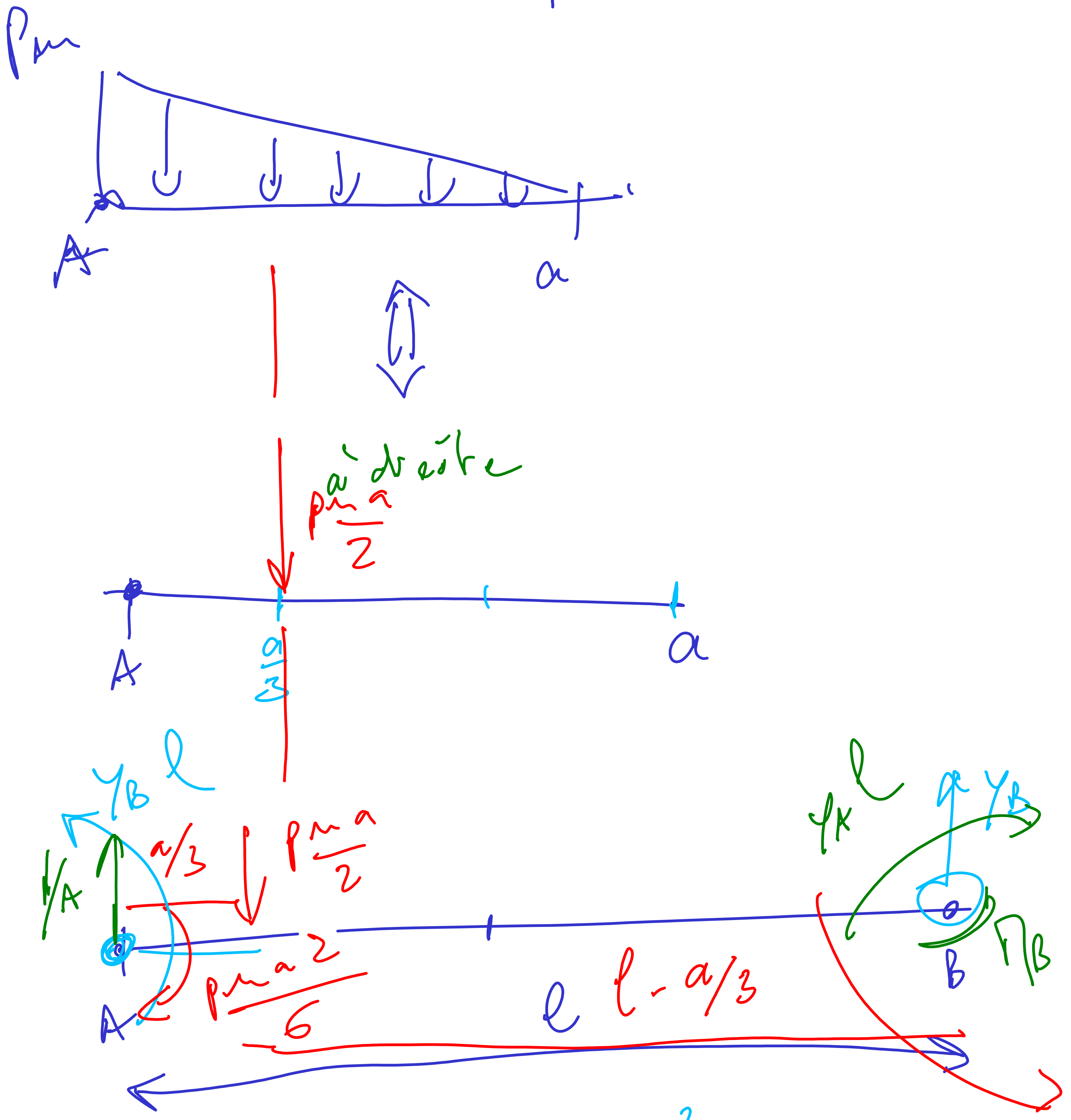
$$\vec{M_A} = \int_0^a +x(x-a)\frac{p_m}{a}\,dx\,\vec{z}$$

$$= \left[-a\frac{x^2}{2}+\frac{x^3}{3}\right]_0^a \frac{p_m}{a}\,\vec{z}$$

$$\Gamma_A' = -\frac{a^2}{6}\, p_m\, \bar{z}' = -p_m \frac{a}{2}\,\frac{a}{3}\,\bar{z}'$$

m^2

$N.m^{-1}$



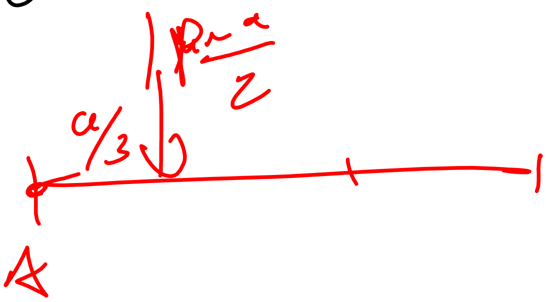
Γ_A'

$$Y_B = p_m \frac{a^2}{6\ell}$$

$$Y_A = \frac{p_m a (3\ell - a)}{6\ell} = p_m\frac{a}{2} - \frac{p_m a^2}{6\ell}$$

1) An élémentaire

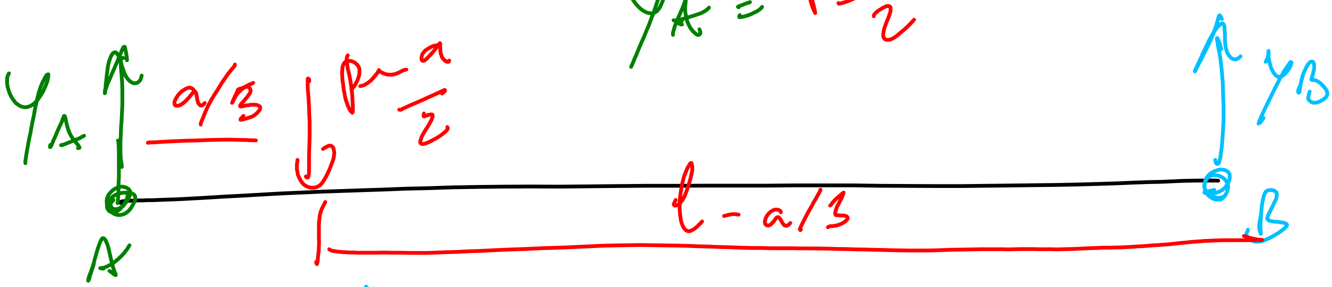
2) An globale en A



3) Statique 2 inc $\longrightarrow$ 2 eq $\left| \begin{array}{l} \vec{R}\cdot\vec{y} \\ \mathcal{M}_A \end{array} \right.$

Y_A Y_B

$Y_A = p_m \frac{a}{2} - Y_B$

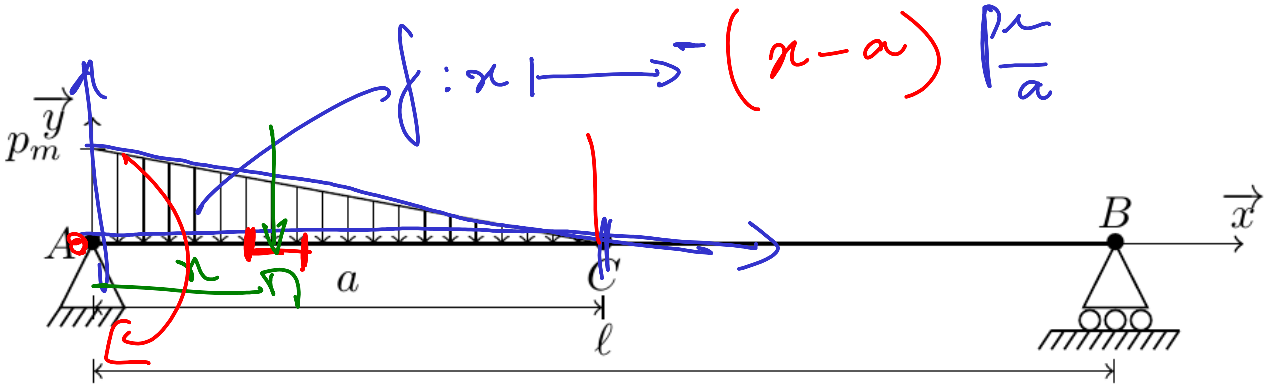


eq. du moment en A =

$$Y_B\, l - p_m \frac{a^2}{6} = 0 \Rightarrow Y_B$$

Eq. du moment en B

$$-Y_A\, l + p_m \frac{a}{2}\left(l - \frac{a}{3}\right) = 0 \Rightarrow Y_A$$



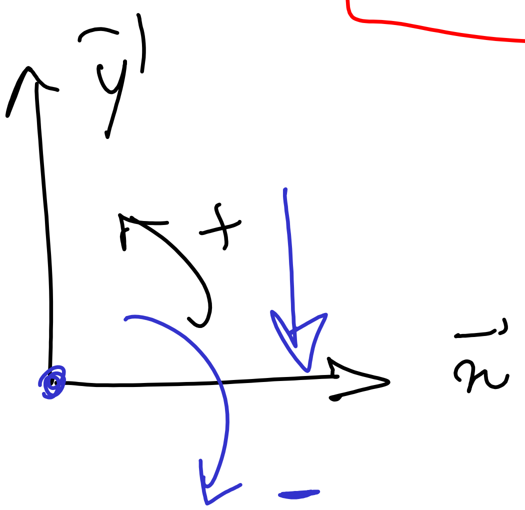
$$\overrightarrow{dF} = \underbrace{(x-a)\,\frac{p_m}{a}}\,\vec{y}\;dx$$

$$\forall x \in [0,a],\ (x-a) \leq 0$$

$$\overrightarrow{d\Pi_A} = \cancel{\overrightarrow{A\Pi_\Omega}} + \overrightarrow{dF}\wedge\overrightarrow{\Omega A}$$

