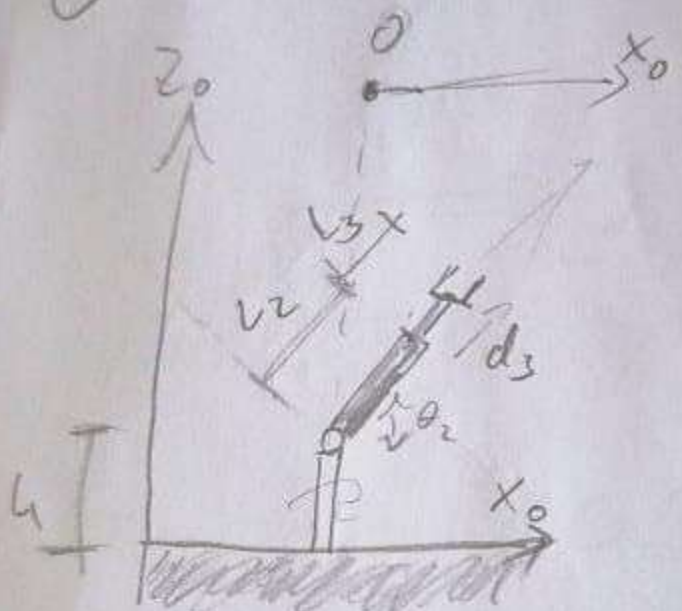
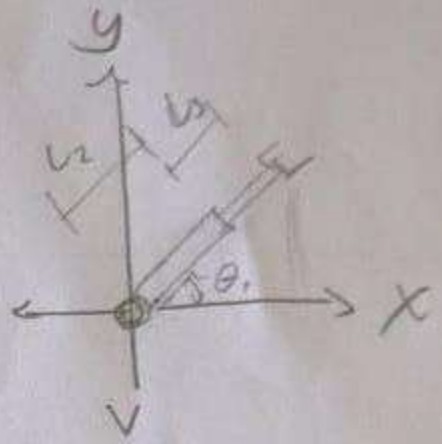
(2)



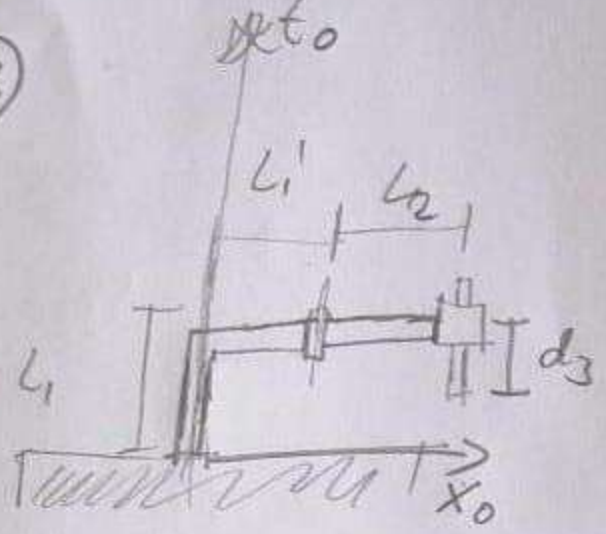


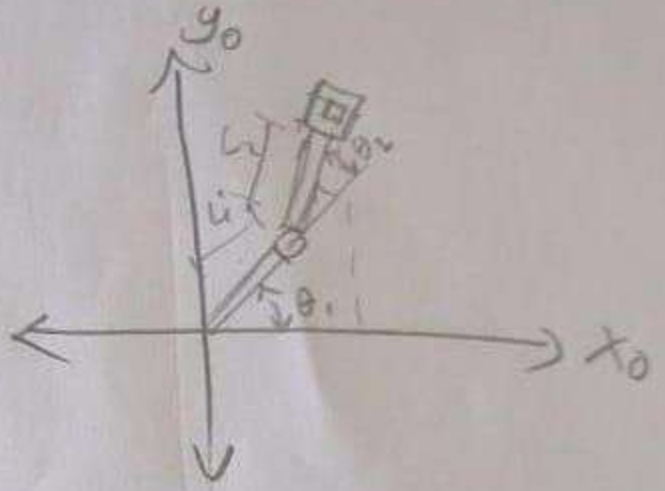
$$x = (L_2 + d_3)\cos\theta_2 \cos\theta_1 = (L_2 + d_3)C\theta_2 C\theta_1$$

