CS 4610/5335: Robotic Science and Systems (Spring 2023)
Professor:Robert Platt Northeastern University

HW 3: Motion Planning, Sample Based

M0:

Explanation-

1. check_collision() -
   1. It calculates the end point position of each robots links. Link 1 can be rotated along all axis but link 2 can only rotate along 1 axis.
   Linespace() generates a row vector of 11 linearly equally spaced points.
   When points lies of link which is cylindrical in shape. We calculate -
   Threshold_Distance = radius(robot_link) + radius(spherical_obstacle)
   If this distance(at any given point) < Threshold_Distance
   Then -> point is in collision

2. check_edge
   Chcek_edeg also checks if the connected edge between 2 points are in collision or not by calling collision check function.

Potential drawbacks of the code-

1. It only checks collision between cylindrical links and spherical obstacles but fails to detect collision between the links themselves.
2. Value of resolution is constant/ hardcoded. If the length of the link is larger and resolution here - 11 is too small a number then, the code may not be able to identify the potential collisions.
3. Computational time might increase if a smaller link is present and resolution = 11 are too many points on the link.
4. We can also add code written in M1 in these functions to check if the given configuration is within the joint limits of the robot instead of calculating everytime in the assignment.

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M1-

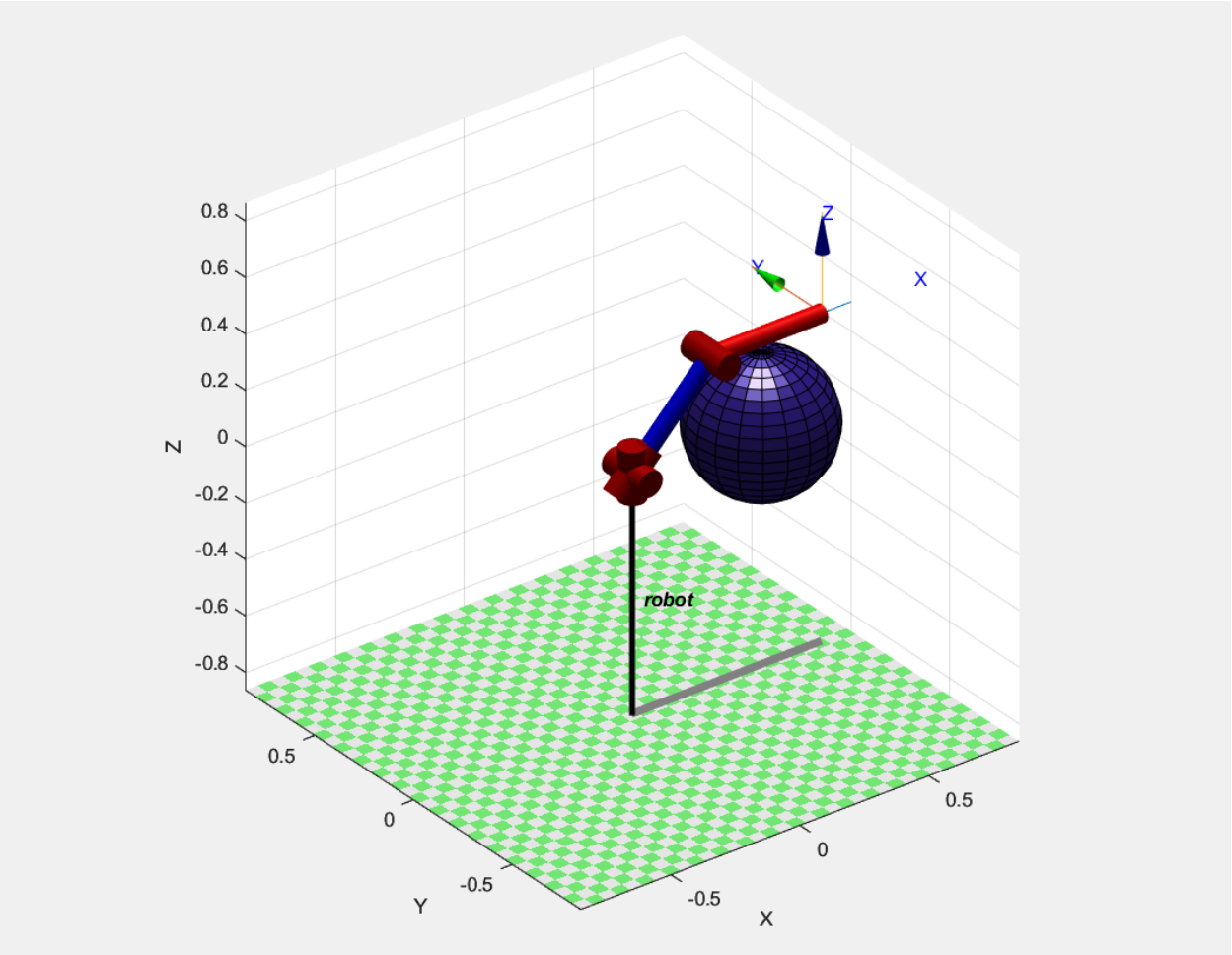
Output-

Number of samples: 100

Number within bounds: 100

Number in collision: 24

I believe the probability of the collisions can be found using this formula:
Volume of spherical Obstacle / Total volume of the (cube) workspace



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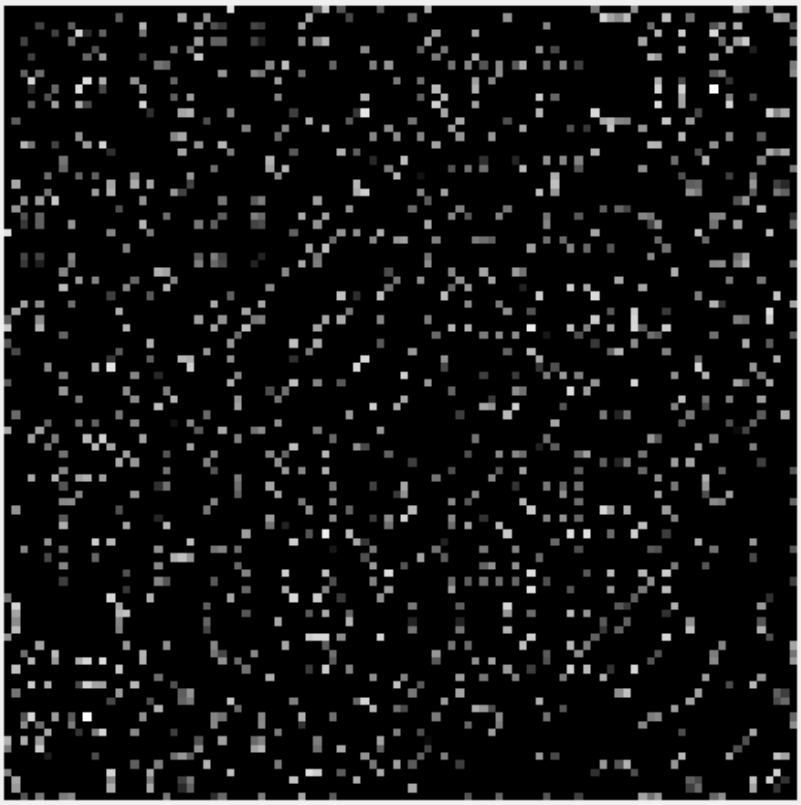
M2- PRM

Collision-free Adjacency Matrix.

It is a symmetric matrix.