$$= (x-a)\,\frac{p_m}{a}\,dx\,\vec{y}\wedge -x\,\vec{x}$$

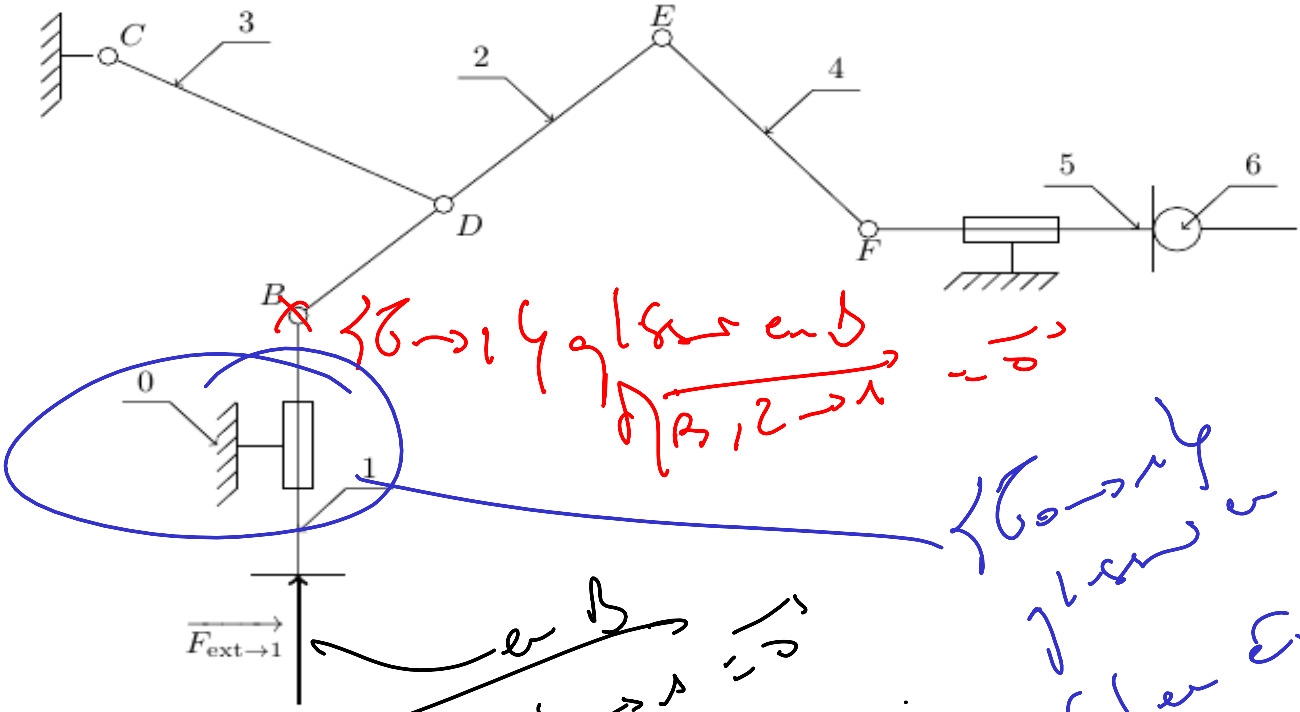
$$= \underbrace{\underbrace{x}_{\geq 0}\,\underbrace{(x-a)}_{\leq 0}}_{\leq 0}\,\frac{p_m}{a}\,dx\,\vec{z}$$



× Montrer que $\{\mathcal{T}_{0\to1}\}$ est un glisseur ?

× Axe central de $\{\mathcal{T}_{1\to2}\}$?

× $F_{5\to6}$?



$\{\mathcal{T}_{2\to1}\}$ glisseur en B

$\overrightarrow{M_{B,2\to1}} = \vec{0}$

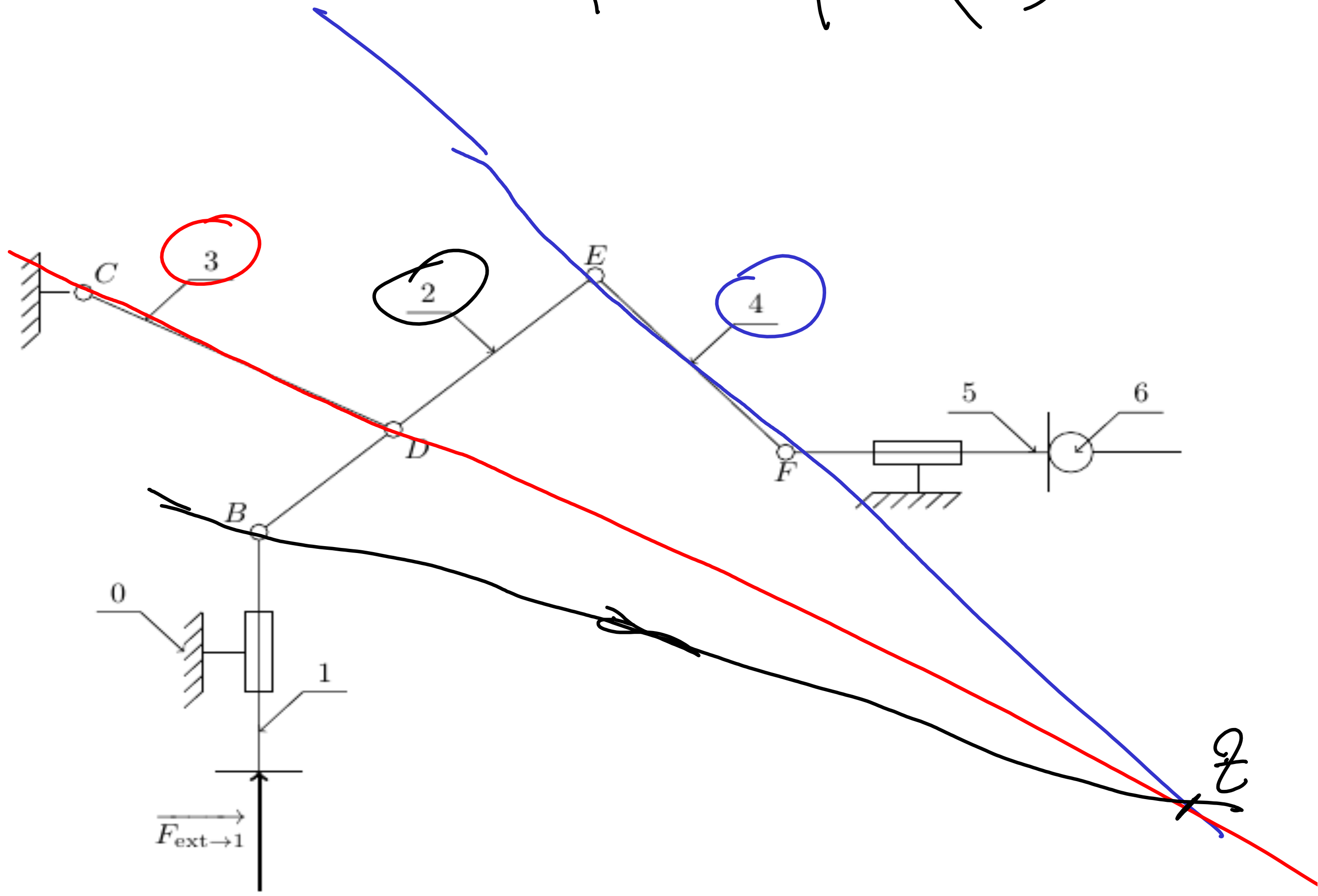
$\{\mathcal{T}_{0\to1}\}$ glisseur en B

en B

$\overrightarrow{M_{B,\text{ext}\to1}} = \vec{0}$

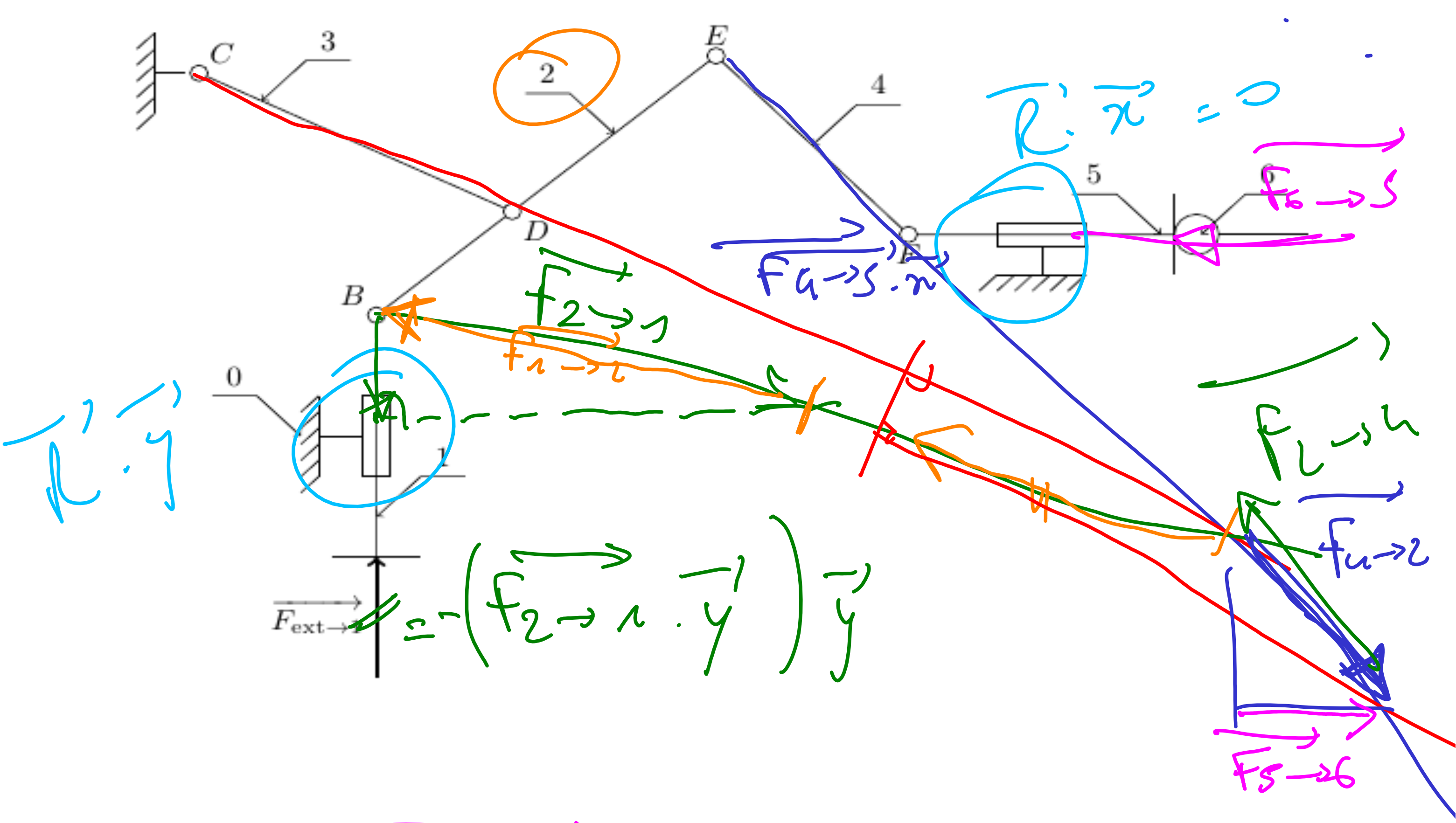
d'où ... (1 en Eq) $\overrightarrow{F_{0\to1}} \neq \vec{0}$, $\overrightarrow{M_{B,0\to1}} = \vec{0}$

