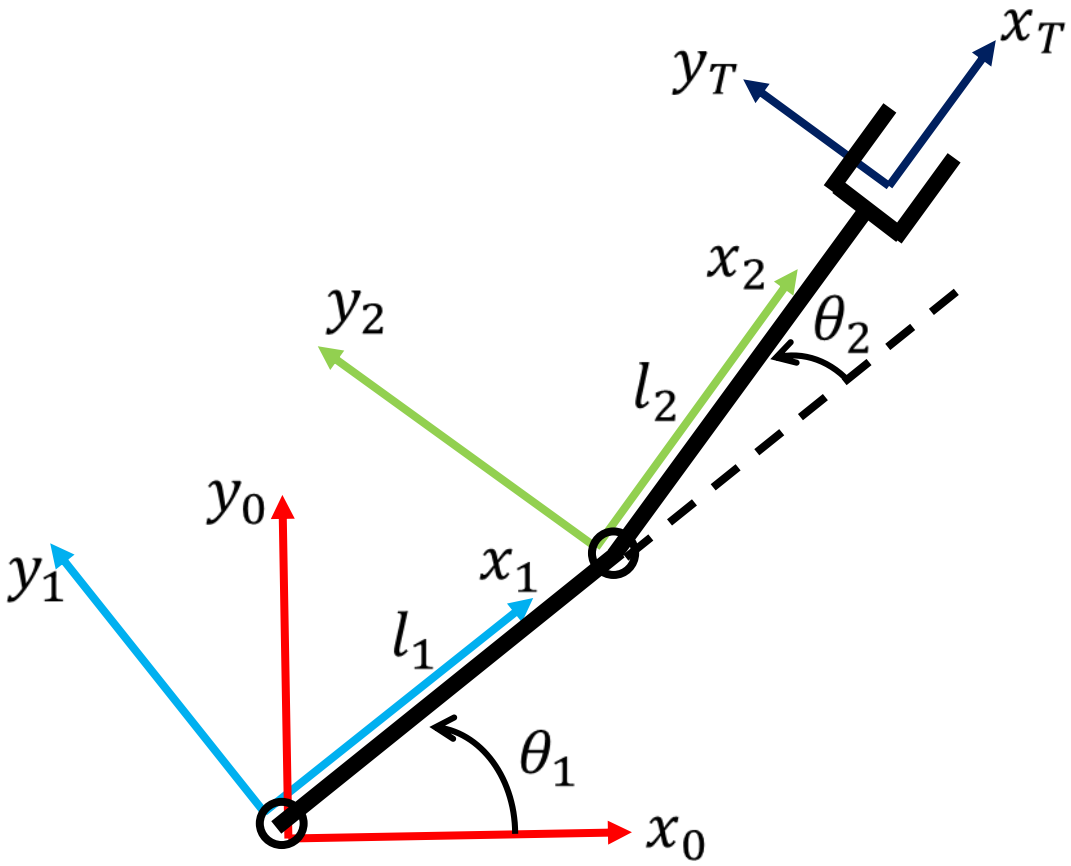
Robotic Arms Library – HW 1 – DH Parameters

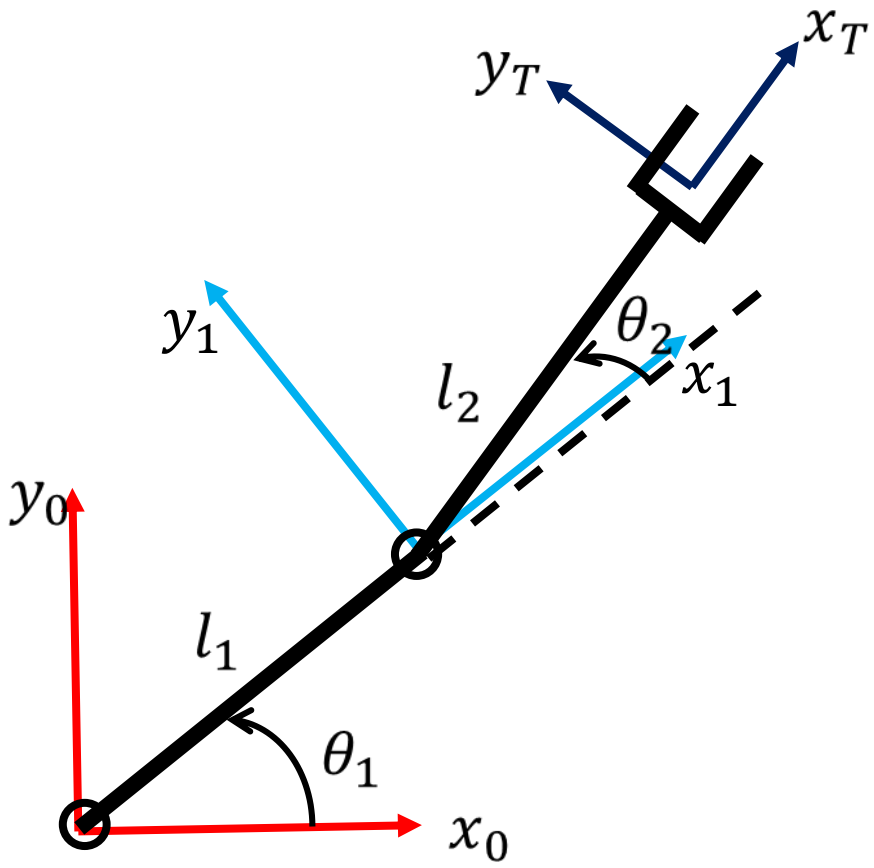
2D – 1 – RR (modified DH)



2D – 1 – RR - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	0	θ_1
1	2	0	l_1	0	θ_2
2	T	0	l_2	0	0

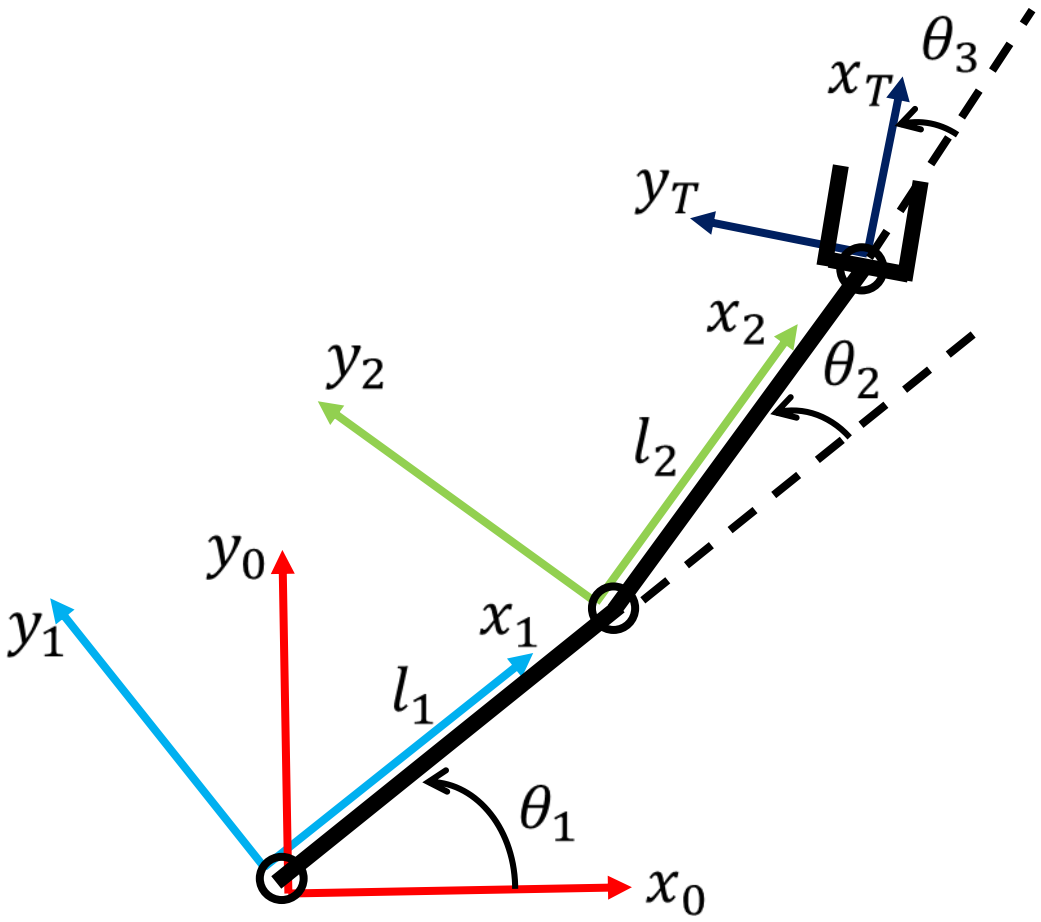
2D – 1 – RR (standard DH)



