

Robótica grupo2

Clase 22

Facultad de Ingeniería UNAM

M.I. Erik Peña Medina

Derechos reservados

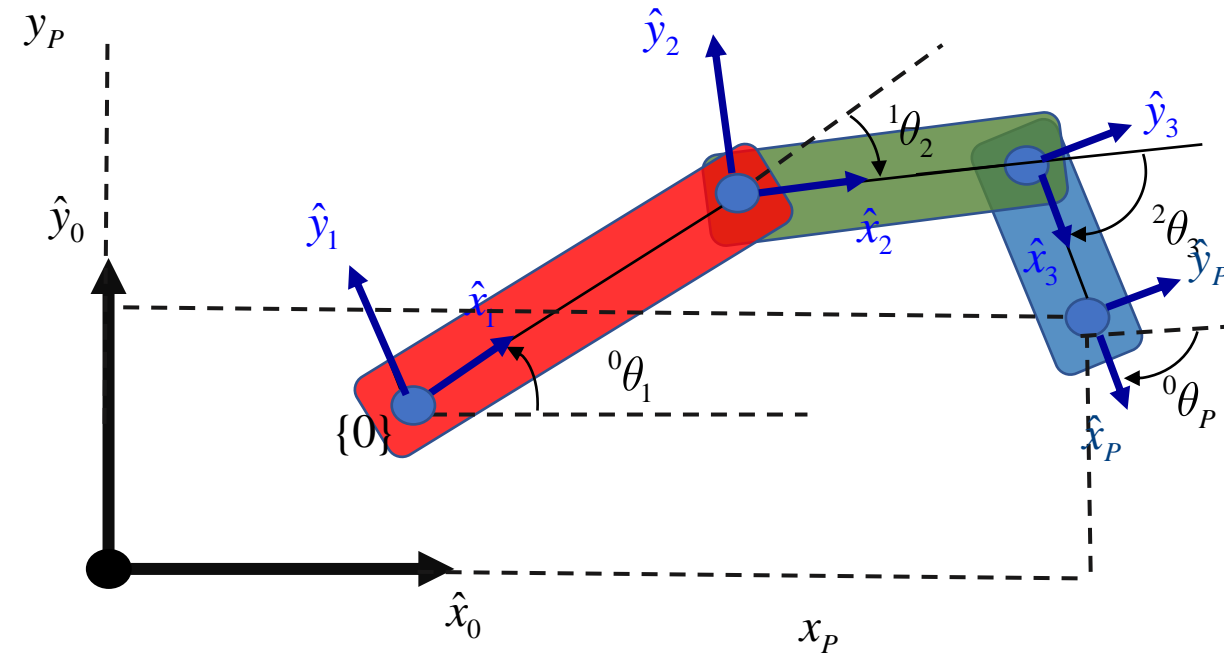
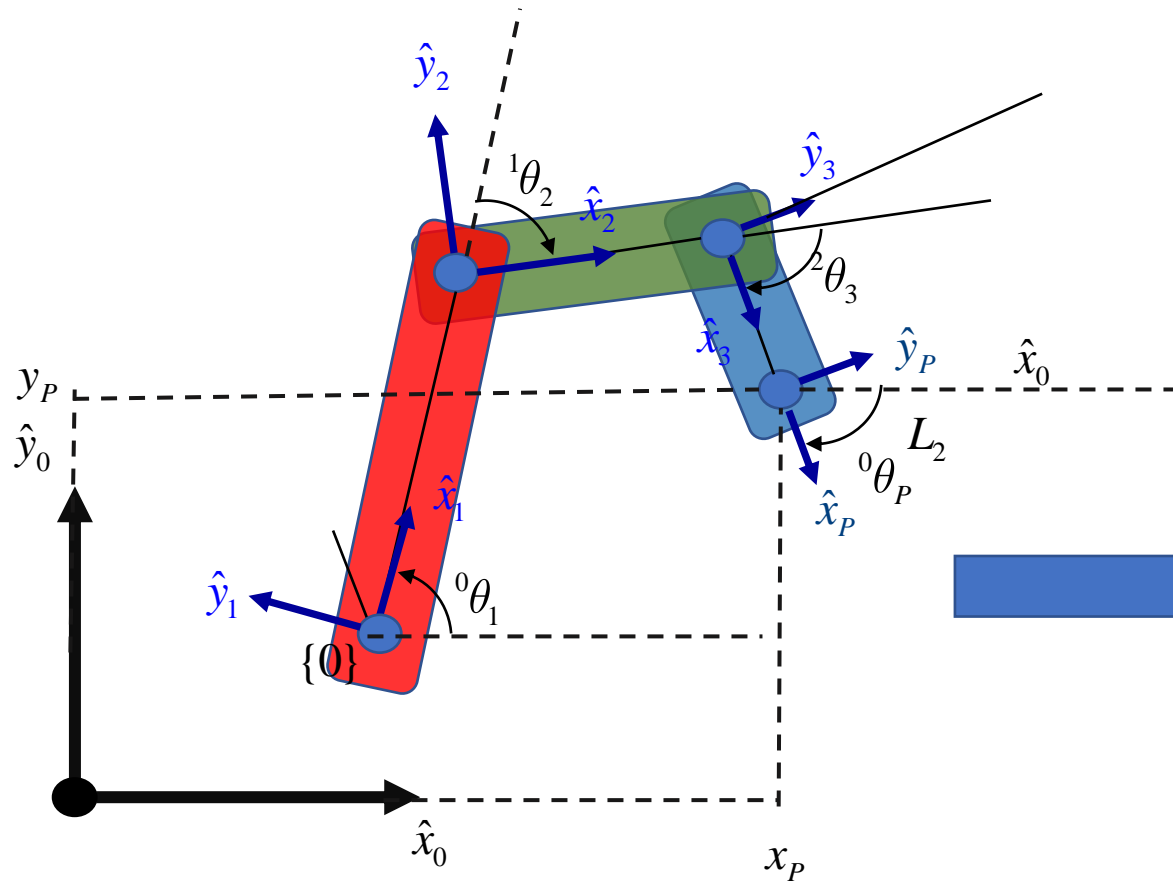
Todos los derechos reservados, Facultad de Ingeniería de la Universidad Nacional Autónoma de México © 2020. Quedan estrictamente prohibidos su uso fuera del ámbito académico, alteración, descarga o divulgación por cualquier medio, así como su reproducción parcial o total.

