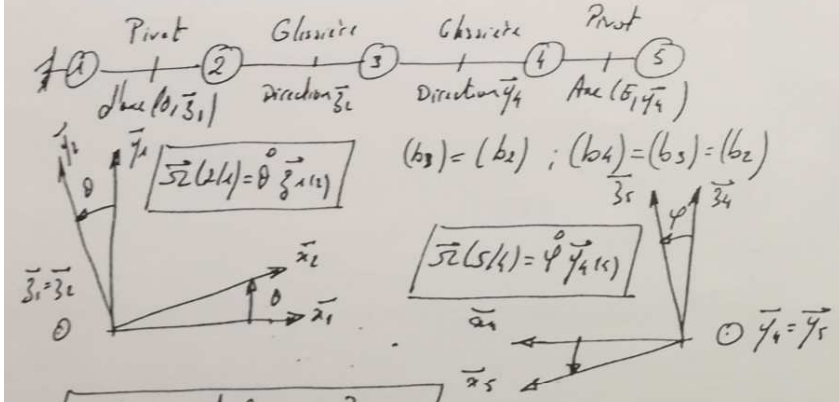
Manipulateur Pneumatique



$$\mathcal{V}(2/1)=\left\{\dot{\theta}\,\vec{z}_1\,,\vec{0}\right\}_{O,A,B}$$

$$\vec{V}(B,3/2)=\left[\frac{d\vec{OB}}{dt}\right]_2=\dot{\mu}\,\vec{z}_1 \rightarrow \boxed{\mathcal{V}(3/2)=\left\{\vec{0}\,,\dot{\mu}\,\vec{z}_1\right\}_M \ \forall M}$$

$$\vec{V}(E,4/3)=\left[\frac{d\vec{CE}}{dt}\right]_3=\dot{\rho}\,\vec{y}_4 \rightarrow \boxed{\mathcal{V}(4/3)=\left\{\vec{0}\,,\dot{\rho}\,\vec{y}_4\right\}_M \ \forall M}$$

$$\mathcal{V}(5/4)=\left\{\dot{\varphi}\,\vec{y}_{4(5)}\,,\vec{0}\right\}_{E,D,C,F}$$

$$\mathcal{V}(5/1)=\mathcal{V}(5/4)+\mathcal{V}(4/3)+\mathcal{V}(3/2)+\mathcal{V}(2/1) \text{ en } F$$

$$\vec{\Omega}(5/1)=\dot{\theta}\,\vec{z}_1+\dot{\varphi}\,\vec{y}_4$$

$$\begin{aligned}\vec{V}(F,5/1)&=\vec{V}(F,5/4)+\vec{V}(F,4/3)+\vec{V}(F,3/2)+\vec{V}(F,2/1)\\&=\vec{0}+\dot{\rho}\,\vec{y}_4+\dot{\mu}\,\vec{z}_1+\vec{V}(B,2/1)+\vec{FB}\wedge\vec{\Omega}(2/1)\\&=\dot{\rho}\,\vec{y}_4+\dot{\mu}\,\vec{z}_1+(-b+\rho)\,\vec{y}_4+(-a\,\vec{x}_2)\wedge\dot{\theta}\,\vec{z}_1\\&=\dot{\rho}\,\vec{y}_4+\dot{\mu}\,\vec{z}_1-(b+\rho)\dot{\theta}\,\vec{y}_4\wedge\vec{z}_{1(4)}-a\dot{\theta}\,\vec{x}_2\wedge\vec{z}_{1(2)}\\&=\dot{\rho}\,\vec{y}_{4(1)}+\dot{\mu}\,\vec{z}_{1(1)}-(b+\rho)\dot{\theta}\,\vec{x}_{4(1)}+a\dot{\theta}\,\vec{y}_2\end{aligned}$$

$$\boxed{\vec{V}(F,5/1)=-(b+\rho)\dot{\theta}\,\vec{x}_2+(\dot{\rho}+a\dot{\theta})\vec{y}_2+\dot{\mu}\,\vec{z}_2}$$

$$\boxed{\|\vec{V}(F,5/1)\|=\sqrt{(b+\rho)^2\dot{\theta}^2+(\dot{\rho}+a\dot{\theta})^2+\dot{\mu}^2}}$$