2D – 1 – RR - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	0	l_1	0	θ_1
1	T	0	l_2	0	θ_2

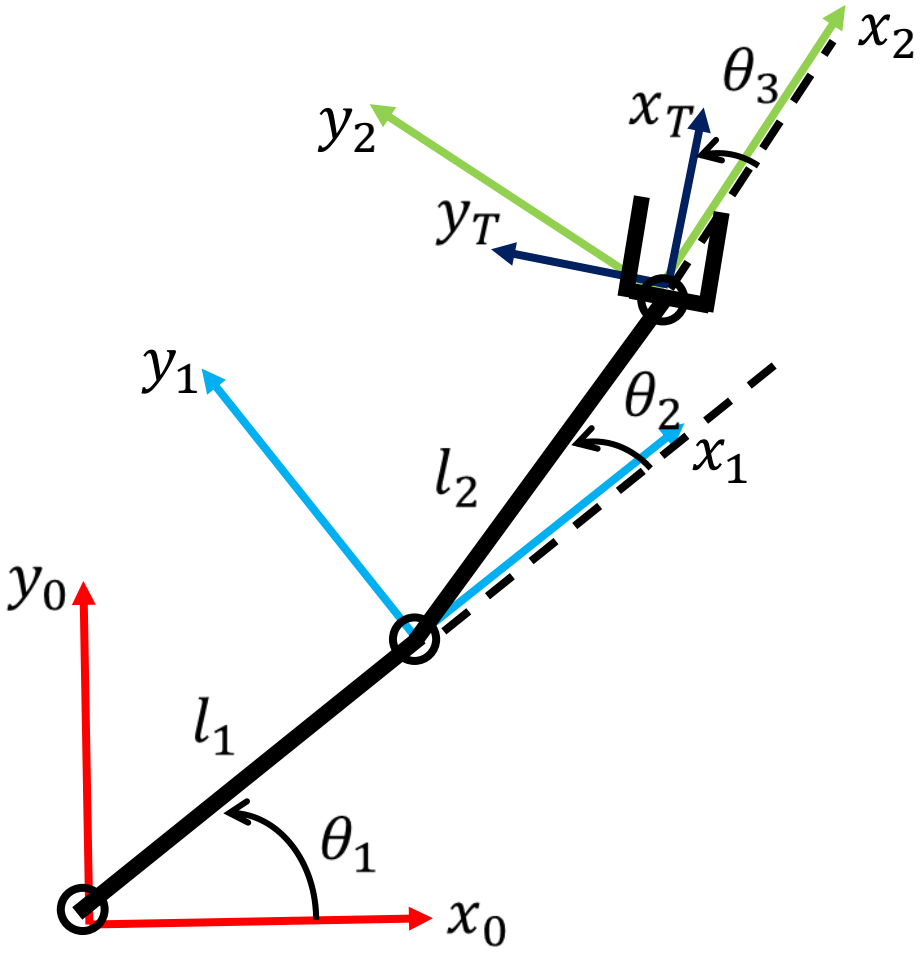
2D – 2 – RRR (modified DH)



2D – 2 – RRR - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	0	θ_1
1	2	0	l_1	0	θ_2
2	T	0	l_2	0	θ_3

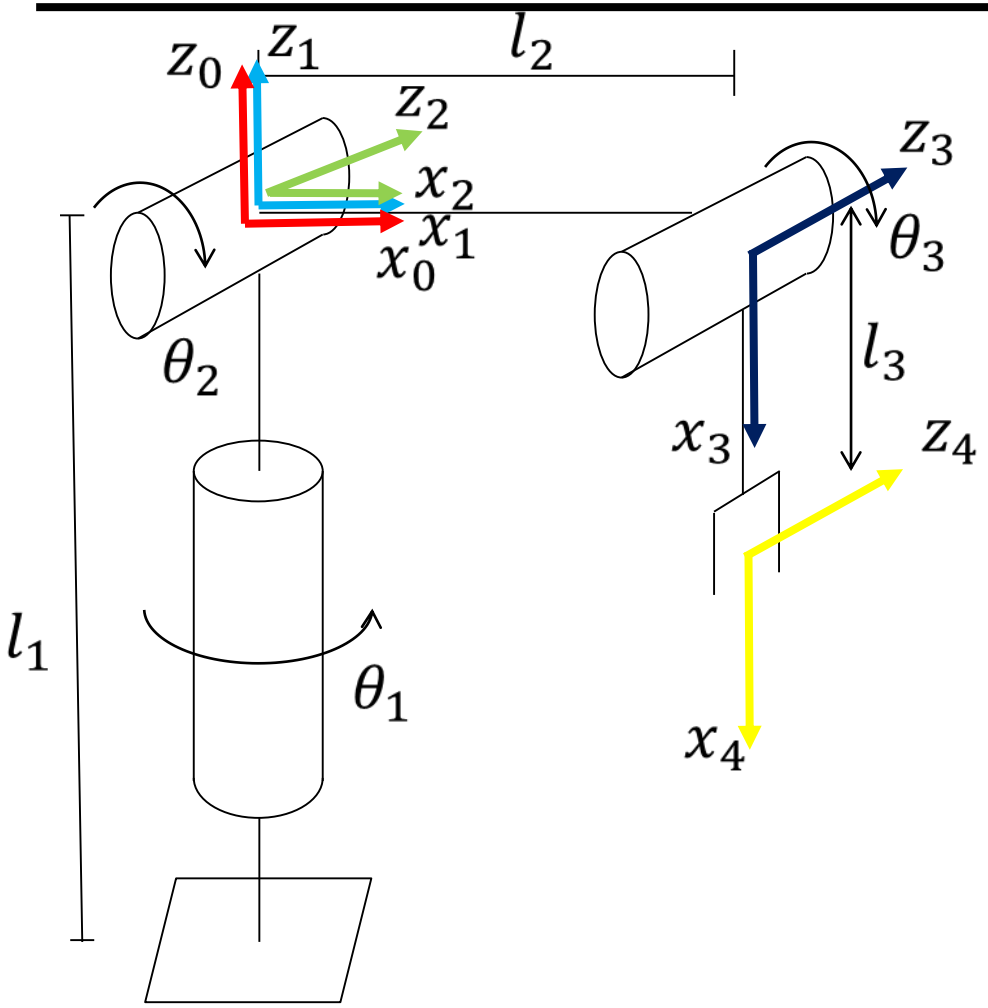
2D – 2 – RRR (standard DH)



2D – 2 – RRR - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	0	l_1	0	θ_1
1	2	0	l_2	0	θ_2
2	T	0	0	0	θ_3

