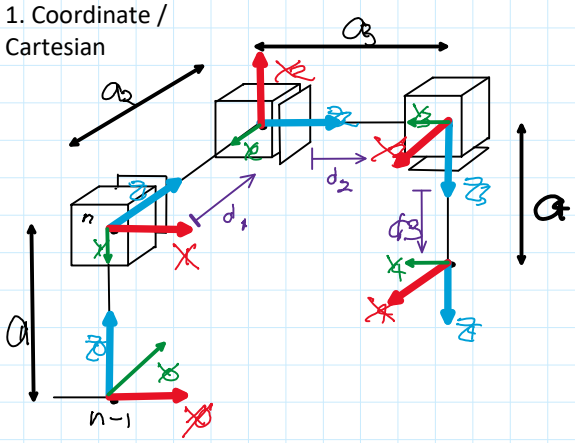
Denavit-Hartenberg Notation

Step 1: Assign Frames according to the 4 D-H Frame Rules
Step 2: Fill out the D-H Parametric Table
Step 3: Plug the table into the Homogeneous Transformation Matrix form.
Step 4: Multiply the matrices together

1. Coordinate / Cartesian



^0_1H
^1_2H
^2_3H
^3_4H

n	θ	α	r	d
1	0°	270°	0	a_1
2	270°	270°	0	a_2+d_1
3	90°	270°	0	a_3+d_2
4	0°	0°	0	a_4+d_3

Denavit-Hartenberg Parametric Table

Columns = no. of parameters

Rows = no. of frames - 1

n	θ	α	r	d
1				
2				
3				
4				

$^0_1H \rightarrow 1$
$^1_2H \rightarrow 2$
$^2_3H \rightarrow 3$
$^3_4H \rightarrow 4$

Denavit Hartenberg Parameters

4 Parameters

θ
α
d
r

→ Rotation/Orientation
→ Position/Translation

Denavit Hartenberg Parameters

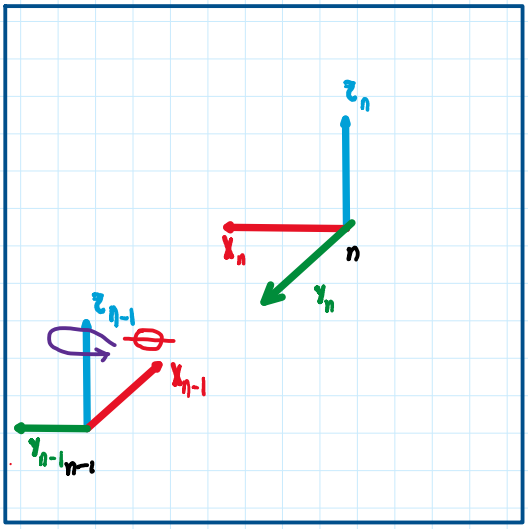
4 Parameters

θ	α
Rotation around z_{n-1} that it is required to get x_{n-1} to match x_n, with the joint variable θ if joint is revolute/twisting/ joint.	Rotation around x_n that is required to match z_{n-1} to z_n.

Denavit Hartenberg Parameters

4 Parameters

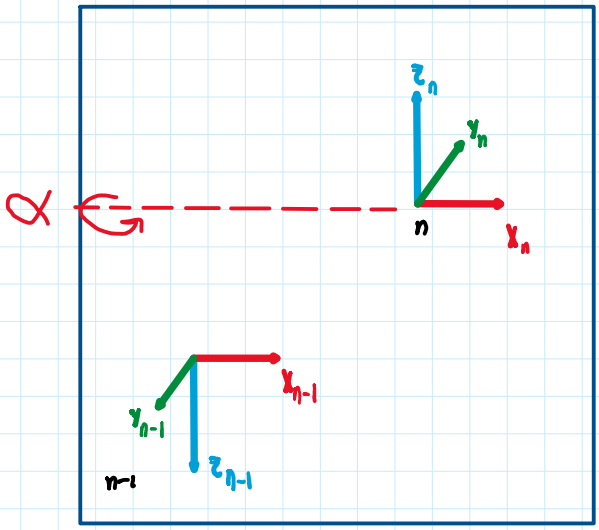
θ	α
Rotation around z_{n-1} that it is required to get x_{n-1} to match x_n, with the joint variable θ if joint is revolute/twisting/ joint.	Rotation around x_n that is required to match z_{n-1} to z_n.



Denavit Hartenberg Parameters

4 Parameters

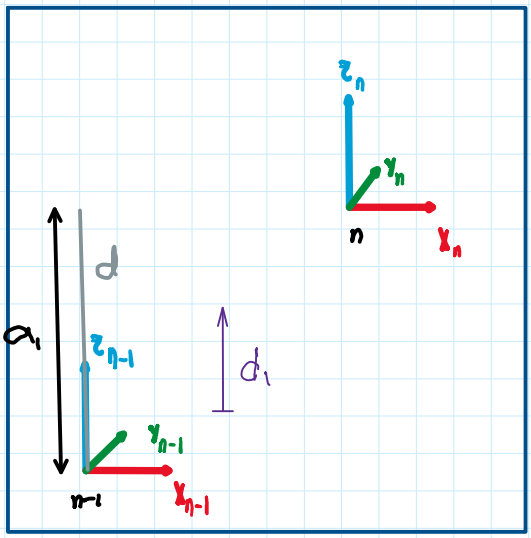
Θ	α
Rotation around z_{n-1} that it is required to get x_{n-1} to match x_n, with the joint variable Θ if joint is revolute/twisting/spherical joint.	Rotation around x_n that is required to match z_{n-1} to z_n.



