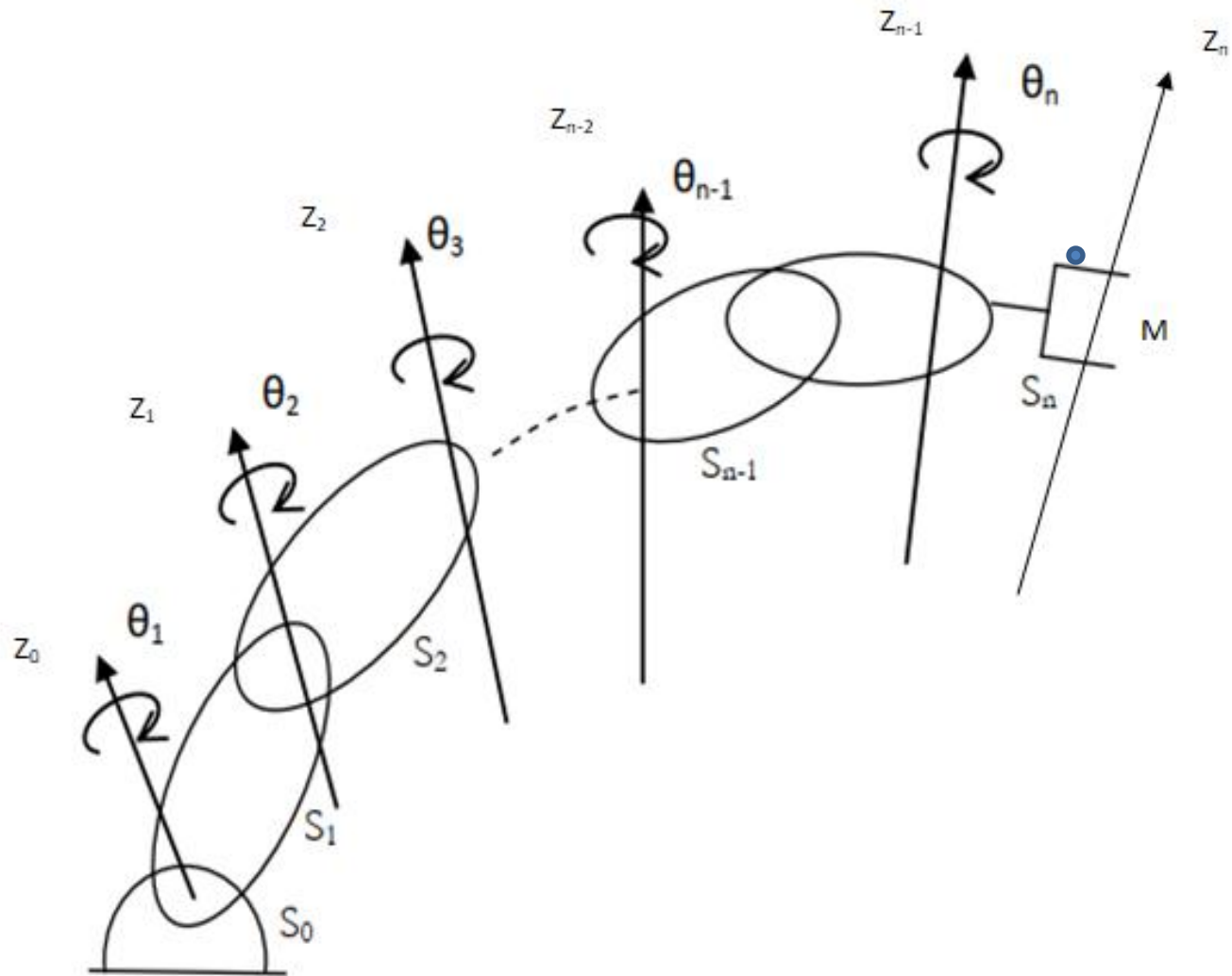
