

Introduction to Robotics

Assignment #6

Due: 08.07.2015, 13.00

Task 6.1 (12 points) Configuration Space – Programming Task:

Given is the planar 2-DOF manipulator as seen in Figure 1.

- The base is mounted at position $(0, 0)$ of the reference coordinate system.
- The manipulator is defined as
 - link length: $l_1 = l_2 = 200$
 - joint range: $\rho_1, \rho_2 \in [0, 2\pi)$
- The reachable workspace has a radius of 400
- The workspace holds two circular obstacles
- Obstacle o_1
 - origin: $(-280, 120)$
 - radius: 50
- Obstacle o_2
 - origin: $(-350, -300)$
 - radius: 200

6.1.1 (8 points): Use the mechanisms of configuration space to shrink the manipulator to a single point. Plot the configuration space with the two C-obstacles and the point-sized manipulator with $\rho_1 = 45^\circ$ and $\rho_2 = 60^\circ$. Discretize the configuration space to a precision of at least 1° .

6.1.2 (4 points): Plot a path from $\rho_1 = 45^\circ$ and $\rho_2 = 60^\circ$ to $\rho_1 = 180^\circ$ and $\rho_2 = 0^\circ$.

Task 6.2 (8 points) Arbitrary C-Obstacles – Programming Task:

Extend the program to support arbitrary polygon obstacles. Assume two new obstacles

- Obstacle o_3 : a rectangle with the following corner points
 - $(150, -150), (150, -300), (300, -300), (150, -300)$
- Obstacle o_4 : a polygon with the following corner points
 - $(100, 300), (50, 400), (250, 400), (200, 300), (150, 250), (100, 300)$

Plot the configuration space with C-obstacles $o_1 - o_4$.

Notice the depicted direction of ρ_1 and ρ_2
The red lines represent the zero position of the joints

Present the resulting plots as a PDF and pack your executable code (with all required libraries) as a ZIP file.

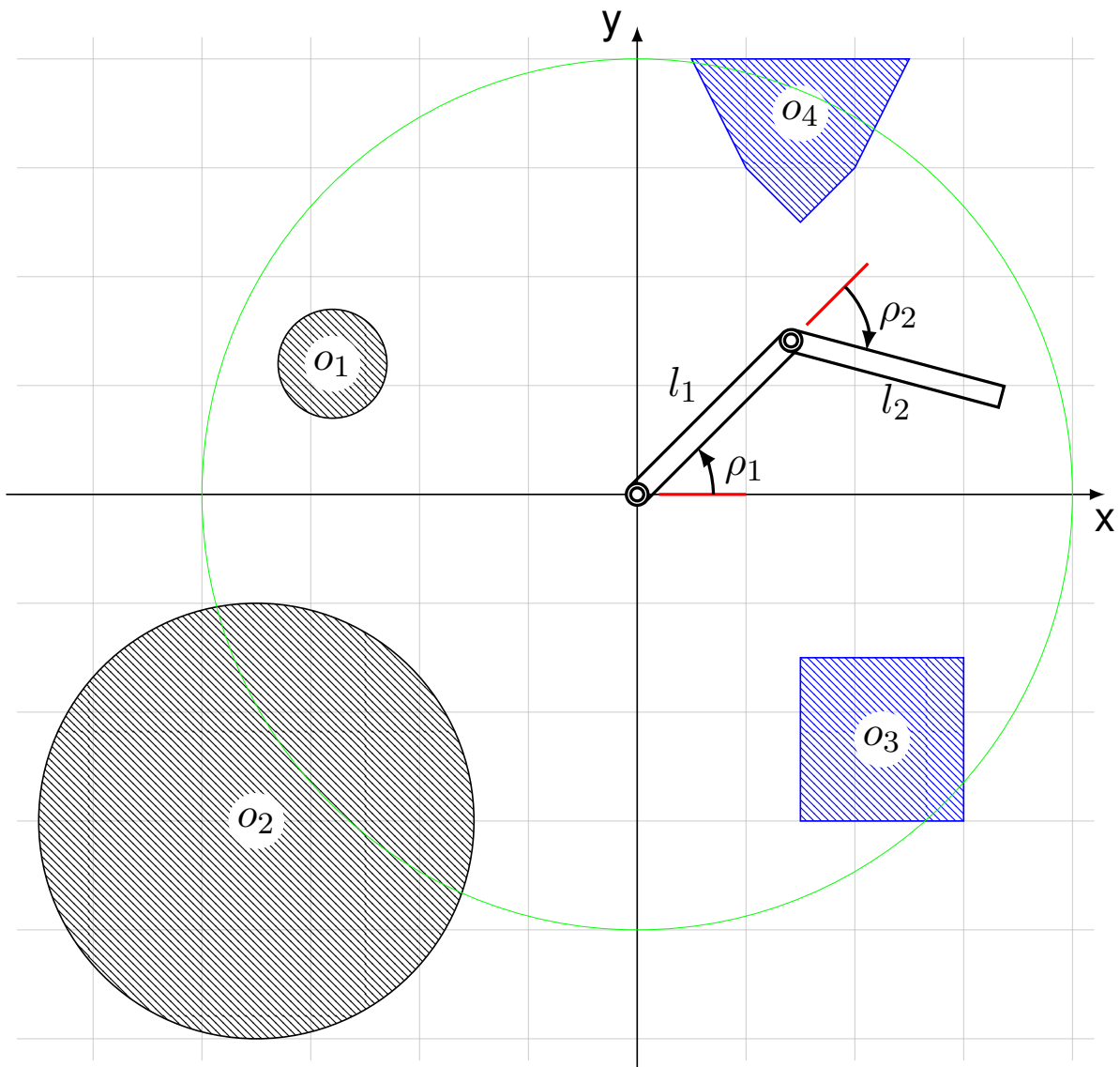


Figure 1: 2-DOF planar manipulator in workspace. Assume circular obstacles o_1, o_2 for **Task 6.1** and o_3, o_4 for **Task 6.2**. The red lines depict the zero position of each joint. The arrows point in the positive joint rotation direction. The green circle marks the reachable workspace. The grid distance is 100.