$$\vec{A}(F,5/1)=\left[\frac{d\vec{V}(F,5/1)}{dt}\right]_{(1)}=\left[-(b+\rho)\ddot{\theta}-\dot{\rho}\dot{\theta}\right]\vec{x}_2+\left[\ddot{\rho}+a\ddot{\theta}\right]\vec{y}_2+\ddot{\mu}\,\vec{z}_2$$
$$-(b+\rho)\dot{\theta}\left[\frac{d\vec{x}_2}{dt}\right]_{(1)}+\left[\dot{\rho}+a\dot{\theta}\right]\left[\frac{d\vec{y}_2}{dt}\right]_{(1)}+\dot{\mu}\underbrace{\left[\frac{d\vec{z}_2}{dt}\right]_{(1)}}_{\vec{0}}$$

$$\left[\frac{d\vec{x}_2}{dt}\right]_{(1)}=\vec{\Omega}(2/1)\wedge\vec{x}_2=\dot{\theta}\,\vec{z}_2\wedge\vec{x}_2=\dot{\theta}\,\vec{y}_2$$

$$\left[\frac{d\vec{y}_2}{dt}\right]_{(1)}=\vec{\Omega}(2/1)\wedge\vec{y}_2=\dot{\theta}\,\vec{z}_2\wedge\vec{y}_2=-\dot{\theta}\,\vec{x}_2$$

$$\left[\frac{d\vec{z}_2}{dt}\right]_{(1)}=\vec{0} \text{ car } \vec{z}_2=\vec{z}_1$$

$$\Rightarrow \vec{A}(F,5/1)=\left[-(b+\rho)\ddot{\theta}-\dot{\rho}\dot{\theta}-(\dot{\rho}+a\dot{\theta})\dot{\theta}\right]\vec{x}_2+\left[\ddot{\rho}+a\ddot{\theta}-(b+\rho)\dot{\theta}^2\right]\vec{y}_2+\ddot{\mu}\,\vec{z}_2$$

Soit $$\boxed{\vec{A}(F,5/1)=\left(-(b+\rho)\ddot{\theta}-2\dot{\rho}\dot{\theta}-a\dot{\theta}^2\right)\vec{x}_2+\left(\ddot{\rho}+a\ddot{\theta}-(b+\rho)\dot{\theta}^2\right)\vec{y}_2+\ddot{\mu}\,\vec{z}_2}$$

Cas Particuliers $\rho=c^{te}\Rightarrow\dot{\rho}=\ddot{\rho}=0$; $\dot{\mu}=c^{te}\rightarrow\ddot{\mu}=0$; $\dot{\varphi}=c^{te}\Rightarrow\ddot{\varphi}=\ddot{\varphi}=0$

$\dot{\theta}=c^{te}\Rightarrow\ddot{\theta}=0$

$$\vec{V}(F,5/1)=-(b+\rho)\dot{\theta}\,\vec{x}_2+a\dot{\theta}\,\vec{y}_2+\dot{\mu}\,\vec{z}_2$$

$$\Rightarrow\|\vec{V}(F,5/1)\|=\sqrt{\dot{\theta}^2(a^2+(b+\rho)^2)+\dot{\mu}^2}$$

$$\vec{A}(F,5/1)=\left[-a\dot{\theta}^2\right]\vec{x}_2+\left[-(b+\rho)\dot{\theta}^2\right]\vec{y}_2$$

$$\rightarrow\|\vec{A}(F,5/1)\|=\dot{\theta}^2\sqrt{a^2+(b+\rho)^2}$$

A.N

$\dot{\theta}=\frac{2\pi\times15}{60}=\frac{\pi}{2}$ rad/s

$\dot{\mu}=150$ mm/s

$a=200$ mm

$b=150$ mm.

$\rho=450$ mm.

$$\|\vec{V}(F,5/1)\|=\sqrt{\left(\frac{\pi}{2}\right)^2\left[200^2+600^2\right]+150^2}=1004\text{ mm/s}=1\text{ m/s}$$

$$\|\vec{A}(F,5/1)\|=\left(\frac{\pi}{2}\right)^2\sqrt{200^2+600^2}=1560\text{ mm/s}^2=1{,}56\text{ m/s}^2=0{,}16g$$