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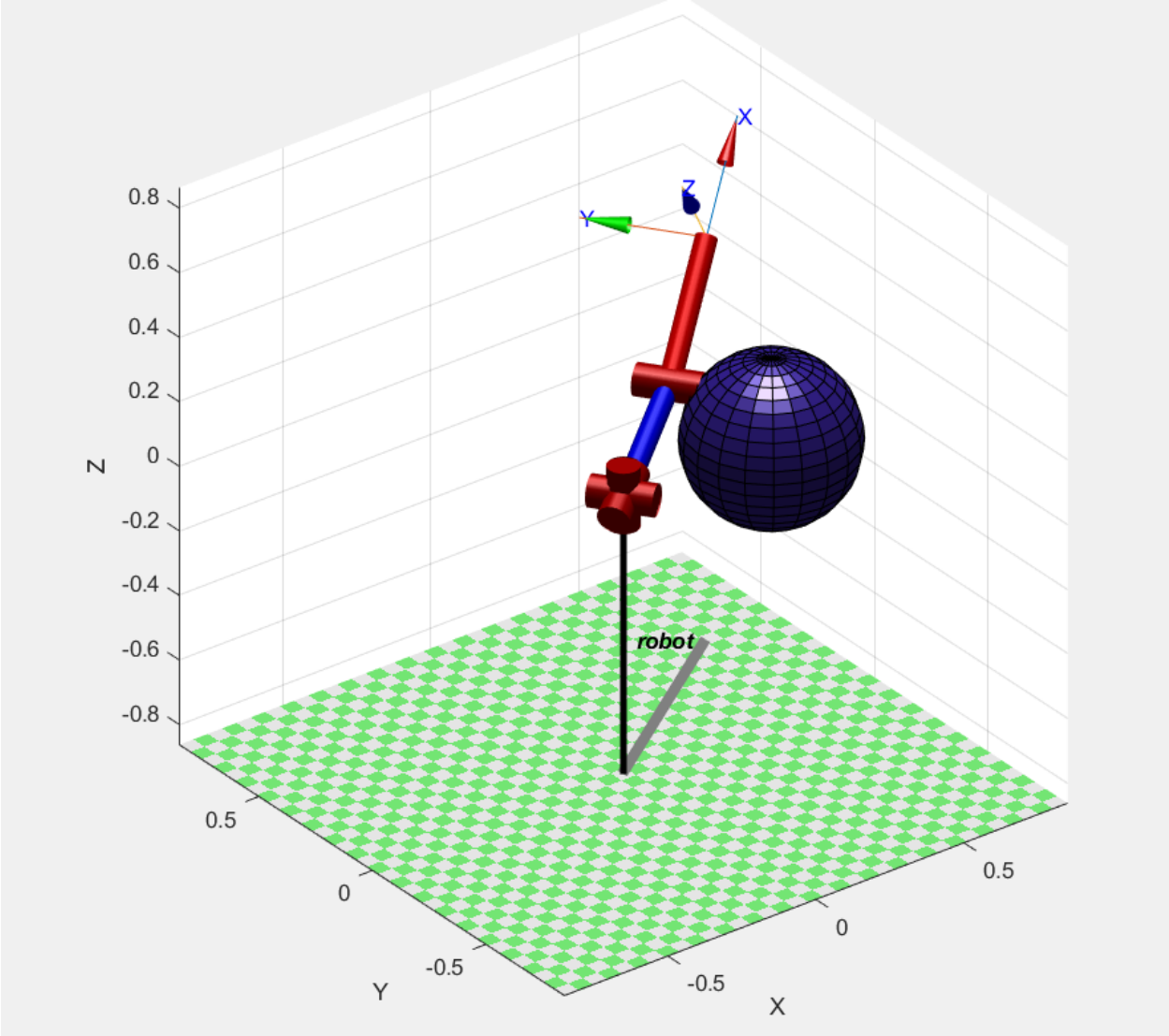
M3-PRM

Output-
Path found with 8 intermediate waypoints:
OR
Path found with 6 intermediate waypoints:

Figure : Intermediate path : avoiding collisions



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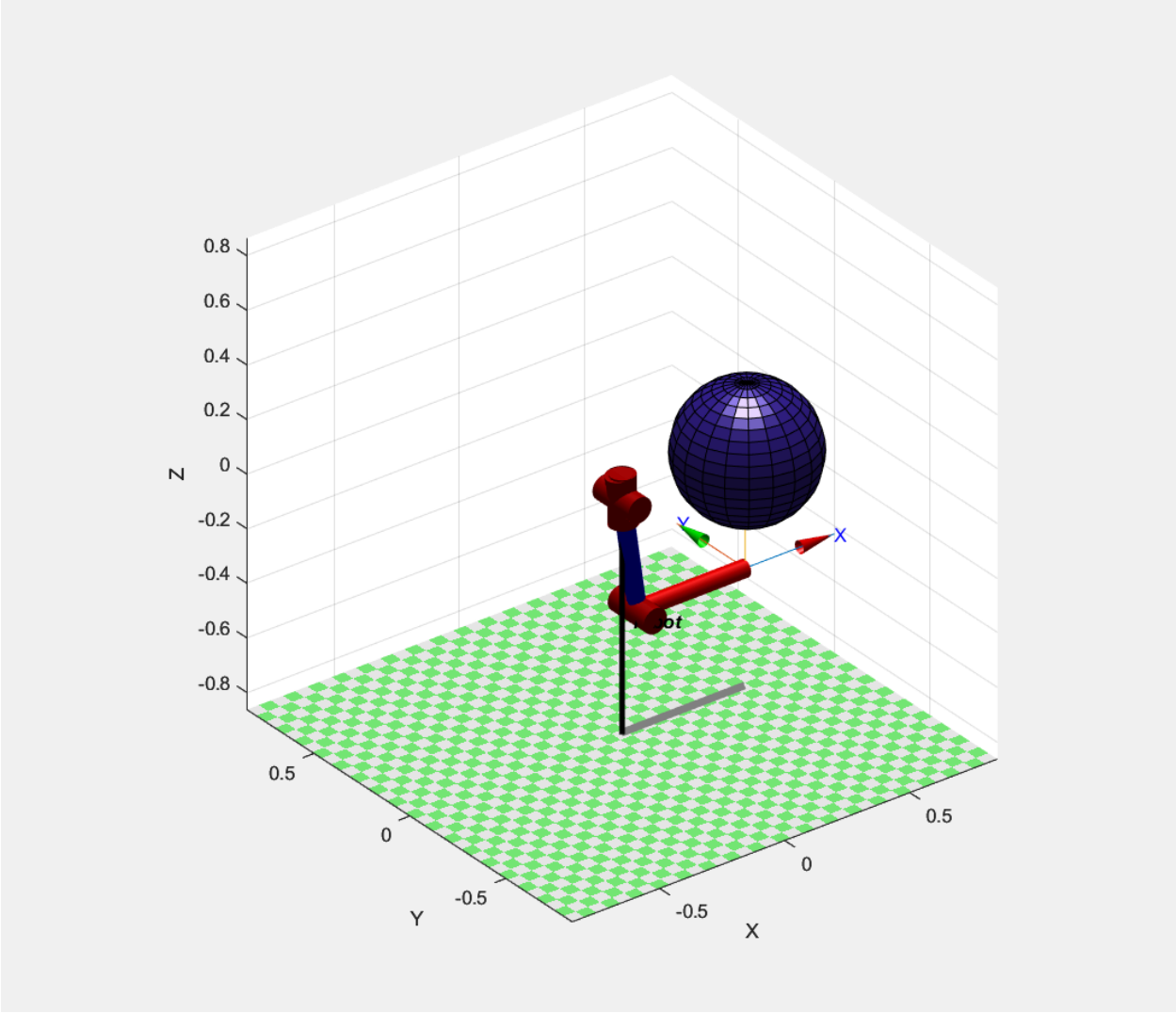
Q_goal



