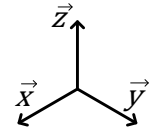
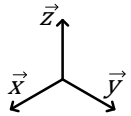
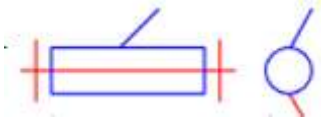
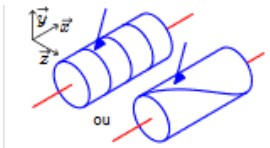
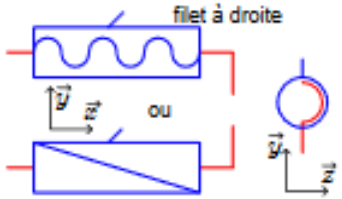
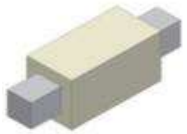
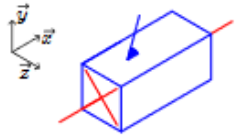
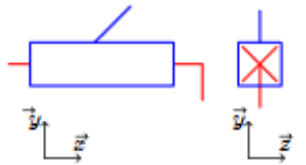
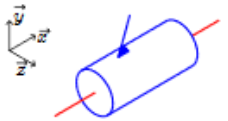
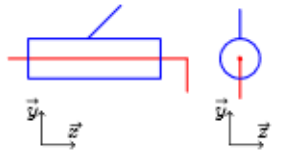
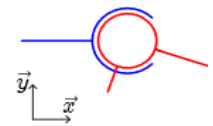
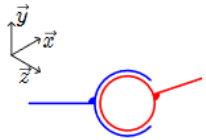
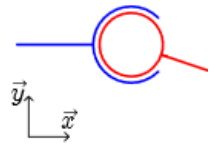
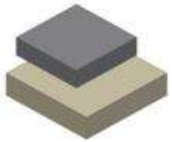
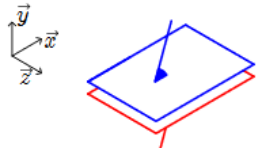
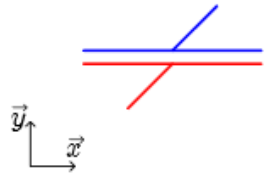
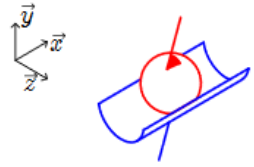
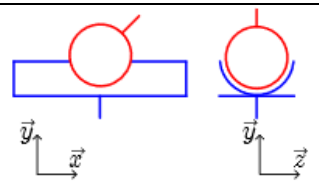
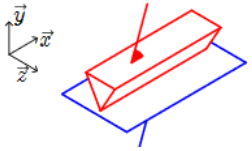
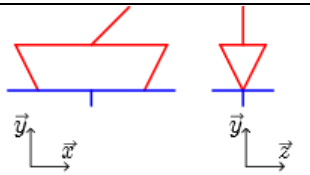
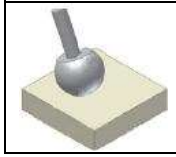
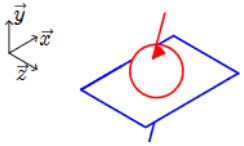
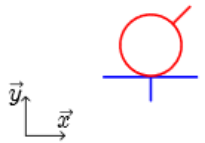
LIAISONS NORMALISÉES D'UN SOLIDE REPÉRÉ PAR R_i EN LIAISON AVEC UN AUTRE SOLIDE REPÉRÉ PAR R_j