× Axe central de $\{\mathcal{T}_{1\to 2}\}$: (BI)

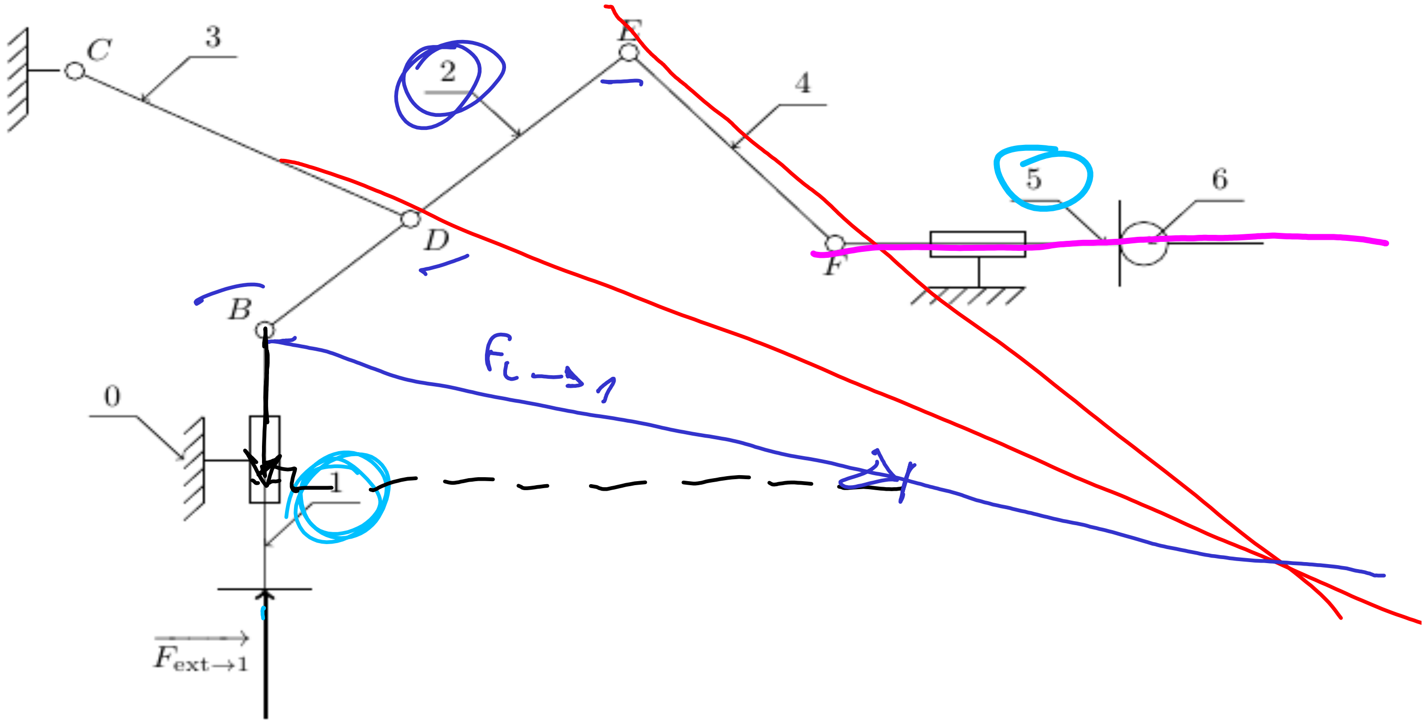


× $F_{5\to 6}$?

$$\overrightarrow{F_{4\to 2}} = \overrightarrow{F_{5\to 4}}$$



$$\overrightarrow{F_{5\to 6}} = \left(\overrightarrow{F_{4\to 5}} \cdot \vec{x}\right)\vec{x}$$



1) isole 4, isole 3 (soumis à 2 glisseurs)

2) isole 2 ⟶ axe central de $\{\mathcal{T}_{2\to 1}\}$

3) isole 1 : $\vec R \cdot \vec y$ (mobilité 1 glissière)

$\vec F_{2\to 1}\cdot\vec y = -\vec F_{ext\to 1}\cdot\vec y$

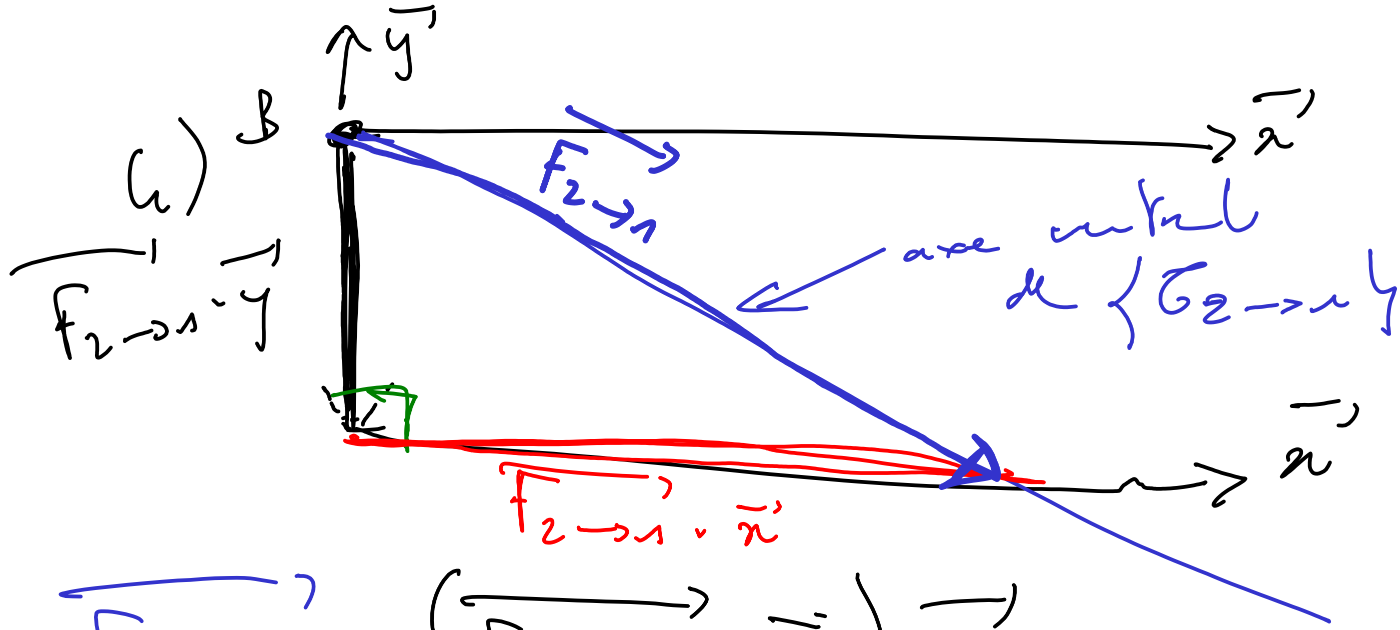
4) reconstruit $\vec F_{2\to 1}$, AR $\vec F_{1\to 2}$

5) isole 2 ⟹ $\vec F_{4\to 2}$

6) isole 5 $\vec R\cdot\vec n$ (mobilité linéaire)

$\vec F_{6\to 5}\cdot\vec n = -\vec F_{4\to 5}\cdot\vec n$

$\vec F_{5\to 6}\cdot\vec n = \vec F_{4\to 5}\cdot\vec n = \vec F_{2\to 4}\cdot\vec n$ projection

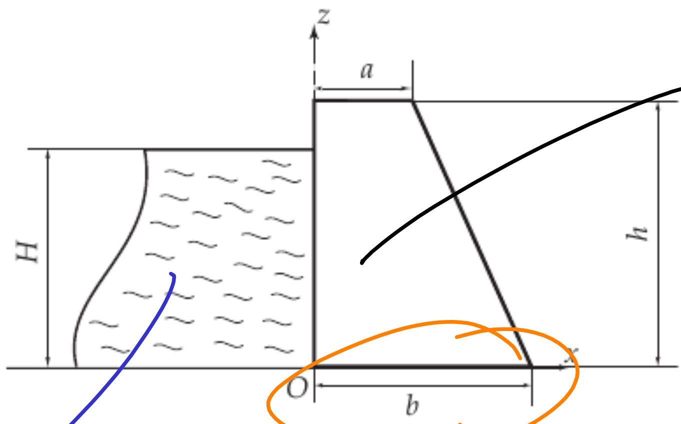


$$\vec{F}_{2\to1} = \left(\vec{F}_{2\to1}\cdot\vec{y}\right)\vec{y} + \underbrace{\left(\vec{F}_{2\to1}\cdot\vec{x}\right)}_{\text{coordonnée}}\vec{x}$$

Barrage poids

très difficile

$\downarrow \vec{g}$



G ?

$\rho_{béton} = 2{,}2 \cdot 10^3 \ kg.m^{-3}$

$\vec{F}_{eau}$?

$\vec{F}_{terre}$?

$\rho_{eau} = 10^3 \ kg.m^{-3}$

basculement ?

