

## PS9: Path Planning

For our assignment, it took a long time to figure out a smooth path that was collision-free. We figured out how the robot could move with a payload by finding a line perpendicular to a given line. We thought of the robot as an arm. We calculated the slope of the forearm using the elbow point and hand point. Then, we found the slope of the payload which was  $-1/\text{slope of the forearm}$ . Since we know one point on this perpendicular line, we used the equation of the line  $y = ax + b$ . Moving along this line on the left and right side of the handpoint until the number of circles completes, then we record the centers

We first created a robot with the payload.

Then, we came up with a cspace befitting to this new arrangement.

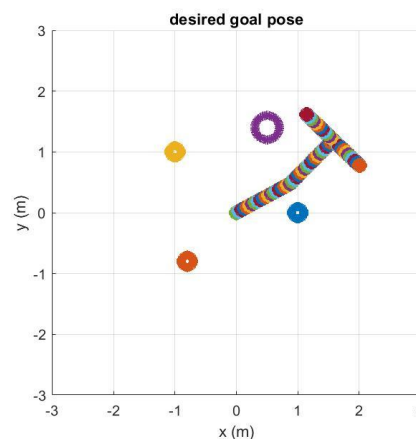
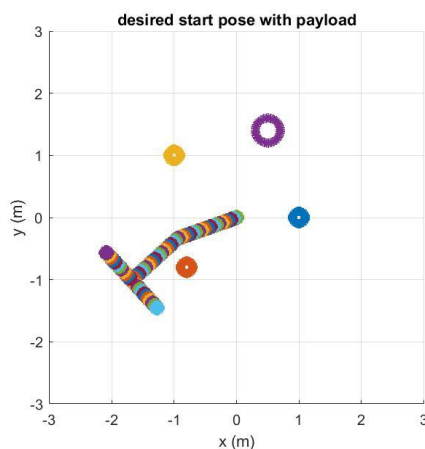
Then, we came up with a continuous viable path, which was not smooth.

For this, we broke the path into 3 parts and connected them through line segments.

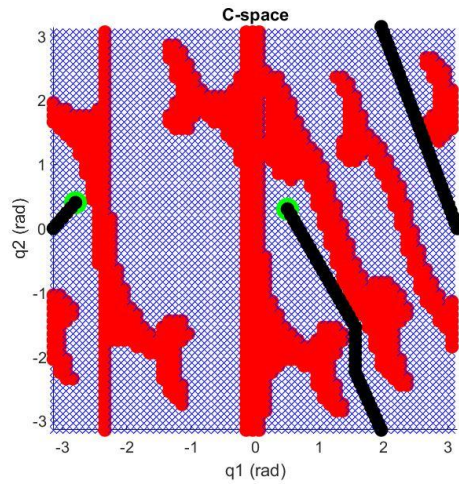
This was a successful attempt.

We then proceeded to make the paths smoother, we could only be successful partially. This we did using the curve fitting app in matlab.

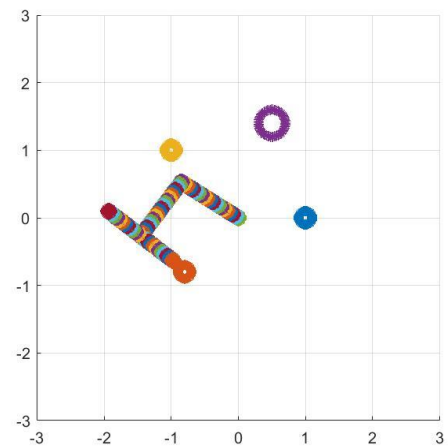
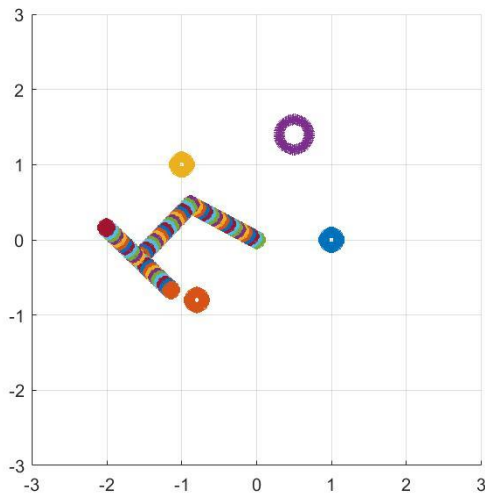
Partially successful : Regions where changes in x were unidirectional.

