Robótica grupo2
Clase 23

Facultad de Ingeniería UNAM

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Derechos reservados

Contenido

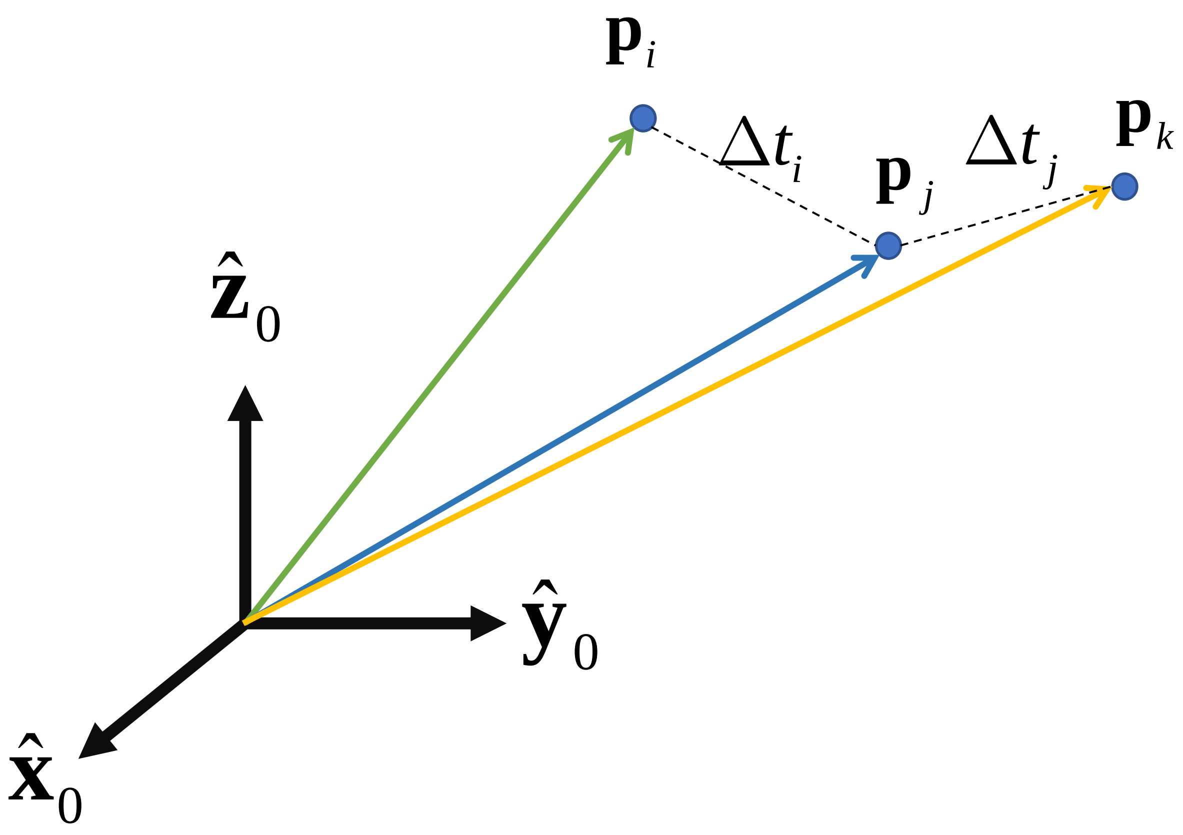
Planeación de movimientos en el espacio de las juntas de un robot