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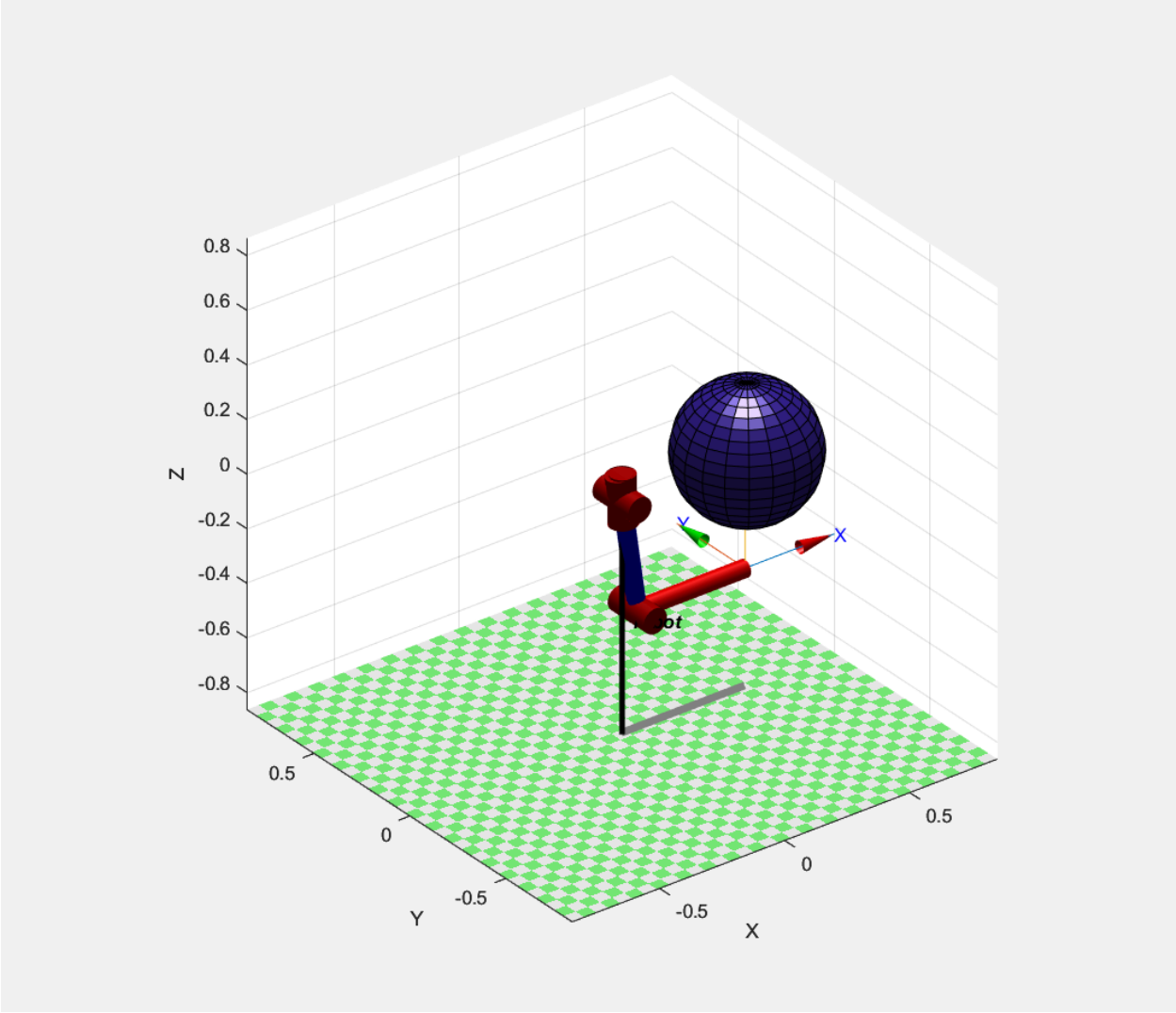
M4: RRT

Output-
Path found with 43 intermediate waypoints.

