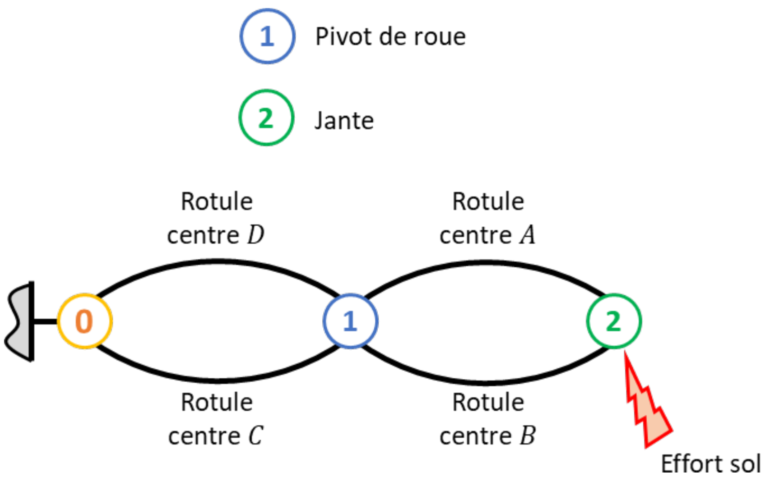
Suspension automobile ★★

C2-07

Question 1 Réaliser le graphe des liaisons en faisant apparaître les actions mécaniques. Exprimer les torseurs des actions mécaniques de chacune des liaisons.



On a :

- $\{\mathcal{T}(0 \rightarrow 1_C)\} = \left\{ \begin{array}{l} X_C \overrightarrow{a} + Y_C \overrightarrow{r} + Z_C \overrightarrow{x} \\ \overrightarrow{0} \end{array} \right\}_C$;
- $\{\mathcal{T}(0 \rightarrow 1_D)\} = \left\{ \begin{array}{l} X_D \overrightarrow{a} + Y_D \overrightarrow{r} + Z_D \overrightarrow{x} \\ \overrightarrow{0} \end{array} \right\}_D$;
- $\{\mathcal{T}(2 \rightarrow 1_A)\} = \left\{ \begin{array}{l} X_A \overrightarrow{a} + Y_A \overrightarrow{r} + Z_A \overrightarrow{x} \\ \overrightarrow{0} \end{array} \right\}_A$;
- $\{\mathcal{T}(2 \rightarrow 1_B)\} = \left\{ \begin{array}{l} X_B \overrightarrow{a} + Y_B \overrightarrow{r} + Z_B \overrightarrow{x} \\ \overrightarrow{0} \end{array} \right\}_B$.

Question 2 En isolant l'ensemble {pneumatique + jante + axe de roue}, écrire les équations issues du principe fondamental de la statique appliqué au point C, en projection sur les axes de la base $\left(\overrightarrow{a}, \overrightarrow{r}, \overrightarrow{x}\right)$ en fonction des composantes F_{sol}^a et F_{sol}^r et des dimensions d_0, d_3 et d_4.

On isole l'ensemble demandé.

BAME :

- $\{\mathcal{T}(0 \rightarrow 1_C)\}$;
- $\{\mathcal{T}(0 \rightarrow 1_D)\} = \left\{ \begin{array}{l} X_D \overrightarrow{a} + Y_D \overrightarrow{r} + Z_D \overrightarrow{x} \\ \overrightarrow{0} \end{array} \right\}_D = \left\{ \begin{array}{l} X_D \overrightarrow{a} + Y_D \overrightarrow{r} + Z_D \overrightarrow{x} \\ (d_4 + d_3) Y_D \overrightarrow{x} - (d_4 + d_3) Z_D \overrightarrow{r} \end{array} \right\}_C$
  $\overrightarrow{\mathcal{M}(C, 0 \rightarrow 1_D)} = \overrightarrow{\mathcal{M}(D, 0 \rightarrow 1_D)} + \overrightarrow{CD} \wedge \overrightarrow{R(0 \rightarrow 1_D)} = (d_4 + d_3)\overrightarrow{a} \wedge \left(X_D \overrightarrow{a} + Y_D \overrightarrow{r} + Z_D \overrightarrow{x}\right)$
  $= (d_4 + d_3)\overrightarrow{a} \wedge Y_D \overrightarrow{r} + (d_4 + d_3)\overrightarrow{a} \wedge Z_D \overrightarrow{x} = (d_4 + d_3) Y_D \overrightarrow{x} - (d_4 + d_3) Z_D \overrightarrow{r}$.
- $\{\mathcal{T}(\text{Sol} \rightarrow 2)\} = \left\{ \begin{array}{l} F_{\text{sol}}^a \overrightarrow{a} - F_{\text{sol}}^t \overrightarrow{r} \\ \overrightarrow{0} \end{array} \right\}_I = \left\{ \begin{array}{l} F_{\text{sol}}^a \overrightarrow{a} - F_{\text{sol}}^t \overrightarrow{r} \\ d_0 F_{\text{sol}}^t \overrightarrow{x} \end{array} \right\}_C$.

On applique le PFS en C et on a :

$$\left\{\begin{array}{l} X_C + X_D + F^a_{\text{sol}} = 0 \\ Y_C + Y_D - F^t_{\text{sol}} = 0 \\ Z_C + Z_D = 0 \end{array}\right. \qquad \left\{\begin{array}{l} 0 = 0 \\ -\left(d_4 + d_3\right) Z_D = 0 \\ \left(d_4 + d_3\right) Y_D + d_0 F^t_{\text{sol}} = 0 \end{array}\right.$$

Question 3 Résoudre littéralement le système.

$$\left\{\begin{array}{l} X_C + X_D + F^a_{\text{sol}} = 0 \\ Y_C = -Y_D + F^t_{\text{sol}} \\ Z_C = 0 \end{array}\right. \qquad \left\{\begin{array}{l} 0 = 0 \\ Z_D = 0 \\ Y_D = -\dfrac{d_0 F^t_{\text{sol}}}{d_4 + d_3} \end{array}\right.$$