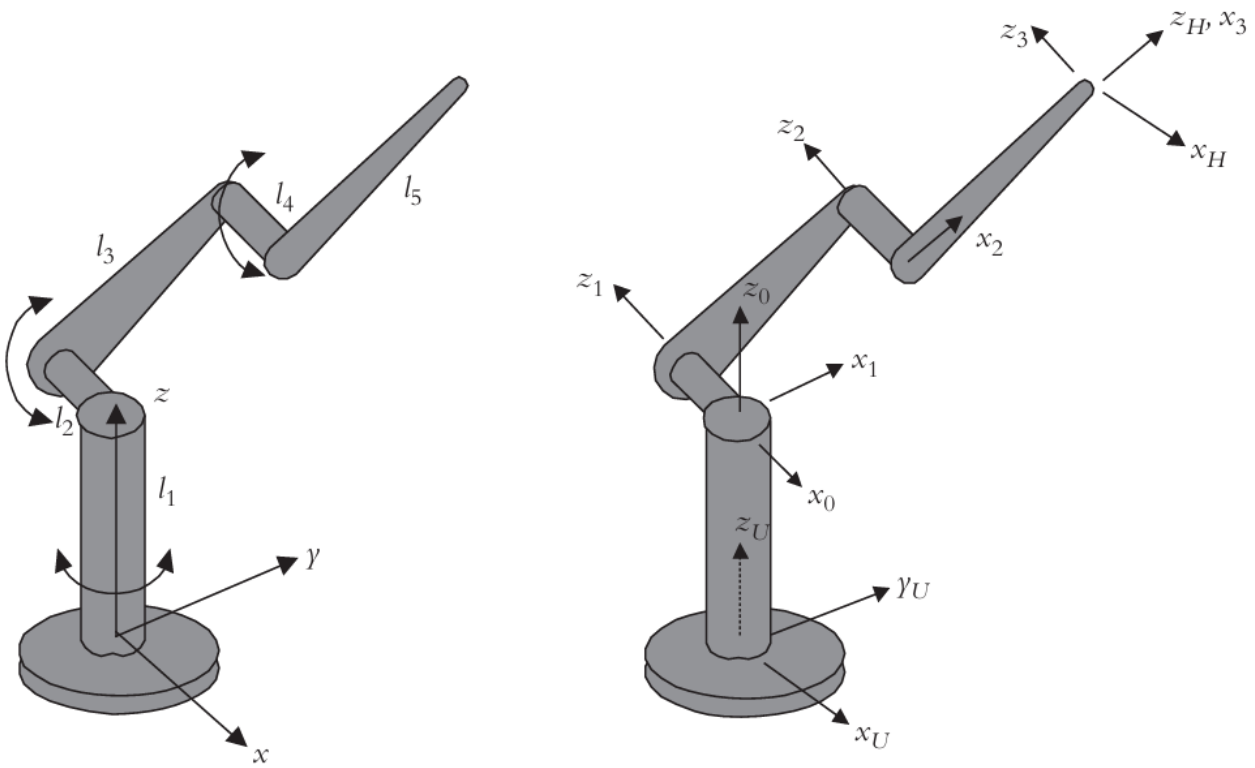
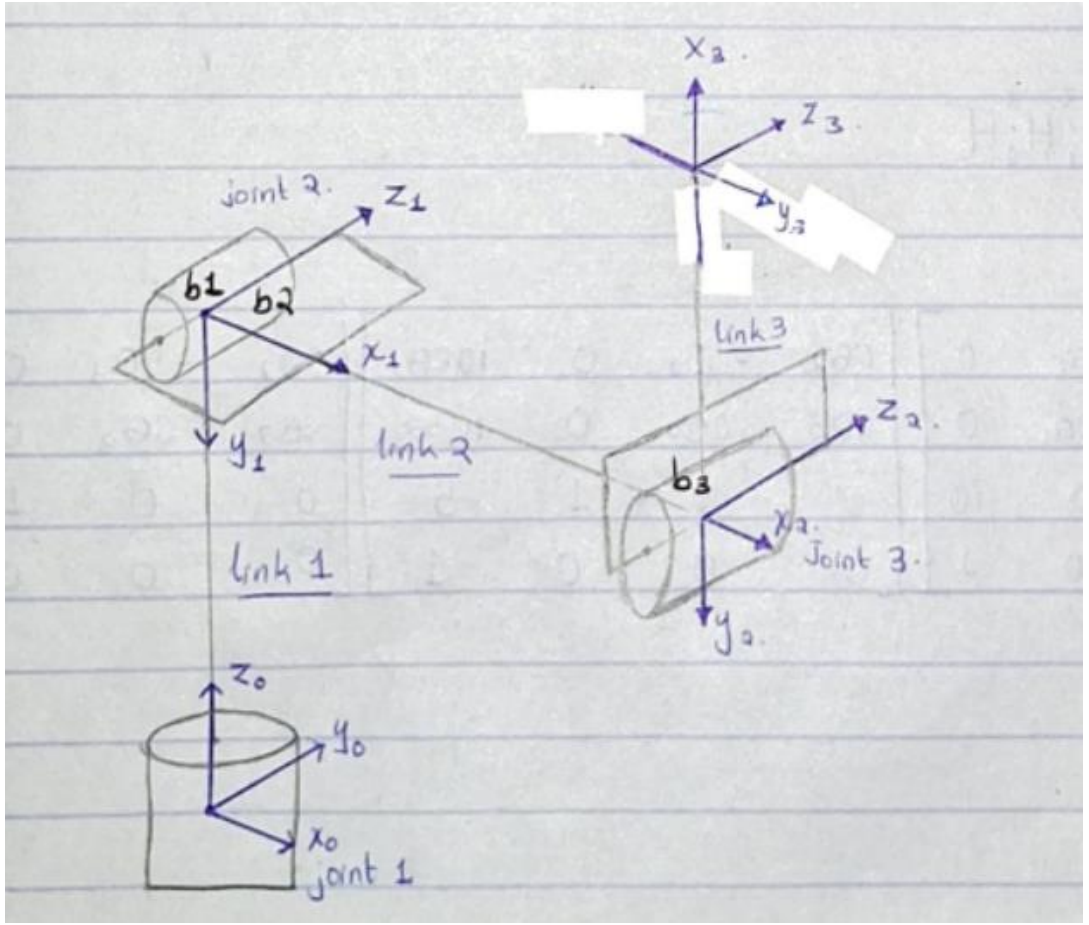
09 October, 2024