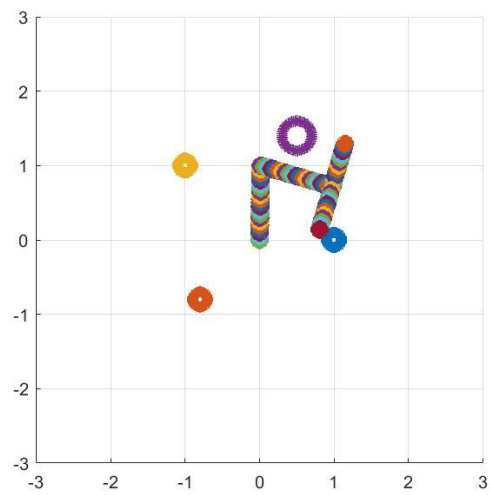
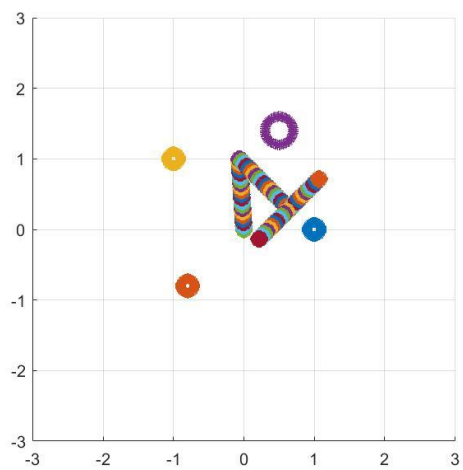
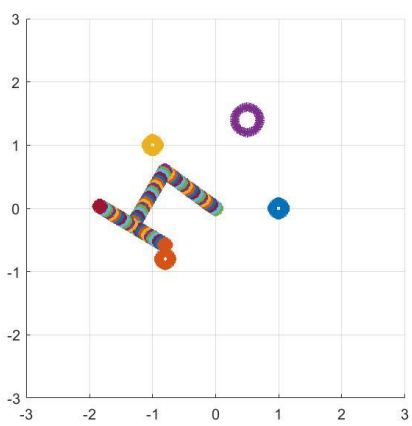
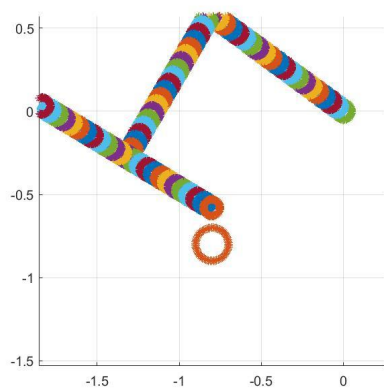
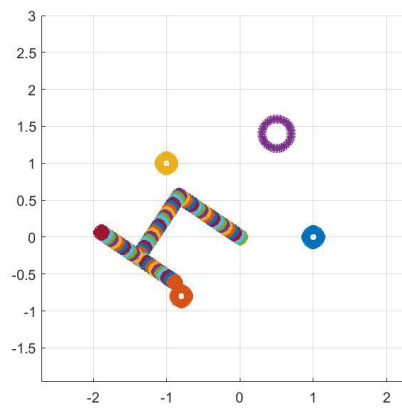
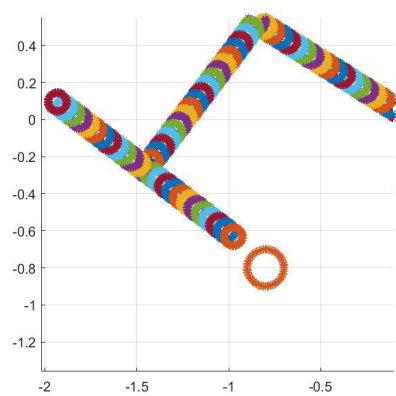


