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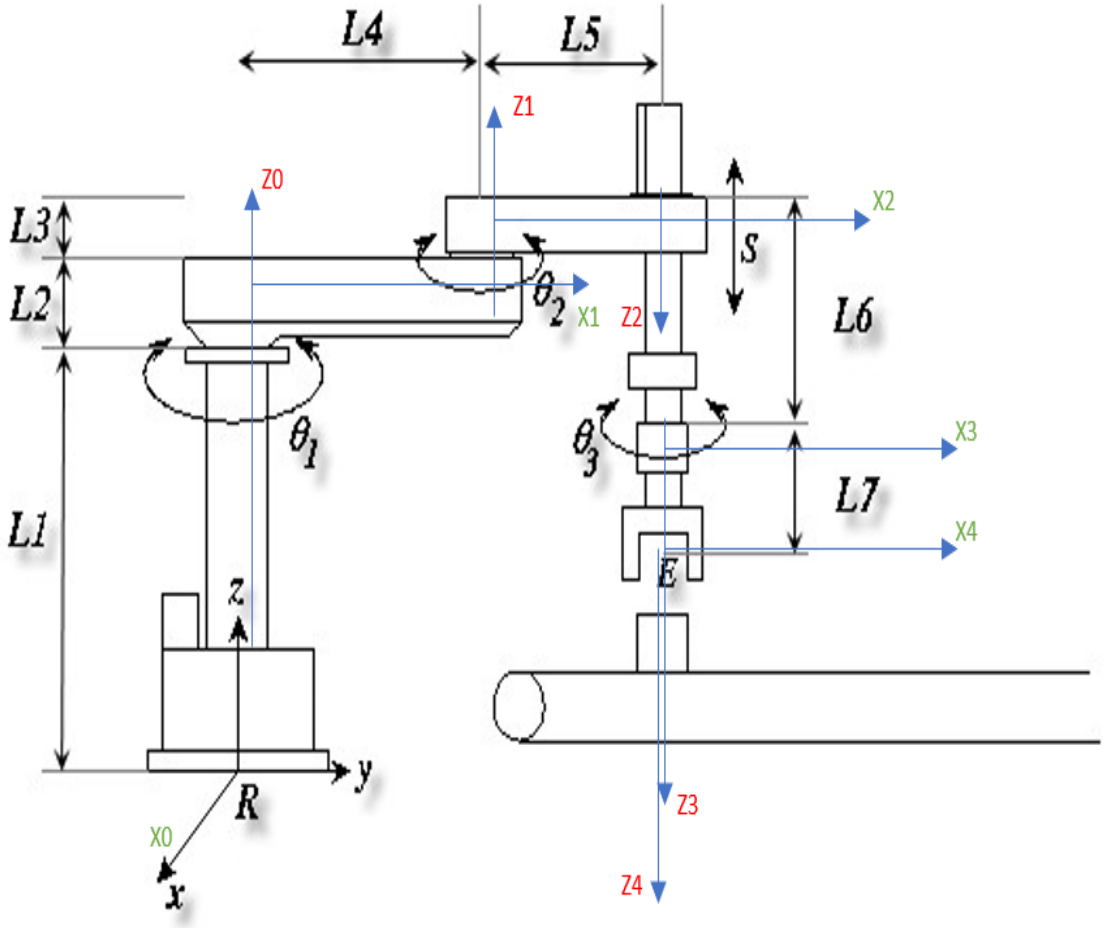
1. Bài 7



ONE

TWO

Thứ ngày tháng

Bài 7

	θ	l	α	d	var
0	θ_1	l_4	0	l_1+l_2	θ_1
1	$\theta_4+\frac{\pi}{2}$	l_4	0	l_3	θ_2
2	θ_2	l_5	0	l_6+S	S
3	0	0	0	l_7	θ_3
4	θ_3	0	0		

$$
{}^0T_4 = \begin{bmatrix} C_1 & -S_1 & 0 & l_4C_1 \\ -S_1 & -C_1 & 0 & -l_4S_1 \\ C_1C_1 & -S_1C_1 & 0 & l_4C_1 \\ 0 & 0 & 1 & l_1+l_2 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

