



**Credit Hours System**  
**INTN125**  
**Mechanical Engineering**



**Cairo University**  
**Faculty of Engineering**

**Project Report**  
**3-LINK ROBOTIC ARM SIMULATOR**  
**Fall 2021**

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# Code Demonstration

-----Welcome To RoboTool Main Menu -----

Enter manipulator link dimensions and angle ranges

Enter 1st link length:

5

Enter 2nd link length:

4

Enter 3rd link length:

3

Enter angle range of 1st link (Degrees):

[0 90]

Enter angle range of 2nd link (Degrees):

[0 120]

Enter angle range of 3rd link (Degrees):

[50 200]

At the start, the user is prompted to enter the manipulator arm parameters: the lengths and angle ranges of the 3 links.

## 1] DKPM

Please Choose an Option From The Menu

[1]-Calculate DKPM

[2]-Calculate IKPM

[3]-Calculate Working Area

[4]-Plot Working Area

[5]-Generate straight line trajectory

[6]-Robot Animation

Please Enter The Number Of The Option:

1

DKPM Chosen

Enter 1st link angle:

80

Enter 2nd link angle:

45

Enter 3rd link angle:

160

X coordinate =-0.65

Y coordinate =5.30

Sum of angles is =285.00

To continue enter 1

To terminate enter 0

Option 1 calculates the DKPM given a set of link angles.

## 2] IKPM

```
Please Enter The Number Of The Option:
2
IKPM Choosen
Enter X coordinate of the final point:
7
Enter Y coordinate of the final point:
10
Enter phi:
180
Angle out of range! The position you specified cannot be reached.To continue enter 1
To terminate enter 0
```

Option 2 calculates the IKPM of the robotic arm for a given position in the XY plane and a given sum of link angles.

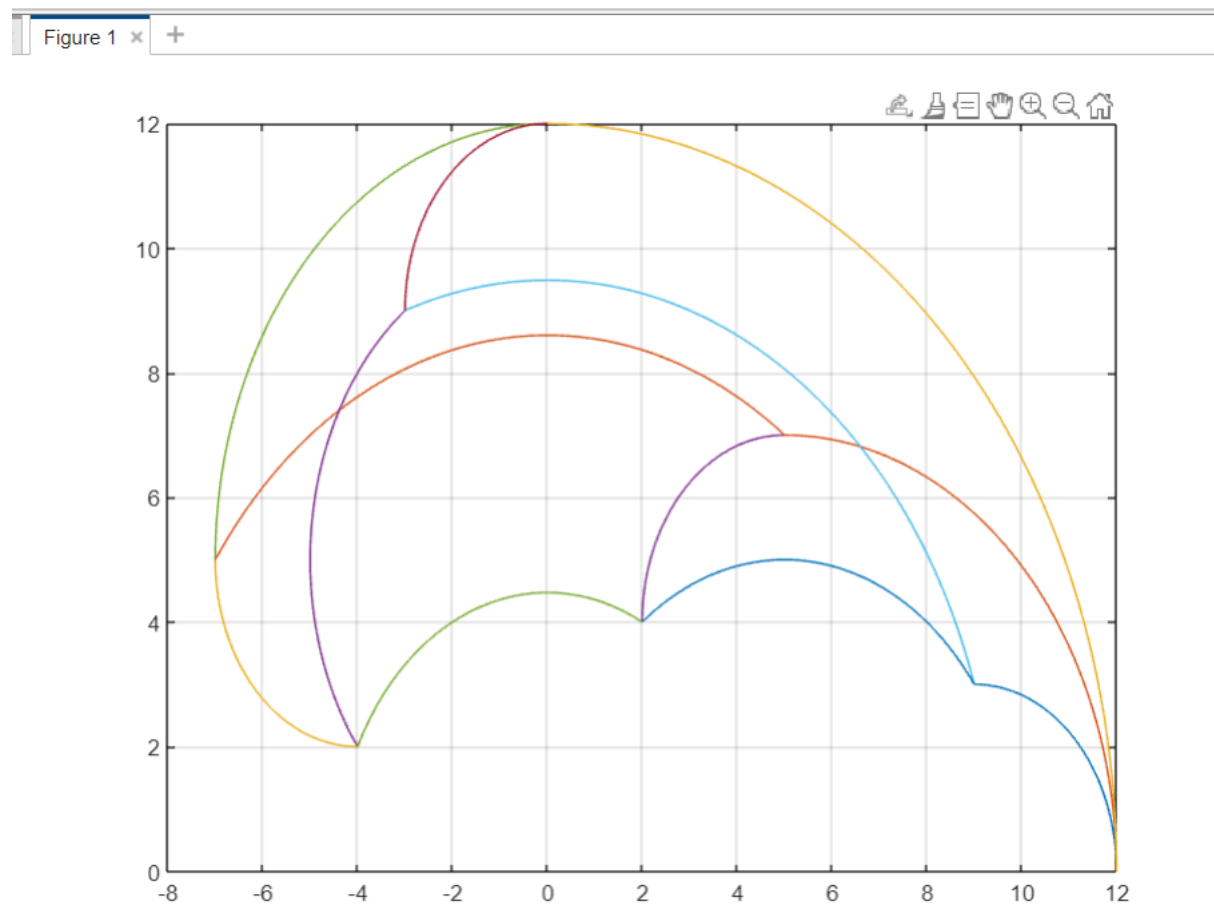
In that case, the entered combination had no solution, since the point specified is out of the reachable working area of the robot.

The user is prompted to enter a valid position (inside the working area). After entering the position, the IKPM is constructed and a solution was found for the given parameters.

```
Please Choose an Option From The Menu
[1]-Calculate DKPM
[2]-Calculate IKPM
[3]-Calculate Working Area
[4]-Plot Working Area
[5]-Generate straight line trajectory
[6]-Robot Animation
Please Enter The Number Of The Option:
2
IKPM Choosen
Enter X coordinate of the final point:
10
Enter Y coordinate of the final point:
10
Enter phi:
180
1st link angle q1 = 43.45093
2nd link angle q2 = 0.00000
3rd link angle q3 = 136.54907
To continue enter 1
To terminate enter 0
```

### 3] Working Area calculation

Working Area is calculated and displayed by option 3.



### 4] Working Area Plotting

Option 4 plots the working area, as shown, while also displaying the contours of each path of the robotic arm for defining that region.

### 5] Trajectory Generation

Option 5 plots the trajectory for going from an initial position to a final position. The user is prompted to enter the initial position, final position, summation of link angles, start time and final time.

```

10 terminate end
[1]-Calculate DKPM
[2]-Calculate IKPM
[3]-Calculate Working Area
[4]-Plot Working Area
[5]-Generate straight line trajectory
[6]-Robot Animation
Please Enter The Number Of The Option:
5
Trajectory planning
Enter initial position[x y]:
[9 13]
Enter final position[x y]:
[-8 10]
Enter phi(deg):
180
Enter initial time:
0
Enter final time:
1

```



The trajectory going from the initial to final position is shown in green.

## 6] Robot Animation

Option 6 shows a general animation for the movement of the robotic arm. Snippet photos are shown but it can be best observed by running the code.

