# PICK & PLACE ROBOTIC ARM FOR LABELING MINI PROJECT

IN PARTIAL FULFILMENT OF THE IN-COURSE MODULE

EC 6090 – ROBOTICS AND AUTOMATION


Submitted by:

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**GROUP G23**


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SEMESTER 6


**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

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# INTRODUCTION

**Overview of the Robotic Pick & Place Task**

In this task, we are automating the pick and place operation of a disk as part of a manufacturing process line. The workflow involves the robotic arm picking a disk from a conveyor at Station 1, moving to Station 2 for labeling, and finally placing the disk at Station 3 for transfer to another conveyor. The disk dimensions are 2 cm in width and weigh 0.5 kg, making it feasible for a variety of robotic arms to handle.

The entire process will be simulated using **RoboDK**, a powerful software for robotics simulation and programming, alongside MATLAB to perform trajectory planning and verify kinematic calculations.

**Robotic Arm Selection**

**Introduction to the ABB CRB 1300-11/0.9**

The ABB CRB 1300 is part of ABB's collaborative robot series, designed to work alongside human operators while adhering to safety guidelines. It combines advanced robotics technology with ease of programming, making it ideal for tasks such as pick and place operations in a manufacturing environment. The robot's inherent safety features, high-speed motion capabilities, and efficient energy usage contribute to its effectiveness in automation applications.

**1.Degree of Freedom:** The ABB CRB 1300 has 6 degrees of freedom.

- Base Rotation (Joint 1): Rotates the entire arm around its base.
- Shoulder Joint (Joint 2): Moves the arm up and down, allowing for vertical reach.
- Elbow Joint (Joint 3): Extends and retracts the arm, adjusting the horizontal reach.
- Wrist Rotation (Joint 4): Rotates the wrist around its axis.
- Wrist Bend (Joint 5): Moves the wrist up and down.
- Wrist Twist (Joint 6): Rotates the end effector, allowing for precise orientation control.

**2.Reach (Workspace):** With a reach of approximately 900 mm, this manipulator is suitable for the distances between the stations. It can easily handle the movements required to move from Station 1 to Station 2, and then to Station 3, providing more than enough reach for our needs.

**3.Payload Capacity:** The arm is capable of handling payloads up to 11 kg, which is well above the 0.5 kg disk. This ensures that the arm operates efficiently without risk of overload.

**4.Precision and Speed:** The ABB CRB series is known for its precision and speed, which are critical for maintaining the efficiency of the manufacturing process.

**5.Robustness and Versatility:** This robotic arm is designed for industrial applications and can be easily adapted to various automated tasks, making it a suitable choice for our simulation needs.