Diagrammes de Bode

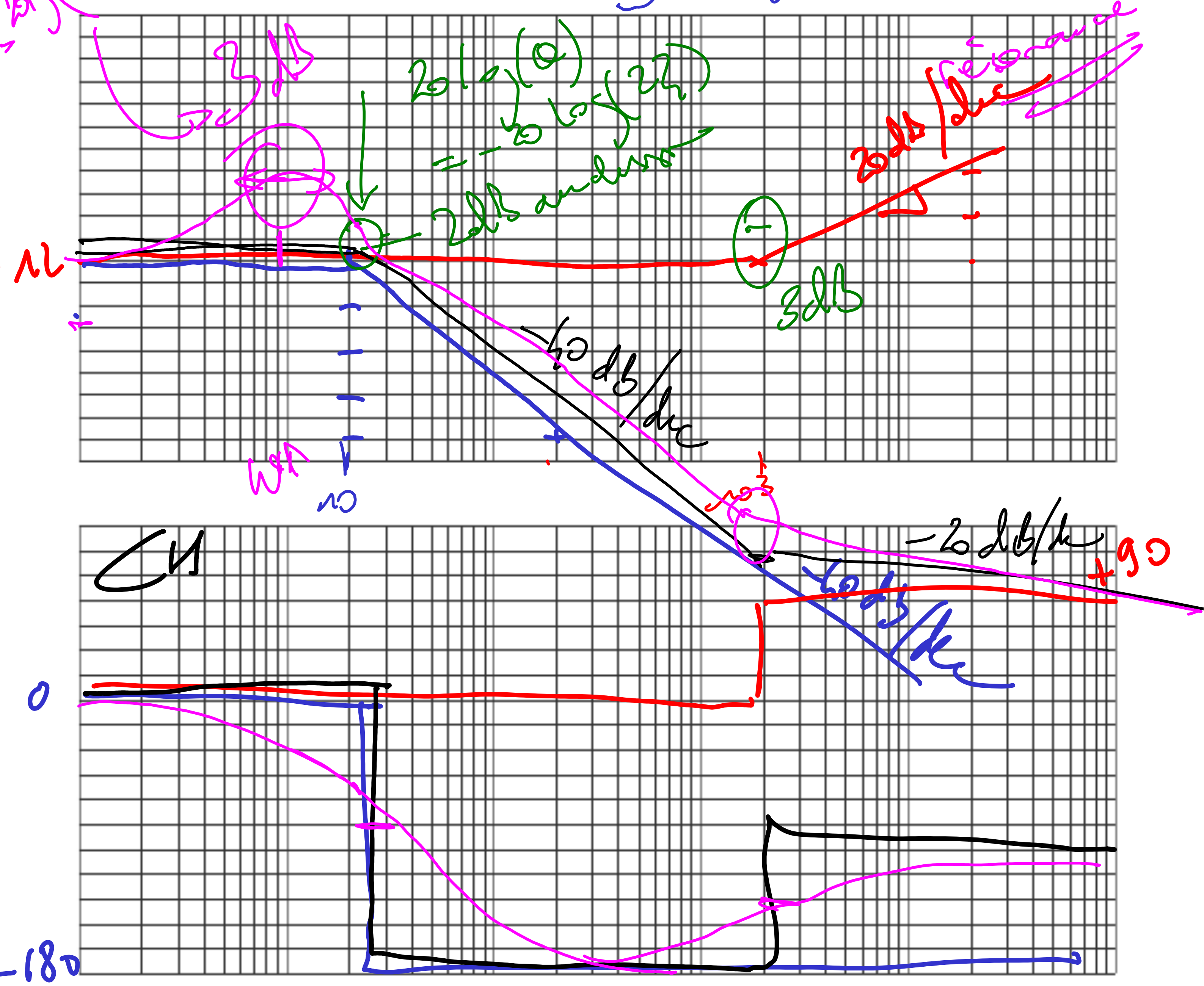
$$H(p) = \frac{4+0,004\,p}{1+0,08\,p+0,01\,p^2} = \frac{4\left(1+\frac{p}{1000}\right)}{\omega}$$

$\omega_0 = 10\ rad.s^{-1}$

$\xi < 1\ ?$

$\frac{2\xi}{\omega_0} = \frac{8}{100} \iff \xi = \frac{4}{10} < \frac{1}{\sqrt{2}}$

$20\log\left(2\xi\sqrt{1-\xi^2}\right)$

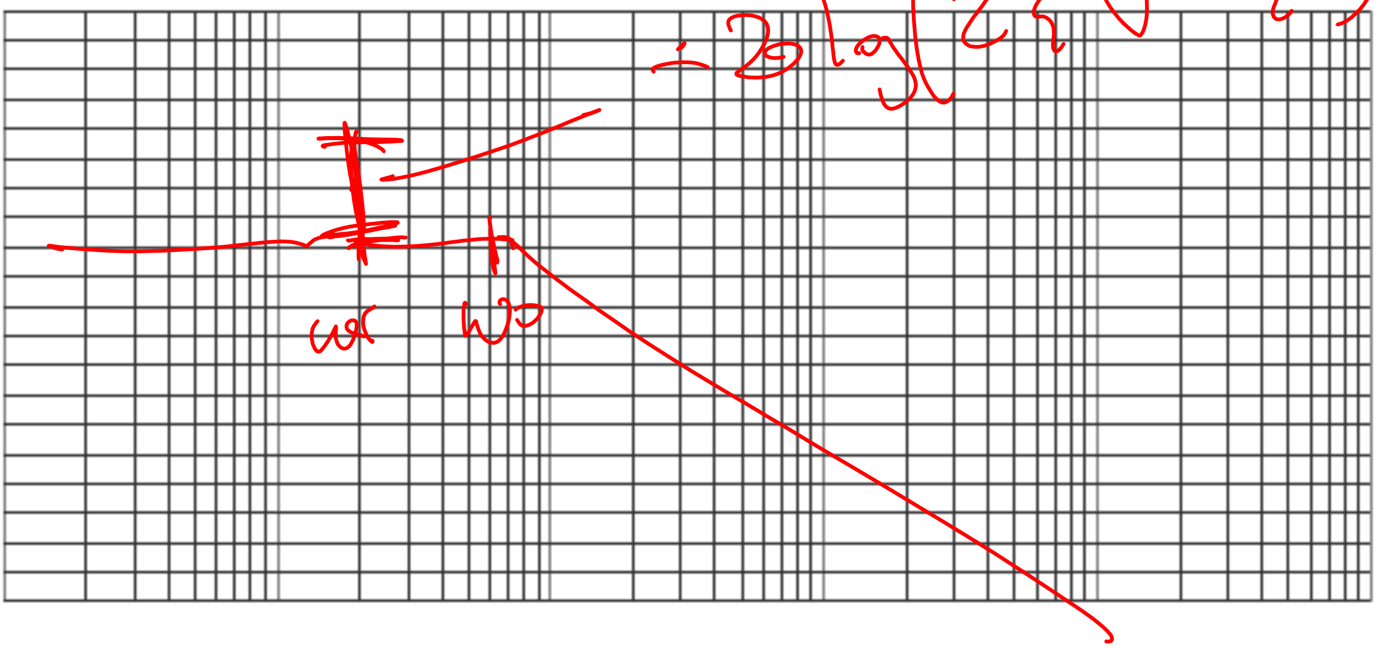


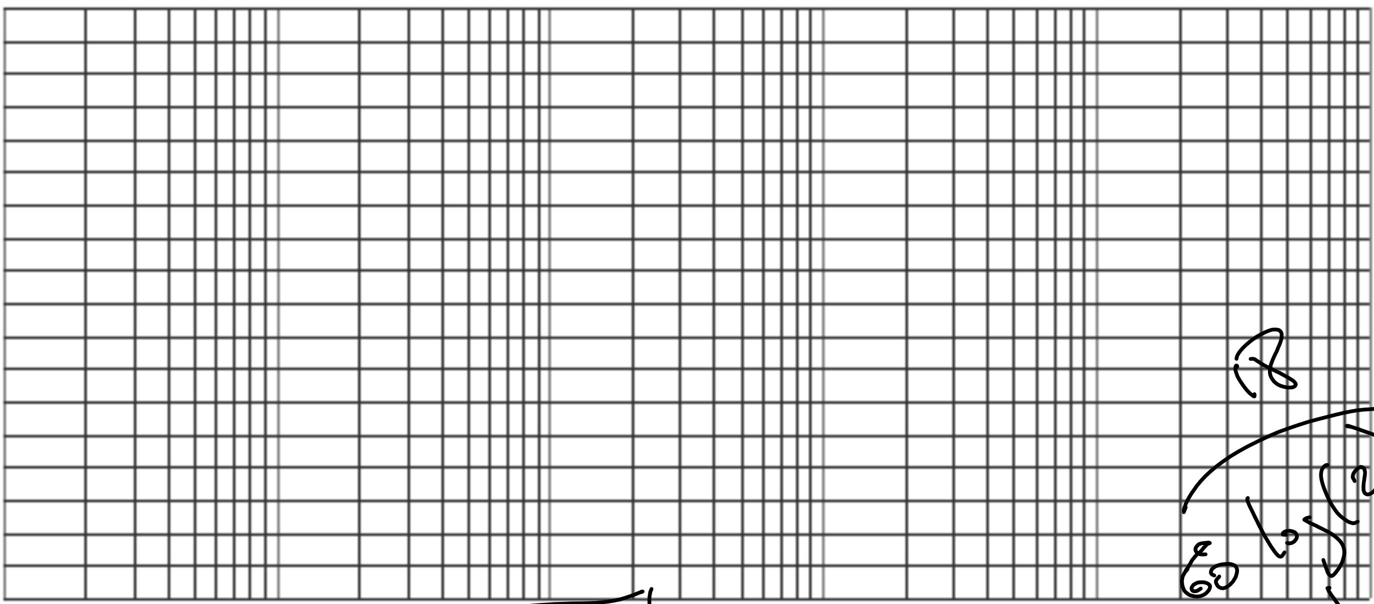
$$\omega_r = \omega_0\underbrace{\sqrt{1-2\xi^2}}_{0,68} = 10\sqrt{2/3} \simeq 8,5\ rad.s^{-1}$$

$$20\log(0,8) = \underbrace{60\log(2)}_{18} - 20 \simeq -2$$

$$|H(j\omega_r)|_{dB} = 20\log\left(\frac{K}{\underbrace{2\zeta\sqrt{1-\zeta^2}}}\right)$$

"surtension"





$\zeta = 0,4$

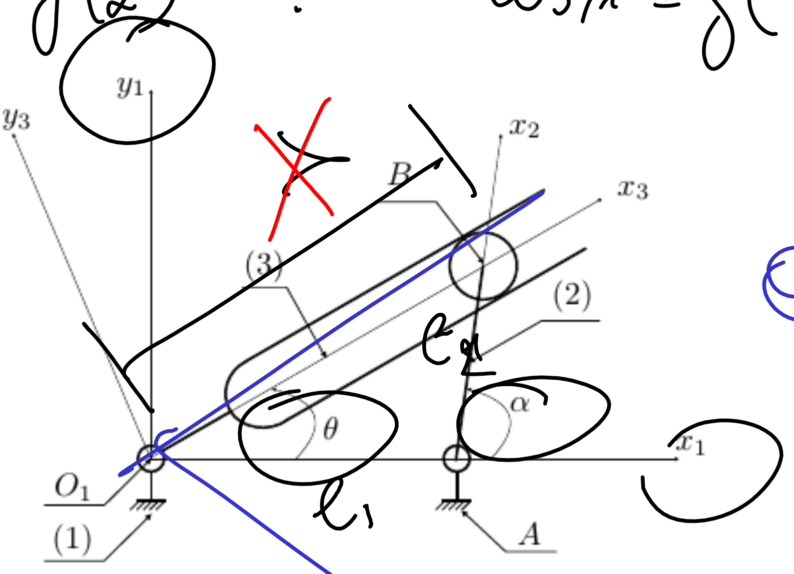
$2\zeta\underbrace{\sqrt{1-\zeta^2}}$

$0,8 \quad \sqrt{0,84}\,) \approx 0,9$

$)\,0,72 \quad < 20\log 8$

$\underbrace{20\log(10)}_{20} - \underbrace{20\log(7)}$

1) $\theta = f(\alpha)$? $\omega_{3/1} = g(\omega_{2/1})$?