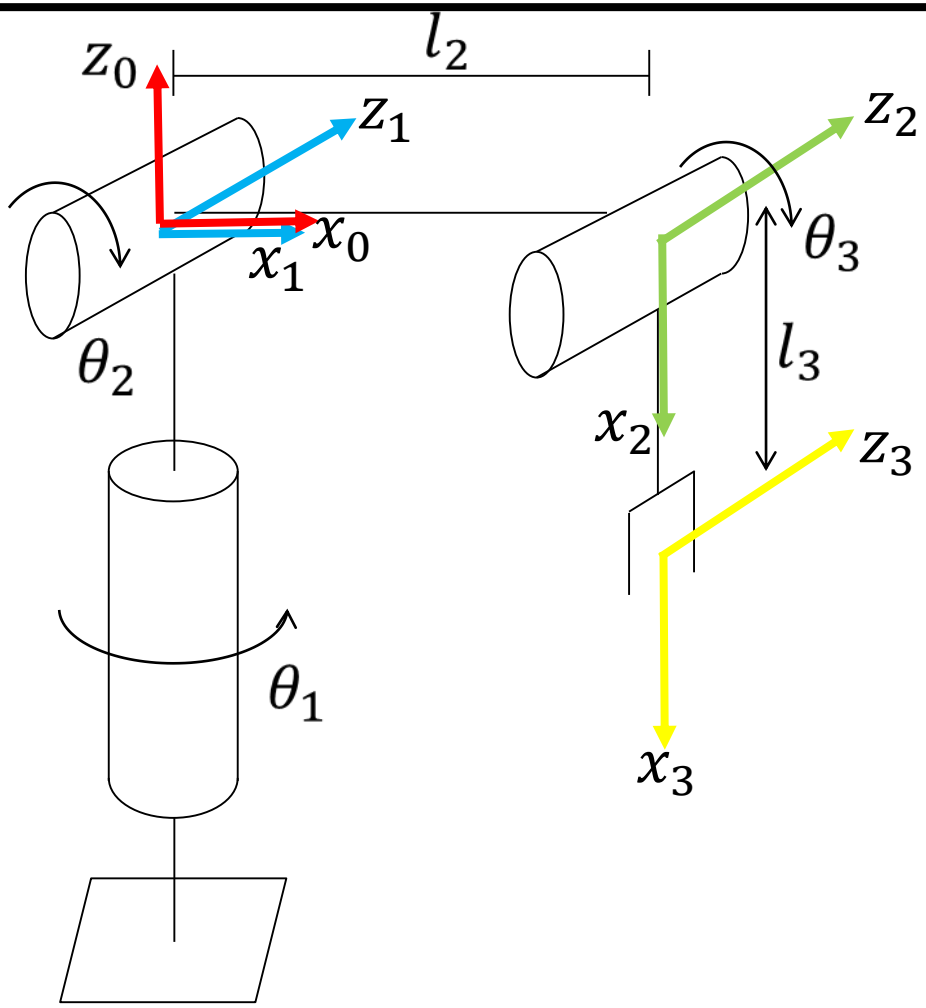
3D – 1 – RRR (modified DH)



3D – 1 – RRR - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	0	θ_1
1	2	-90°	0	0	θ_2
2	3	0	l_2	0	θ_3
3	4	0	l_3	0	0

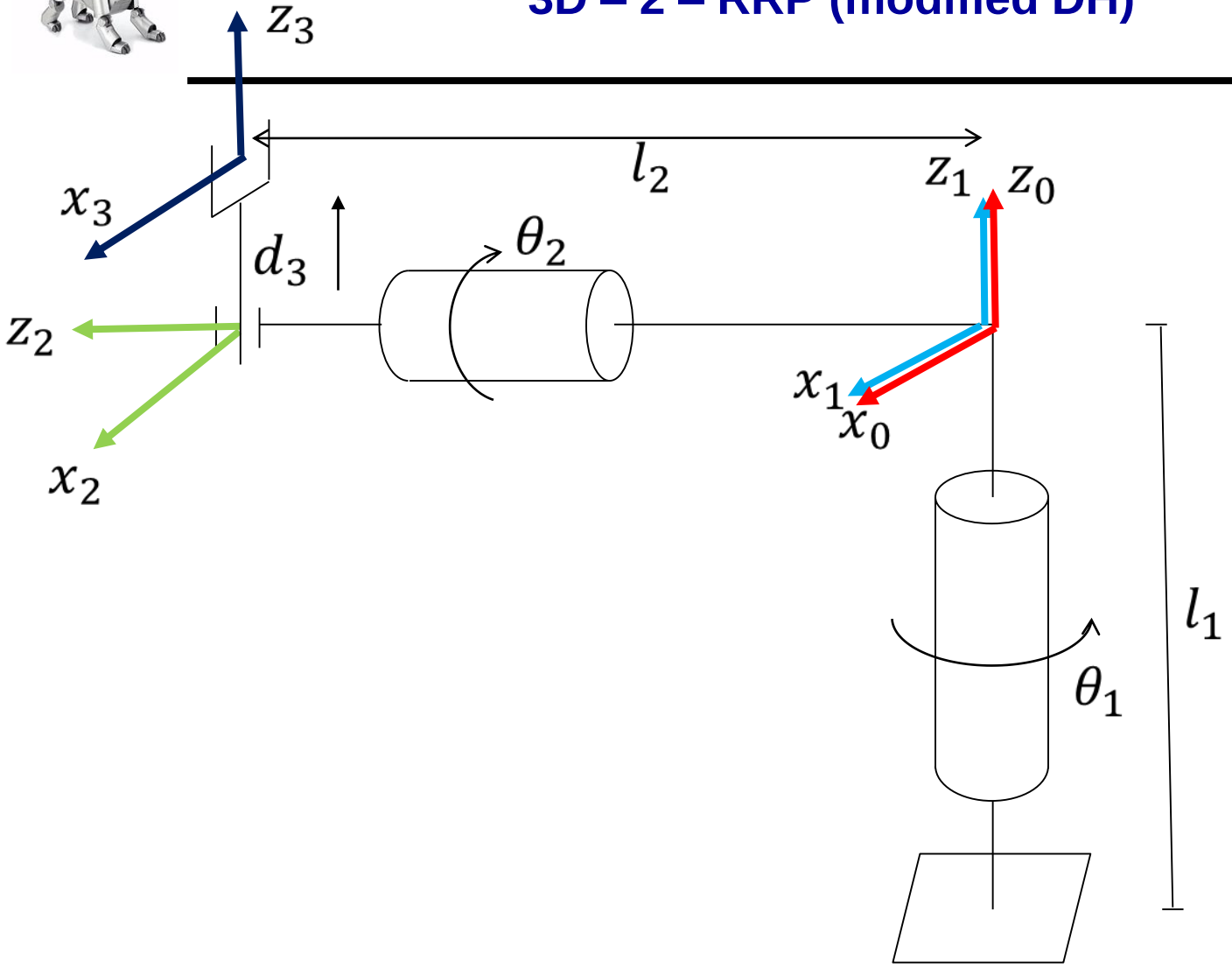
3D – 1 – RRR (standard DH)



3D – 1 – RRR - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	-90°	0	0	θ_1
1	2	0	l_2	0	θ_2+90°
2	3	0	l_3	0	θ_3