## RESULTS

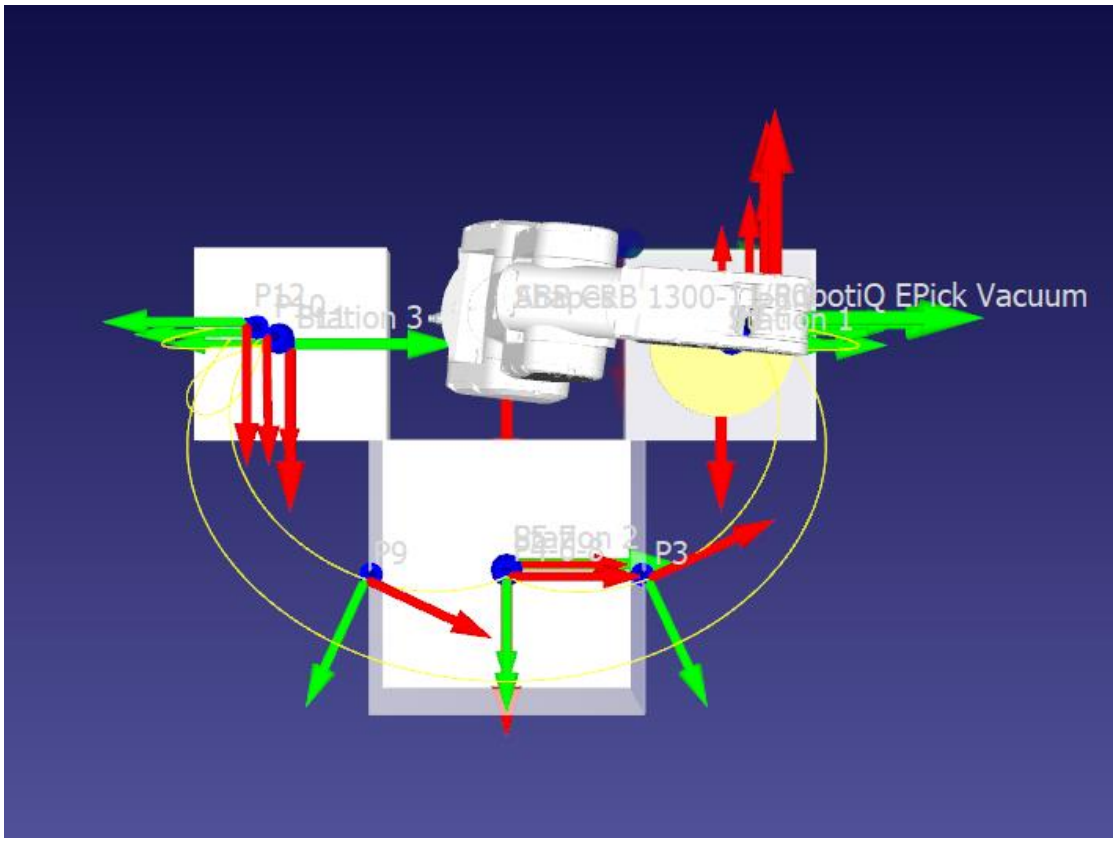


**Figure 1: Top View**

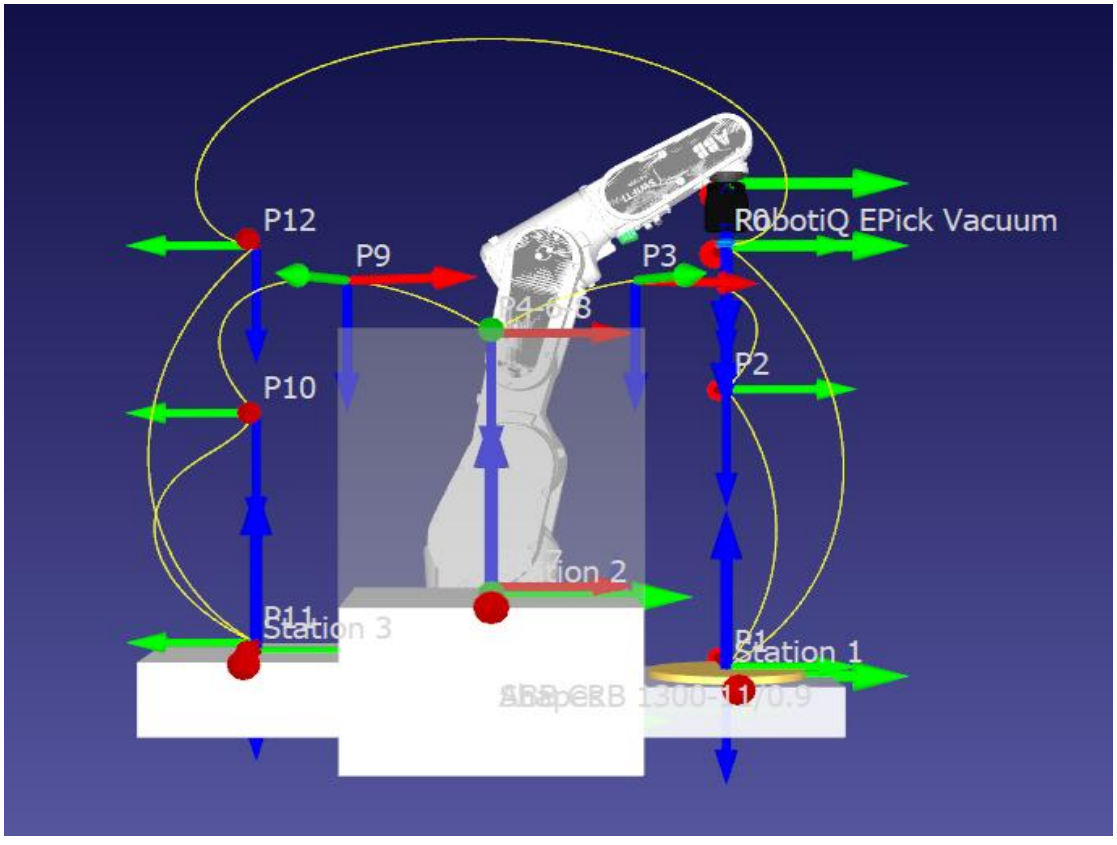