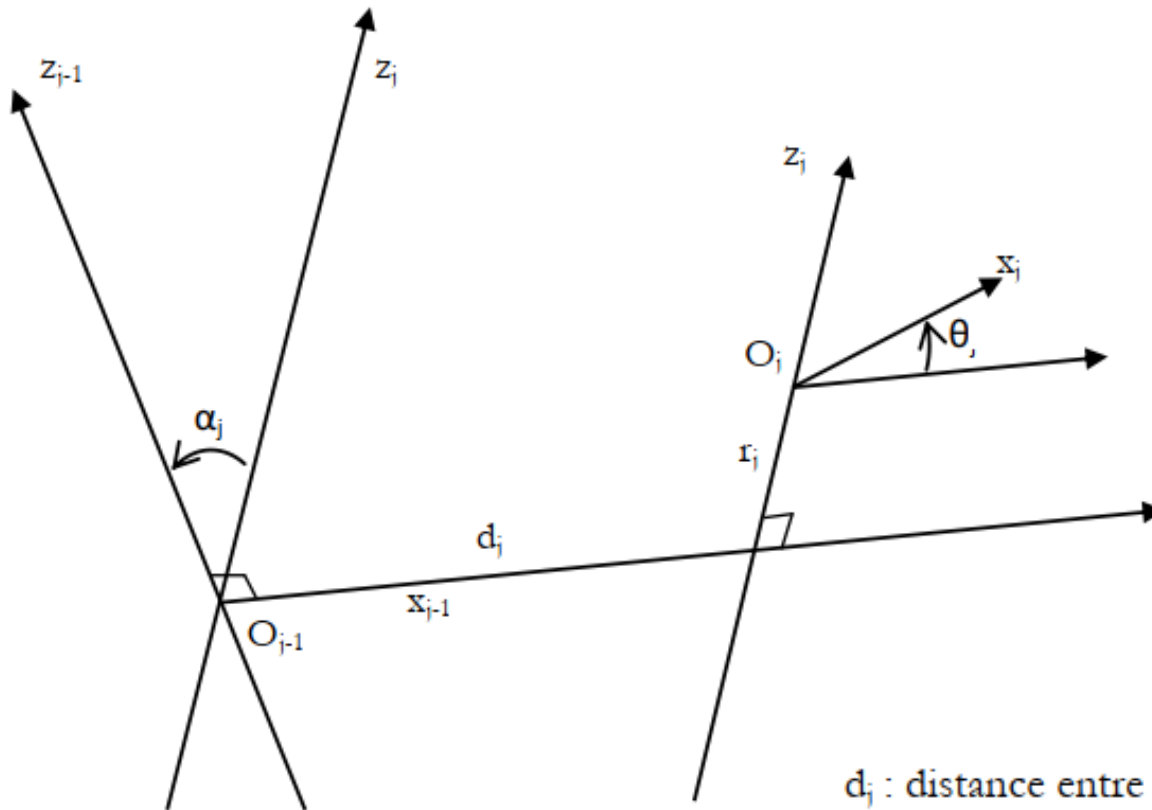