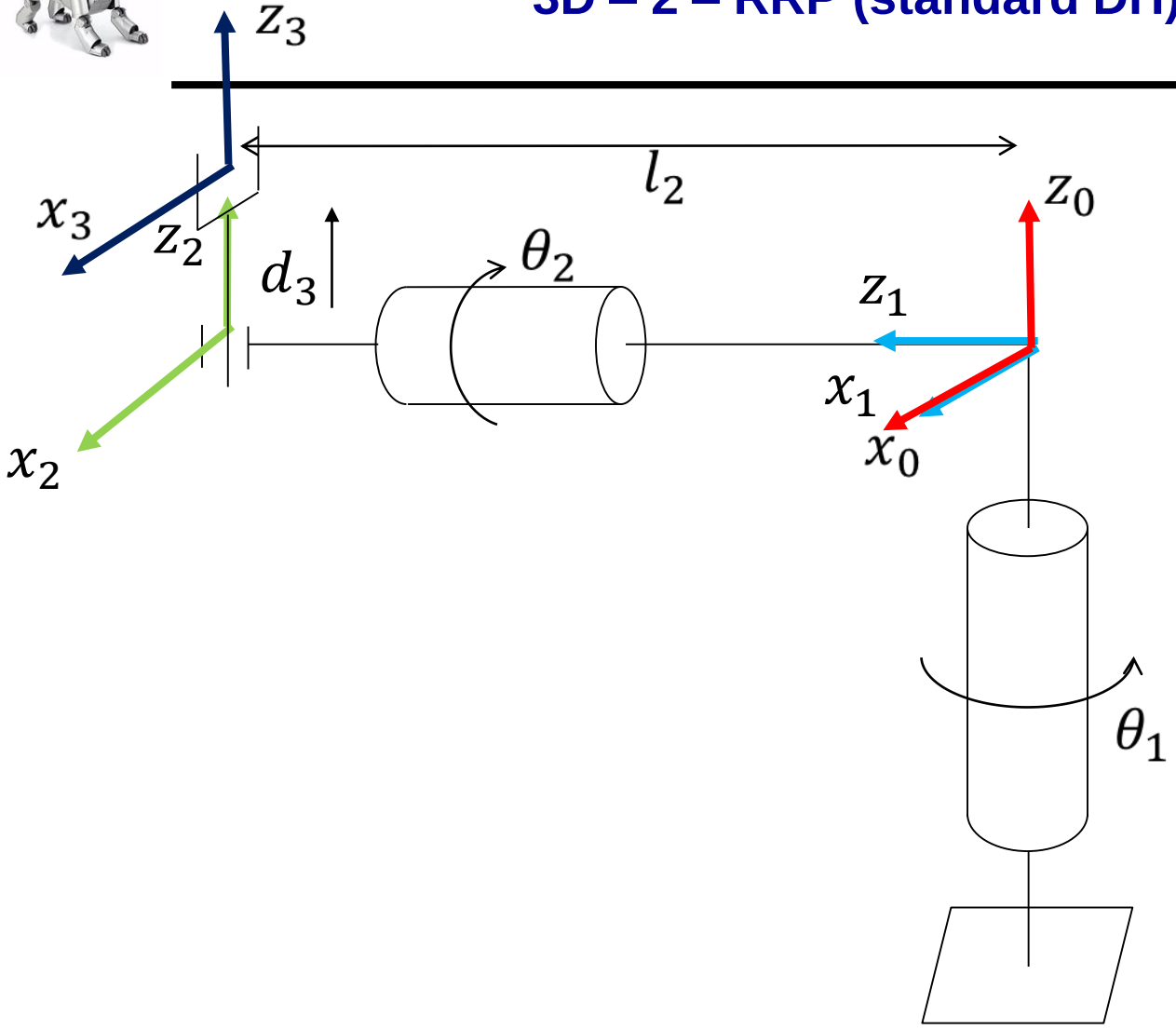
3D – 2 – RRP (modified DH)



3D – 2 – RRP - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	0	θ_1
1	2	90°	0	l_2	θ_2
2	3	-90°	0	d_3	0

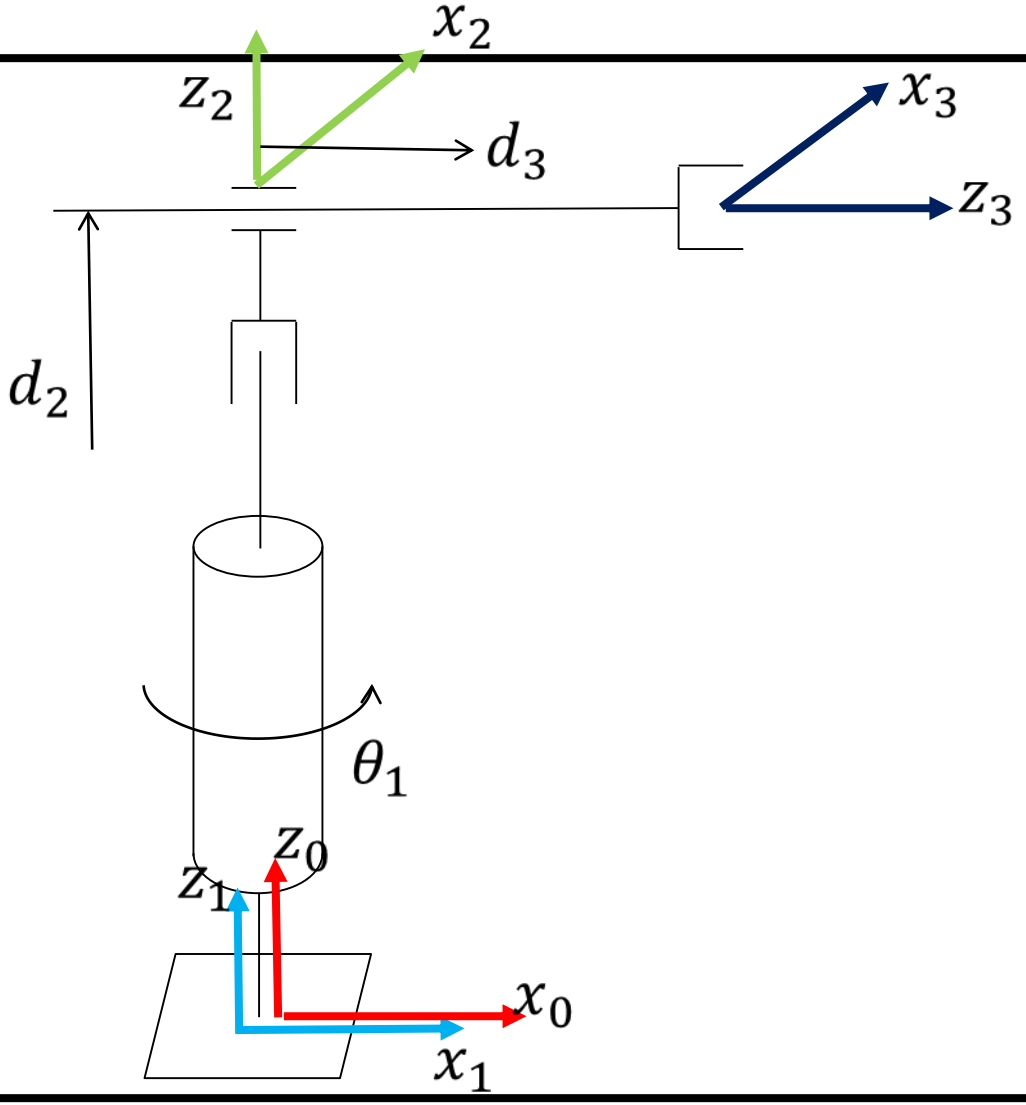
3D – 2 – RRP (standard DH)



3D – 2 – RRP - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	90°	0	0	θ_1
1	2	-90°	0	l_2	θ_2
2	3	0	0	d_3	0