Figure: q_goal



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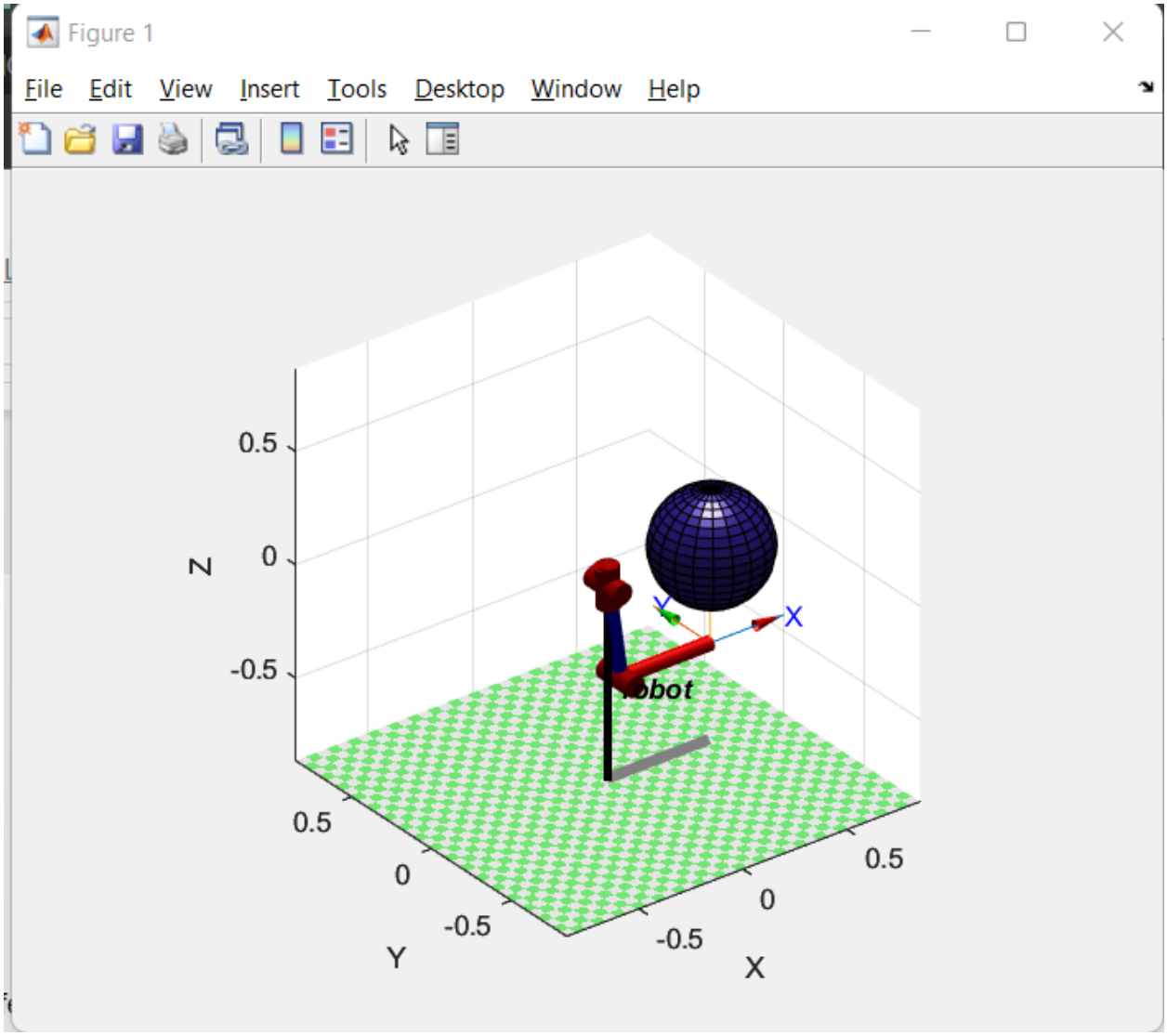
M5:RRT

Output-
Path found with 41 intermediate waypoints:
Smoothed path found with 2 intermediate waypoints:



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Acknowledgement:
https://www.mathworks.com/help/stats/knnsearch.html
https://www.mathworks.com/help/matlab/ref/graph.html
https://www.youtube.com/watch?v=lN61Hp9Gl88

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