

ME4K03 ROBOTICS
Assignment #1

1.a) Workspace for a PPR manipulator:

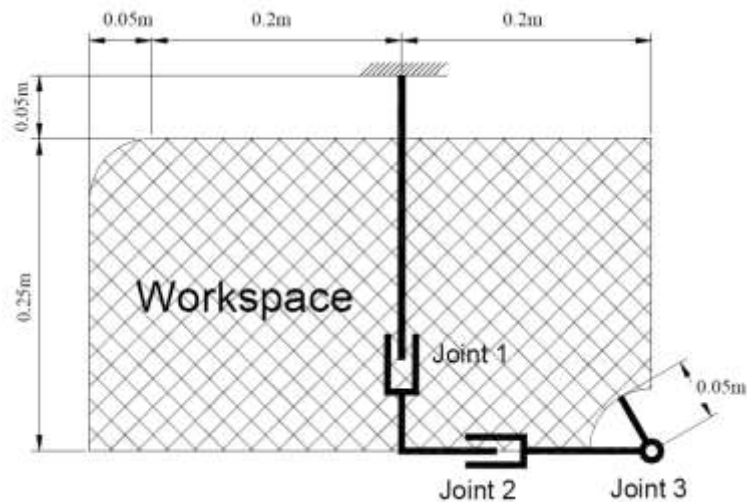
$$d = 0.05m$$

$$0.1m \leq a \leq 0.3m$$

$$-0.2m \leq b \leq 0.2m$$

$$270^\circ \leq c \leq 360^\circ$$

Solution:



1.b) Workspace for a PRR manipulator:

$$b = 0.5m$$

$$e = 0.1m$$

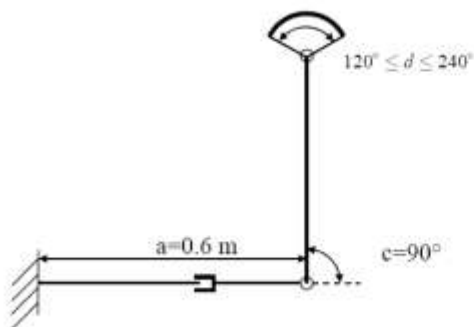
$$0.1m \leq a \leq 0.6m$$

$$-45^\circ \leq c \leq 90^\circ$$

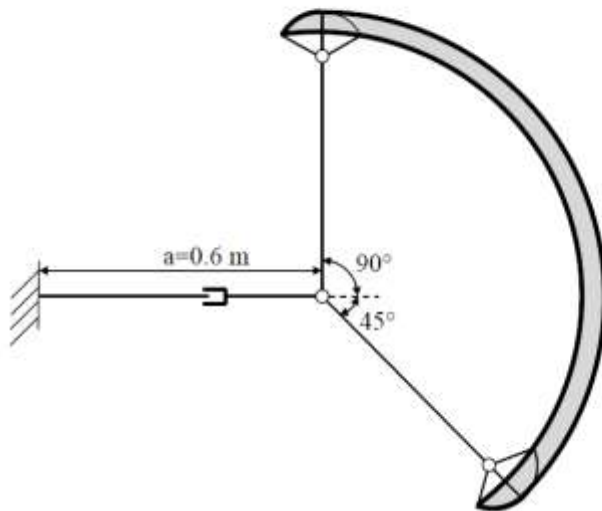
$$120^\circ \leq d \leq 240^\circ$$

Step by Step Solution:

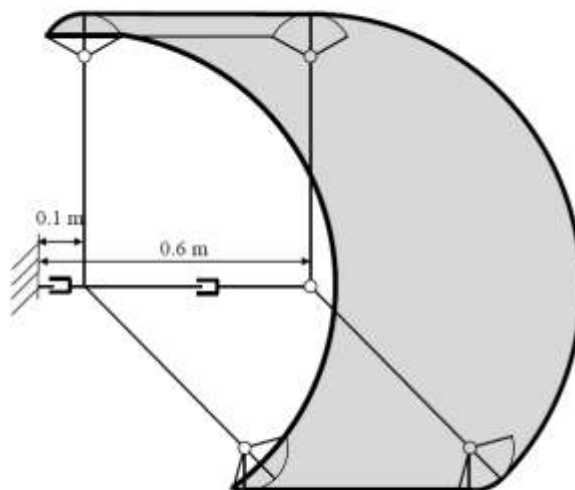
Since this is a 3 DOF robot, we start by moving the third joint through its full range of motion ($120^\circ \leq d \leq 240^\circ$), with joint 1 and 2 at their upper limits. The workspace characterized by this motion is an arc, as shown below.