$\theta \in [-\pi/2, \pi/2]$

1) par fermeture géométrique, on a :

$\overrightarrow{O_1B} = \overrightarrow{O_1A} + \overrightarrow{AB}$

$\lambda \vec{x_3} = \ell_1 \vec{x_1} + \ell_2 \vec{x_2}$

$/\vec{y_1}$: $\lambda \sin\theta = \ell_2 \sin\alpha$

$/\vec{x_1}$: $\lambda \cos\theta = \ell_1 + \ell_2 \cos\alpha$

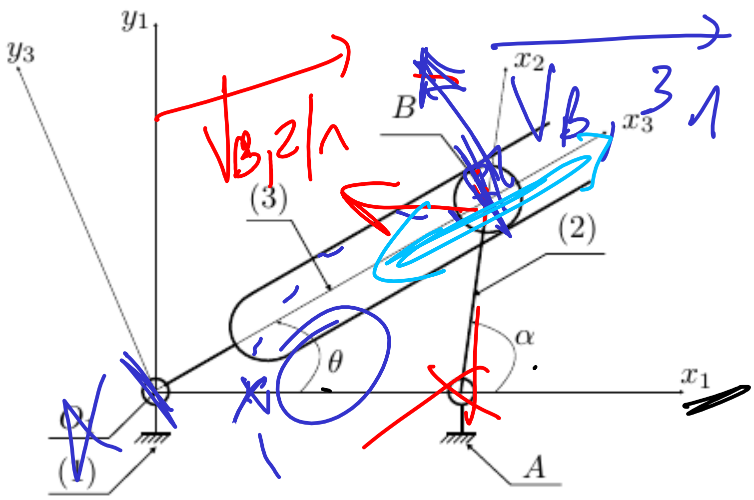
$\Rightarrow \tan\theta = \dfrac{\ell_2 \sin\alpha}{\ell_1 + \ell_2\cos\alpha}$

$$\boxed{\theta = \operatorname{Arctan}\left(\frac{\ell_2 \sin\alpha}{\ell_1 + \ell_2 \cos\alpha}\right) \; [2\pi]}$$

2) $\omega_{3/1} = f(\omega_{2/1})$?

$\omega_{3/1} = \dot{\theta}$

$\omega_{2/1} = \dot{\alpha}$



~~O_1~~, ~~A~~, $\boxed{B}$

Par composition des vitesses au point B,

on a :

$$\vec{V}_{B,2/1} - \cancel{\vec{0}} = \vec{V}_{B,3/1} - \vec{V}_{B,2/1}$$

FAUX

avec le changement de point :

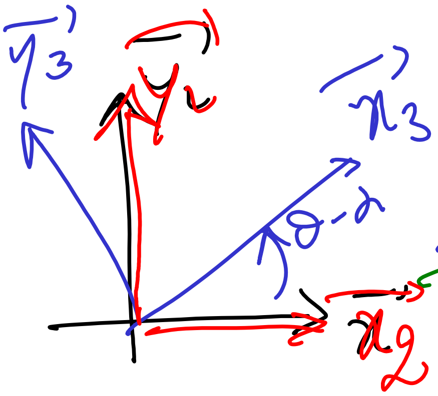
$$\vec{V}_{B,3/1} = \cancel{\vec{V}_{O_1,3/1}} + \vec{\Omega}_{3/1} \wedge \vec{O_1B}$$

$$= \lambda\, \omega_{3/1}\, \vec{y_3},$$

$$\vec{V}_{B,2/1} = \vec{V}_{A,2/1} + \vec{\Omega}_{2/1} \wedge \vec{AB}$$

$$= l_2\, \omega_{2/1}\, \vec{y_2}.$$

d'où : $\vec{0} = \lambda\, \omega_{3/1}\, \vec{y_3} - l_2\, \omega_{2/1}\, \vec{y_2}$



b_1	b_2	b_c
$\cancel{2+2}$	2	2

$\sin(\theta-\alpha) = 0$

$\neq 0$

vrai $\forall\, \omega_{21} \Rightarrow \neq 0$

$/\vec{x_3}$: $-l_2\, \omega_{21} \sin(\alpha-\theta) = \vec{0}$

$/\vec{y_3}$: $\lambda\, \omega_{3/1} - l_2\, \omega_{2/1} \cos(\theta-\alpha) = 0$

$\vec{V}_{B,3/2} \cdot \vec{y_3}$

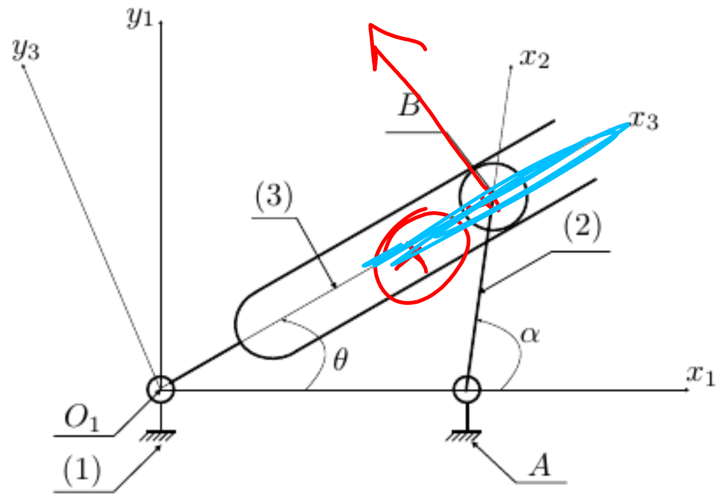
d'où

$$\boxed{\omega_{3/1} = \left(\frac{l_2 \cos(\theta-\alpha)}{\lambda}\right) \omega_{21}}$$

cinématiquement linéaire

géométriquement non linéaire

~~$\sin(\theta-\alpha) = 0 \Leftrightarrow \theta-\alpha \equiv 0\ [\pi]$~~ étrange non ?



Δ c'est $\boxed{\overrightarrow{V_{B,3/2}} \cdot \vec{y_3} = 0}$

$$\boxed{\overrightarrow{V_{B,3/2}} \cdot \vec{x_3} = -\dot{\lambda} \neq 0}$$

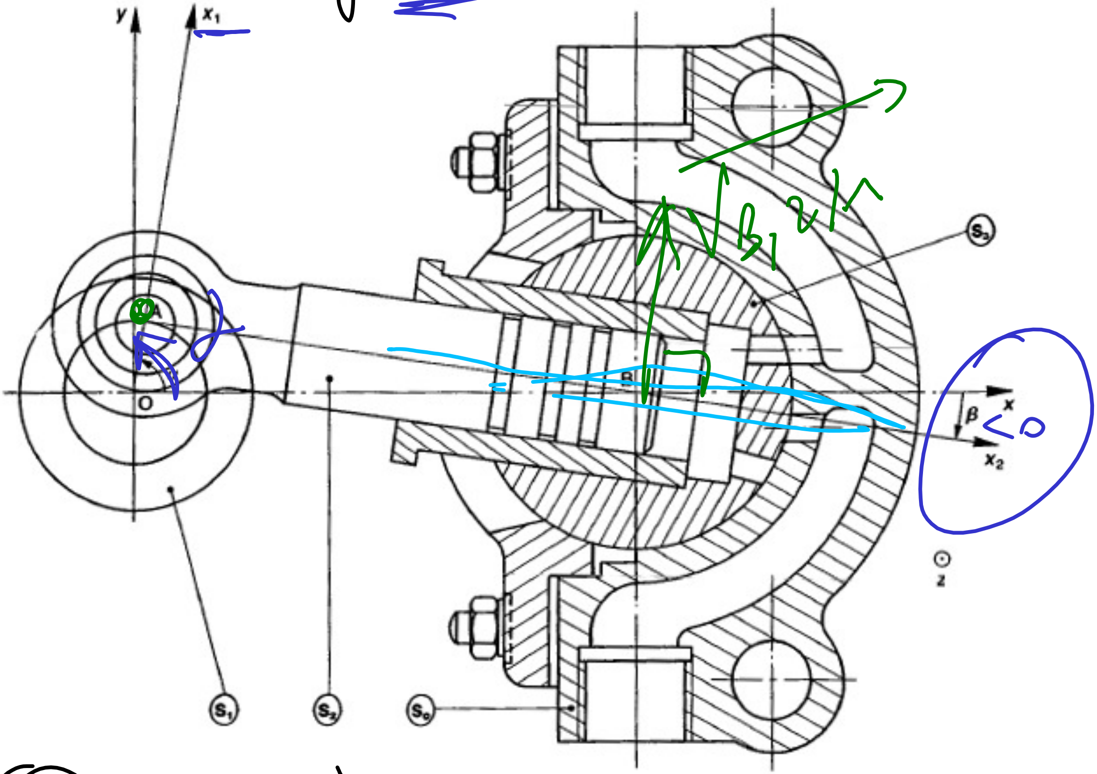
$$\overrightarrow{V_{B/3}} = \left.\frac{d\overrightarrow{O_1B}}{dt}\right|_3 = \dot{\lambda}\,\vec{x_3}$$