Contenido

Planeación de movimientos en el espacio de las juntas de un robot

- Planteamiento general
- Perfil de quinto grado
- Consideraciones de para el cálculo de postura de un robot
- Comprobación numérica
- Simulación de una cadena cinemática (Práctica 2)

Planteamiento de la solución en el espacio de trabajo



Modelo cinemático de la postura

$${}^0\xi_P = \begin{pmatrix} {}^0x_P \\ {}^0y_P \\ {}^0\theta_P \end{pmatrix}$$

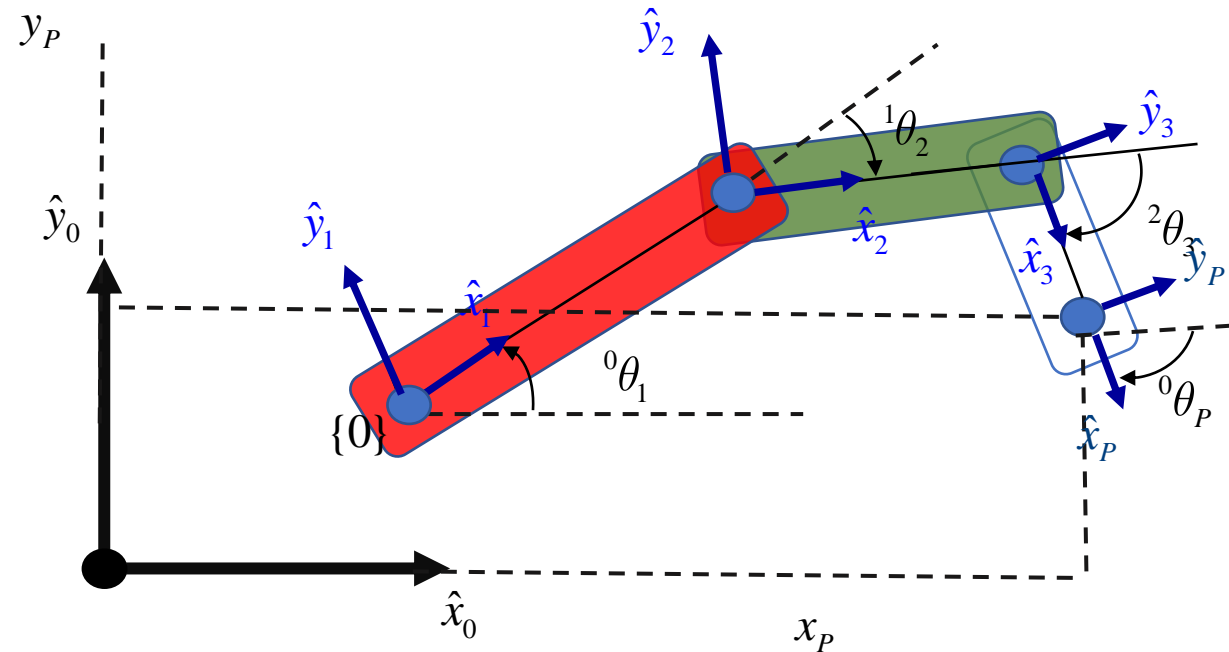
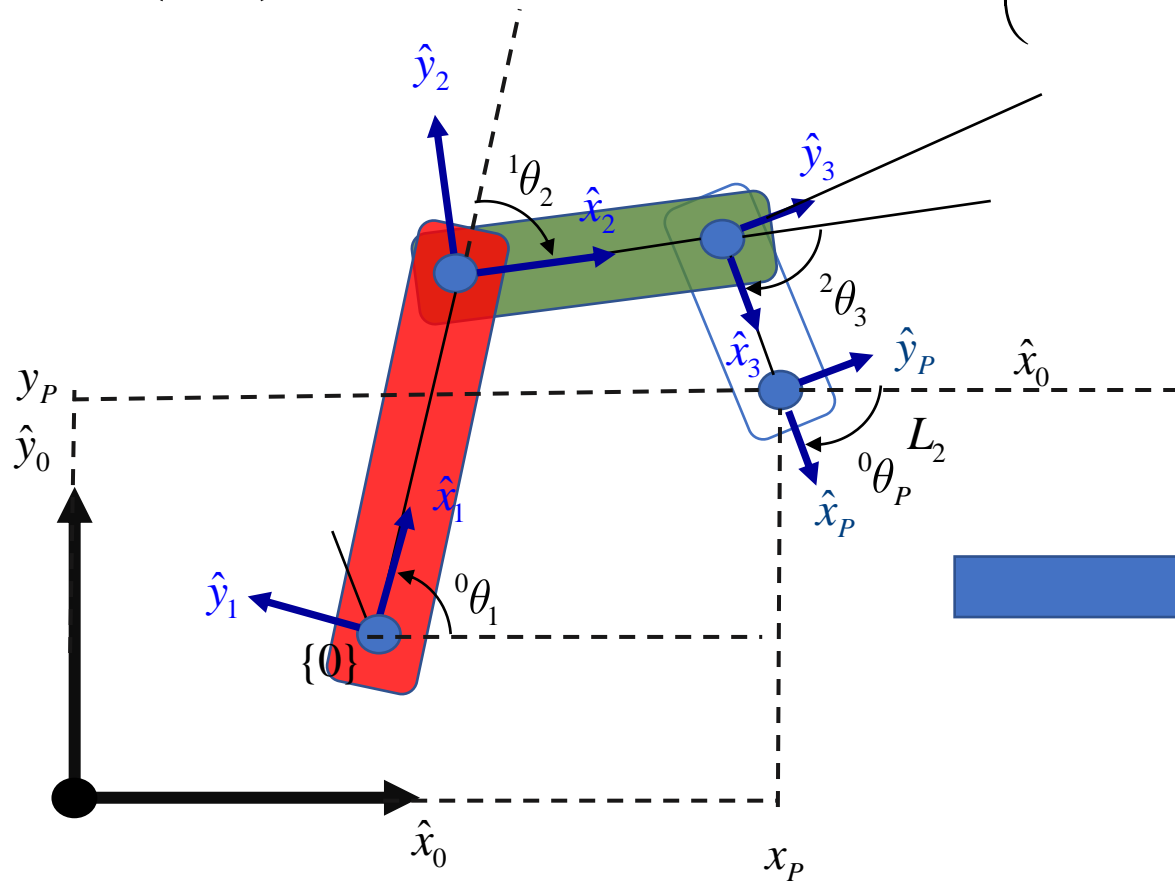
$${}^0\xi_P(q) = \begin{pmatrix} {}^0\mathbf{p}_P \\ {}^0\boldsymbol{\theta}_P \end{pmatrix} = \begin{pmatrix} {}^0x_1 + L_1 \cos({}^0\theta_1) + L_2 \cos({}^0\theta_1 + {}^1\theta_2) + L_3 \cos({}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3) \\ {}^0y_1 + L_1 \sin({}^0\theta_1) + L_2 \sin({}^0\theta_1 + {}^1\theta_2) + L_3 \sin({}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix}$$

$$\mathbf{F} = {}^0\xi_P - {}^0\xi_P(q) = \mathbf{0} = \begin{pmatrix} {}^0x_P - {}^0x_1 - L_1 \cos({}^0\theta_1) - L_2 \cos({}^0\theta_1 + {}^1\theta_2) - L_3 \cos({}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3) \\ {}^0y_P - {}^0y_1 - L_1 \sin({}^0\theta_1) - L_2 \sin({}^0\theta_1 + {}^1\theta_2) - L_3 \sin({}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3) \\ {}^0\theta_P - {}^0\theta_1 - {}^1\theta_2 - {}^2\theta_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