Robot Motion Planning Project

Selected Project



Design



DH Parameters table (Initial)

Link	Theta	Alpha	Link Length	Link Offset
1	q1	-90	0	10
2	q2	0	10	5
3	q3	0	10	5

DH Parameters table (Adjusted)

Link	Theta	Alpha	Link Length	Link Offset
1	q1	-90	0	10
2	q2	0	10	0.5
3	q3	0	10	0.5

MATLAB IMPLEMENTATION

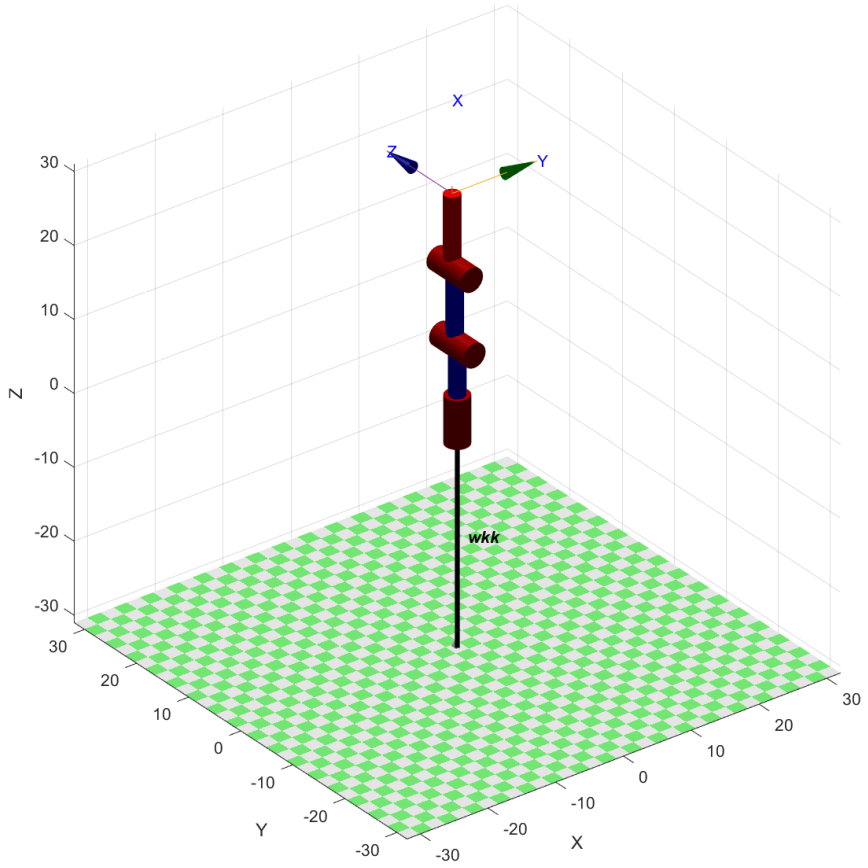
```
L(1) = Link([0, 10, 0, deg2rad(-90), 0]);
L(2) = Link([0, 0.5, 10, deg2rad(0), 0]);
L(3) = Link([0, 0.5, 10, deg2rad(0), 0]);

robot = SerialLink(L, 'name', 'wkk');
robot % Display the robot details
```

```
robot =

wkk:: 3 axis, RRR, stdDH, slowRNE
+---+-----------+-----------+-----------+-----------+-----------+
| j |     theta |         d |         a |     alpha |    offset |
+---+-----------+-----------+-----------+-----------+-----------+
|  1|         q1|         10|          0|    -1.5708|          0|
|  2|         q2|        0.5|         10|          0|          0|
|  3|         q3|        0.5|         10|          0|          0|
+---+-----------+-----------+-----------+-----------+-----------+
```

