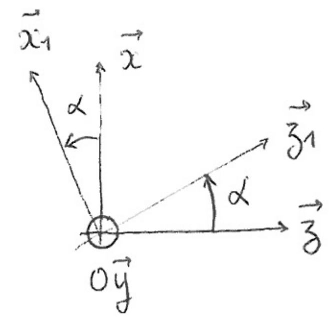
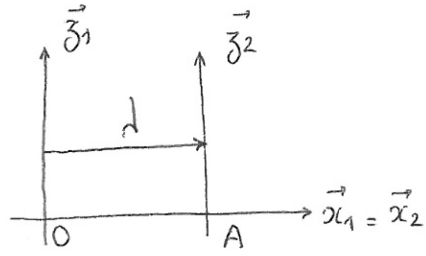
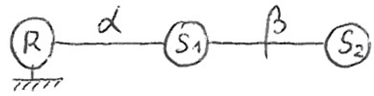
Problème 1 - Elevateur





$\vec{V}_{P,S_2/R}$ et $\vec{\Gamma}_{P,S_2/R}$



$\vec{AP} = a\,\vec{x}_2$

Meth 1

$$\vec{V}_{P,S_2/R} = \left.\frac{d\vec{OP}}{dt}\right|_{/R} = \left.\frac{d}{dt}(\lambda+a)\,\vec{x}_2\right|_{/R} = \dot{\lambda}\,\vec{x}_2 + (\lambda+a)\left.\frac{d\vec{x}_1}{dt}\right|_{/R}$$

$$= \dot{\lambda}\,\vec{x}_2 - (\lambda+a)\,\dot{\alpha}\,\vec{z}_1$$

Meth 2

$$\vec{V}_{P,S_2/R} = \vec{V}_{P,S_2/S_1} + \vec{V}_{P,S_1/R}$$

$\dot{\lambda}\,\vec{x}_2$ (translation)

$\vec{\Omega}_{1/R} \wedge \vec{OP}$ (rotation $/O\vec{y}$)

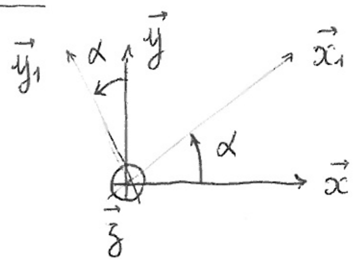
$\dot{\alpha}\,\vec{y} \wedge (\lambda+a)\,\vec{x}_1 = -(\lambda+a)\,\dot{\alpha}\,\vec{z}_1$

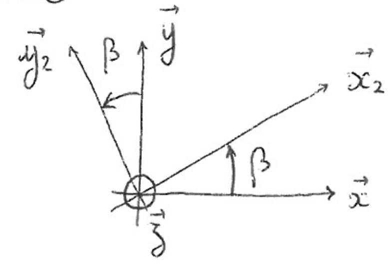
Acceleration

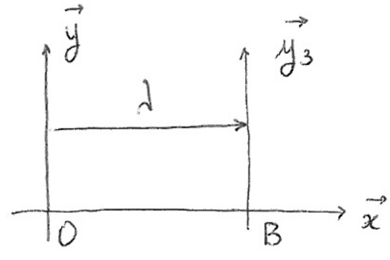
$$\vec{\Gamma}_{P,S_2/R} = \left.\frac{d\vec{V}_{P,S_2/R}}{dt}\right|_{/R} = \underbrace{\ddot{\lambda}\,\vec{x}_2}_{\vec{\Gamma}_{P,S_2/S_1}} \underbrace{- (\lambda+a)\,\ddot{\alpha}\,\vec{z}_1 - (\lambda+a)\,\dot{\alpha}^2\,\vec{x}_1}_{\vec{\Gamma}_{P,S_1/R}}$$

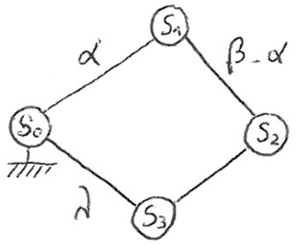
$$\underbrace{-\,2\,\dot{\lambda}\,\dot{\alpha}\,\vec{z}_1}_{\vec{\Gamma}_{coriolis}}$$

Problème 2 . Bielle - manivelle









Problème plan

$\vec{V}_{A,1/R}$

nature du mouvement :

rotation $/ O\vec{z}$

$$\vec{V}_{A,1/R} = \vec{\Omega}_{1/R} \wedge \vec{OA} = \dot{\alpha}\,\vec{z} \wedge a\,\vec{x}_1 = a\,\dot{\alpha}\,\vec{y}_1$$