Planteamiento de la solución en el espacio de trabajo

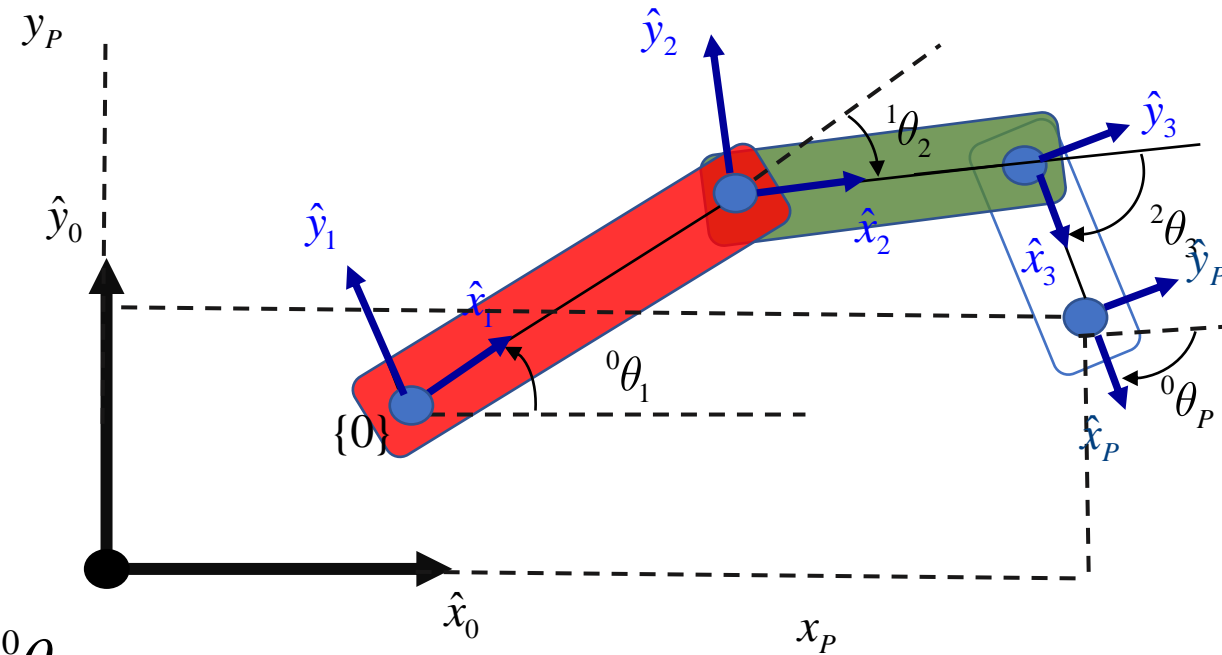
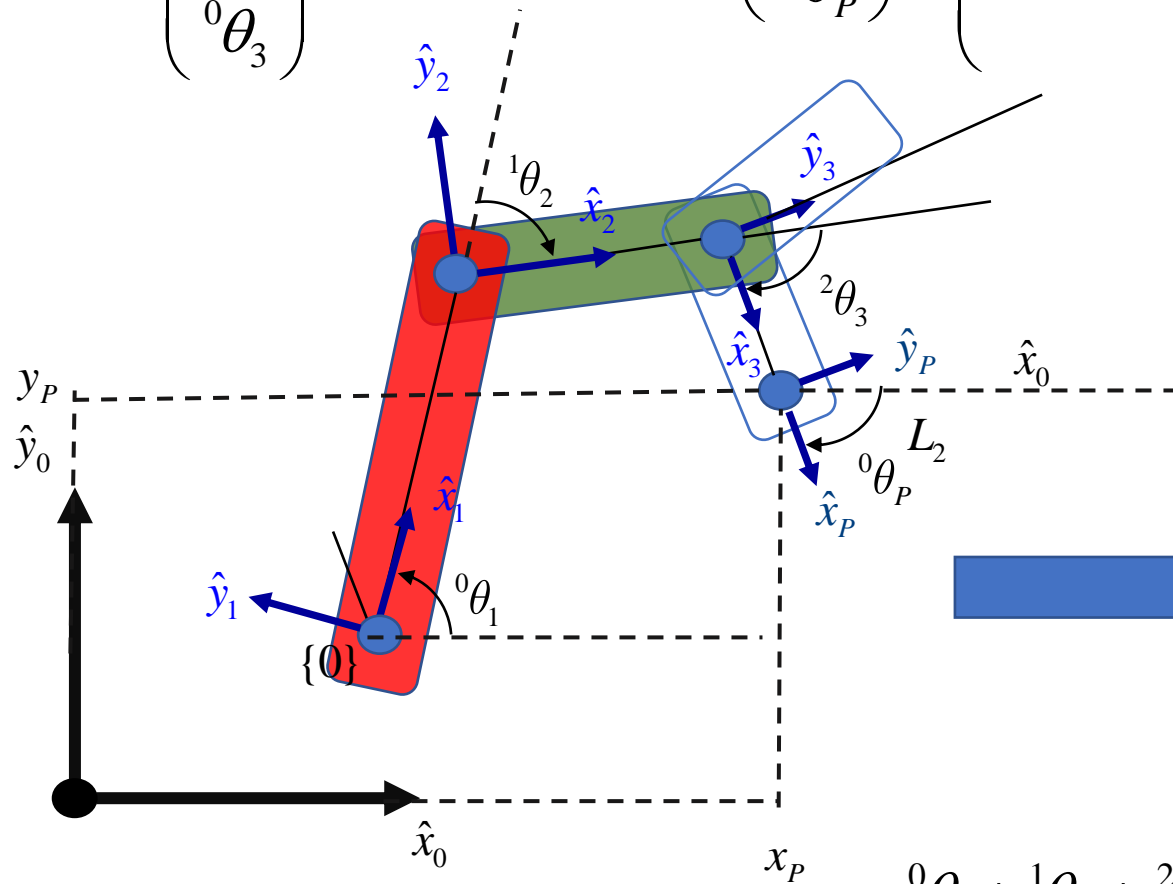
$${}^0\xi_P = \begin{pmatrix} {}^0x_P \\ {}^0y_P \\ {}^0\theta_P \end{pmatrix}$$