Denavit Hartenberg Representation



First representation



d_j : distance entre z_{j-1} et z_j mesurée le long de x_{j-1} .

α_j : angle entre z_{j-1} et z_j mesuré autour de x_{j-1} .

r_j : distance entre x_{j-1} et x_j mesurée le long de z_j .

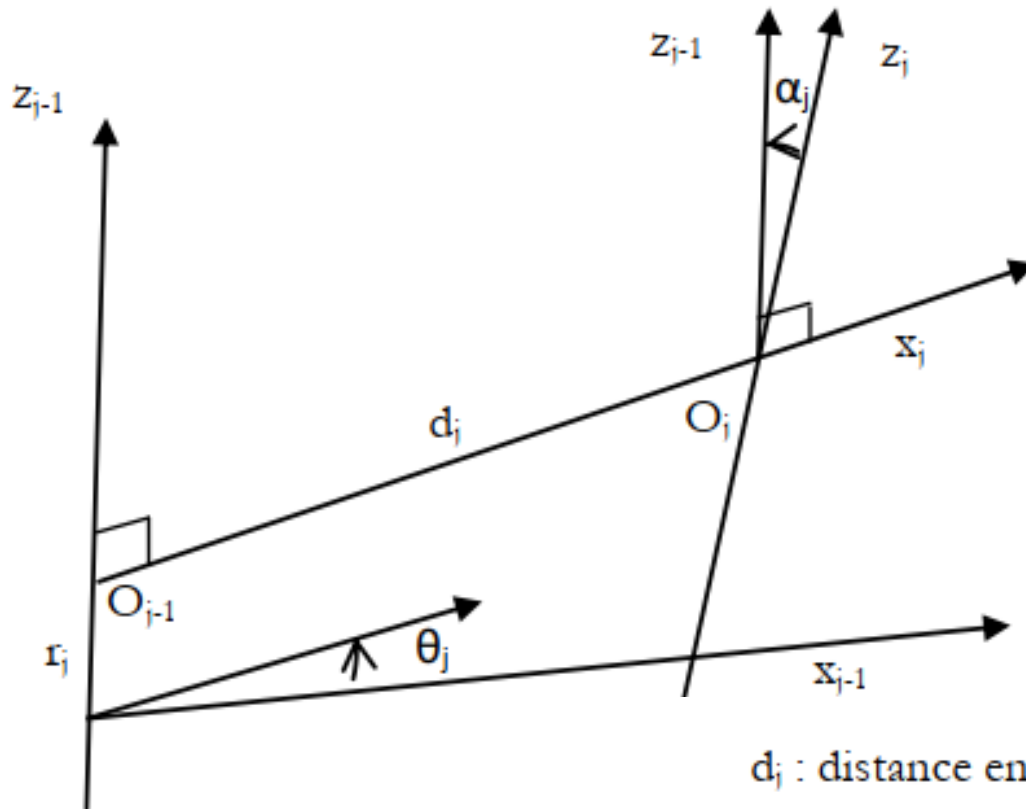
θ_j : angle entre x_{j-1} et x_j mesuré autour de z_j .

$$T^{j-1,j} = Rot(x, \alpha_j) Trans(x, d_j) Rot(z, \theta_j) Trans(z, r_j)$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & c\alpha_j & -s\alpha_j & 0 \\ 0 & s\alpha_j & c\alpha_j & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & d_j \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} c\theta_j & -s\theta_j & 0 & 0 \\ s\theta_j & c\theta_j & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & r_j \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$T^{j-1,j} = \begin{pmatrix} c\theta_j & -s\theta_j & 0 & d_j \\ c\alpha_j s\theta_j & c\alpha_j c\theta_j & -s\alpha_j & -r_j s\alpha_j \\ s\alpha_j s\theta_j & s\alpha_j c\theta_j & c\alpha_j & r_j c\alpha_j \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Second representation



d_j : distance entre z_{j-1} et z_j mesurée le long de x_j .

α_j : angle entre z_{j-1} et z_j mesurée autour de x_j .

r_j : distance entre x_{j-1} et x_j mesurée le long de z_{j-1} .

