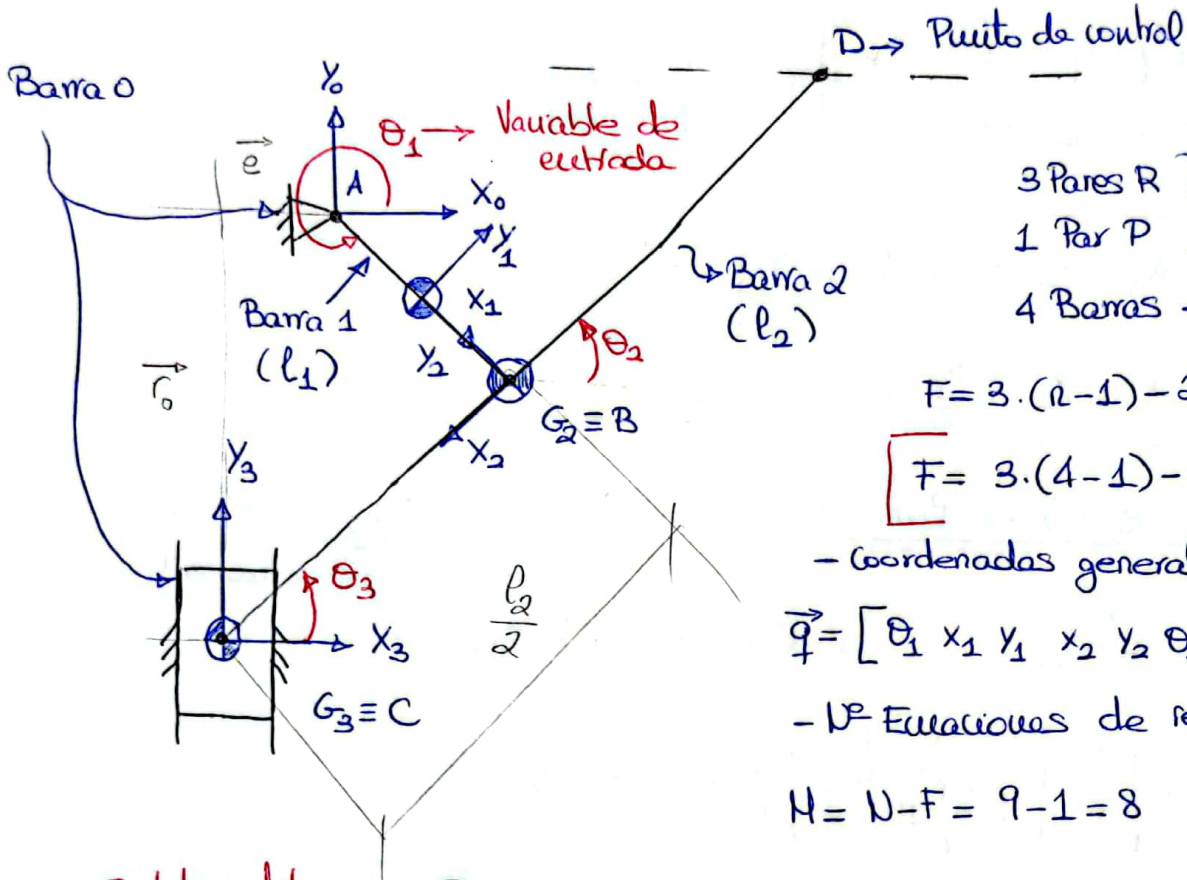


Ejercicios Modelado Cinemático

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Mecanismo N° 3

a) Dibujar un diagrama cinemático [...] dimensiones y variables empleadas para modelarlo.


$$\left. \begin{array}{l} 3 \text{ Pares R} \\ 1 \text{ Par P} \end{array} \right\} J_1 = 4$$

4 Barras $\rightarrow n=4$

$$F = 3 \cdot (n-1) - 2J_1 - J_2$$

$$F = 3 \cdot (4 - 1) - 2 \cdot 4 = 1 \text{ g.d.l}$$

- Coordenadas generalizadas:

$$\vec{q} = [\theta_1 \ x_1 \ y_1 \ x_2 \ y_2 \ \theta_2 \ x_3 \ y_3 \ \theta_3]$$

- 1ª Ecuaciones de restricción:

$$N = N - F = 9 - 1 = 8$$

Sentido antihorario \oplus

b) Plantear las ecuaciones de restricción mediante coordenadas cartesianas.

- En A (Par R) \rightarrow Barras 0-1:

$$\{0\} = {}^0\vec{r}_{AG_1} + {}^0R_1 {}^1\vec{r}_{G_1A} \rightarrow \begin{Bmatrix} 0 \\ 0 \end{Bmatrix} = \begin{Bmatrix} x_1 \\ y_1 \end{Bmatrix} + \begin{bmatrix} \\ \end{bmatrix} \begin{Bmatrix} -\frac{b_1}{2} \\ 0 \end{Bmatrix}$$

$${}^0R_1 = \begin{bmatrix} \cos \theta_1 & -\sin \theta_1 \\ \sin \theta_1 & \cos \theta_1 \end{bmatrix}$$