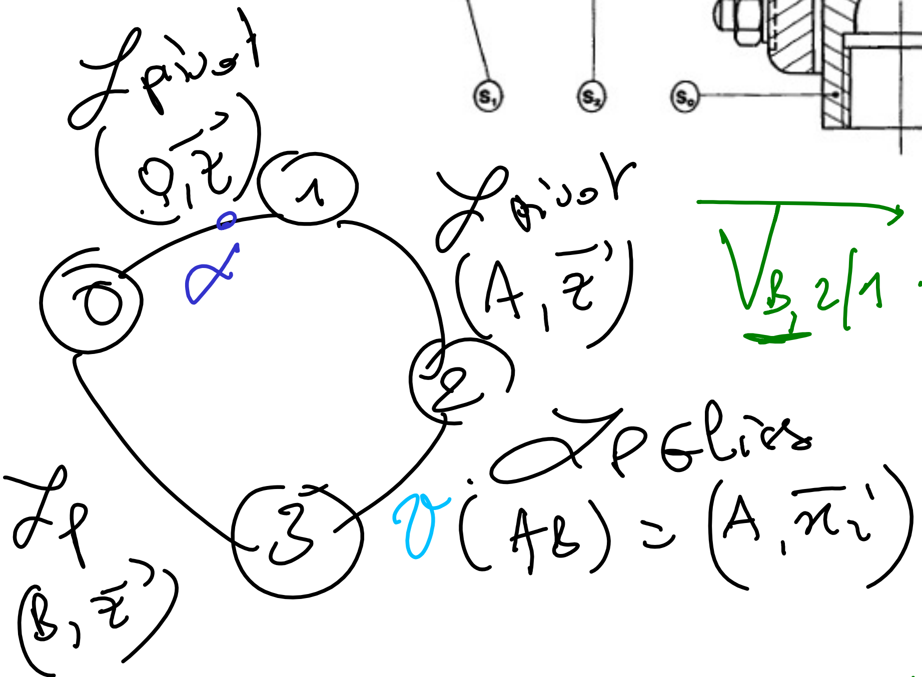
$$\overrightarrow{V_{B/3}} = \overrightarrow{V_{B,2/3}} = -\overrightarrow{V_{B,3/2}}$$

$$\overrightarrow{V_{B,3/2}} \cdot \vec{y_3} = 0$$

$$= \overrightarrow{V_{B,3/1}} \cdot \vec{y_3} - \overrightarrow{V_{B,2/1}} \cdot \vec{y_3}$$

$v = \overrightarrow{V_{B,2/3}} \cdot \vec{x_2} = f(\dot{\alpha})$





$\overrightarrow{V_{B,2/1}} \cdot \overrightarrow{AB} = 0$

indication : th d'équiprojectivité $\{\mathcal{V}_{2/1}\}$ le long de AB

$\cancel{\overrightarrow{V_{B,2/1}} \cdot \vec{x_2}}$

$+ \overrightarrow{V_{B,1/0}} \cdot \vec{x_2}$

$+ \overrightarrow{V_{B,3/2}} \cdot \vec{x_2}$ $= -v$

$= \cancel{\overrightarrow{V_{B,3/0}} \cdot \vec{x_2}}$

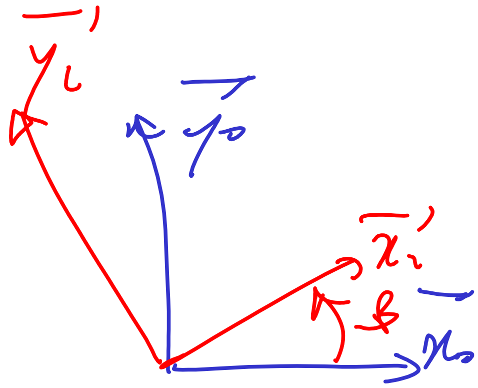
d'où $v = \overrightarrow{V_{B,1/0}} \cdot \vec{x_2}$

par changement de point, il vient :

$$\vec{V}_{B,1/0} = \cancel{\vec{V}_{O,1/0}} + \vec{\Omega}_{1/0} \wedge \vec{OB}$$

$$= \dot\alpha \, \vec{z} \wedge L \, \vec{x_0}$$

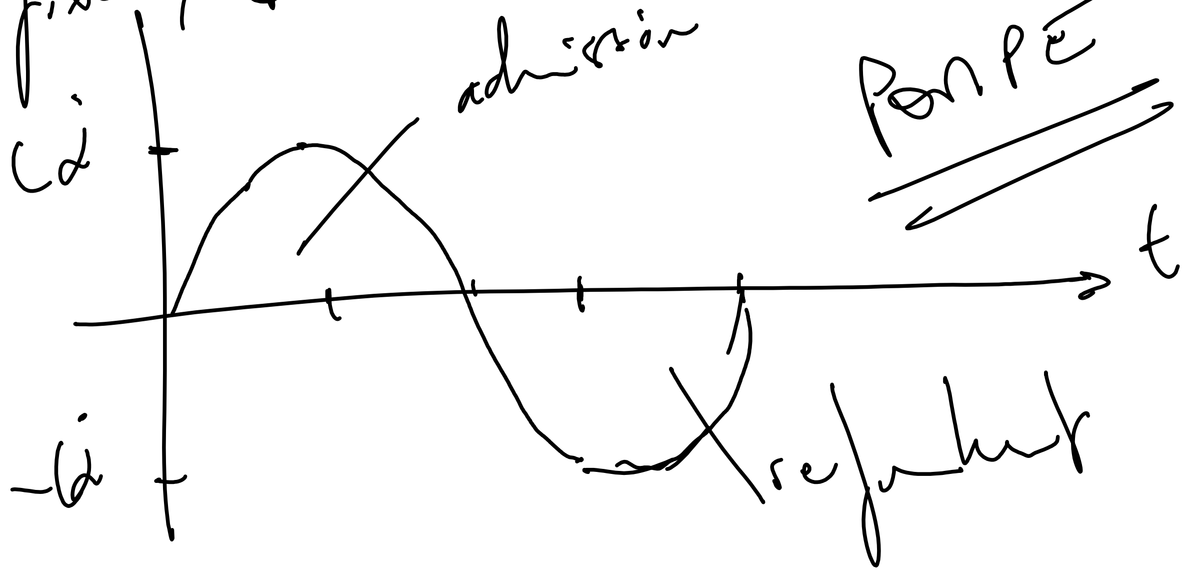
$$= L\dot\alpha \, \vec{y_0}$$



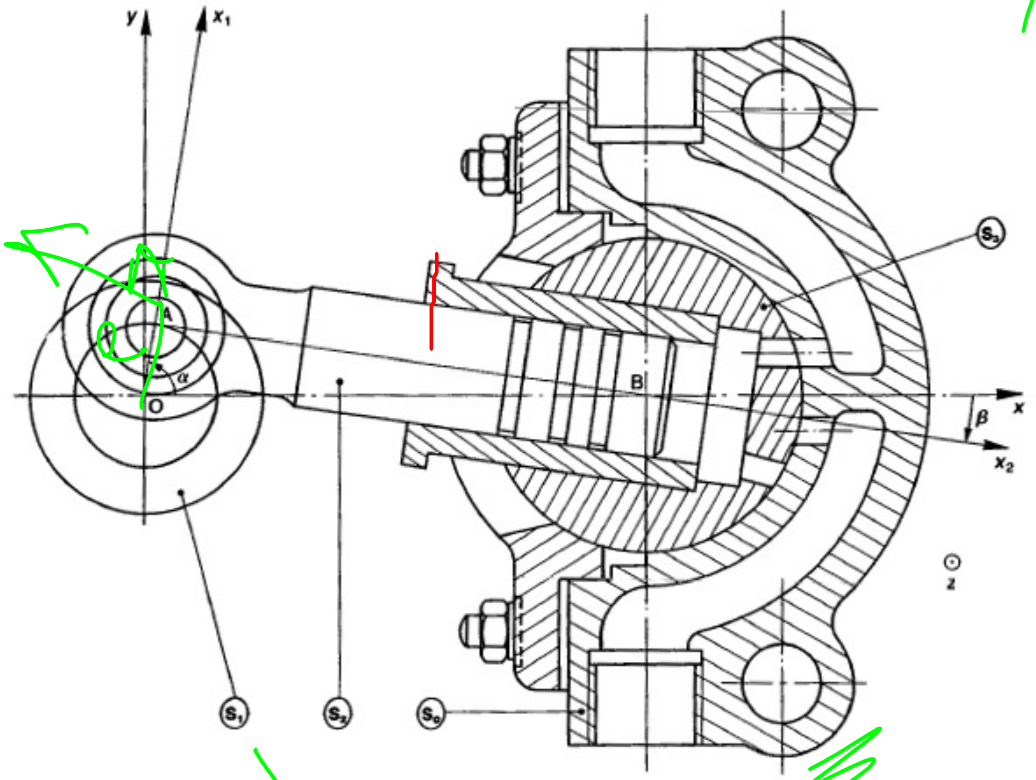
$$\vec{V}_{B,1/0} \cdot \vec{x_1} = L\dot\alpha \sin\beta$$

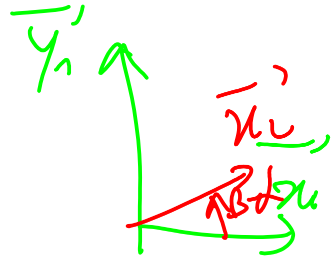
d'où $\boxed{V = (L\sin\beta)\dot\alpha}$

$\dot\alpha$ fixé, β varie



POMPE





$$\{\mathcal{V}_{3/0}\} = \{\mathcal{V}_{3/2}\} + \{\mathcal{V}_{2/1}\} + \{\mathcal{V}_{1/0}\}$$