$${}^0\xi_P(q) = \begin{pmatrix} {}^0\mathbf{p}_P \\ {}^0\boldsymbol{\theta}_P \end{pmatrix} = \begin{pmatrix} {}^0x_1 + L_1 \cos({}^0\theta_1) + L_2 \cos({}^0\theta_1 + {}^1\theta_2) + L_3 \cos({}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3) \\ {}^0y_1 + L_1 \sin({}^0\theta_1) + L_2 \sin({}^0\theta_1 + {}^1\theta_2) + L_3 \sin({}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix}$$



Planteamiento del modelo dinámico

$${}^0\xi_3 = \begin{pmatrix} {}^0x_3 \\ {}^0y_3 \\ {}^0\theta_3 \end{pmatrix} \quad {}^0\xi_P(q) = \begin{pmatrix} {}^0\mathbf{p}_P \\ {}^0\boldsymbol{\theta}_P \end{pmatrix} = \begin{pmatrix} {}^0x_1 + L_1 \cos({}^0\theta_1) + L_2 \cos({}^0\theta_1 + {}^1\theta_2) \\ {}^0y_1 + L_1 \sin({}^0\theta_1) + L_2 \sin({}^0\theta_1 + {}^1\theta_2) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix} = \begin{pmatrix} {}^0x_3 \\ {}^0y_3 \\ {}^0\theta_3 \end{pmatrix}$$