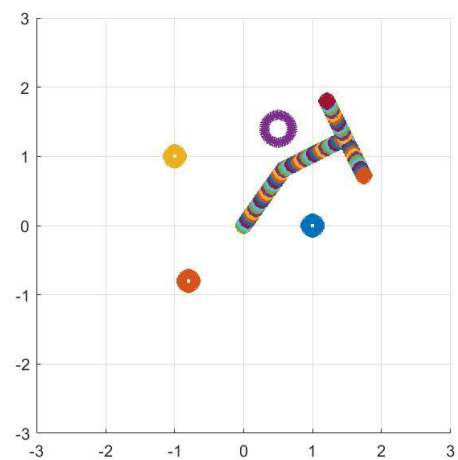
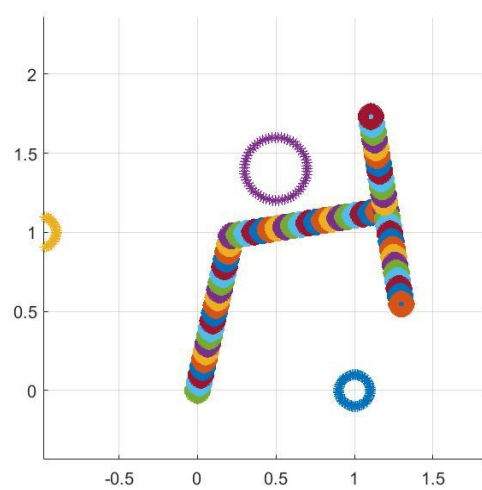
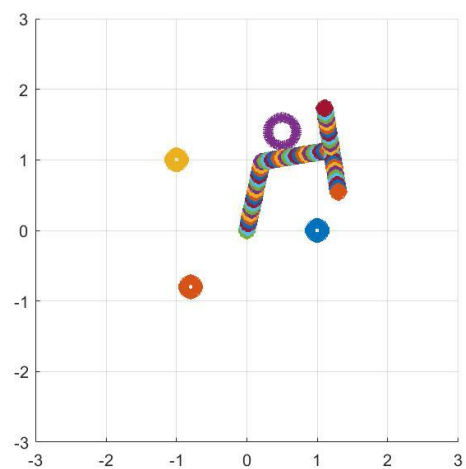
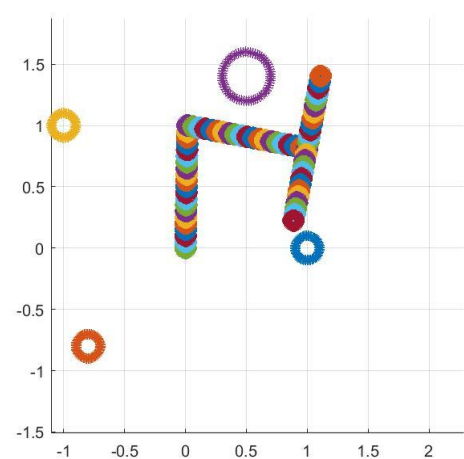
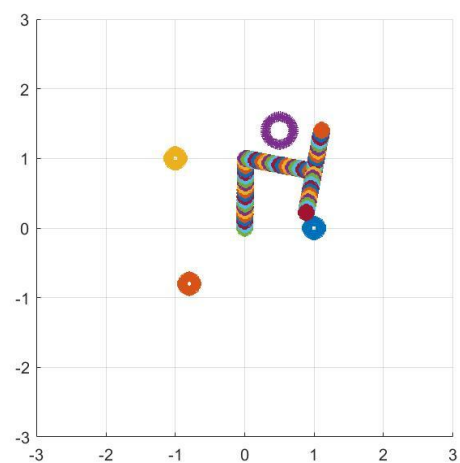
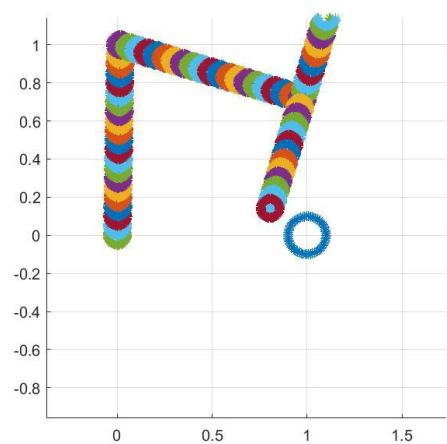
This is the graph of the C-space from our first attempt:

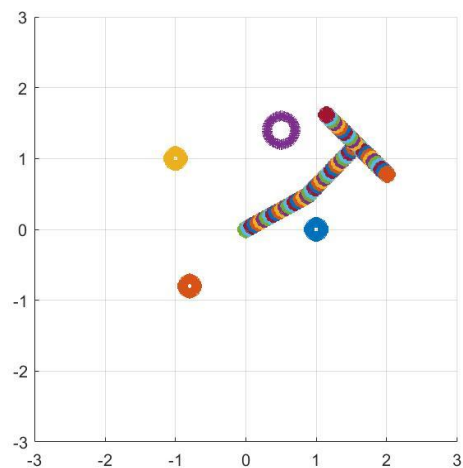
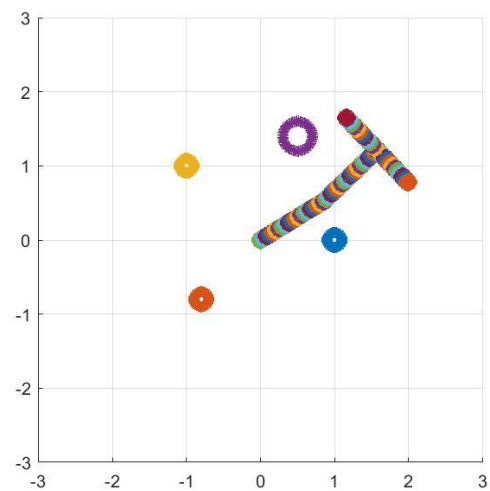
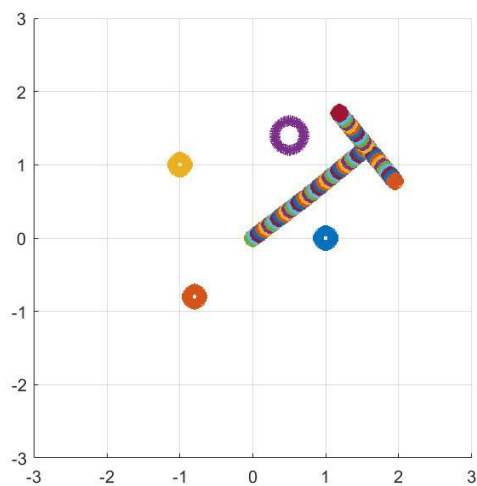
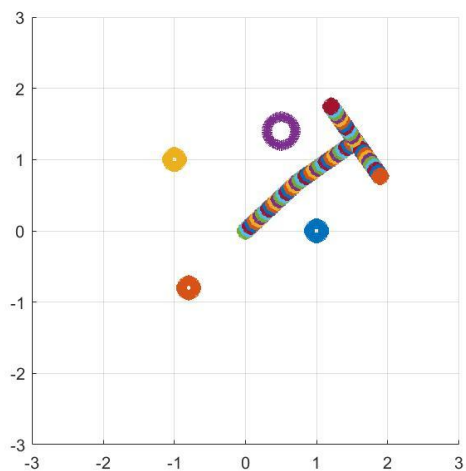


Eventually, we were able to find an initial solution that mostly works as shown below. Note: our graphs while zoomed out may seem like they hit obstacles, you will notice from our zoomed in graphs that they do not actually touch. This means our path is smooth and viable. While we were able to obtain a continuous path with no obstruction, We could not get a smoother version of it. Our code for this assignment is attached.

