UR5e Frames + DH

Frame Assignment:

Z_0: base yaw axis, vertical.

Z_1: shoulder pitch axis; perpendicular to Z_0 (points “forward” in a side view).

Z_2: elbow pitch axis; parallel to Z_1.

Z_3: wrist-1 pitch axis; typically parallel to Z_1 and Z_2.

Z_4: wrist-2 axis; orthogonal to Z_3.

Z_5: wrist-3 (tool roll) axis; orthogonal to Z_4.

UR5e Geometric Constants:

$d_1 = 0.1625$ m

$a_2 = -0.425$ m

$a_3 = -0.392$ m

$d_4 = 0.1333$ m

$d_5 = 0.0997$ m

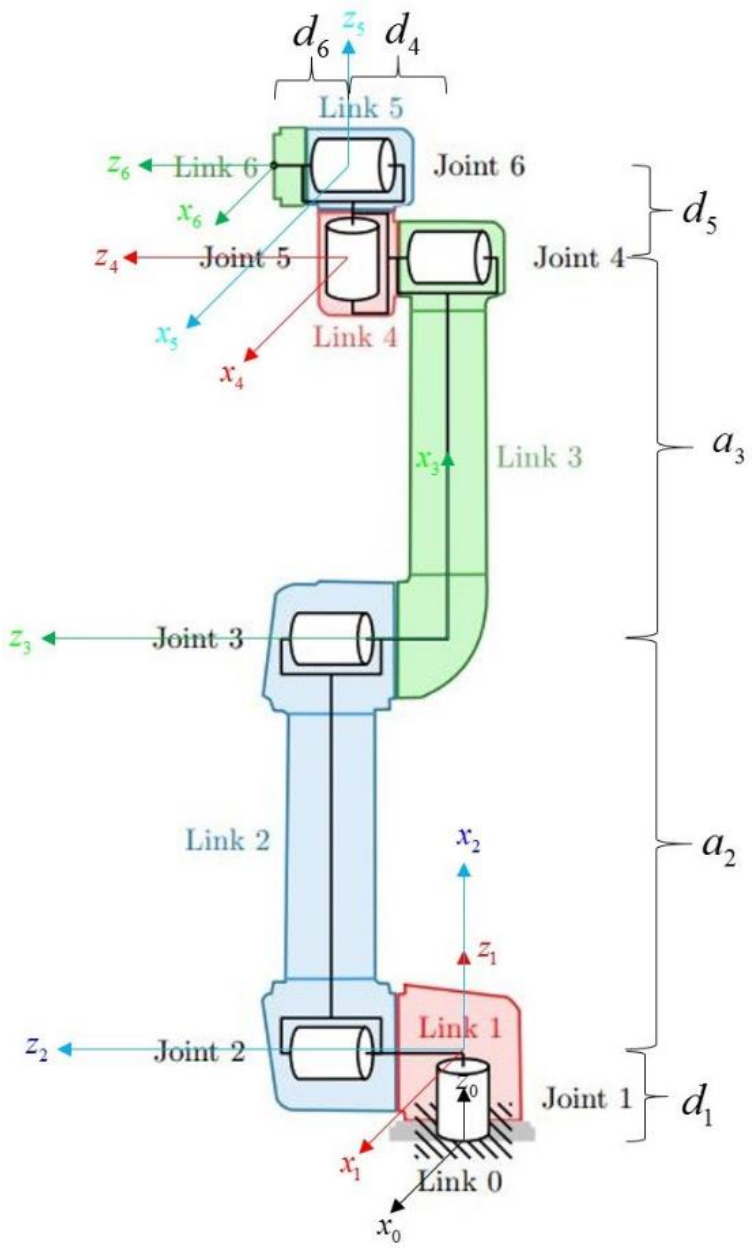
$d_6 = 0.0996$ m

Base height $L_B = 0.163$ m

Tool-plate thickness $L_{TP} = 0.1$ m

For context, a2 and a3 are the “upper arm” and “forearm” link lengths; d4 and d5 are the wrist stack offsets. L_B is the base pedestal height.

Figure X: UR5e manipulator with labeled DH parameters ai and di . (Source: Universal Robots / ResearchGate)



Standard DH Table(UR5e):

Joint(i)	a_{i-1}	α_{i-1}	d_i	θ_i
1	0	$\pi/2$	0.1625 m	θ_1
2	-0.425 m	0	0	θ_2
3	-0.392 m	0	0	θ_3
4	0 m	$\pi/2$	0.1333 m	θ_4
5	0 m	$-\pi/2$	0.0997 m	θ_5
6	0 m	0	0.0996 m	θ_6

Sources:

1. Universal Robots. *DH Parameters for Calculations of Kinematics and Dynamics.* Retrieved from: https://www.universal-robots.com/articles/ur/application-installation/dh-parameters-for-calculations-of-kinematics-and-dynamics/
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3. ROS-Industrial Consortium. *UR5 Robot Description (URDF file).* GitHub Repository: https://github.com/ros-industrial/universal_robot/blob/melodic-devel/ur_description/urdf/ur5.urdf.xacro