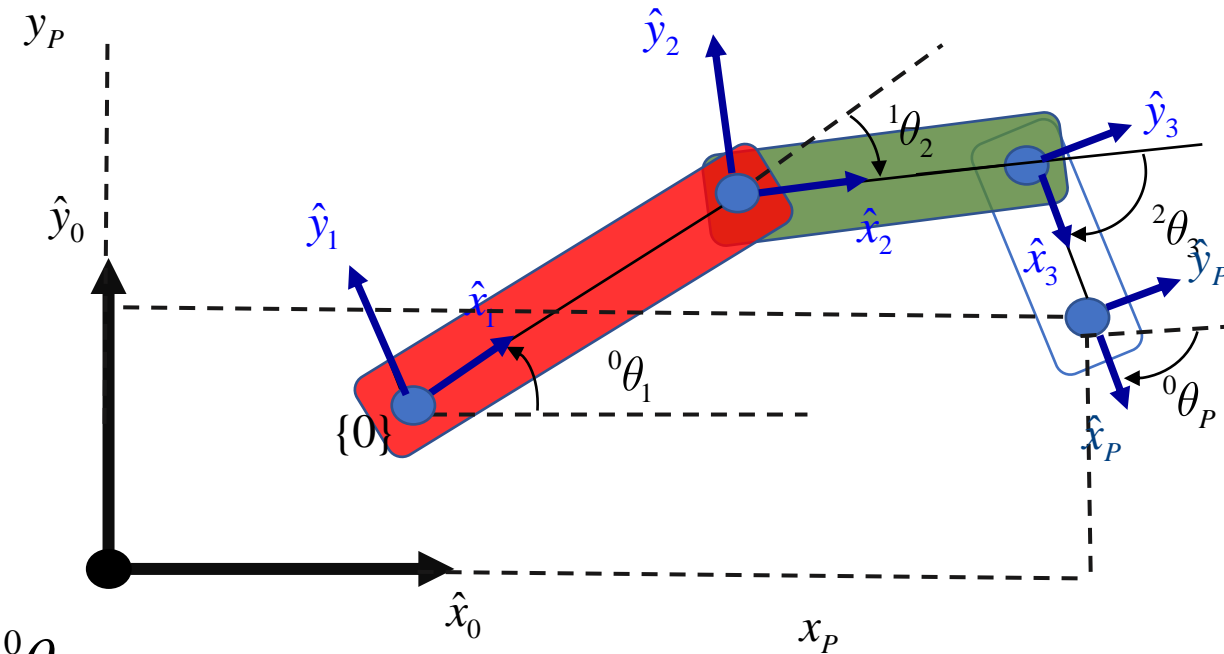
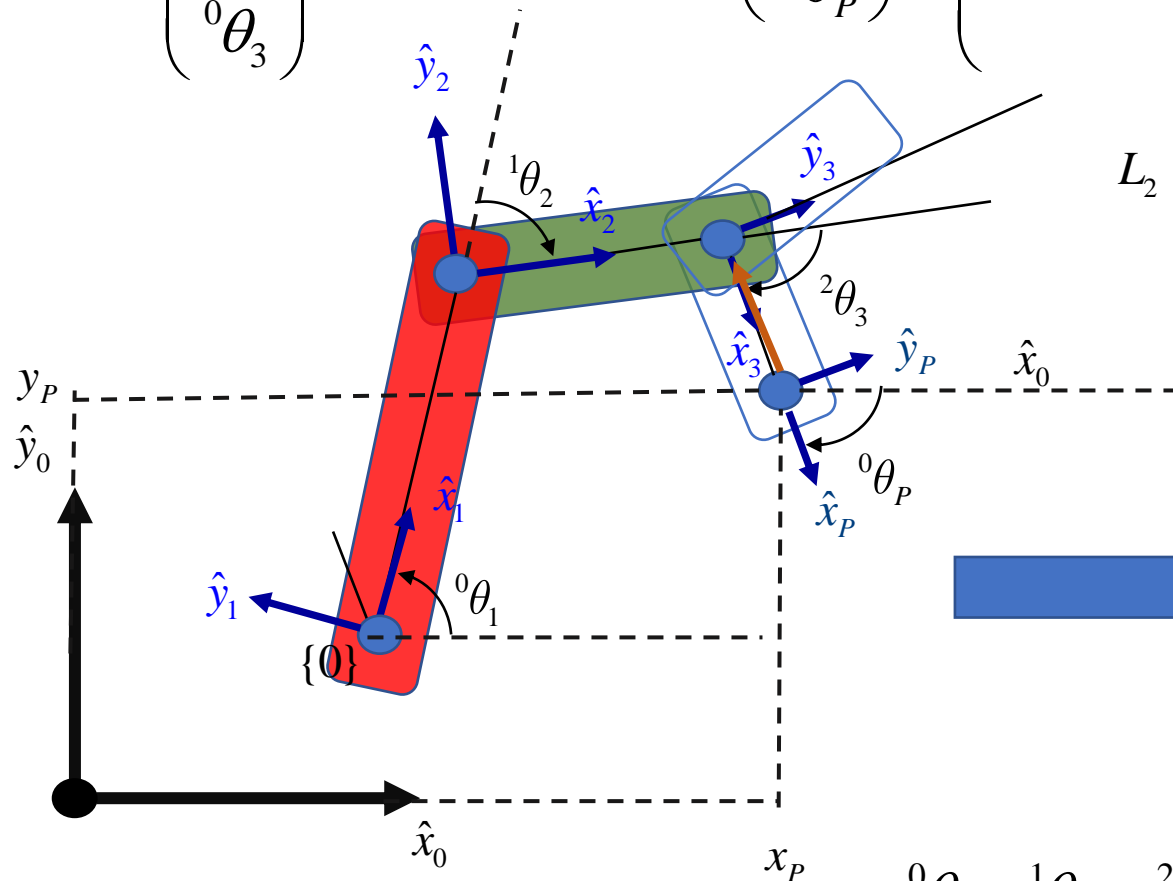