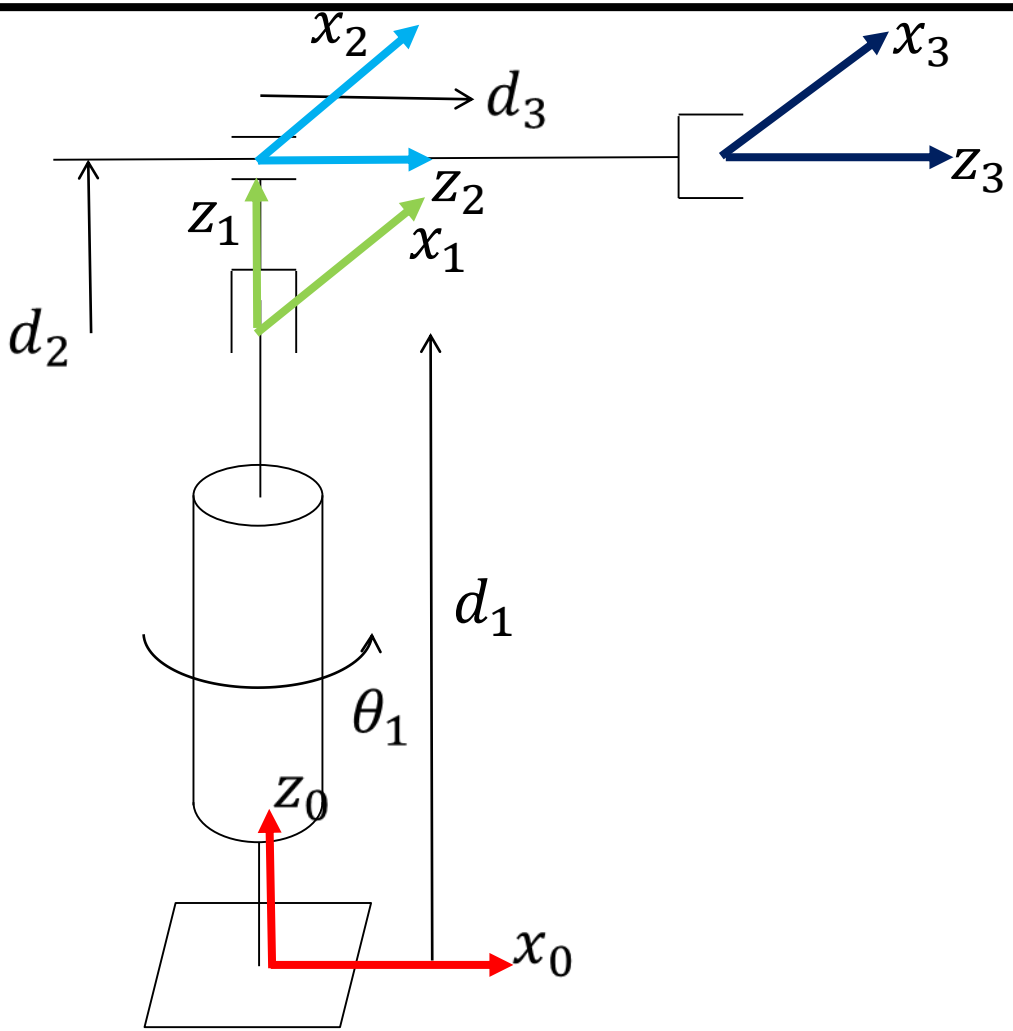
3D – 4 – RPP (Cylindrical Robot, modified DH)



3D – 4 – RPP - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	0	θ_1
1	2	0	0	d_2	90°
2	3	90°	0	d_3	0

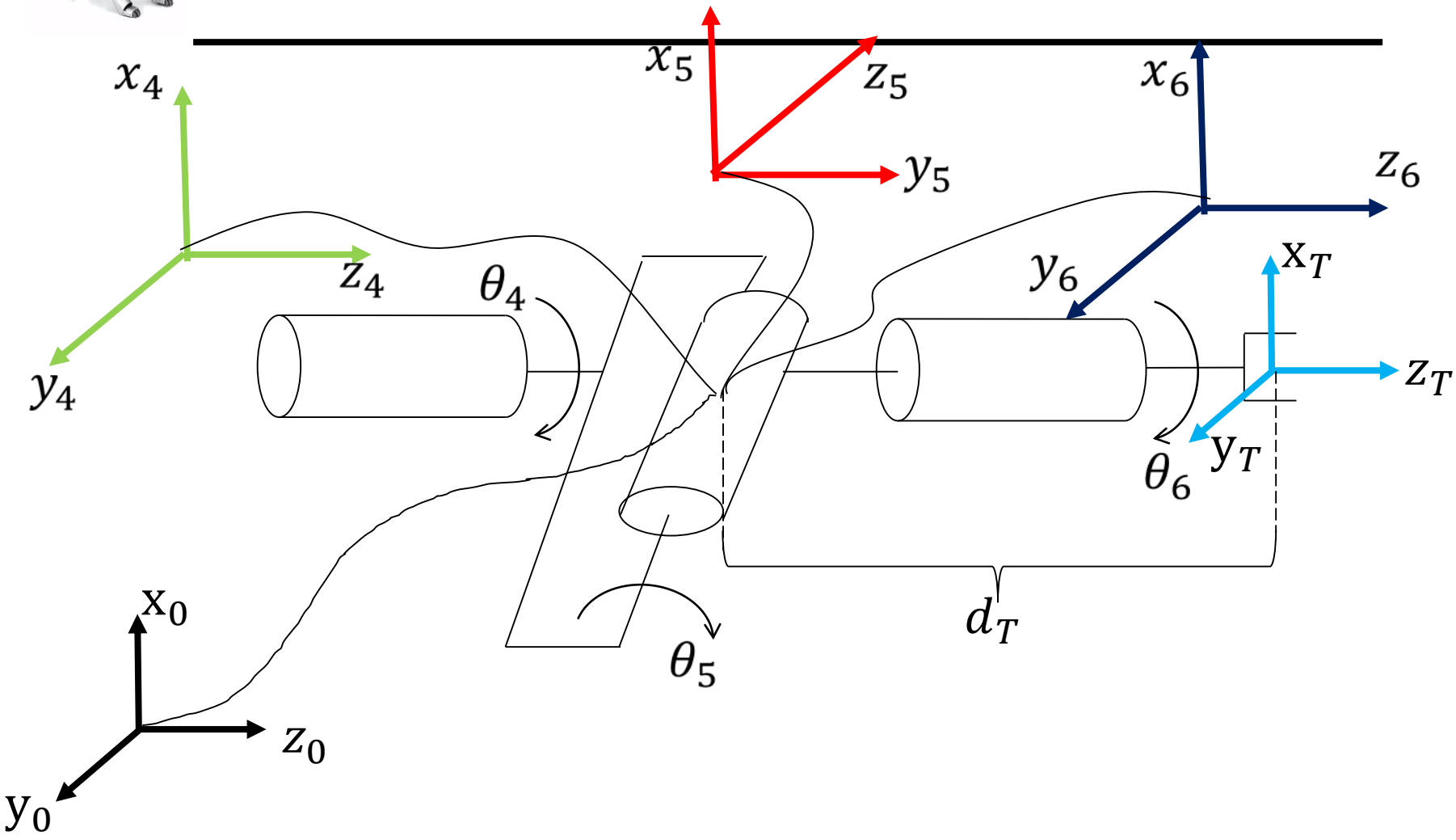
3D – 4 – RPP (Cylindrical Robot, standard DH)



3D – 4 – RPP - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	0	0	d_1	θ_1+90°
1	2	90°	0	d_2	0
2	3	0	0	d_3	0