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

Planeación de movimientos

Planeación de movimientos de trabajo de un robot

Trayectoria



- Lugar geométrico
- Perfil de trayectoria

Planeación de movimientos

Planeación de movimientos de trabajo de un robot

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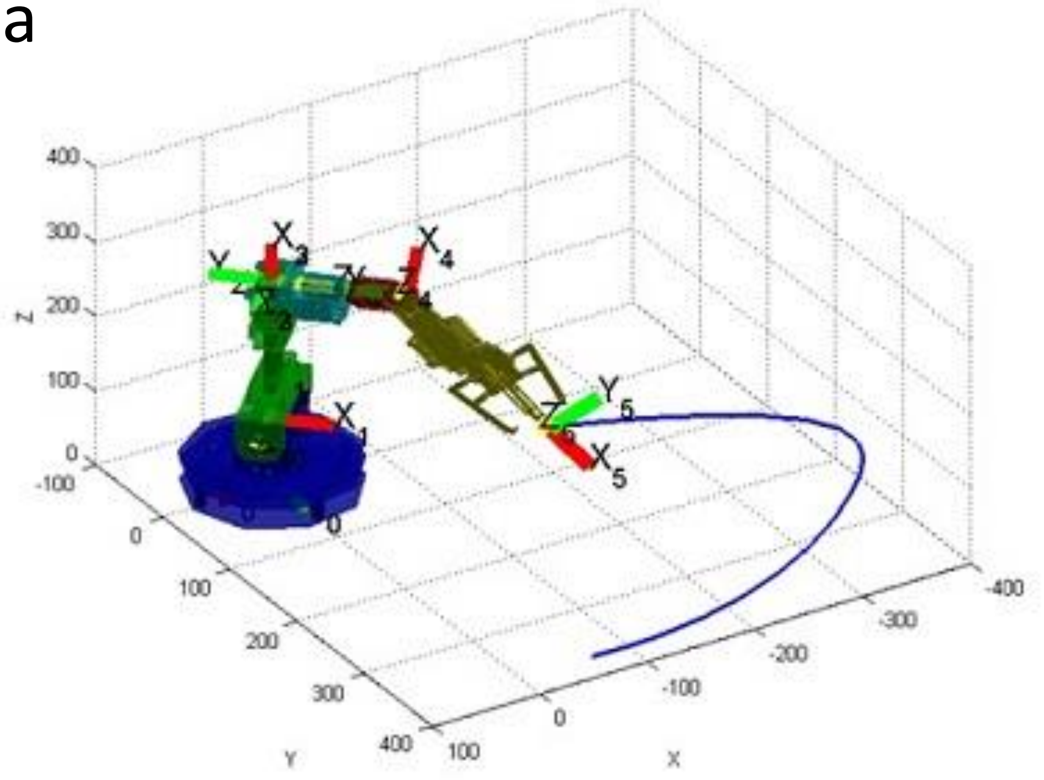
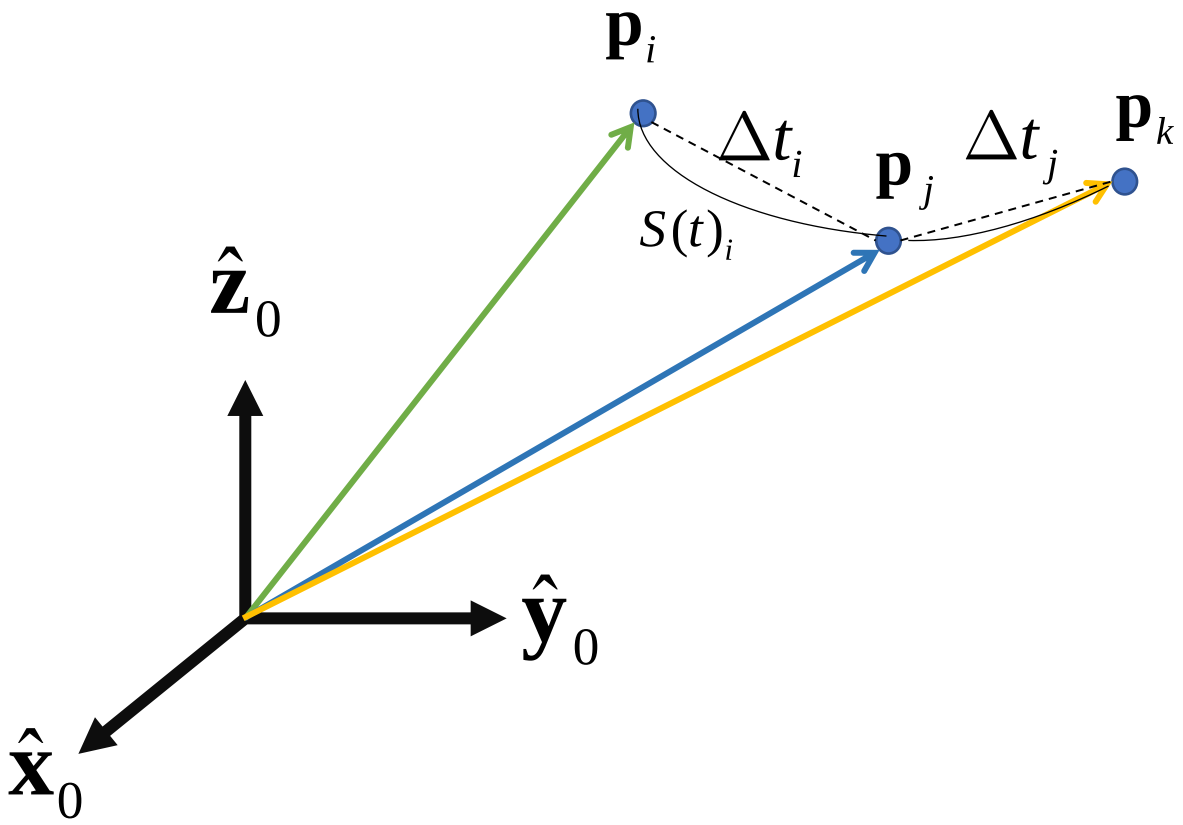