MATLAB IMPLEMENTATION

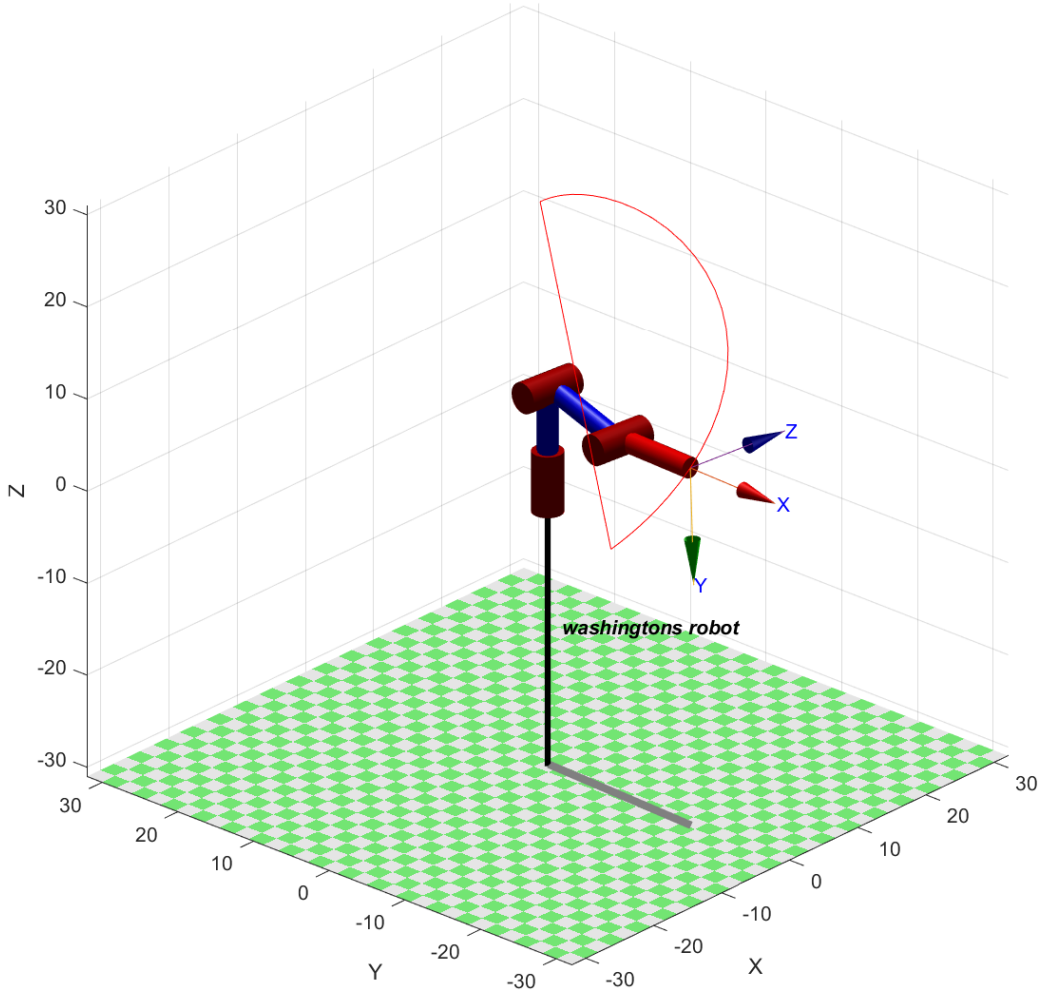