$$y = (L_2 + d_3)\cos\theta_2 \sin\theta_1 = (L_2 + d_3)C\theta_2 S\theta_1$$

$$z = L_1 + (L_2 + d_3)\sin\theta_2 = L_1 + (L_2 + d_3)S\theta_2$$

③



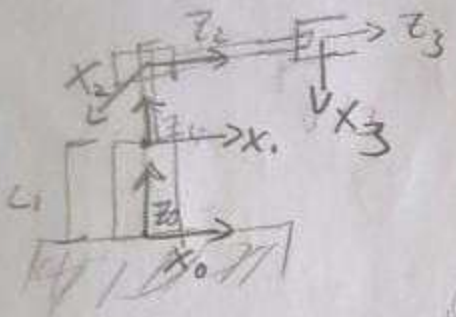


$$x = L_1' C\theta_1 + L_2 C(\theta_1+\theta_2) = L_1' C\theta_1 + L_2 C(\theta_1+\theta_2)$$

$$y = L_1' S\theta_1 + L_2 S(\theta_1+\theta_2)$$

$$z = L_1 - d_3$$

①



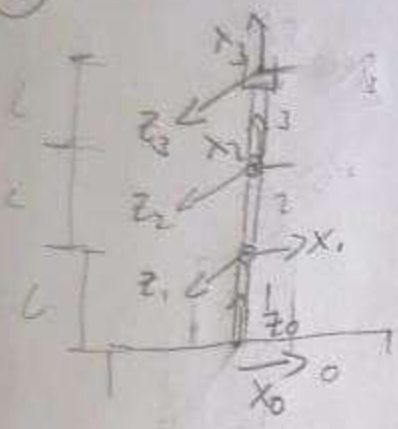
A_i	θ_i	d_i	a_i	α_i
1	q_1	L_1	0	0
2	-90	q_2	0	-90
3	90	q_3	0	0

$$ {}^{i-1}A_i = \left(\begin{array}{ccc|c} C\theta & -C\alpha S\theta & S\alpha S\theta & aC\theta \\ S\theta & C\alpha C\theta & -S\alpha C\theta & aS\theta \\ 0 & S\alpha & C\alpha & d_i \\ \hline 0 & 0 & 0 & 1 \end{array}\right) \qquad T = {}^0A_3 = {}^0A_1\,{}^1A_2\,{}^2A_3 $$

$$ {}^0A_1 = \left(\begin{array}{ccc|c} C\theta_1 & -S\theta & 0 & 0 \\ S\theta_1 & C\theta & 0 & 0 \\ 0 & 0 & 1 & L_1 \\ \hline 0 & 0 & 0 & 1 \end{array}\right) \qquad {}^1A_2 = \left(\begin{array}{ccc|c} 0 & 0 & 1 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & q_2 \\ \hline 0 & 0 & 0 & 1 \end{array}\right) $$

$$ {}^2A_3 = \left(\begin{array}{ccc|c} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & q_3 \\ \hline 0 & 0 & 0 & 1 \end{array}\right) $$

④



A	θ_i	d_i	a_i	α_i
1	q_1	L_1	0	90
2	q_2	0	L_2	0
3	q_3	0	L_3	0

$$T = {}^0A_3 = {}^0A_1\,{}^1A_2\,{}^2A_3$$

$${}^{i-1}A_i = \begin{pmatrix} C\theta & -C\alpha S\theta & S\alpha S\theta & aC\theta \\ S\theta & C\alpha C\theta & -S\alpha C\theta & aS\theta \\ 0 & S\alpha & C\alpha & d_i \\ \hline 0 & 0 & 0 & 1 \end{pmatrix}$$

$${}^0A_1 = \begin{pmatrix} C\theta_1 & 0 & S\theta_1 & 0 \\ S\theta_1 & 0 & -C\theta_1 & 0 \\ 0 & 1 & 0 & L_1 \\ \hline 0 & 0 & 0 & 1 \end{pmatrix}$$

$${}^1A_2 = \begin{pmatrix} C\theta_2 & -S\theta_2 & 0 & L_2C\theta_2 \\ S\theta_2 & C\theta_2 & 0 & L_2S\theta_2 \\ 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 0 & 1 \end{pmatrix}$$

$${}^2A_3 = \begin{pmatrix} C\theta_3 & -S\theta_3 & 0 & L_3C\theta_3 \\ S\theta_3 & C\theta_3 & 0 & L_3S\theta_3 \\ 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 0 & 1 \end{pmatrix}$$