1-0-1

$$
\begin{bmatrix} C_2 & S_2 & 0 & l_5C_2 \\ S_2 & C_2 & 0 & l_5S_2 \\ 0 & 0 & 1 & l_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & -l_6-S \\ 0 & 0 & 0 & 1 \end{bmatrix}
\begin{bmatrix} C_3 & -S_3 & 0 & 0 \\ S_3 & C_3 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

HONGHA

Thứ ___ ngày ___ tháng ___

$$= \begin{bmatrix} -S_{12} & -C_{12} & 0 & -l_5 S_{12} - l_4 S_1 \\ C_{12} & -S_{12} & 0 & l_5 C_{12} + l_4 C_1 \\ 0 & 0 & 1 & l_1 + l_2 + l_3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & -l_6 - l_7 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} C_3 & -S_3 & 0 & 0 \\ S_3 & C_3 & 0 & 0 \\ 0 & 0 & 1 & l_7 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -S_{12} & -C_{12} & 0 & -l_5 S_{12} - l_4 S_1 \\ C_{12} & -S_{12} & 0 & l_5 C_{12} + l_4 C_1 \\ 0 & 0 & 1 & l_1 + l_2 + l_3 - l_6 - l_7 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} C_3 & -S_3 & 0 & 0 \\ S_3 & C_3 & 0 & 0 \\ 0 & 0 & 1 & l_7 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -S_{123} & -C_{123} & 0 & -l_5 S_{12} - l_4 S_1 \\ C_{123} & -S_{123} & 0 & l_5 C_{12} - l_4 C_1 \\ 0 & 0 & 1 & l_1 + l_2 + l_3 - l_6 + l_7 - S \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$P_x = -l_5 S_{12} - l_4 S_1$

$P_y = l_5 C_{12} + l_4 C_1$

$P_z = l_1 + l_2 + l_3 - l_6 + l_7 + S \Rightarrow S = P_z - l_1 - l_2 - l_3 + l_6 - l_7$

$P_x^2 = l_5^2 S_{12}^2 + 2 l_5 S_{12} l_4 S_1 + l_4^2 S_1^2$

$P_y^2 = l_5^2 C_{12}^2 + 2 l_5 C_{12} l_4 C_1 + l_4^2 C_1^2$

$P_x^2 + P_y^2 = l_5^2 + l_4^2 + 2 l_5 l_4 (S_{12} S_1 + C_{12} C_1)$

HONG HA

Thứ ... ngày ... tháng ...

$$= l_4^2 + l_5^2 + 2 l_4 l_5 C_2$$

$$\Rightarrow C_2 = \frac{P_x^2 + P_y^2 - l_4^2 - l_5^2}{2 l_4 l_5}$$

$$S_2 = \sqrt{1 - C_2^2}$$

$$\theta_2 = \text{atan2}(C_2, S_2)$$

$$\begin{cases} P_x = -l_5(S_1 C_2 + C_1 S_2) - l_4 S_1 \\ P_y = l_5(C_1 C_2 - S_1 S_2) + l_4 C_1 \end{cases}$$

$$\begin{cases} P_x = -l_5 S_1 C_2 - l_5 C_1 S_2 - l_4 S_1 \\ P_y = l_5 C_1 C_2 - l_5 S_1 S_2 + l_4 C_1 \end{cases}$$

$$\begin{bmatrix} P_x \\ P_y \end{bmatrix} = \begin{bmatrix} -l_5 S_2 & -(l_4 + l_5 S_1 C_2) \\ l_4 + l_5 C_2 & -l_5 S_2 \end{bmatrix}$$

$$\Rightarrow C_1 = \frac{-P_x l_5 S_2 + P_y(l_4 + l_5 S_1)}{D}$$

$$S_1 = \frac{-P_y l_5 S_2 - P_x(l_4 + l_5 C_2)}{D}$$

$$\theta_1 = \text{atan2}(C_1, S_1)$$

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