$$\Phi_1: x_1 - \frac{q_1}{2} c \theta_1 = 0$$

$$\Phi_2: y_1 - \frac{b_1}{2} s\theta_1 = 0$$

→ En B (Par R) → Barras 1-2 : ${}^0\vec{r}_{AG_1} + {}^0\vec{r}_{G_1B_1} = {}^0\vec{r}_{AG_2} + {}^0\vec{r}_{G_2B_2}$

$${}^0\vec{r}_{AG_1} + {}^0R_1 {}^1\vec{r}_{G_1B_1} = {}^0\vec{r}_{AG_2} + {}^0R_2 {}^2\vec{r}_{G_2B_2}$$

$$\begin{Bmatrix} x_1 \\ y_1 \end{Bmatrix} + \begin{bmatrix} \cos\theta_1 & -\sin\theta_1 \\ \sin\theta_1 & \cos\theta_1 \end{bmatrix} \begin{Bmatrix} \frac{l_1}{2} \\ 0 \end{Bmatrix} = \begin{Bmatrix} x_2 \\ y_2 \end{Bmatrix}$$

$$\Phi_3: x_1 - x_2 + \frac{l_1}{2}\cos\theta_1 = 0$$

$$\Phi_4: y_1 - y_2 + \frac{l_1}{2}\sin\theta_1 = 0$$

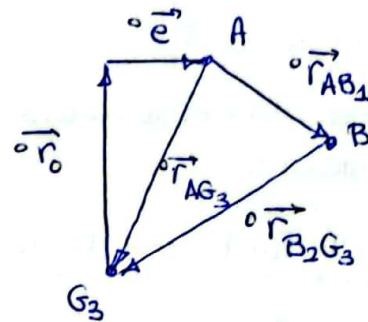
→ En C (Par P) → Barras 0-3 : $\vec{r}_0 \parallel {}^0\vec{f}_3 \quad \theta_3 = \theta_2$

$\begin{Bmatrix} 0 \\ 0 \end{Bmatrix} \leftarrow {}^0\vec{r}_0 = {}^0\vec{e} + {}^0\vec{r}_{AG_3} \quad ({}^0\vec{e} + {}^0\vec{r}_{AG_3}) \cdot {}^0\vec{f}_3 = 0$

$\left(\begin{Bmatrix} e \\ 0 \end{Bmatrix} + \begin{Bmatrix} x_3 \\ y_3 \end{Bmatrix} \right) \cdot \begin{Bmatrix} 0 \\ 1 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix} \rightarrow y_3 = 0$

$$\Phi_5: y_3 = 0$$

$$\Phi_6: \theta_3 - \theta_2 = 0$$



Comprobación :

$${}^0\vec{r}_0 = {}^0\vec{e} + {}^0\vec{r}_{AB_1} + {}^0\vec{r}_{B_2G_3} = {}^0\vec{e} + {}^0R_1 {}^1\vec{r}_{AB_1} + {}^0R_2 {}^2\vec{r}_{B_2G_3} =$$

$$= \begin{Bmatrix} e \\ 0 \end{Bmatrix} + \begin{bmatrix} \cos\theta_1 & -\sin\theta_1 \\ \sin\theta_1 & \cos\theta_1 \end{bmatrix} \begin{Bmatrix} l_1 \\ 0 \end{Bmatrix} + \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 \\ \sin\theta_2 & \cos\theta_2 \end{bmatrix} \begin{Bmatrix} \frac{l_2}{2} \\ 0 \end{Bmatrix} =$$

$$= \begin{Bmatrix} e + l_1\cos\theta_1 + \frac{l_2}{2}\cos\theta_2 \\ l_1\sin\theta_1 + \frac{l_2}{2}\sin\theta_2 \end{Bmatrix}$$

$${}^0\vec{r}_0 \cdot {}^0\vec{f}_3 = 0 \rightarrow l_1\sin\theta_1 + \frac{l_2}{2}\sin\theta_2 = 0$$

$$\Phi_5: l_1\sin\theta_1 + \frac{l_2}{2}\sin\theta_2 = 0$$

$$\Phi_6: \theta_3 - \theta_2 = 0$$

→ En C (Par R) \Rightarrow Barras 2-3:

$${}^0\vec{r}_{AD_2} = {}^0\vec{r}_{AD_3}$$

$${}^0\vec{r}_{AG_2} + {}^0\vec{r}_{G_2D_2} = {}^0\vec{r}_{AG_3} + {}^0\vec{r}_{G_3D_3}$$

$${}^0R_1 {}^1\vec{r}_{AB_1} + {}^0R_2 {}^2\vec{r}_{G_2D_2} = {}^0\vec{r}_{AG_3}$$

$$\begin{Bmatrix} x_3 \\ y_3 \end{Bmatrix} = \begin{bmatrix} \cos_1 & -\sin_1 \\ \sin_1 & \cos_1 \end{bmatrix} \begin{Bmatrix} l_1 \\ 0 \end{Bmatrix} + \begin{bmatrix} \cos_2 & -\sin_2 \\ \sin_2 & \cos_2 \end{bmatrix} \begin{Bmatrix} \frac{l_2}{2} \\ 0 \end{Bmatrix}$$

$$\Phi_7: x_3 - l_1 \cos_1 - \frac{l_2}{2} \cos_2 = 0$$

$$\Phi_8: y_3 - l_1 \sin_1 - \frac{l_2}{2} \sin_2 = 0$$