Figura. 25. Simulación del sistema robótico usando un interpolador cubico

Planeación de movimientos

Planeación de movimientos de trabajo de un robot

Trayectoria

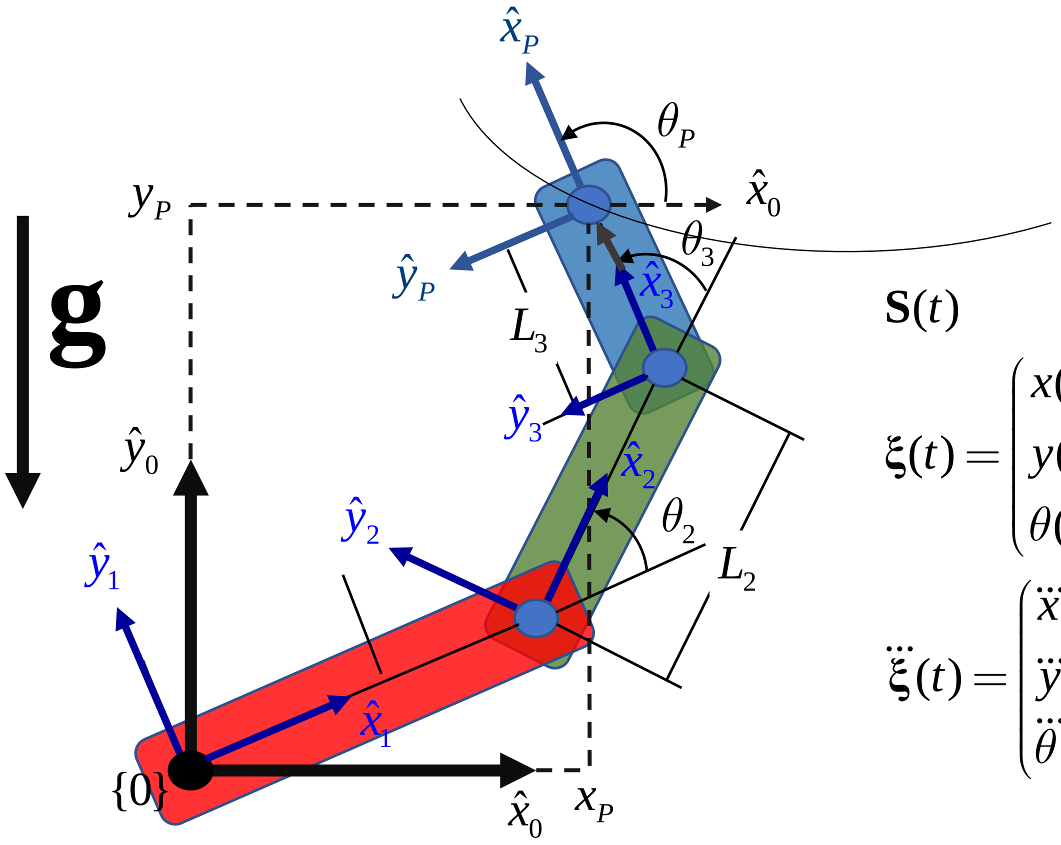


- Lugar geométrico
- Perfil de trayectoria

Planteamiento del modelo dinámico

Cálculo de los pares de un robot (Eüler-Lagrange)

