Optimal Kinematic Design of Robots

Lab 1: Workspace-based design of a SCARA robot (duration: 4 hours)

Objective:
The goal of this lab is to show how the workspace can be used as a tool to design a SCARA robot using an interactive Matlab function.

Work plan
1/ Write a Matlab function that plots the workspace boundaries of a planar SCARA robot with joint limits and link lengths given by the user. Take into account a disc obstacle that obstructs only link1 (no plot and a message error should appear if it is not the case).

2/ Design for *point-to-point tasks.*
The SCARA robot has joint limits $\pm 132°$ and $\pm 141°$ for theta1 and theta2, respectively. A disk obstacle of radius 0.3 is placed at (1.2 , 0.1).
The maximal reach of the robot is set to 2. Using the provided Matlab Interface, find the 'best' link length ratio for the robot to be able to pick parts from an L-shaped palette of dimensions 2m x1m and of width 0.5m (fig) and place them into another identical palette.
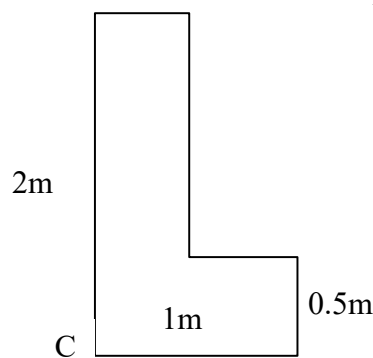
3/ Design for *process tasks.*
The SCARA robot with joint limits $\pm 132°$ and $\pm 141°$ for theta1 and theta2, respectively, is now used for laser cutting tasks (same obstacle place and size).
Using the Matlab Interface, find the 'best' link length ratio for the robot to be able to cut an L-shaped plate of dimensions 2m x1m and of width 0.5m (fig).

Deliverables
- A pdf file with all necessary explanations and figures (max 6 pages not incl. code);
- Your Matlab function. Provide sufficient comments in your Matlab code;
- Send a zipped file (pdf+code) and name it as follows: XXX-YYY-Lab1 where XXX and YYY are the first three letters of your last names;
Email address: Pierre.Garnault@ls2n.fr
- Due date: 18 October