Th Eq. A

Th eq

	A	B
~~0~~		

Th eq AB

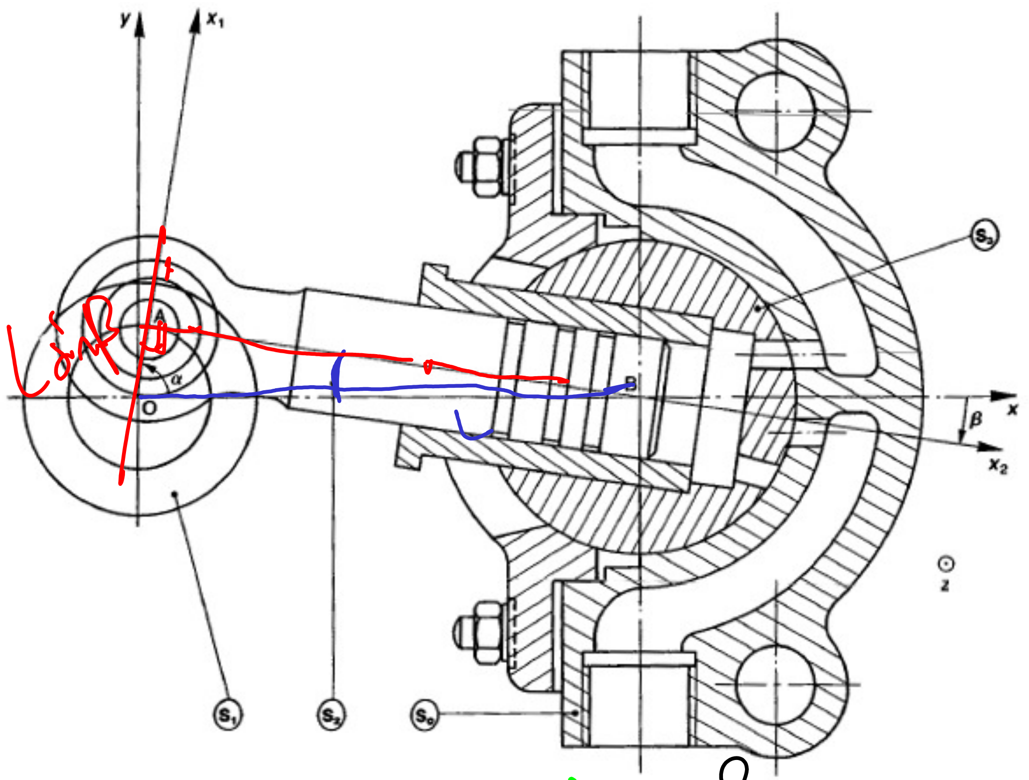
Th Eq AB

$$\vec{V}_{B,2/1}\cdot\vec{AB} = 0$$

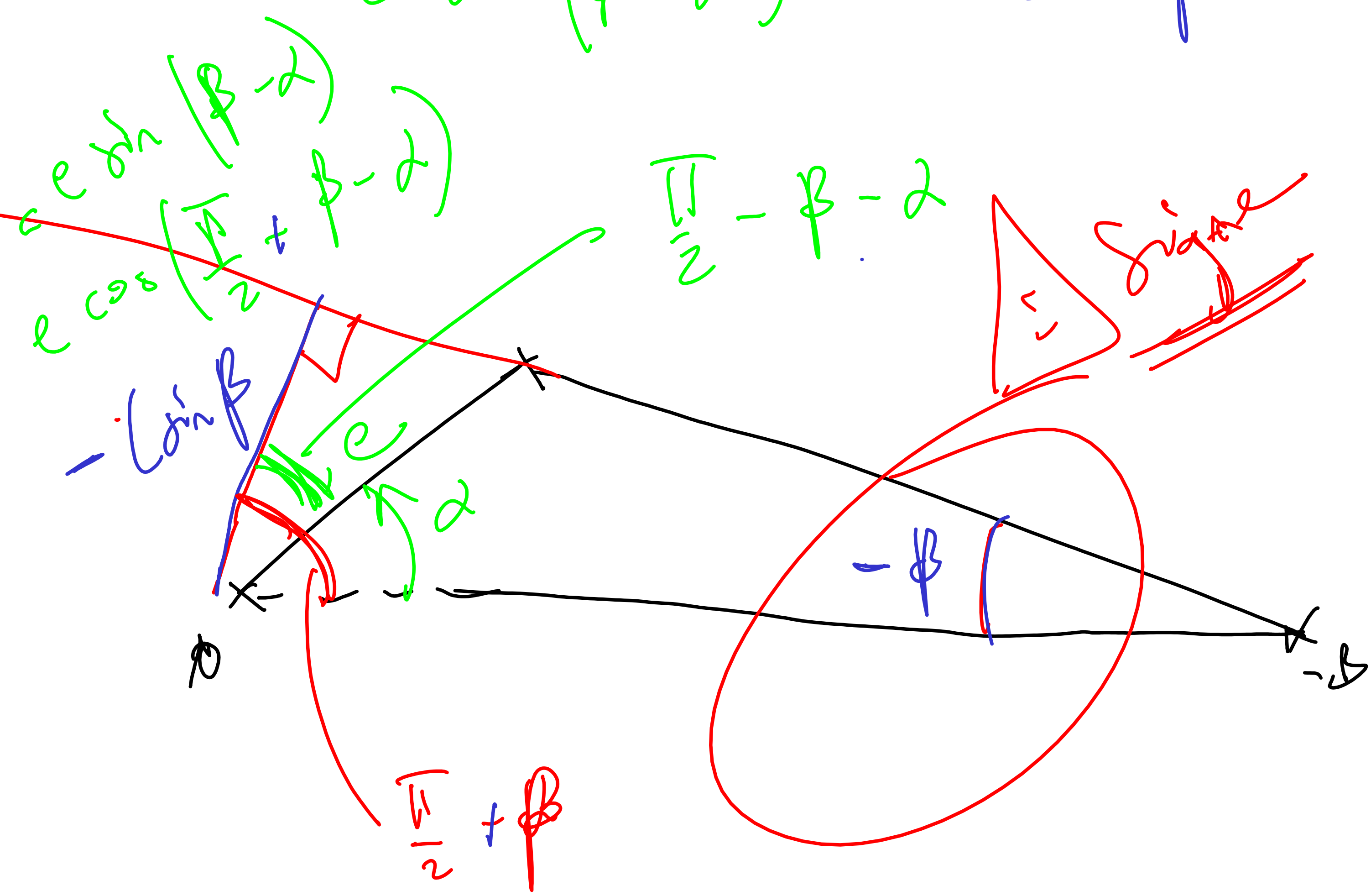
$$\vec{V}_{A,3/0}\cdot\vec{AB} = 0$$

$$\vec{V}_{A,3/2}\cdot\vec{x_2} = -V$$

$$\vec{V}_{A,1/0}\cdot\vec{x_2} = e\dot{\alpha}\sin(\beta-\alpha)$$

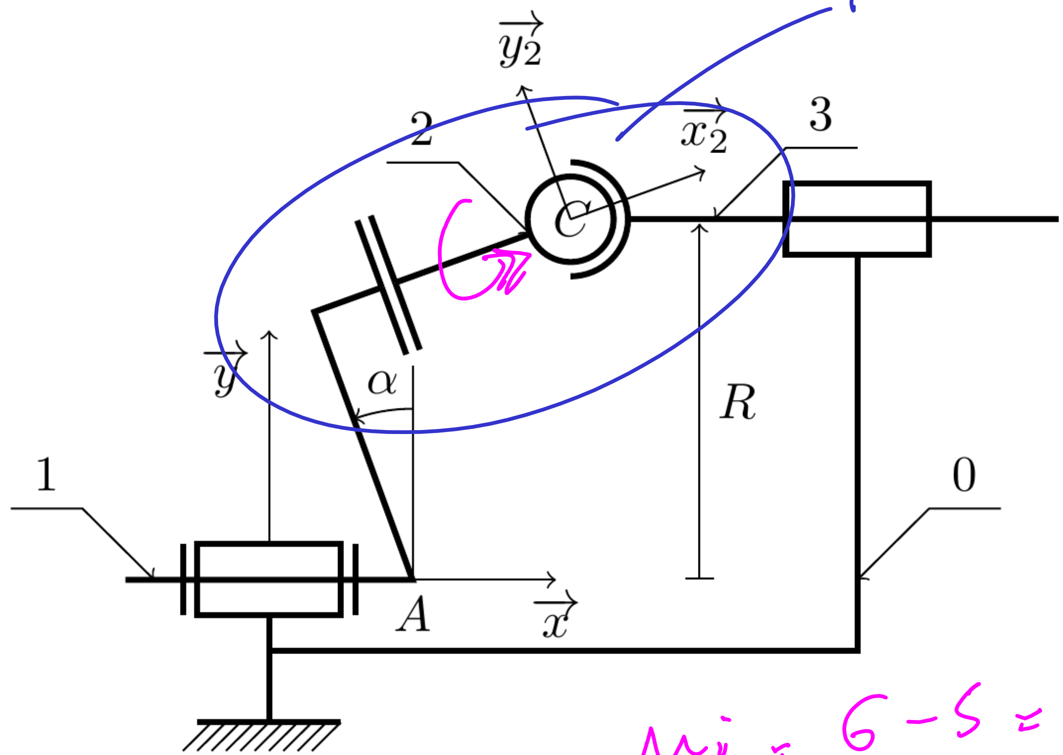


$$e \sin(\beta - \alpha) \overset{?}{=} L \sin\beta$$



$\overrightarrow{V_{C,3/0}} \cdot \vec{x} = f(\omega_{1/0})$

mu, mi ?



$m_i = 6 - 5 = 1$

2 liaisons en série $\dim(\mathcal{V}_{32}) = 5 = m_u$ $\quad \sum \dim = 6$

$$\{\mathcal{V}_{3/1}\} = \{\mathcal{V}_{3/2}\} + \{\mathcal{V}_{2/1}\}$$

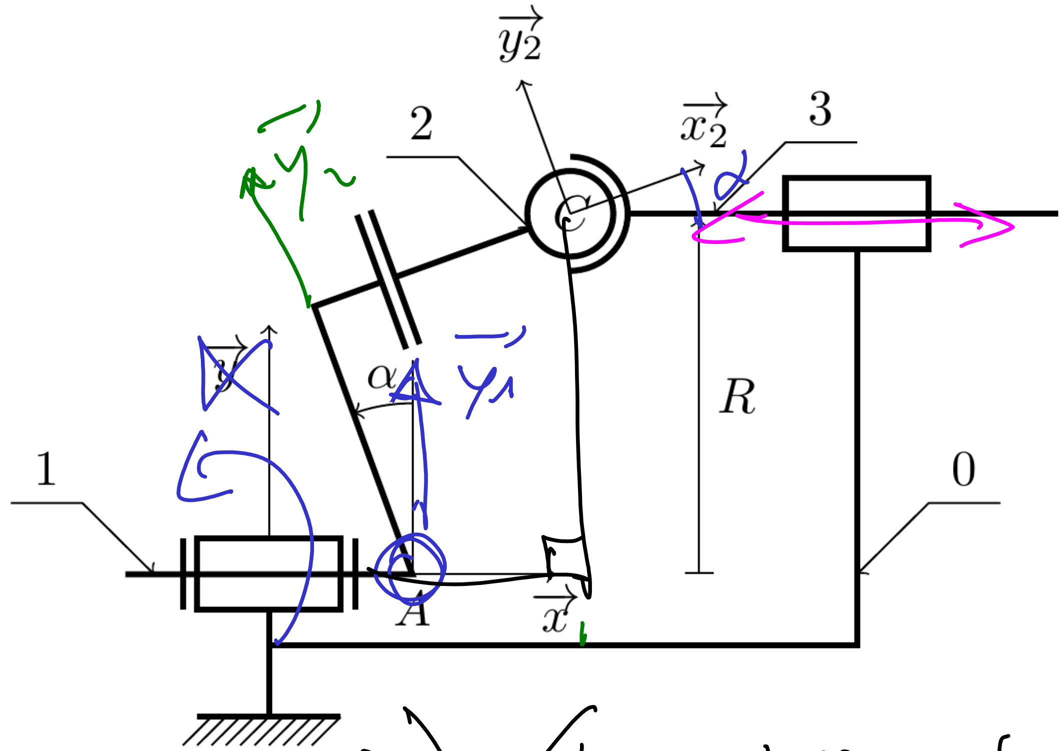
$$= \left\{ \begin{matrix} p_{32}\vec{x_2} + q_{32}\vec{y_2} + r_{32}\vec{z_2} \\ \vec{0} \end{matrix} \right\}_C$$

$$+ \left\{ \begin{matrix} p_{21}\vec{x_2} \\ v_{21}\vec{y_2} + w_{21}\vec{z_2} \end{matrix} \right\}_C$$