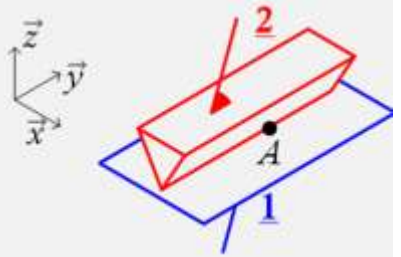
 **Repère local associé à la …**	**Géométrie du contact**	Nom	Nbre de ddl indépendants	**Forme générale du torseur cinématique** $\{\mathcal{V}(2/1)\}$	**Validité de la forme générale du torseur**	Représentation 3D 	Représentation 2D
	Cylindre	Pivot d'axe $(A,\vec{x})$	1	$\left\{\begin{matrix}\omega_x & 0\\ 0 & 0\\ 0 & 0\end{matrix}\right\}_{\mathcal{B}}$	**Tout point de l'axe $(A,\vec{x})$**		
	Hélice	Hélicoïdale d'axe $(A,\vec{x})$ et de pas p	1	$\left\{\begin{matrix}\omega_x & \pm\frac{pas}{2.\pi}.\omega_x\\ 0 & 0\\ 0 & 0\end{matrix}\right\}_{\mathcal{B}}$ $V_x = \pm\frac{pas}{2.\pi}.\omega_x$	**Tout point de l'axe $(A,\vec{x})$**		
	Prisme	Glissière de direction $\vec{x}$	1	$\left\{\begin{matrix}0 & V_x\\ 0 & 0\\ 0 & 0\end{matrix}\right\}_{\mathcal{B}}$	**Tout point A de l'espace**		
	Cylindre	Pivot glissantd'axe $(A,\vec{x})$	2	$\left\{\begin{matrix}\omega_x & V_x\\ 0 & 0\\ 0 & 0\end{matrix}\right\}_{\mathcal{B}}$	**Tout point de l'axe $(A,\vec{x})$**		
	Sphère	Rotule (ou sphérique) à doigt de centre O et de rotation interdite $(O,\vec{y})$	2	$\left\{\begin{matrix}\omega_x & 0\\ 0 & 0\\ \omega_z & 0\end{matrix}\right\}_{\mathcal{B}}$	**Seulement en O**		
	Sphère	Rotule (ou sphérique) de centre O	3	$\left\{\begin{matrix}\omega_x & 0\\ \omega_y & 0\\ \omega_z & 0\end{matrix}\right\}_{\mathcal{B}}$	**Seulement en O**		

	Plane	Appui plan de normale $\vec{y}$	3	$\begin{Bmatrix} 0 & V_x \\ \omega_y & 0 \\ 0 & V_z \end{Bmatrix}_{A,\mathcal{B}}$	**Tout point de l'espace**		
	Cercle	Linéaire annulaire de centre O et de direction $\vec{x}$	4	$\begin{Bmatrix} \omega_x & V_x \\ \omega_y & 0 \\ \omega_z & 0 \end{Bmatrix}_{O,\mathcal{B}}$	**Seulement O**		
	Droite	Linéaire rectiligne de ligne de contact $(O,\vec{x})$ et de normale $\vec{y}$	4	$\begin{Bmatrix} \omega_x & V_x \\ \omega_y & 0 \\ 0 & V_z \end{Bmatrix}_{O,\mathcal{B}}$	**Tout point du plan $(O,\vec{x},\vec{y})$**		
	Point	Ponctuelle (ou sphère/plan) en O de normale $\vec{y}$	5	$\begin{Bmatrix} \omega_x & V_x \\ \omega_y & 0 \\ \omega_z & V_z \end{Bmatrix}_{O,\mathcal{B}}$	**Tout point de la normale $(O,\vec{y})$**		

Exemple de démonstration : on cherche la zone de validité pour la liaison linéaire rectiligne de ligne $(A,\vec{y})$ et de normale $\vec{z}$.

La forme du torseur cinématique est :

$$\{\mathcal{V}(2/1)\} = \begin{Bmatrix} 0 & V_{x21} \\ \omega_{y21} & V_{y21} \\ \omega_{z21} & 0 \end{Bmatrix}_{A,\mathcal{B}}$$



Supposons un point P tel que : $\overrightarrow{PA} = a.\vec{x} + b.\vec{y} + c.\vec{z}$. Ainsi :

$$\begin{aligned} \overrightarrow{V(P \in 2/1)} &= \overrightarrow{V(A \in 2/1)} + \overrightarrow{PA} \wedge \overrightarrow{\Omega(2/1)} \\ &= (V_{x21}.\vec{x} + V_{y21}.\vec{y}) + (a.\vec{x} + b.\vec{y} + c.\vec{z}) \wedge (\omega_{y21}.\vec{y} + \omega_{z21}.\vec{z}) \\ &= (V_{x21} + b\omega_{z21} - c\omega_{y21}).\vec{x} + (V_{y21} - a\omega_{z21}).\vec{y} + (a\omega_{y21}.\vec{z}) \end{aligned}$$

Soit : $\{\mathcal{V}(2/1)\} = \begin{Bmatrix} 0 & V_{x21} + b\omega_{z21} - c\omega_{y21} \\ \omega_{y21} & V_{y21} - a\omega_{z21} \\ \omega_{z21} & a\omega_{y21} \end{Bmatrix}_{P,\mathcal{B}}$

Pour que le torseur ait la même forme (0 sur V_z donc), il faut nécessairement que $a = 0$.

Conclusion : la forme du torseur cinématique (avec deux zéros) est valide en tous points du plan $(\boldsymbol{A},\vec{\boldsymbol{y}},\vec{\boldsymbol{z}})$.