The second step involves sweeping this arc across the second joint's range of motion ($-45^\circ \leq \theta \leq 90^\circ$). The workspace characterized by these first two motions is the shaded area shown below.

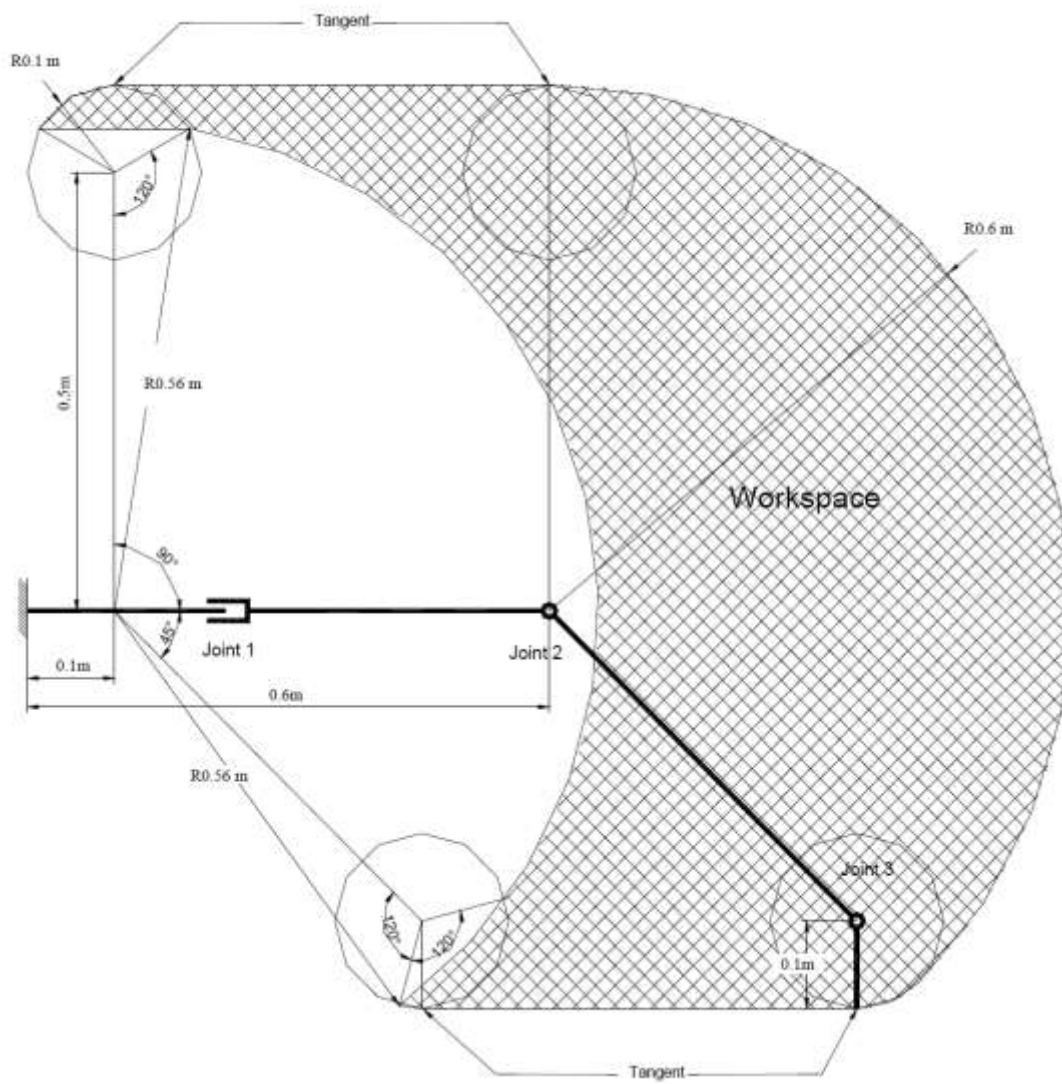


The third step involves sweeping the previous area across the first joint's range of motion. The workspace characterized by all three motions is the shaded area shown below:



The final step is to crosshatch and dimension the drawing. The final answer is shown on the next page.

Final answer for 1. b)



2. Reachable workspace for a RRR manipulator:

$$l_1 = 1m$$

$$l_2 = 0.7m$$

$$l_3 = 0.1m$$

$$OuterRadius(R_o) = l_1 + l_2 + l_3 = 1.8m$$

$$InnerRadius(R_I) = l_1 - l_2 - l_3 = 0.2m$$