Denavit Hartenberg Parameters

4 Parameters

Θ	α
Rotation around z_{n-1} that it is required to get x_{n-1} to match x_n, with the joint variable Θ if joint is revolute/twisting/spherical joint.	Rotation around x_n that is required to match z_{n-1} to z_n.



Denavit Hartenberg Parameters

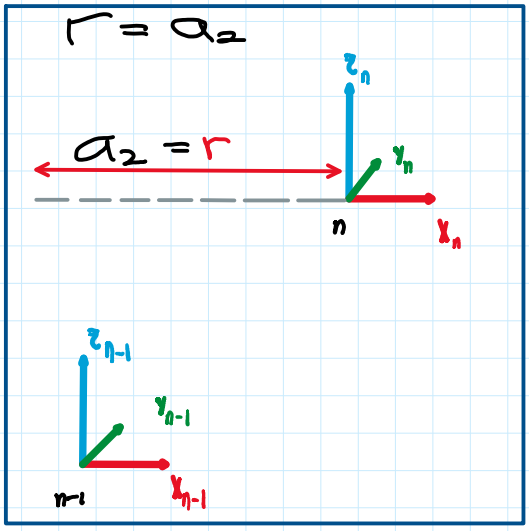
4 Parameters

d	r
The distance from the center of n-1and n frames along the z_{n-1} direction, with joint variable if joint is prismatic.	The distance from the center of n-1 and n frames along the x_n direction.

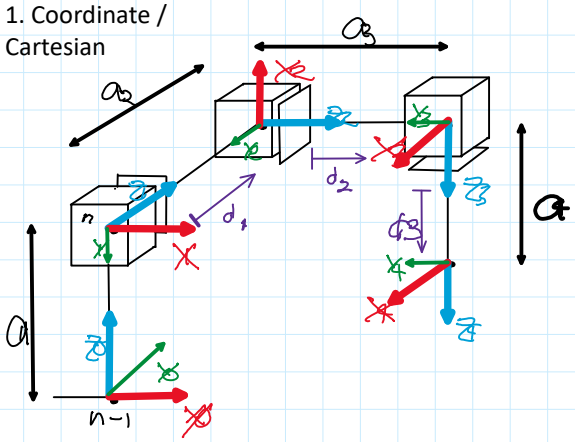
Denavit Hartenberg Parameters

4 Parameters

d	r
The distance from the ~~center of~~ origin n-1and n frames along the z_{n-1} direction, with joint variable if joint is prismatic.	The distance from the ~~center of~~ origin n-1 and n frames along the x_n direction.

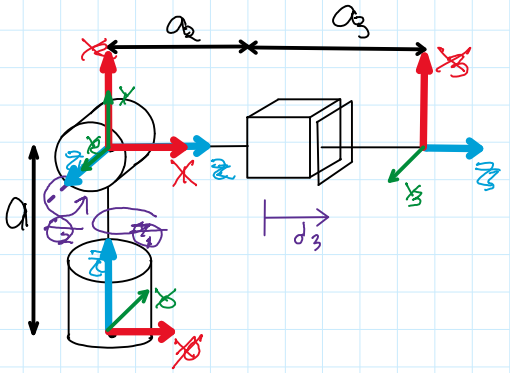


1. Coordinate / Cartesian



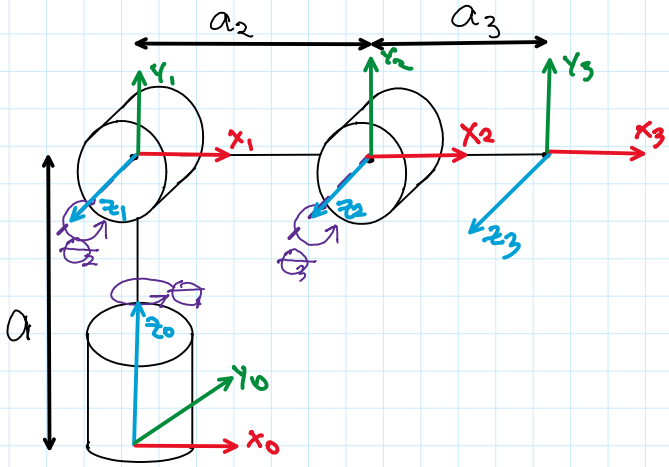
	n	θ	α	r	d
${}^0_1H$	1	0°	270°	0	a_1
${}^1_2H$	2	270°	270°	0	$a_2 + d_1$
${}^2_3H$	3	90°	270°	0	$a_3 + d_2$
${}^3_4H$	4	0°	0°	0	$a_4 + d_3$