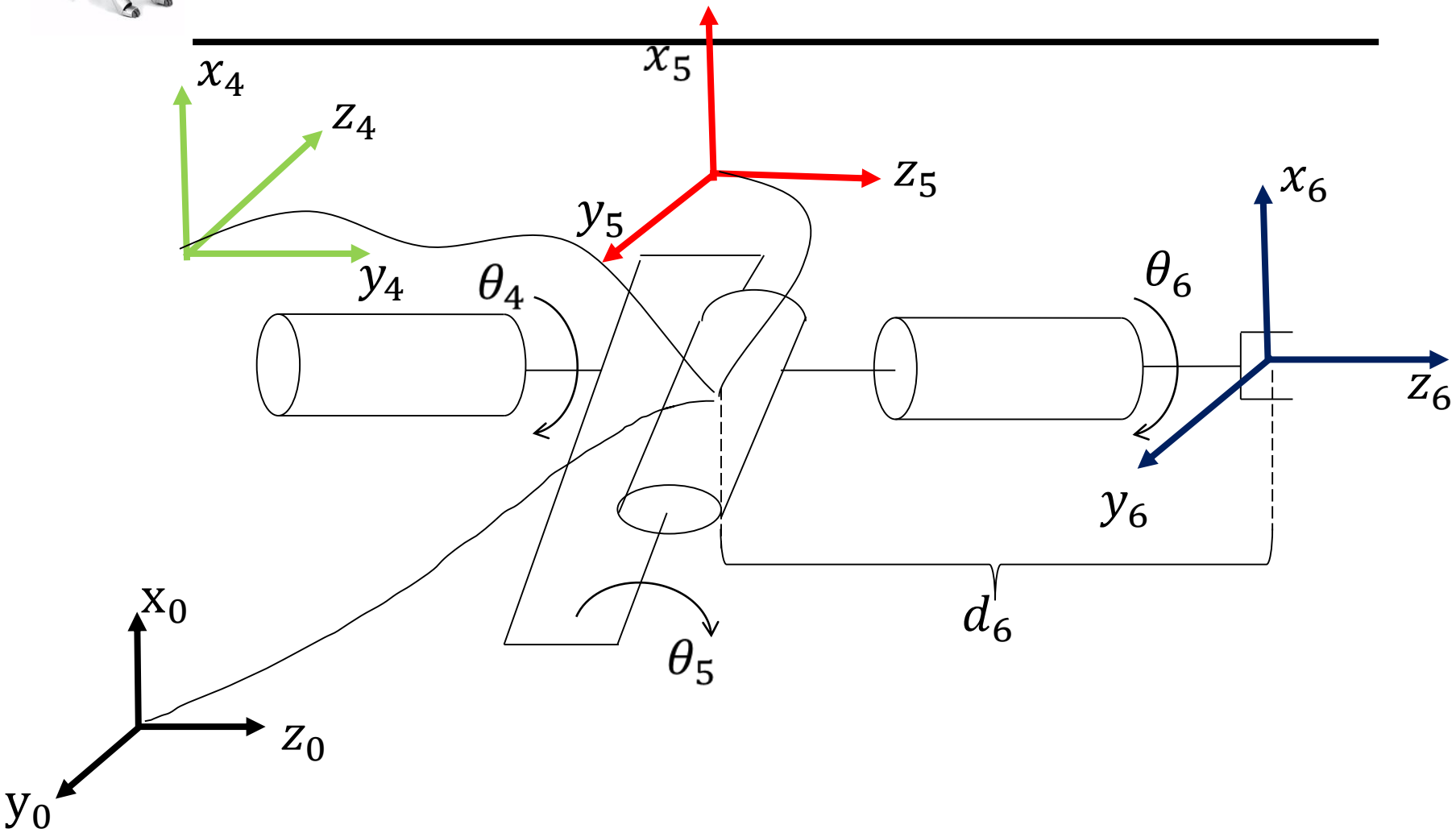
3D – 4 – RRR (Spherical Wrist, modified DH)



3D – 4 – RRR - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
3	4	0	0	0	θ_4
4	5	90°	0	0	θ_5
5	6	-90°	0	0	θ_6
6	T	0	0	d_T	0

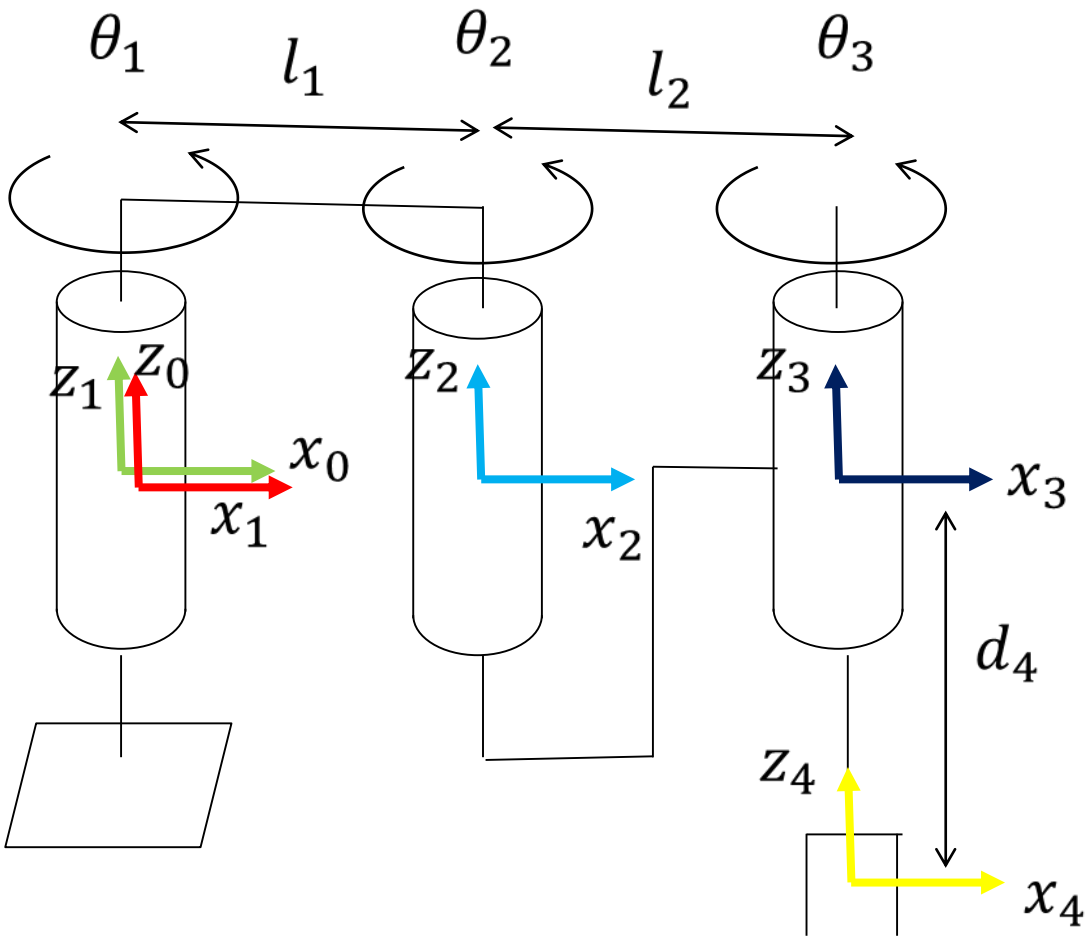
3D – 4 – RRR (Spherical Wrist, standard DH)



3D – 4 – RRR - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
3	4	90°	0	0	θ_4
4	5	-90°	0	0	θ_5
5	6	0	0	d_6	θ_6