Efectos dinámicos externos



$\mathbf{S}(t)$

$$\xi(t) = \begin{pmatrix} x(t) \\ y(t) \\ \theta(t) \end{pmatrix} \Rightarrow \dot{\xi}(t) = \begin{pmatrix} \dot{x}(t) \\ \dot{y}(t) \\ \dot{\theta}(t) \end{pmatrix} \Rightarrow \ddot{\xi}(t) = \begin{pmatrix} \ddot{x}(t) \\ \ddot{y}(t) \\ \ddot{\theta}(t) \end{pmatrix}$$

$$\dddot{\xi}(t) = \begin{pmatrix} \dddot{x}(t) \\ \dddot{y}(t) \\ \dddot{\theta}(t) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

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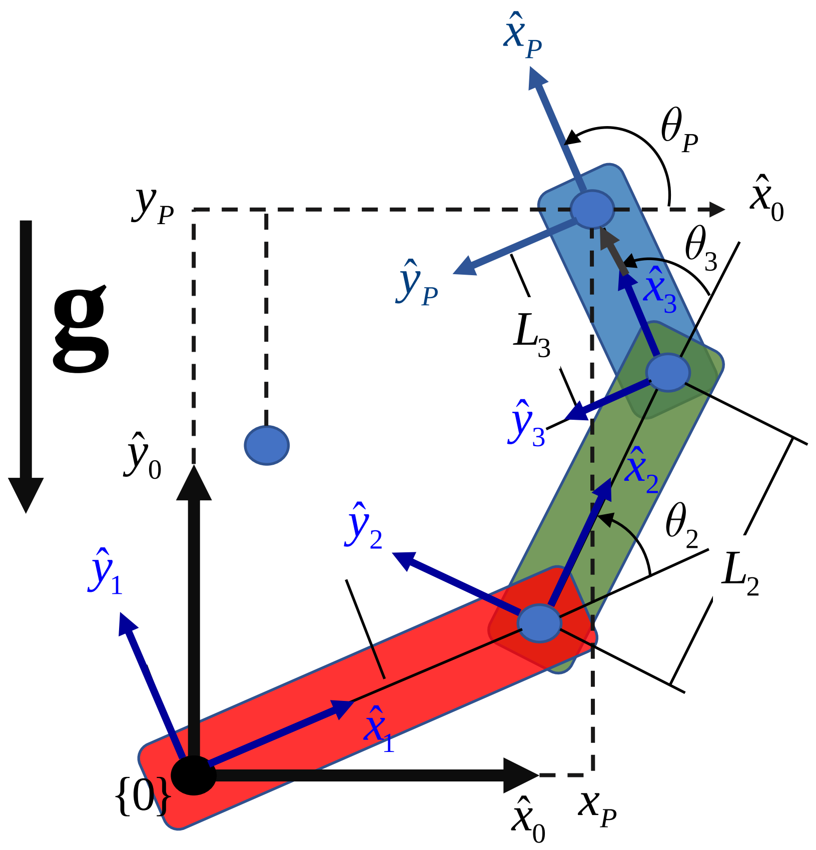

$\mathbf{S}(t)$

$$\xi(t)=\begin{pmatrix}x(t)\\y(t)\\\theta(t)\end{pmatrix}\Rightarrow\dot{\xi}(t)=\begin{pmatrix}\dot{x}(t)\\\dot{y}(t)\\\dot{\theta}(t)\end{pmatrix}\Rightarrow\ddot{\xi}(t)=\begin{pmatrix}\ddot{x}(t)\\\ddot{y}(t)\\\ddot{\theta}(t)\end{pmatrix}$$