3. Spherical

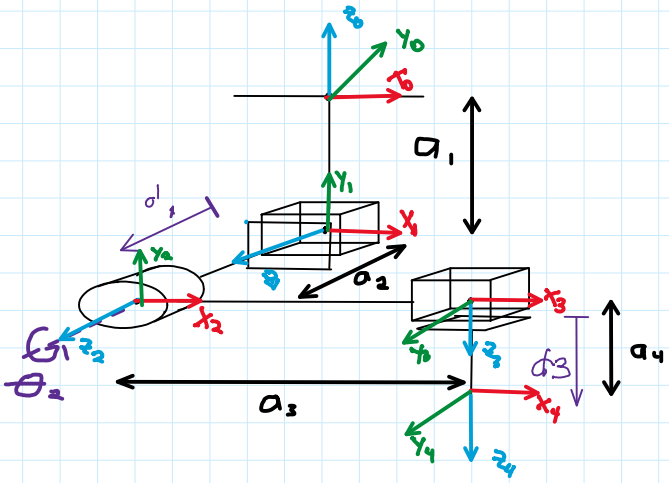


	n	θ	α	r	d
${}^0_1H$	1	θ_1	90°	0	a_1
${}^1_2H$	2	$90° + \theta_2$	90°	0	0
${}^2_3H$	3	0°	0°	0	$a_2 + a_3 + d_3$

4. Articulated

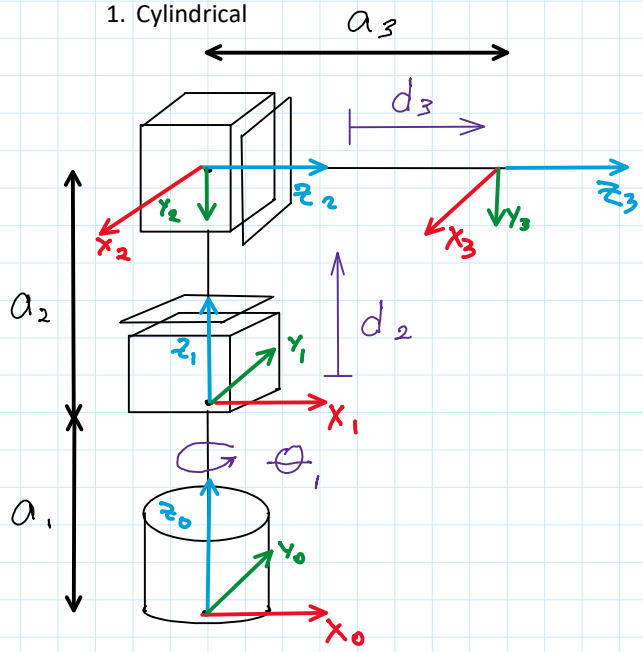


	n	θ	α	r	d
${}^0_1H \rightarrow$	1	$0° + \theta_1$	90°	0	a_1
${}^1_2H \rightarrow$	2	$0° + \theta_2$	0°	a_2	0
${}^2_3H \rightarrow$	3	$0° + \theta_3$	0°	a_3	0



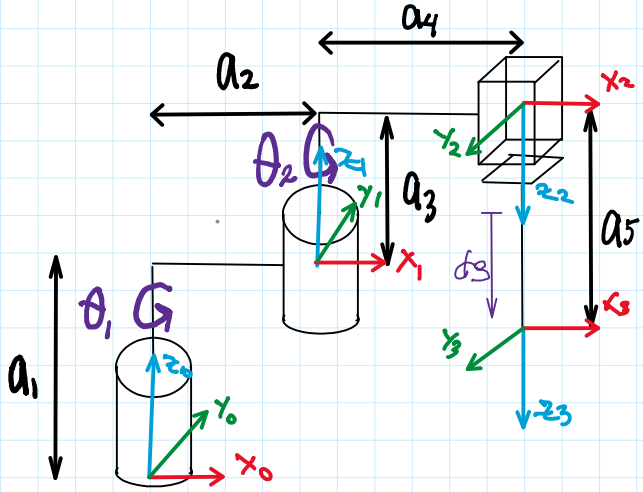
	n	θ	α	r	d
${}^0_1H \rightarrow$	1	$0^\circ + \theta_1$	90°	0	$-d_1$
${}^1_2H \rightarrow$	2	$0^\circ + \theta_2$	0°	0	$a_2 + d_2$
${}^2_3H \rightarrow$	3	0°	90°	a_3	0
	4	0°	0°	0	$a_4 + d_3$

1. Cylindrical



n	θ	α	r	d
1	$0^\circ + \theta_1$	0°	0	a_1
2	270°	270°	0	$a_2 + d_2$
3	0°	0°	0	$a_3 + d_3$

3. SCARA (Selective Compliance Assembly Robot Arm)



	n	θ	α	r	d
${}^0_1H \rightarrow$	1	$0^\circ + \theta_1$	0°	a_2	a_1
${}^1_2H \rightarrow$	2	$0^\circ + \theta_2$	180°	a_4	a_3
${}^2_3H \rightarrow$	3	0°	0°	0	$a_5 + d_3$