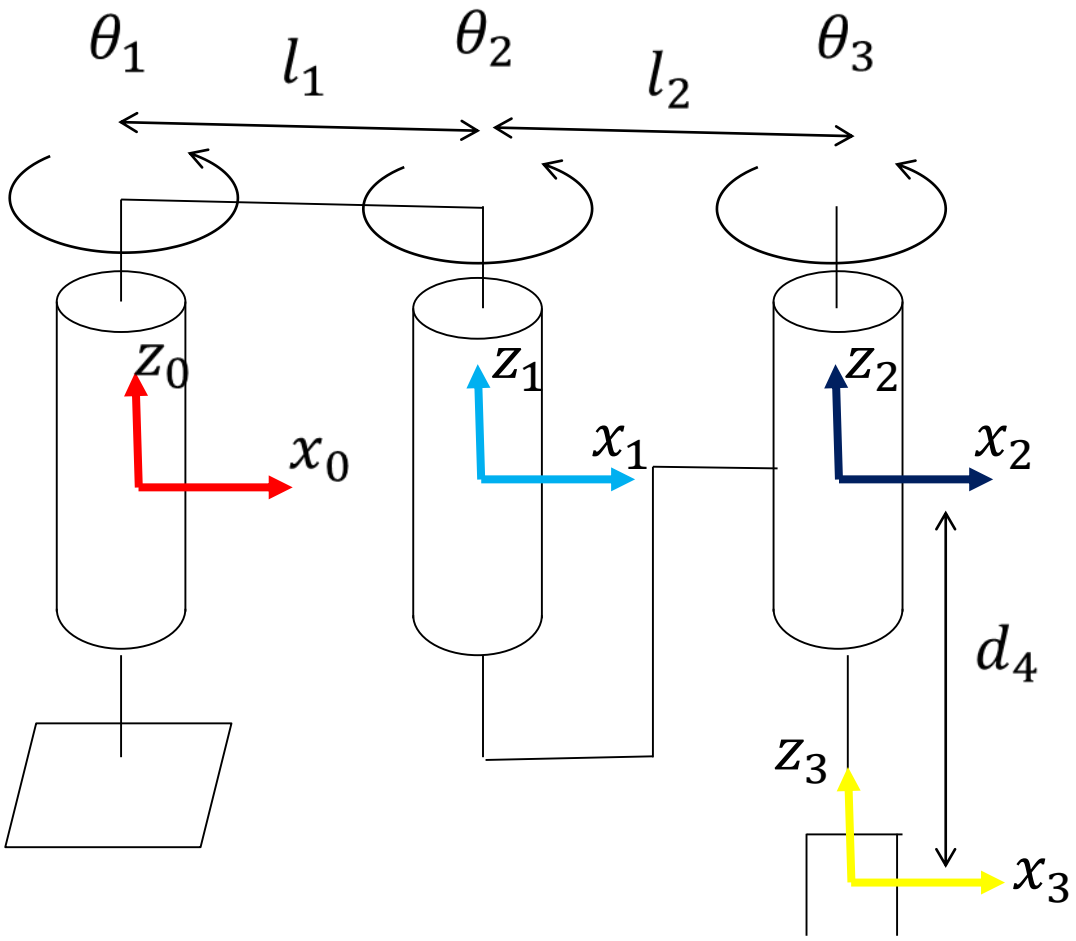
3D – 5 – RRRP (modified DH)



3D – 5 – RRRP - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	0	θ_1
1	2	0	l_1	0	θ_2
2	3	0	l_2	0	θ_3
3	4	0	0	$-d_4$	0

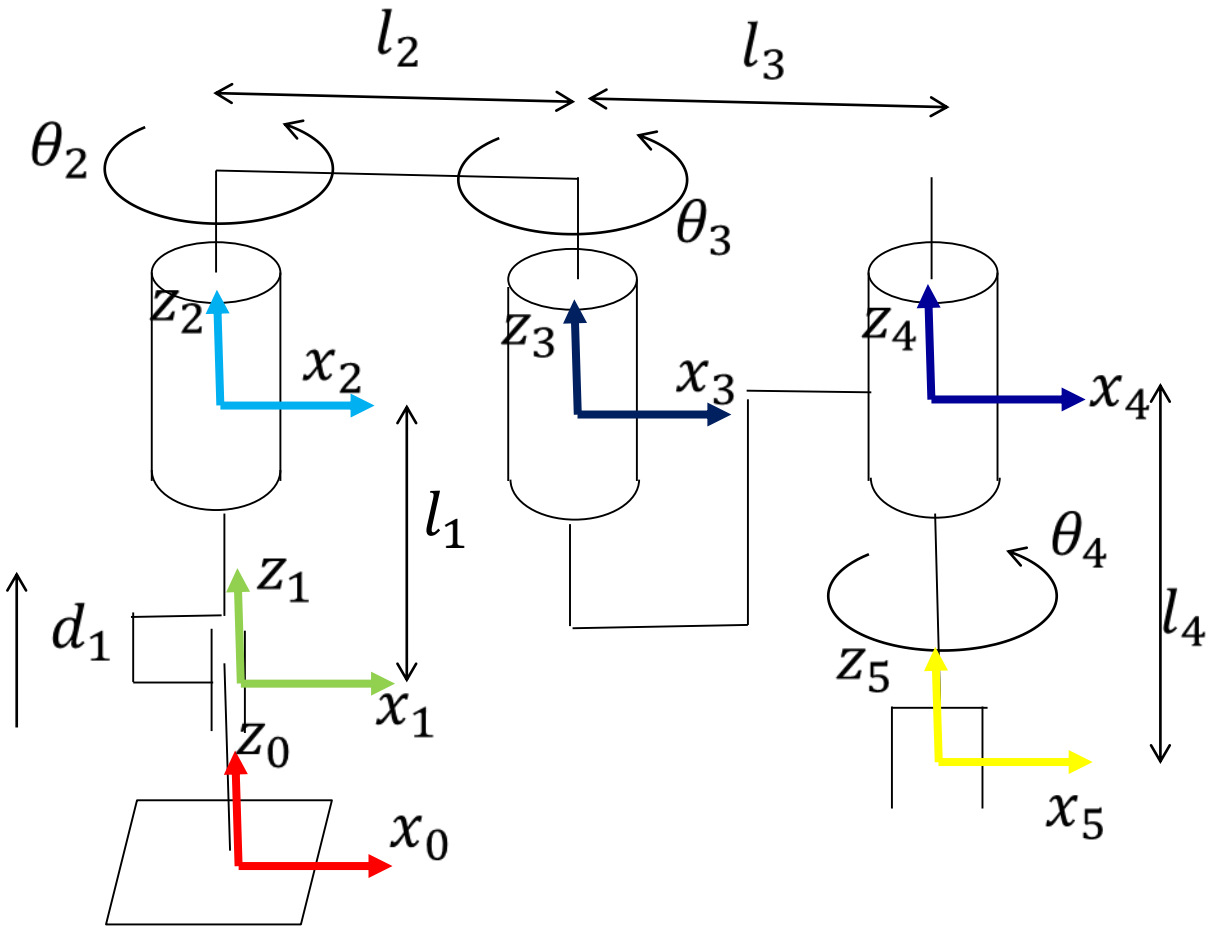
3D – 5 – RRRP (standard DH)



3D – 5 – RRRP - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	0	l_1	0	θ_1
1	2	0	l_2	0	θ_2
2	3	0	0	$-d_4$	θ_3