$\vec{V}_{B,3/R}$ nature du mouvement : translation d'axe $B\vec{x}$

$$\vec{V}_{B,3/R} = \dot{\lambda}\,\vec{x}$$

remarque : relations entre paramètres $\vec{OA} + \vec{AB} = \vec{OB}$

$$a\,\vec{x}_1 + L\,\vec{x}_2 = -h\,\vec{y} + \lambda\,\vec{x}$$

$$\left.\begin{array}{ll} /\vec{x} & a\cos\alpha + L\cos\beta = \lambda \\ /\vec{y} & a\sin\alpha + L\sin\beta = -h \end{array}\right\} \quad \lambda = a\cos\alpha + \sqrt{L^2 - (h + a\sin\alpha)^2}$$

$\vec{V}_{G,2/R}$ nature du mouvement : quelconque

soit calcul direct $\left(\left.\frac{d\,\vec{OG}}{dt}\right|_{/R} \right)$, soit champ des vitesses par A ou par B,

soit composition de mouvement. $\vec{V}_{G,2/R} = \vec{V}_{G,2/3} + \vec{V}_{G,3/R}$

translation

$\dot{\lambda}\,\vec{x}$

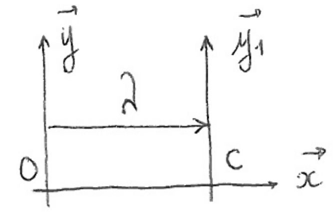
rotation $/ B\vec{z}$

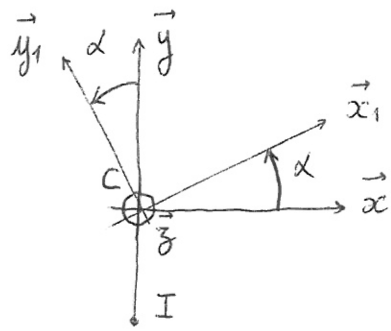
$$\dot{\beta}\,\vec{z} \wedge \vec{BG} = \dot{\beta}\,\vec{z} \wedge \left(-\frac{L}{2}\vec{x}_2\right) = -\frac{L}{2}\dot{\beta}\,\vec{y}_2$$

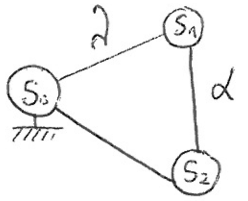
$$\vec{V}_{G,2/R} = \dot{\lambda}\,\vec{x} - \frac{L}{2}\dot{\beta}\,\vec{y}_2 \qquad \text{avec } \dot{\beta} = -\frac{a}{L}\,\frac{\cos\alpha}{\cos\beta}\,\dot{\alpha} \qquad \cos\beta = \frac{\lambda - a\cos\alpha}{L}$$

$$\vec{V}_{G,2/R} = \dot{\lambda}\,\vec{x} + \frac{L\,a\cos\alpha}{(\lambda - a\cos\alpha)}\,\dot{\alpha}\,\vec{y}_2$$

Problème 3. roue sur le sol







Roulement sans glissement en I $\Rightarrow$ relation entre λ et α

$\vec{V}_{I,S_2/R} = \vec{0}$ $\qquad$ $\vec{V}_{C,S_2/R} + \left(\vec{\Omega}_{S_2/R} \wedge \vec{CI}\right) = \vec{0}$

$$\dot{\lambda}\,\vec{x} + \left(\dot{\alpha}\,\vec{z} \wedge -r\vec{y}\right) = \left(\dot{\lambda} + r\dot{\alpha}\right)\vec{x}$$

$$\dot{\lambda} + r\dot{\alpha} = 0$$

$\vec{CG} = e\,\vec{x_1}$

$\vec{V}_{G,S_2/R}$

$\rightarrow$ calcul direct $\left.\dfrac{d\,\vec{OG}}{dt}\right|_R$

$\rightarrow$ champ des vitesses $\vec{V}_{I,S_2/R} + \left(\vec{\Omega}_{S_2/R} \wedge \vec{IG}\right)$

$\downarrow$ composition des vitesses $\vec{V}_{G,S_2/S_1} + \vec{V}_{G,S_1/R}$

Par exemple $\vec{OG} = \lambda\,\vec{x} + e\,\vec{x_1}$

$$\vec{V}_{G,S_2/R} = \dot{\lambda}\,\vec{x} + e\dot{\alpha}\,\vec{y_1} = -r\dot{\alpha}\,\vec{x} + e\dot{\alpha}\,\vec{y_1}$$