**Figure 2: Front View**

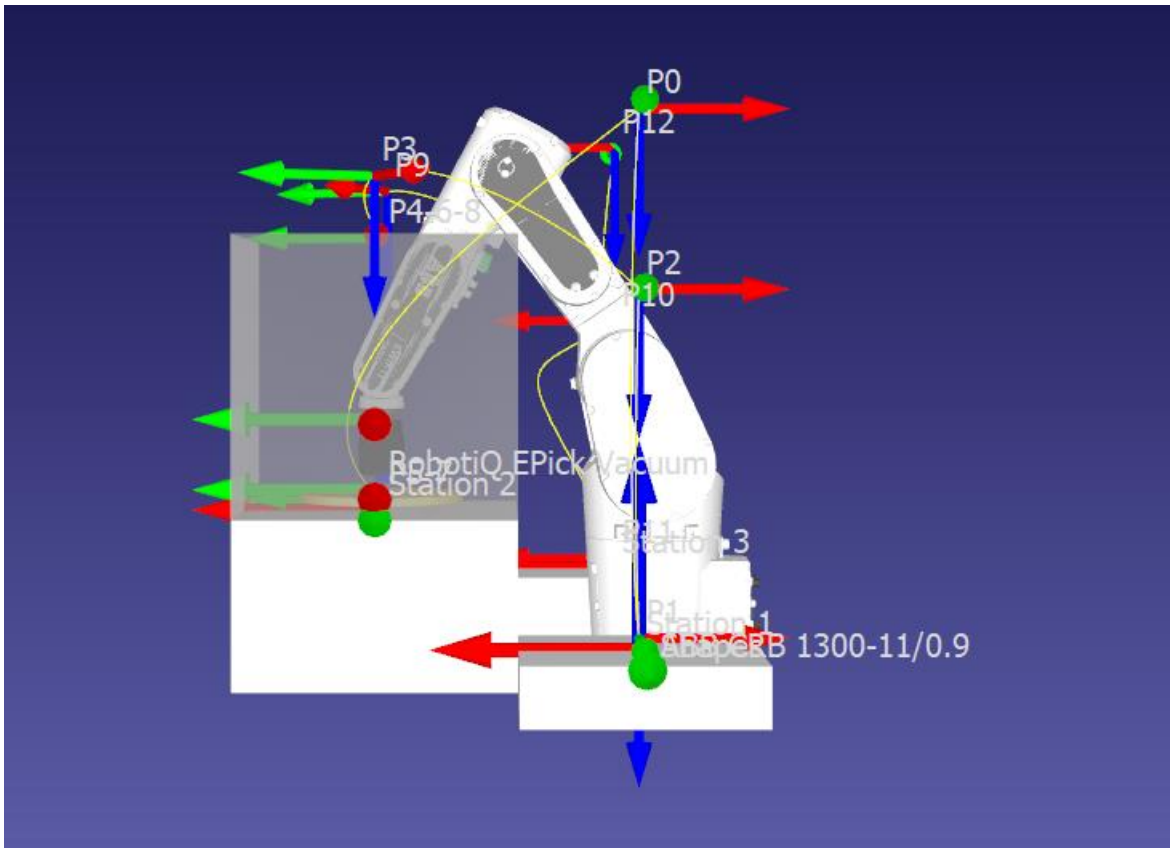


**Figure 3: Right Side View**