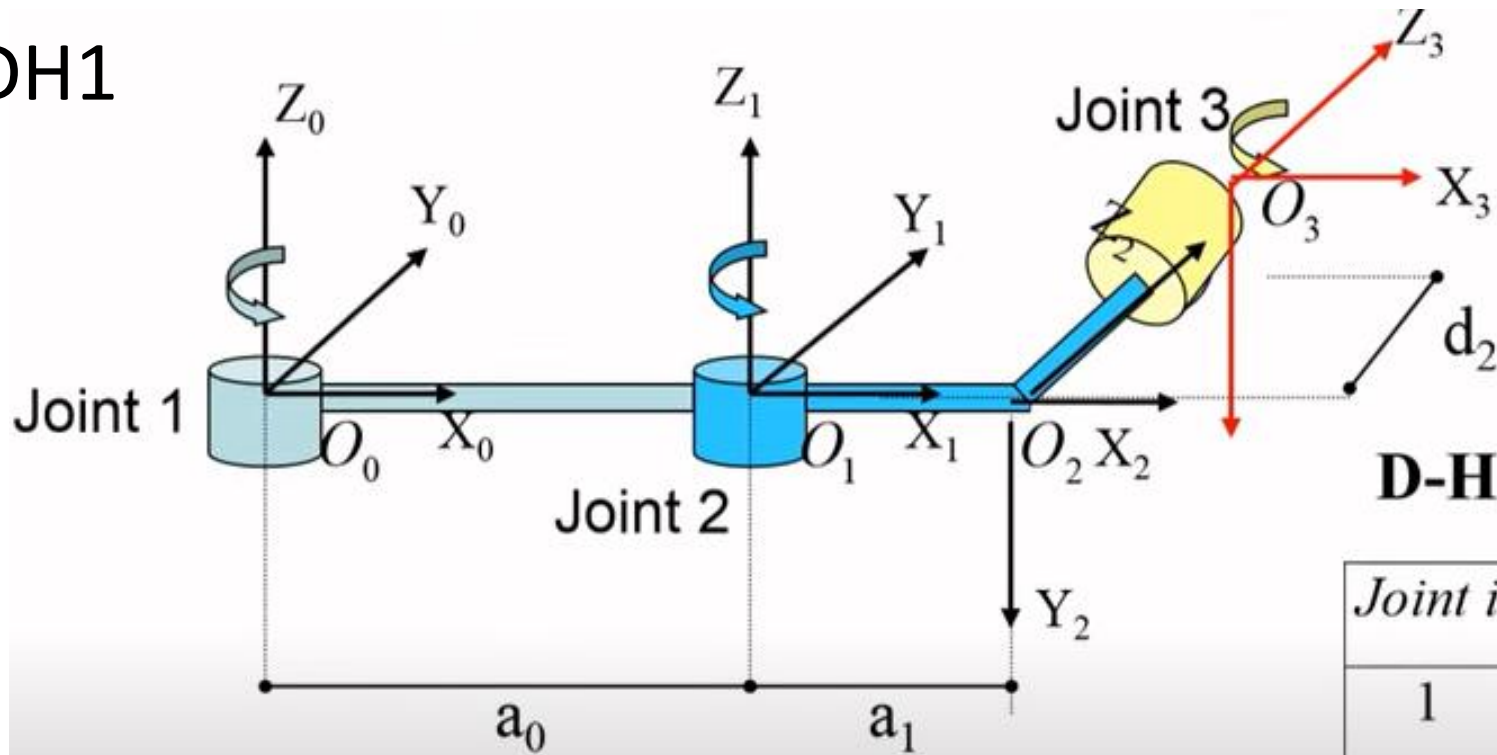
θ_j : angle entre x_{j-1} et x_j mesurée autour de z_{j-1} .

$$T^{j-1,j} = Rot(z, \theta_j) Trans(z, r_j) Trans(x, d_j) Rot(x, \alpha_j)$$

$$\begin{pmatrix} c\theta_j & -s\theta_j & 0 & 0 \\ s\theta_j & c\theta_j & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & r_j \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & d_j \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & c\alpha_j & -s\alpha_j & 0 \\ 0 & s\alpha_j & c\alpha_j & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$T^{j-1,j} = \begin{pmatrix} c\theta_j & -c\alpha_j s\theta_j & s\alpha_j s\theta_j & d_j c\theta_j \\ s\theta_j & c\alpha_j c\theta_j & -s\alpha_j c\theta_j & d_j s\theta_j \\ 0 & s\alpha_j & c\alpha_j & r_j \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