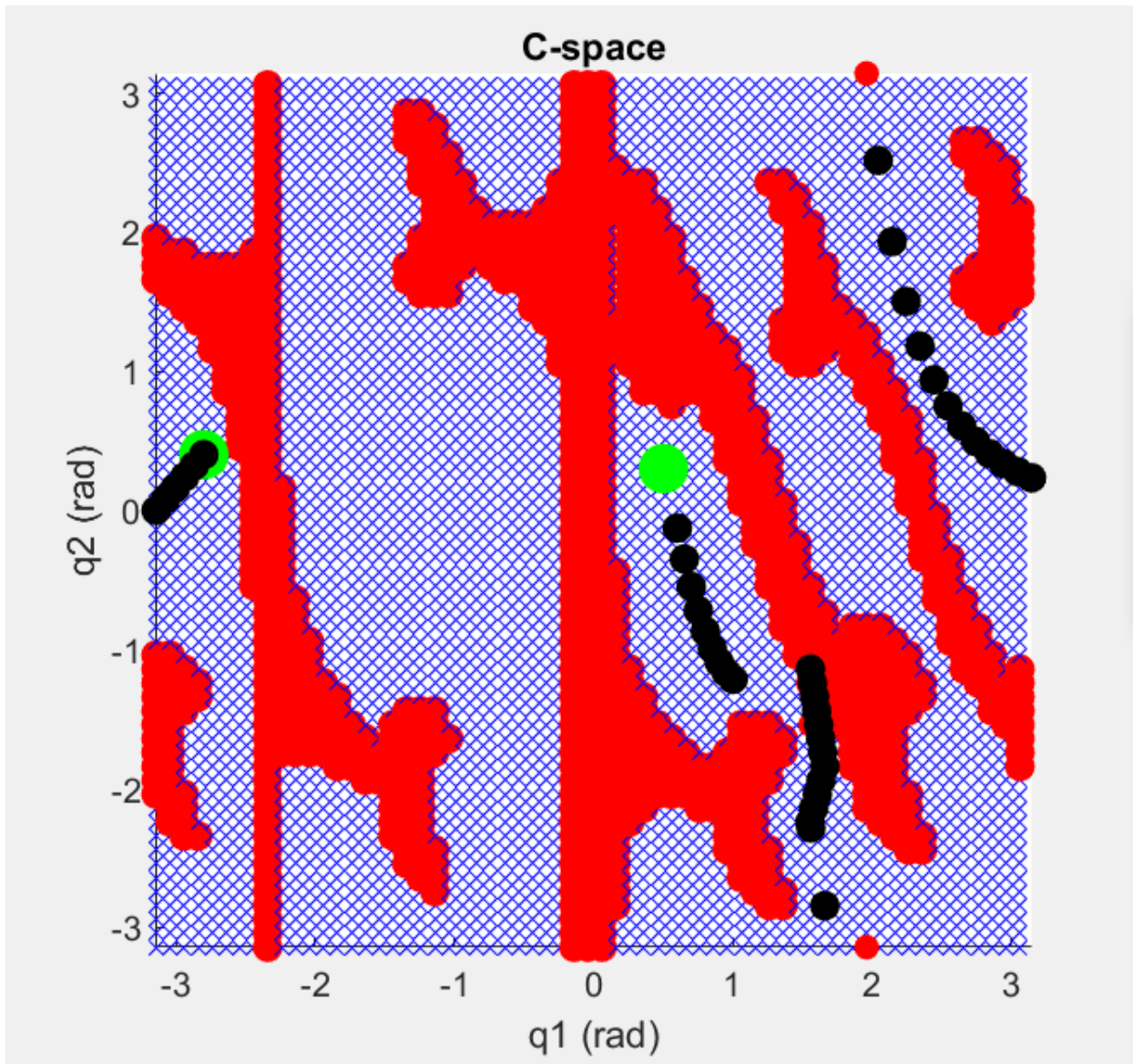




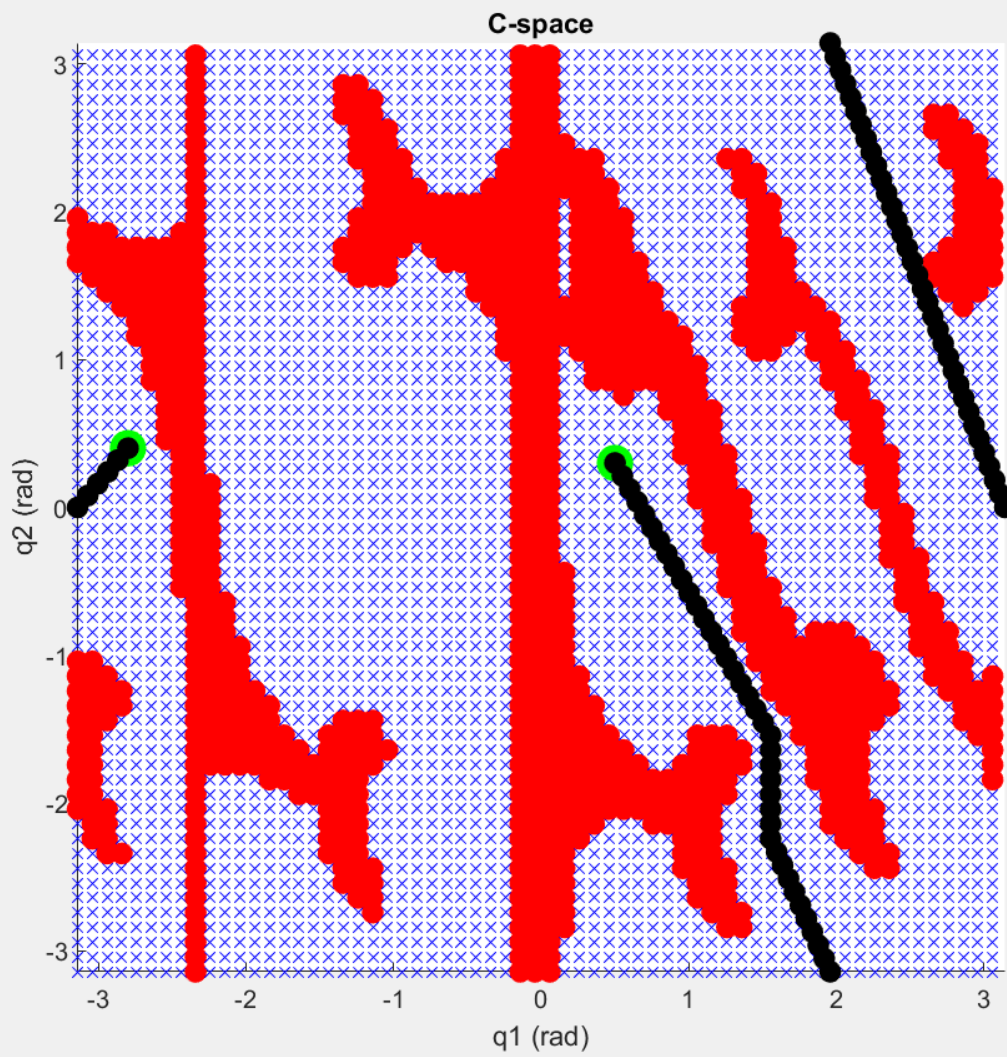




The following contains images of our second attempt:



Second attempt: smooth lines: **plotpath3.m**



First attempt : continuous line : **plotpath.m** file