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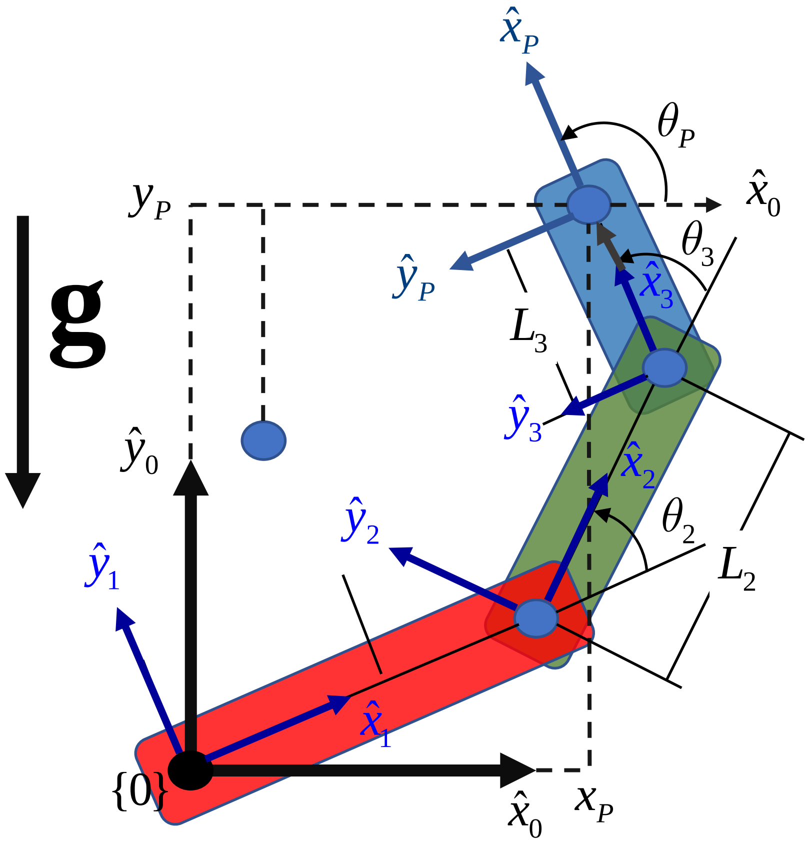

$\mathbf{S}(t)$

$$\xi(t) = \begin{pmatrix} x(t) \\ y(t) \\ \theta(t) \end{pmatrix} \Rightarrow \dot{\xi}(t) = \begin{pmatrix} \dot{x}(t) \\ \dot{y}(t) \\ \dot{\theta}(t) \end{pmatrix} \Rightarrow \ddot{\xi}(t) = \begin{pmatrix} \ddot{x}(t) \\ \ddot{y}(t) \\ \ddot{\theta}(t) \end{pmatrix}$$