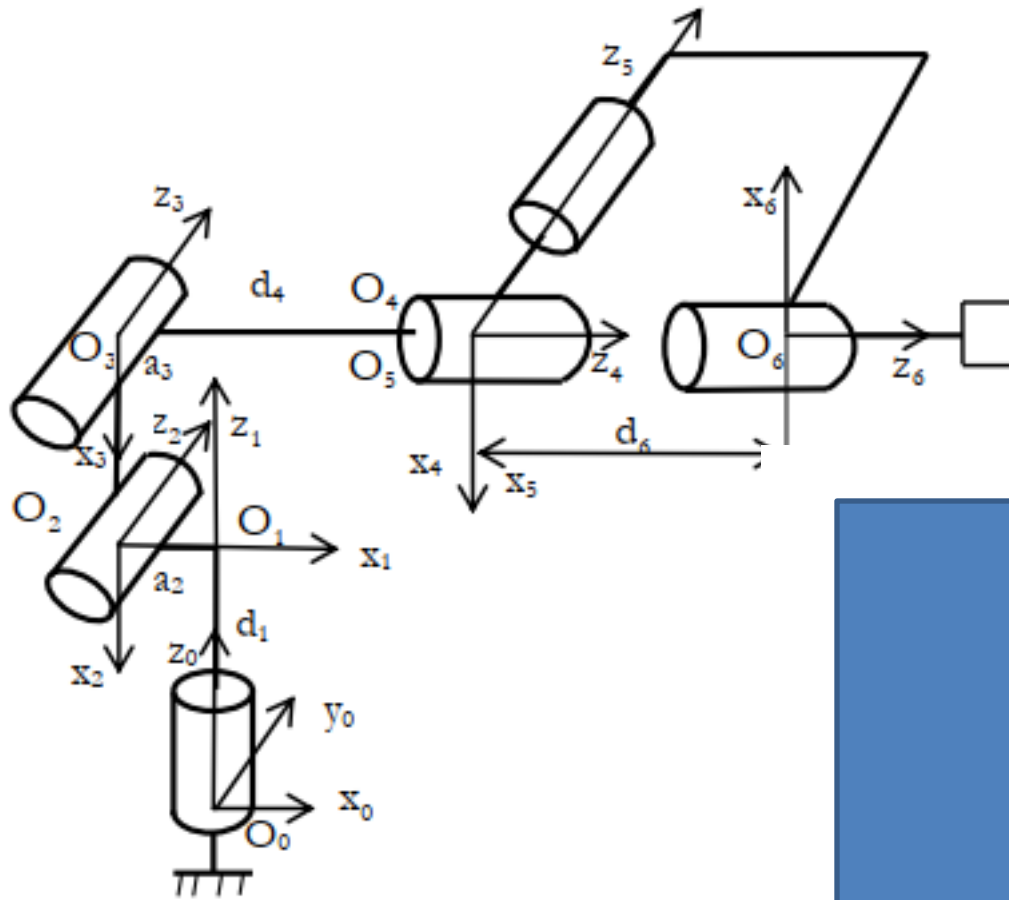
DH1



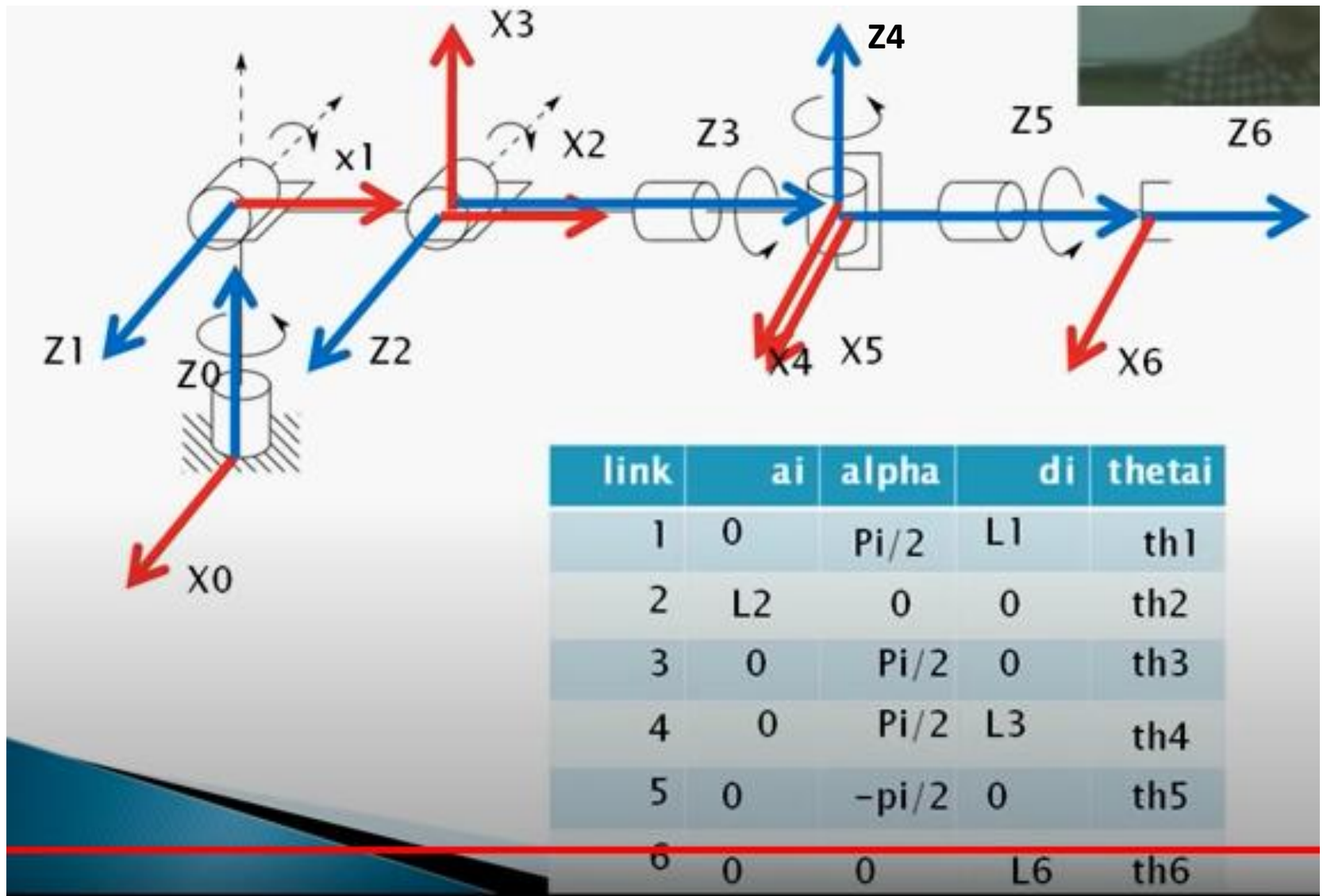
D-H Link Parameter Table

	Joint i	α_i	a_i	d_i	θ_i
0-1	1	0	a_0	0	θ_0
1-2	2	-90	a_1	0	θ_1
2-3	3	0	0	d_2	θ_2