$${}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 = {}^0\theta_P$$

$${}^2\theta_3 = {}^0\theta_P - {}^0\theta_1 - {}^1\theta_2$$

Planteamiento del modelo dinámico

$${}^0\xi_3 = \begin{pmatrix} {}^0x_3 \\ {}^0y_3 \\ {}^0\theta_3 \end{pmatrix} \quad {}^0\xi_P(q) = \begin{pmatrix} {}^0\mathbf{p}_P \\ {}^0\boldsymbol{\theta}_P \end{pmatrix} = \begin{pmatrix} {}^0x_1 + L_1 \cos({}^0\theta_1) + L_2 \cos({}^0\theta_1 + {}^1\theta_2) \\ {}^0y_1 + L_1 \sin({}^0\theta_1) + L_2 \sin({}^0\theta_1 + {}^1\theta_2) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix} = \begin{pmatrix} {}^0x_3 \\ {}^0y_3 \\ {}^0\theta_3 \end{pmatrix}$$

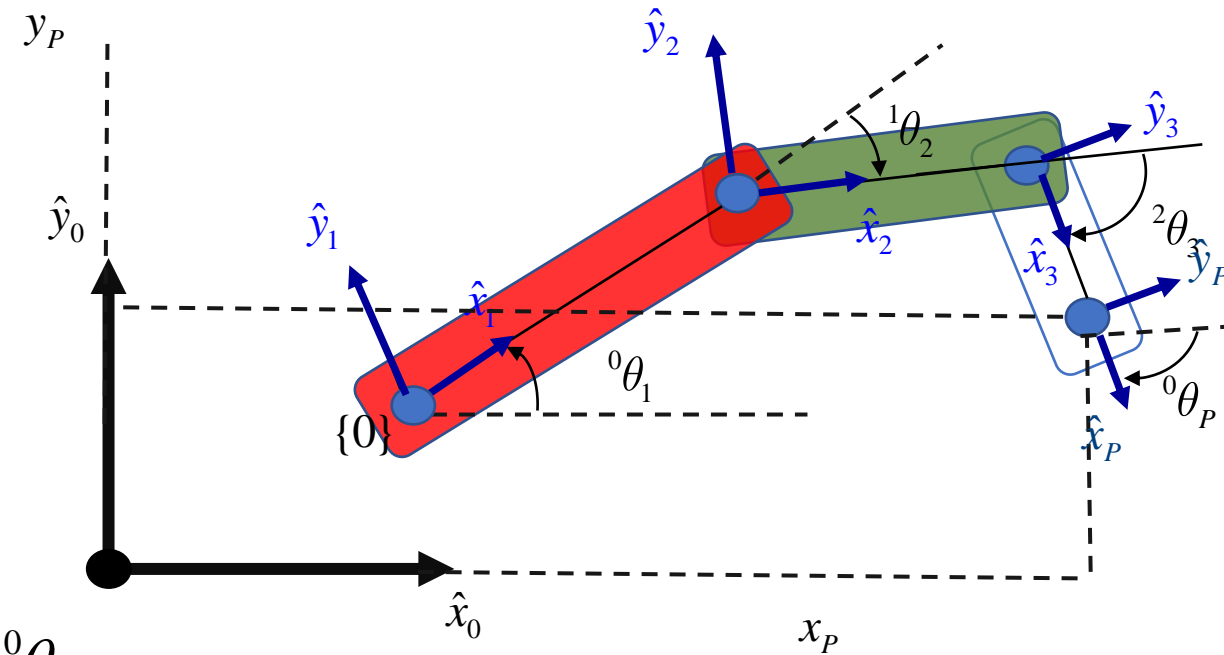
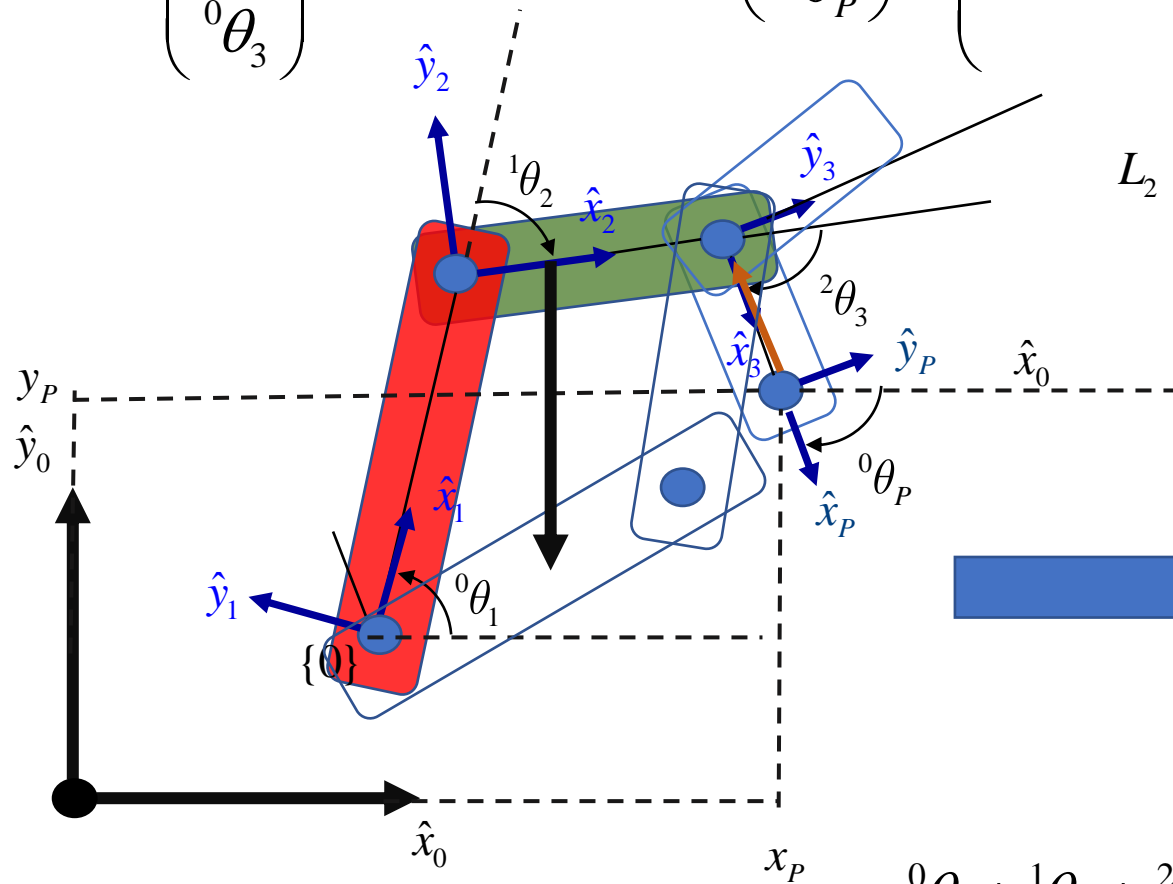


