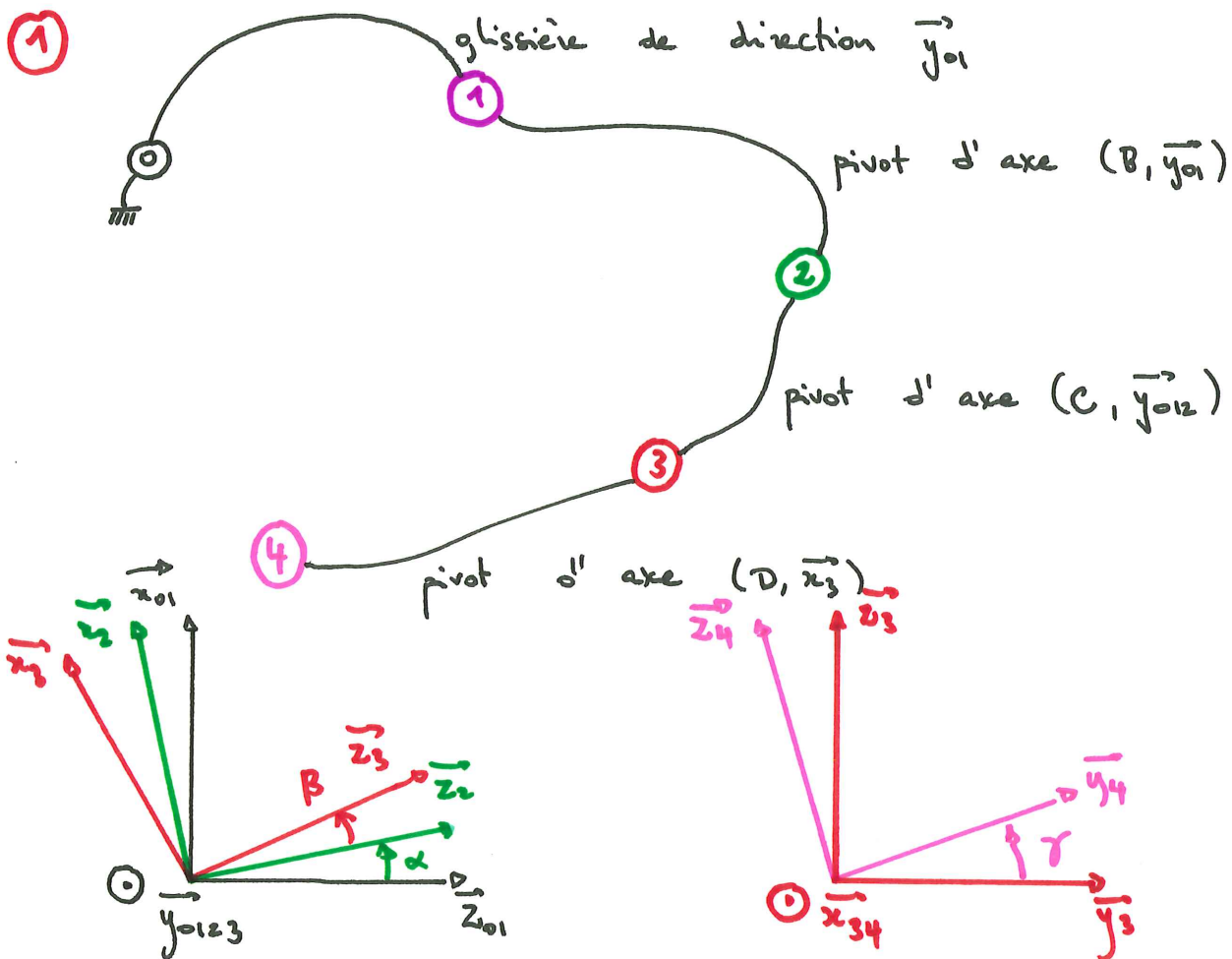


Robot KUKA



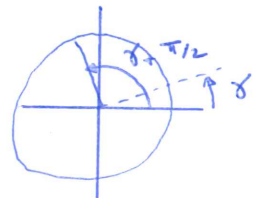
② $J_{PE410} = J_{PE413} + J_{PE312} + J_{PE211} + J_{PE110}$

• $J_{PE413} = J_{DEE413} + \vec{PD} \wedge \vec{\Omega}_{413}$

$= \vec{0} - (d \cdot \vec{z}_{34} + e \cdot \vec{z}_4) \wedge (\dot{\gamma} \cdot \vec{x}_{34})$
 $= -e \cdot \dot{\gamma} \cdot \vec{y}_4$

• $J_{PE312} = J_{CE312} + \vec{PC} \wedge \vec{\Omega}_{312}$

$= \vec{0} - (d \cdot \vec{x}_{34} + e \cdot \vec{z}_4 + c \cdot \vec{x}_{34}) \wedge (\dot{\beta} \cdot \vec{y}_{0123})$
 $= -(c+d) \cdot \dot{\beta} \cdot \vec{z}_3 + e \cdot \dot{\beta} \cdot \sin(\delta + \frac{\pi}{2}) \cdot \vec{x}_{34}$
 $= -(c+d) \cdot \dot{\beta} \cdot \vec{z}_3 + e \cdot \dot{\beta} \cdot \cos \delta \cdot \vec{x}_{34}$



• $J_{PE211} = J_{BE211} + \vec{PB} \wedge \vec{\Omega}_{211}$
 $= \vec{0} - (d \cdot \vec{x}_{34} + e \cdot \vec{z}_4 + c \cdot \vec{x}_{34} + b \cdot \vec{x}_2) \wedge (\dot{\alpha} \cdot \vec{y}_{0123})$
 $= -(c+d) \cdot \dot{\alpha} \cdot \vec{z}_3 + e \cdot \dot{\alpha} \cdot \cos \delta \cdot \vec{x}_{34} - b \cdot \dot{\alpha} \cdot \vec{z}_2$

$$\bullet \vec{J}_{PE1/0} = \dot{p} \cdot \vec{y}_0$$

On a donc :

$$\begin{aligned} \vec{J}_{PE4/0} &= -e \cdot \dot{\gamma} \cdot \vec{y}_4 \\ &\quad - (c+d) \cdot (\dot{\alpha} + \dot{\beta}) \cdot \vec{z}_3 + e \cdot (\dot{\alpha} + \dot{\beta}) \cdot \cos \gamma \cdot \vec{x}_{34} \\ &\quad - b \cdot \dot{\alpha} \cdot \vec{z}_2 \\ &\quad + \dot{p} \cdot \vec{y}_0 \end{aligned}$$

$$\textcircled{3} \text{ On veut que } \vec{J}_{PE4/0} \cdot \vec{x}_{01} = 0$$

$$\text{et } \vec{J}_{PE4/0} \cdot \vec{y}_{01} = 0$$

Avec $\delta = 0$, on a donc :

$$\vec{J}_{PE4/0} \cdot \vec{x}_{01} = \begin{cases} -(c+d) \cdot (\dot{\alpha} + \dot{\beta}) \cdot \sin(\alpha + \beta) + e \cdot (\dot{\alpha} + \dot{\beta}) \cdot \cos(\alpha + \beta) \\ - b \cdot \dot{\alpha} \cdot \sin(\alpha) = 0 \end{cases}$$

$$\vec{J}_{PE4/0} \cdot \vec{y}_{01} = \begin{cases} \dot{p} = 0 \end{cases}$$