Robot at home position

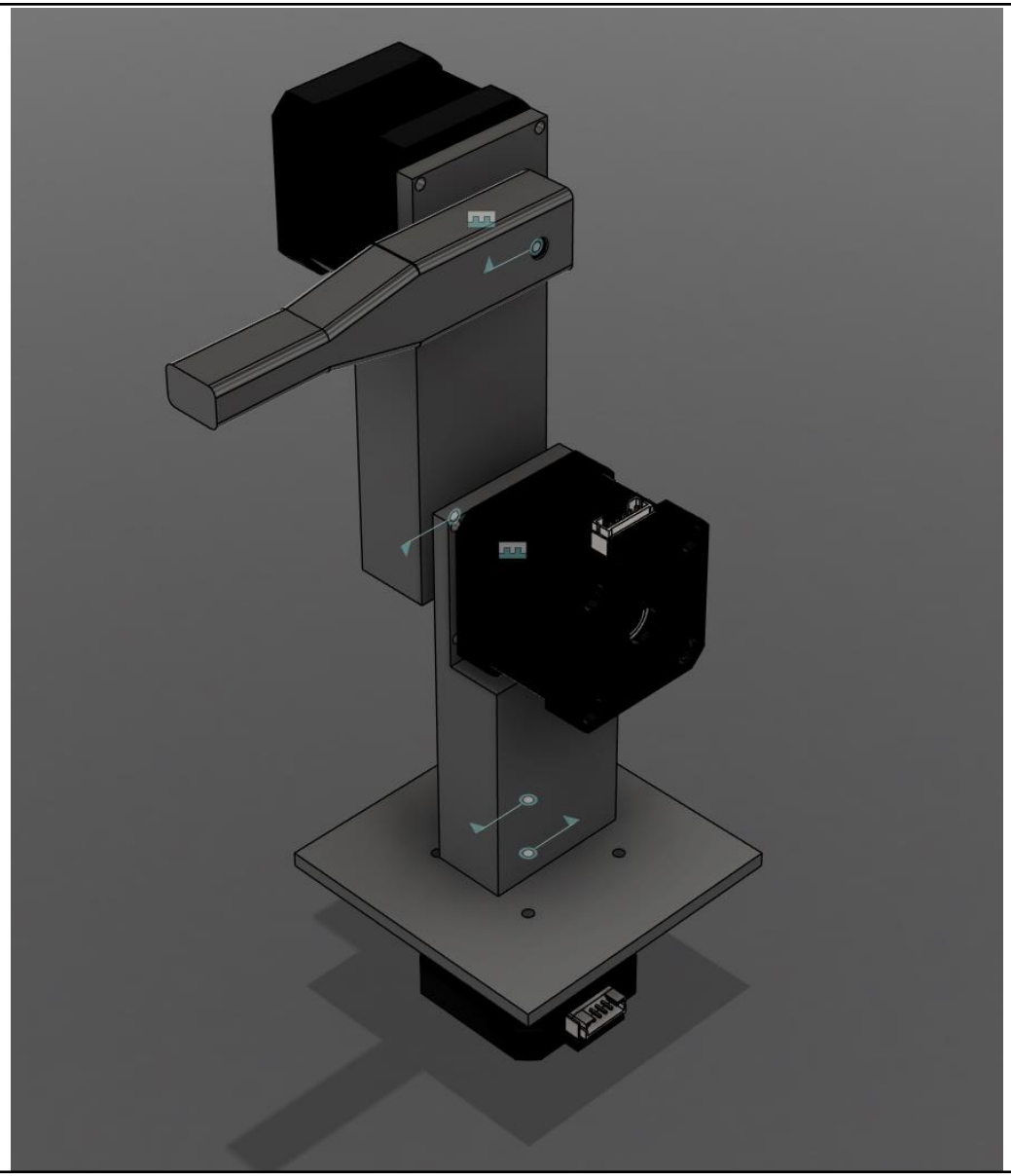
Angles:

- Theta 1 -> 0 rad
- Theta 2 -> -pi/2 rad
- Theta 3 -> 0 rad

Robot Motion



Robot CAD Design



Demonstrations

MATLAB

Matlab with robotics toolbox

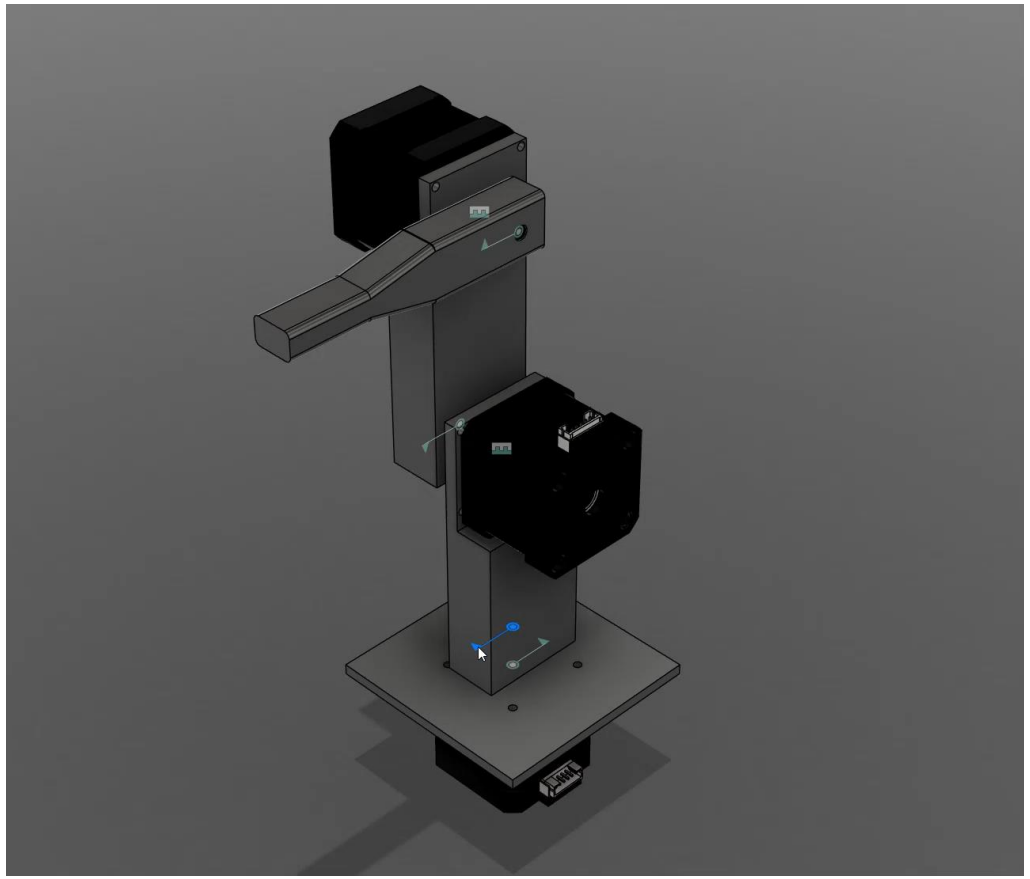
MATLAB

3DOF Robot

- Inverse kinematics
- Modeling
- Work envelope
- Maneuverability and control

Mobile robot

- Obstacle avoidance
- Navigation
- Path planning



CAD Design

- Joint limits
- Physical appearance
- Motor positioning
- Dynamics & material
- Manufacturability
- Joint and link sizes

Observations and Challenges

- Controlling a 3DOF robot to achieve any position is not possible
- Manual training and motion of robot is useful to determine the work envelope
- Physical joint limits also need to be tested and manually input
- Obstacles positioning in 3D is needed