$m_i = 1$

$$= \left\{ \begin{matrix} (p_{32} + p_{21})\vec{x_2} + q_{32}\vec{y_2} + r_{32}\vec{z_2} \\ 0\,\vec{x_2} \quad v_{21}\vec{y_2} + w_{21}\vec{z_2} \end{matrix} \right\}_C$$

$$\overrightarrow{V_{C,3/0}} \cdot \vec{x}' = f(\omega_{1/0})$$



$$\{\mathcal{V}_{3/0}\} = \cancel{\{\mathcal{V}_{3/1}\}} + \{\mathcal{V}_{1/0}\}$$

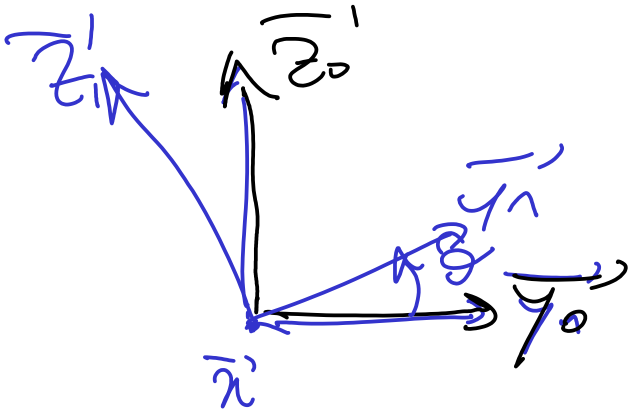
~~A~~ C

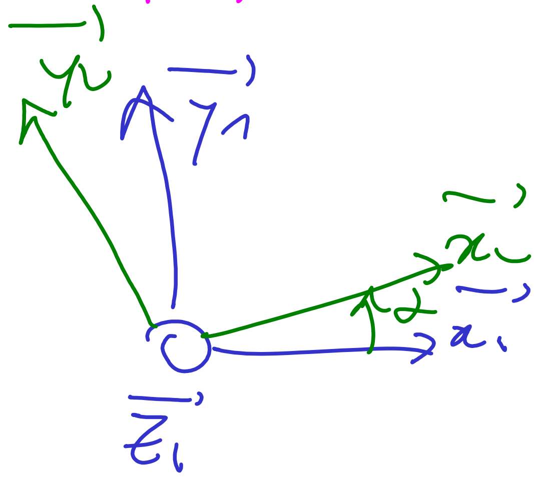
$$\overrightarrow{V_{C,3/1}} \cdot \vec{x_2} = 0$$

d'où :

$$\overrightarrow{V_{C,3/0}} \cdot \vec{x_2} = \overrightarrow{V_{C,1/0}} \cdot \vec{x_2}$$

$$\forall M \in (C,\vec{x}),\ \{\mathcal{V}_{3/0}\} = \left\{ \begin{matrix} p_{30}\,\vec{x} \\ u_{30}\,\vec{x} \end{matrix} \right\}_M$$





$$\vec{V}_{C,3/0} \cdot \vec{x_2} = u_{30} \cos\alpha$$

Par changement de point,

$$\vec{V}_{C,1/0} = \cancel{\vec{V}_{A,1/0}} + \vec{\Omega}_{1/0} \wedge \vec{AC}$$

$$= \omega_{1/0}\,\vec{x} \wedge \left(\cancel{-\vec{x}} + R\,\vec{y_0}\right)$$

$$= R\,\omega_{1/0}\,\vec{z_0}$$

$$\vec{z_0} = \cos\theta\,\vec{z_1} + \sin\theta\,\vec{y_1}$$

$$\vec{z_0} \cdot \vec{x_2} = \sin\theta\,\vec{y_1} \cdot \vec{x_2}$$

$$= \sin\theta \sin\alpha$$

$$\vec{V}_{C,1/0} \cdot \vec{x_2} = R\,\omega_{1/0} \sin\alpha \sin\theta$$

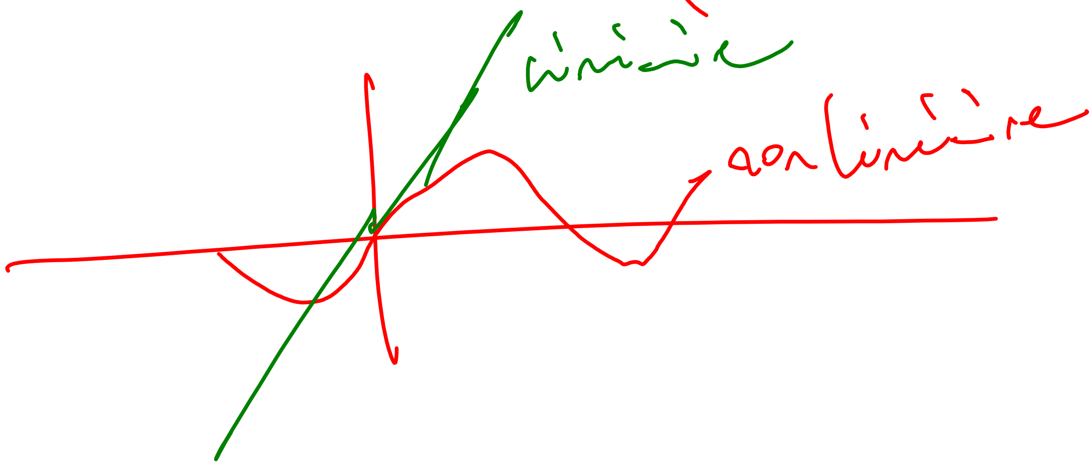
$$\overrightarrow{V_{C,3/0}} \cdot \overrightarrow{x_2}' = u_{30} \cos\alpha$$

$$\overrightarrow{V_{C,1/0}} \cdot \overrightarrow{x_2} = R\,\omega_{1/0} \sin\alpha \sin\theta$$

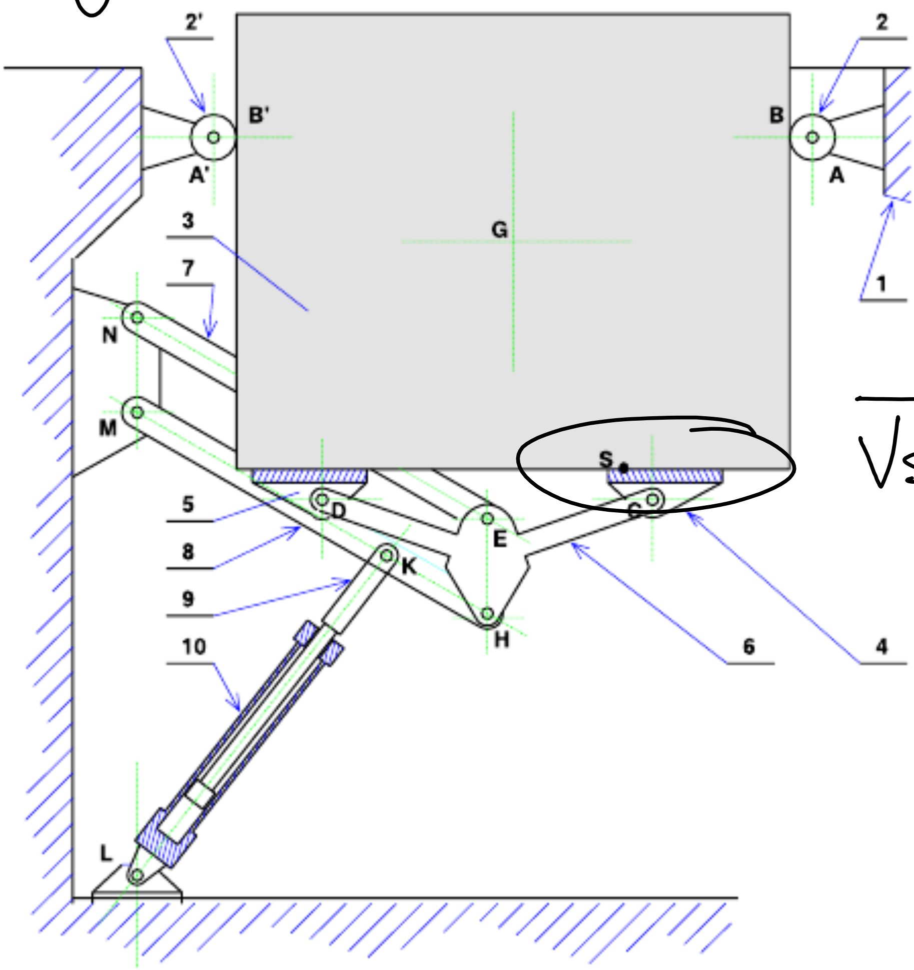
d'où : $\boxed{u_{30} = \left(R \sin\theta \tan\alpha\right)\omega_{1/0}}$

cinématiquement linéaire

géométriquement $\theta \longmapsto \left(R \tan\alpha\right)\sin\theta$



lève-glace



$\overrightarrow{V_{S,4/3}}$?

× $\{V_{6/1}\}$?

× $\overrightarrow{V_{G,3/1}}$ sachant $\|\overrightarrow{V_{K,9/10}}\| = 5\ mm.s^{-1}$