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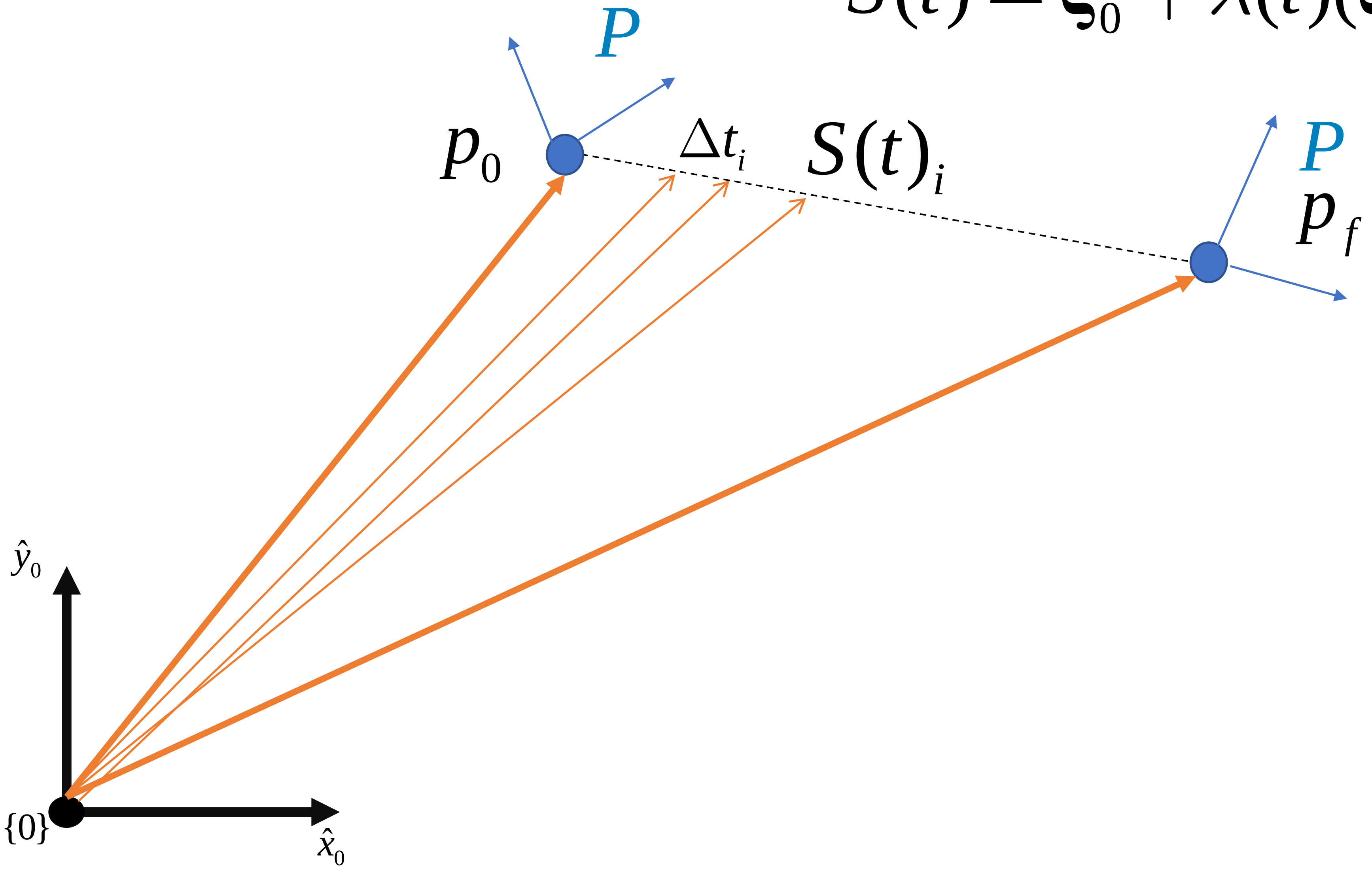
$$S(t) = \xi_0 + \lambda(t)(\xi_f - \xi_0)$$



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

$$
{}^{0}\boldsymbol{\xi}_P = \begin{pmatrix} {}^{0}x_P \\ {}^{0}y_P \\ {}^{0}\theta_P \end{pmatrix}
$$

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

$$
{}^{0}\boldsymbol{\xi}_P(t) = {}^{0}\boldsymbol{\xi}_P(q)
$$

$$
\mathbf{F}(X, q) = {}^{0}\boldsymbol{\xi}_P(t) - {}^{0}\boldsymbol{\xi}_P(q) = \mathbf{0}
$$

$$
\mathbf{F}(X, q) = {}^{0}\boldsymbol{\xi}_P(q) - {}^{0}\boldsymbol{\xi}_P(t) = \mathbf{0}
$$

$$X = \{ {}^0x_P, {}^0y_P, {}^0\theta_P \}$$

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

$$F(X,q) = \begin{pmatrix} {}^0x_3(t) \\ {}^0y_3(t) \\ {}^0\theta_3(t) \end{pmatrix} - \begin{pmatrix} {}^0x_1 + L_1\cos({}^0\theta_1) + L_2\cos({}^0\theta_1 + {}^1\theta_2) \\ {}^0y_1 + L_1\sin({}^0\theta_1) + L_2\sin({}^0\theta_1 + {}^1\theta_2) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

$$F(X,q) = \begin{pmatrix} {}^0x_1 + L_1\cos({}^0\theta_1) + L_2\cos({}^0\theta_1 + {}^1\theta_2) \\ {}^0y_1 + L_1\sin({}^0\theta_1) + L_2\sin({}^0\theta_1 + {}^1\theta_2) \\ {}^0\theta_1 + {}^1\theta_2 + {}^2\theta_3 \end{pmatrix} - \begin{pmatrix} {}^0x_3(t) \\ {}^0y_3(t) \\ {}^0\theta_3(t) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

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

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