$${}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 = {}^0\theta_P$$

$${}^2\theta_3 = {}^0\theta_P - {}^0\theta_1 - {}^1\theta_2$$

Planteamiento del modelo dinámico

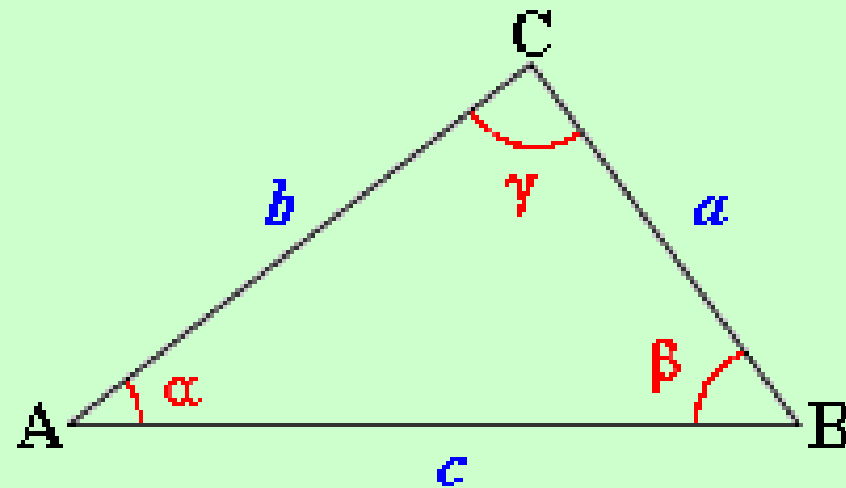
$${}^0\xi_3 = \begin{pmatrix} {}^0x_3 \\ {}^0y_3 \\ {}^0\theta_3 \end{pmatrix} \quad {}^0\xi_P(q) = \begin{pmatrix} {}^0\mathbf{p}_P \\ {}^0\boldsymbol{\theta}_P \end{pmatrix} = \begin{pmatrix} {}^0x_1 + L_1 \cos({}^0\theta_1) + L_2 \cos({}^0\theta_1 + {}^1\theta_2) \\ {}^0y_1 + L_1 \sin({}^0\theta_1) + L_2 \sin({}^0\theta_1 + {}^1\theta_2) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix} = \begin{pmatrix} {}^0x_3 \\ {}^0y_3 \\ {}^0\theta_3 \end{pmatrix}$$



$${}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 = {}^0\theta_P$$

$${}^2\theta_3 = {}^0\theta_P - {}^0\theta_1 - {}^1\theta_2$$

Ley de Cosenos



$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$