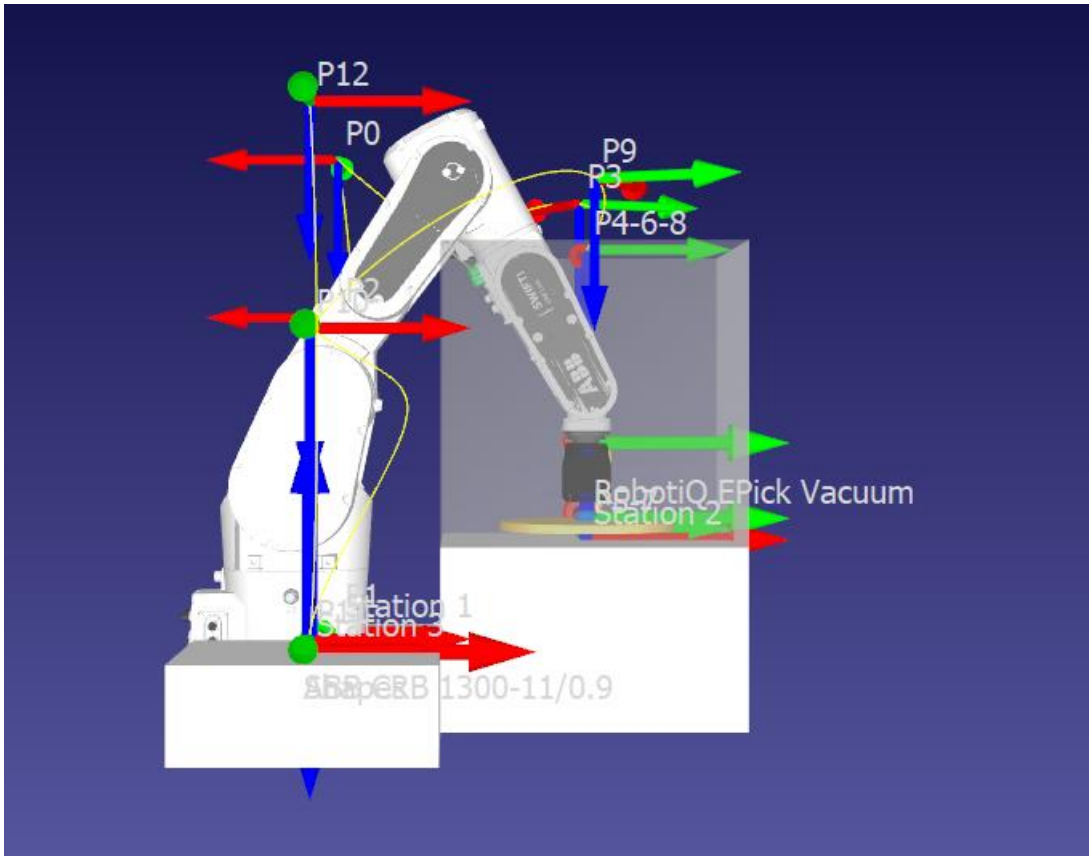


**Figure 4: Left Side View**

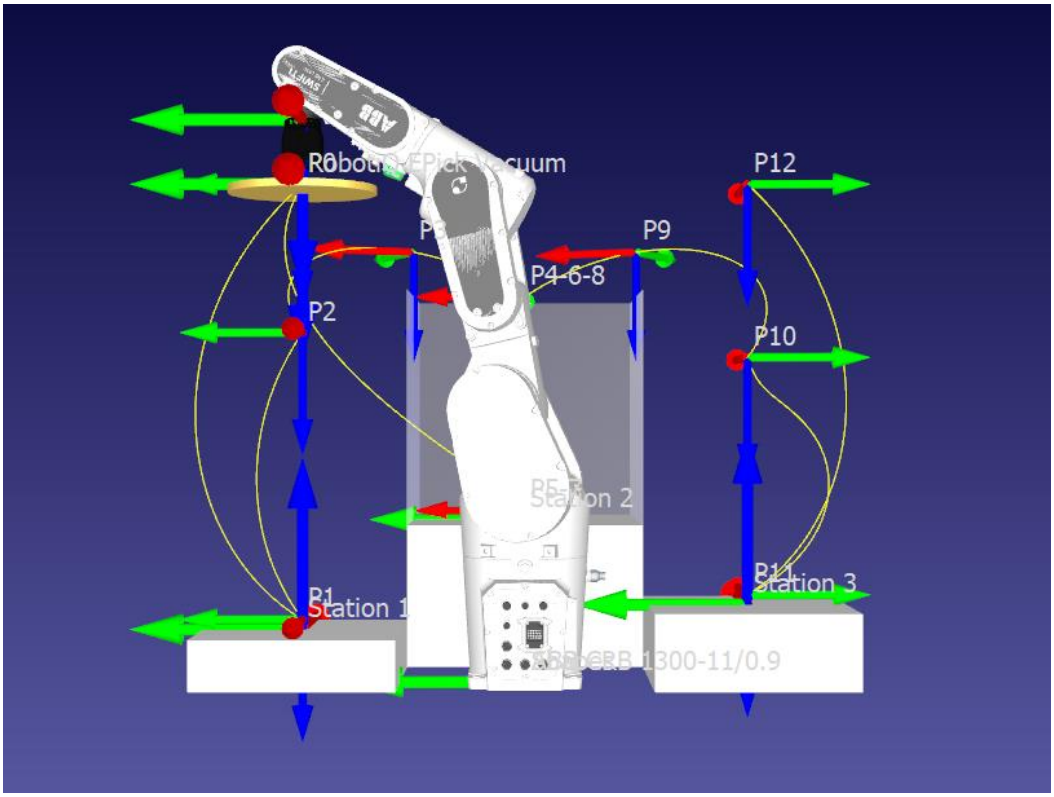


