

16-662

Robot Autonomy HW2

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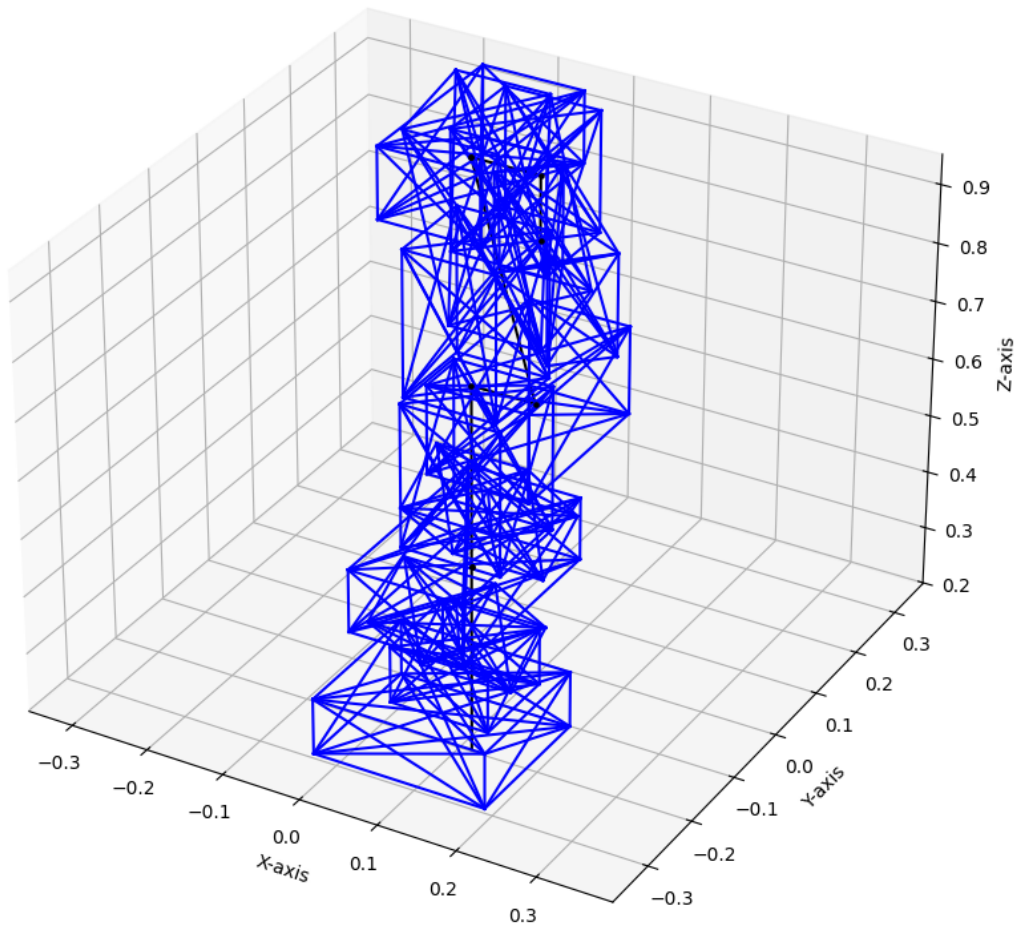
Q3.

A list of yes/no responses for whether the cuboids are colliding with the reference cuboid are shown below:

Test Case	Origin	Orientation	Dimensions	Collision
1	(0,1,0)	(0,0,0)	(0.8,0.8,0.8)	No
2	(1.5,-1.5,0)	(1,0,1.5)	(1,3,3)	No
3	(0,0,-1)	(0,0,0)	(2,3,1)	Yes
4	(3,0,0)	(0,0,0)	(3,1,1)	Yes
5	(-1,0,-2)	(.5,0,0.4)	(2,0.7,2)	Yes
6	(1.8,0.5,1.5)	(-0.2,0.5,0)	(1,3,1)	No
7	(0,-1.2,0.4)	(0,0.785,0.785)	(1,1,1)	Yes
8	(-0.8,0,-0.5)	(0,0,0.2)	(1,0.5,0.5)	Yes

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Collision between block 0 and given test block: False
Collision between block 1 and given test block: False
Collision between block 2 and given test block: True
Collision between block 3 and given test block: True
Collision between block 4 and given test block: True
Collision between block 5 and given test block: False
Collision between block 6 and given test block: True
Collision between block 7 and given test block: True
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The robot's bounding boxes at home configuration is shown below:



Q4.

The implementation is based on RRT Connect with goal bias. The hyperparameters set are:

$$goal_bias = 0.1$$

$$step_size = 0.3$$

Note that the simulation is set so that the Franka arm oscillates between the start and goal poses after reaching the other one. Therefore, the attached videos will show the Franka arm reaching the goal pose, but then immediately start on its return trajectory to the original pose. The full return trajectory is not shown, but you can always play the YouTube video in reverse. ☺

Video of RRT without path shortening (29 planned steps): <https://youtu.be/zMs-jlX755s>

Video of RRT with path shortening (4 planned steps): <https://youtu.be/oxnTlo9wGW0>

Q5.

The implementation is based on the vanilla PRM taught in the lectures. The hyperparameters set are:

$$\text{num_vertices} = 2000$$

Neighbors are defined using the L2 norm with a distance less than 2 radians. The PRM generator took 228.39 seconds to generate. The initial and end poses are the same set in Q4. Again, the Franka arm starts its return trajectory immediately after reaching the goal pose. The return journey is not shown.

Video of PRM path (5 planned steps): https://youtu.be/2nIOe2JY8_o