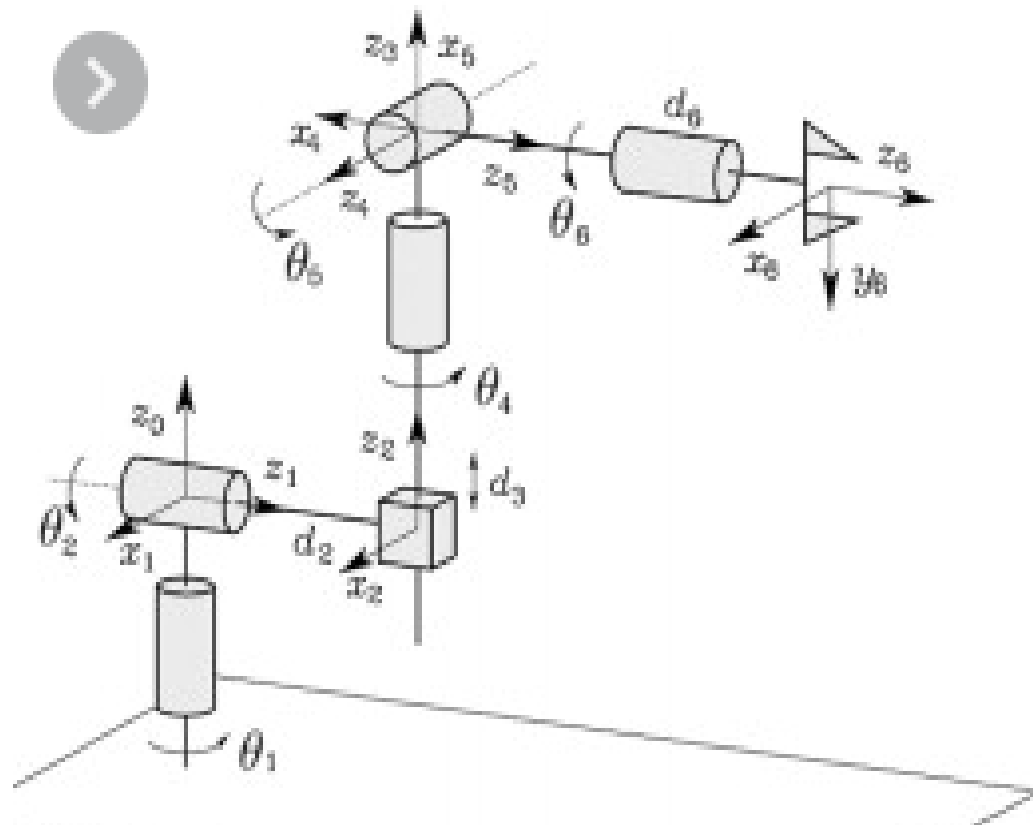
DH1



DH2



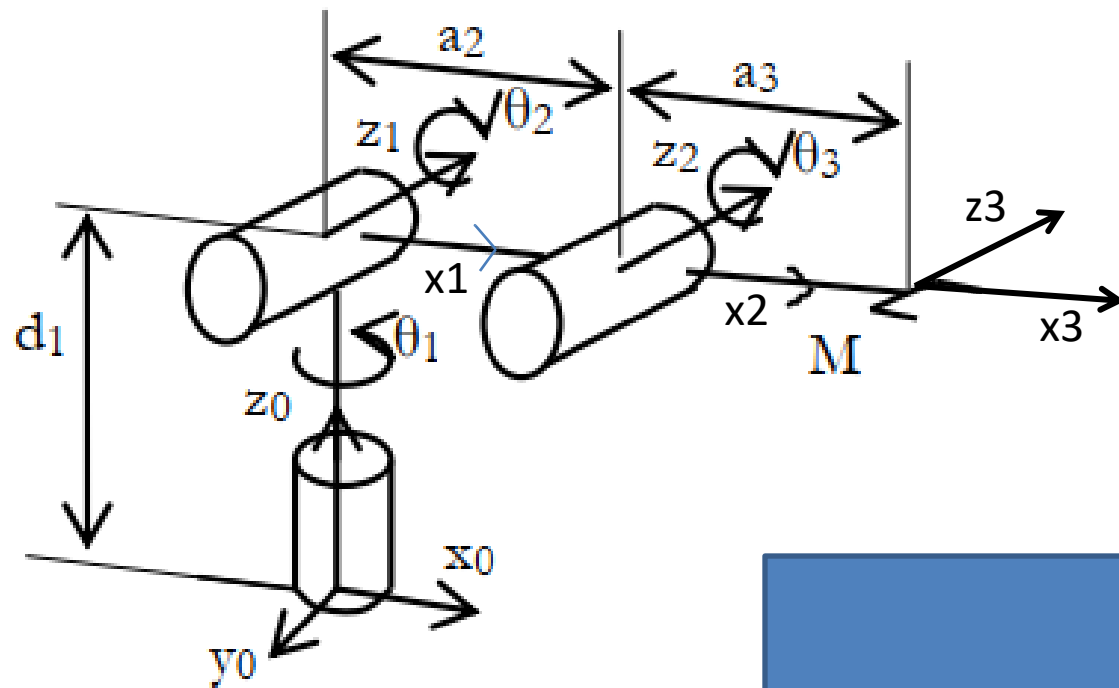
DH2



D-H parameters

Link	a_i	α_i	d_i	θ_i
1	0	$-\pi/2$	0	θ_1
2	0	$\pi/2$	d_2	θ_2
3	0	0	d_3	0
4	0	$-\pi/2$	0	θ_4
5	0	$\pi/2$	0	θ_5
6	0	0	d_6	θ_6

DH2



Position and orientation of the end effector

$$T^{0,n} = \begin{pmatrix} A^{0,n} & O_0 O_n^0 \\ 0 & 1 \end{pmatrix}$$