**Figure 5: Back View**

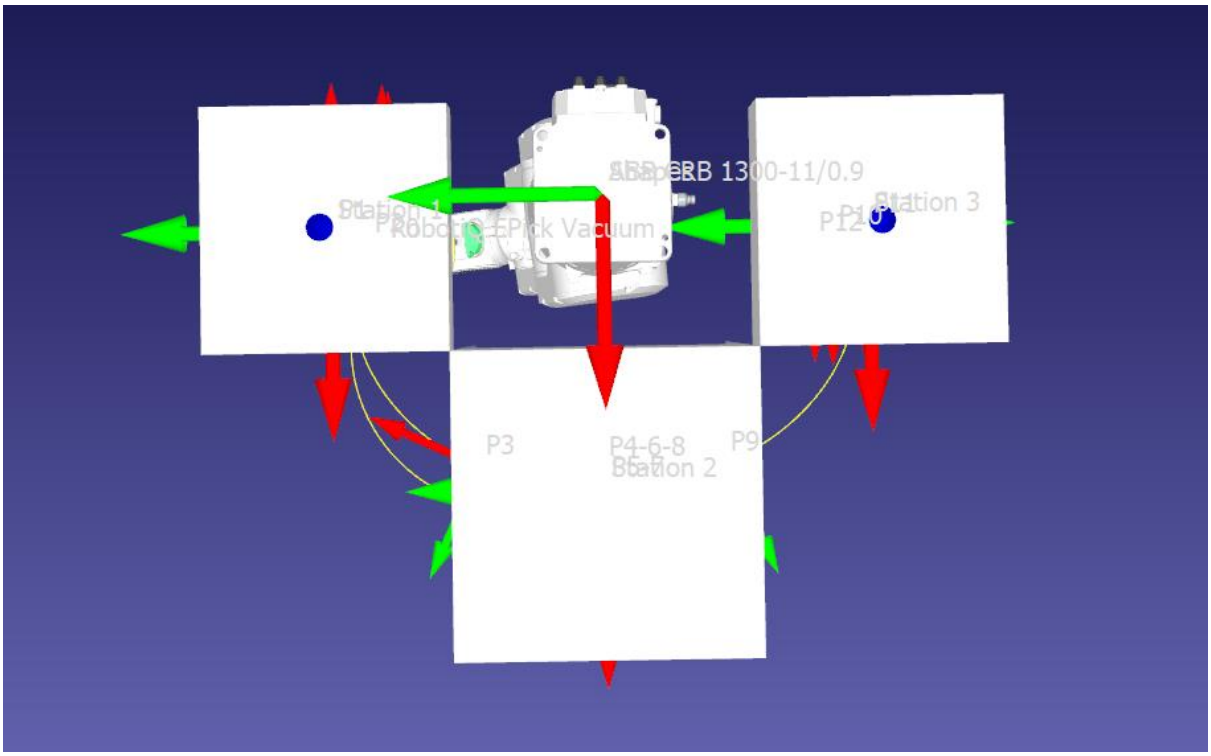


**Figure 6: Bottom View**

# Output From Matlab Design App