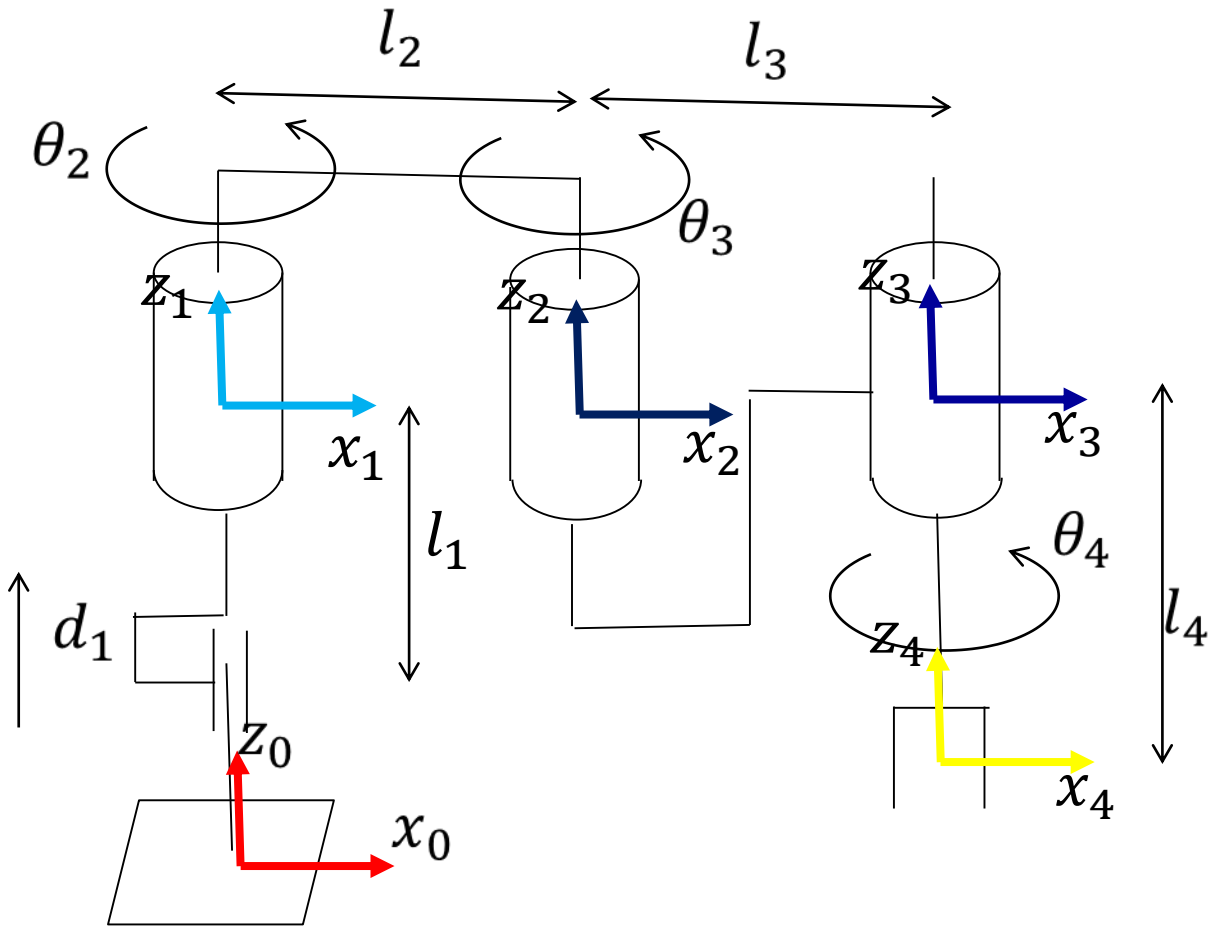
3D – 6 – PRRR (modified DH)



3D – 6 – PRRR - *Modified Form Table*

i-1	*i*	α_{i-1}	a_{i-1}	d_i	θ_i
0	1	0	0	d_1	0
1	2	0	0	l_1	θ_2
2	3	0	l_2	0	θ_3
3	4	0	l_3	0	θ_4
4	5	0	0	$-l_4$	0

3D – 6 – PRRR (standard DH)



3D – 6 – PRRR - *Standard Form Table*

i-1	*i*	α_i	a_i	d_i	θ_i
0	1	0	0	d_1+l_1	0
1	2	0	l_2	0	θ_2
2	3	0	l_3	0	θ_3
3	4	0	0	$-l_4$	θ_4

DH Parameters - Summary

If the link frame have been attached to the links according to our convention, the following definitions of the DH parameters are valid:

Standard form:

a_i - The distance from $\hat{Z}_{i-1}$ to $\hat{Z}_i$ measured along $\hat{X}_i$

α_i - The angle between $\hat{Z}_{i-1}$ and $\hat{Z}_i$ measured about $\hat{X}_i$

d_i - The distance from $\hat{X}_{i-1}$ to $\hat{X}_i$ measured along $\hat{Z}_{i-1}$

θ_i - The angle between $\hat{X}_{i-1}$ and $\hat{X}_i$ measured about $\hat{Z}_{i-1}$

Modified form:

a_{i-1} - The distance from $\hat{Z}_{i-1}$ to $\hat{Z}_i$ measured along $\hat{X}_{i-1}$

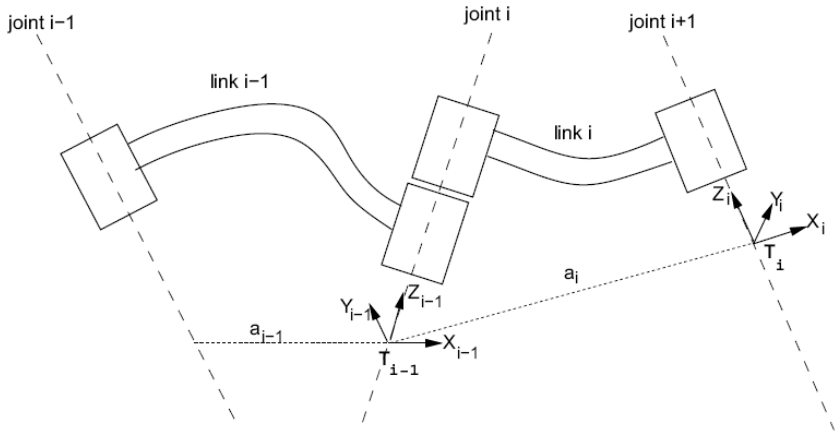
α_{i-1} - The angle between $\hat{Z}_{i-1}$ and $\hat{Z}_i$ measured about $\hat{X}_{i-1}$

d_i - The distance from $\hat{X}_{i-1}$ to $\hat{X}_i$ measured along $\hat{Z}_i$

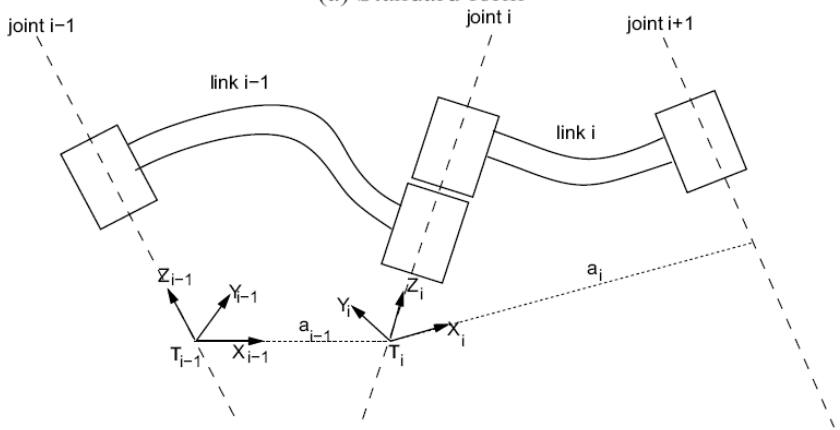
θ_i - The angle between $\hat{X}_{i-1}$ and $\hat{X}_i$ measured about $\hat{Z}_i$

Note: $a_i \geq 0$ α_i d_i θ_i are signed quantities

DH Parameters – Standard / Modified Approach



(a) Standard form



(b) Modified form