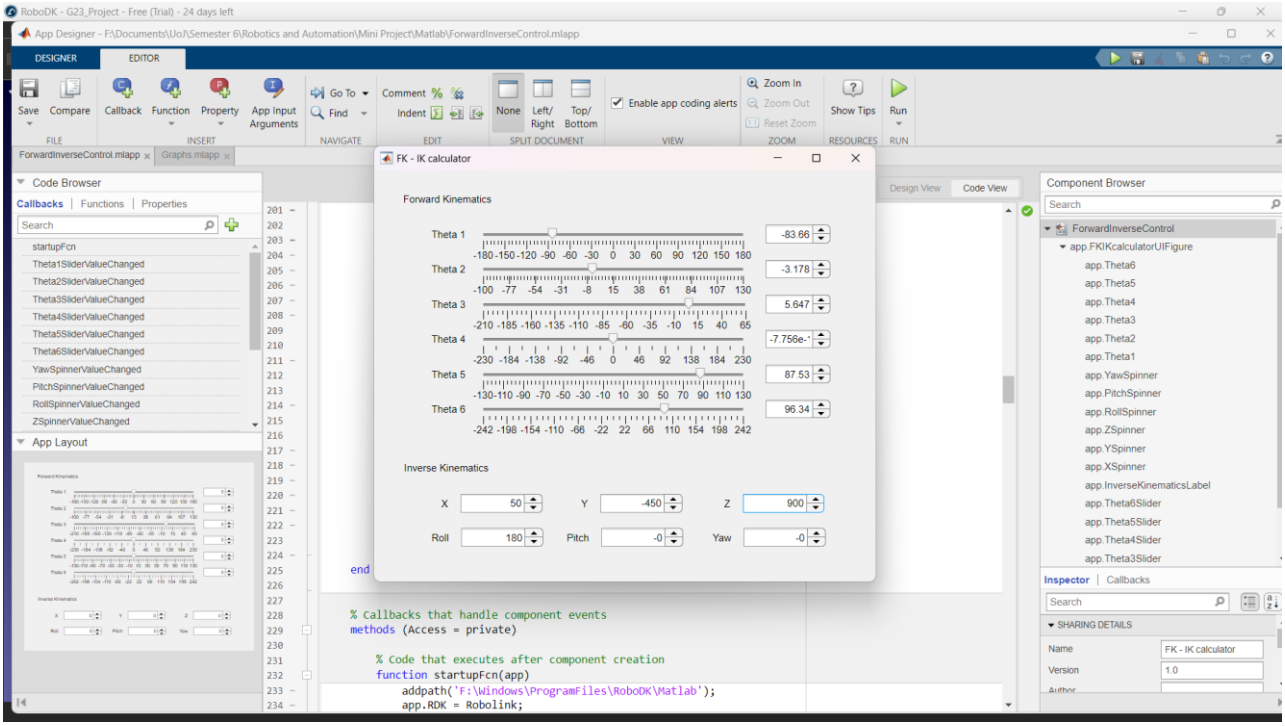


**Figure 7: Forward Kinematics & Inverse Kinematics parameters before changing**

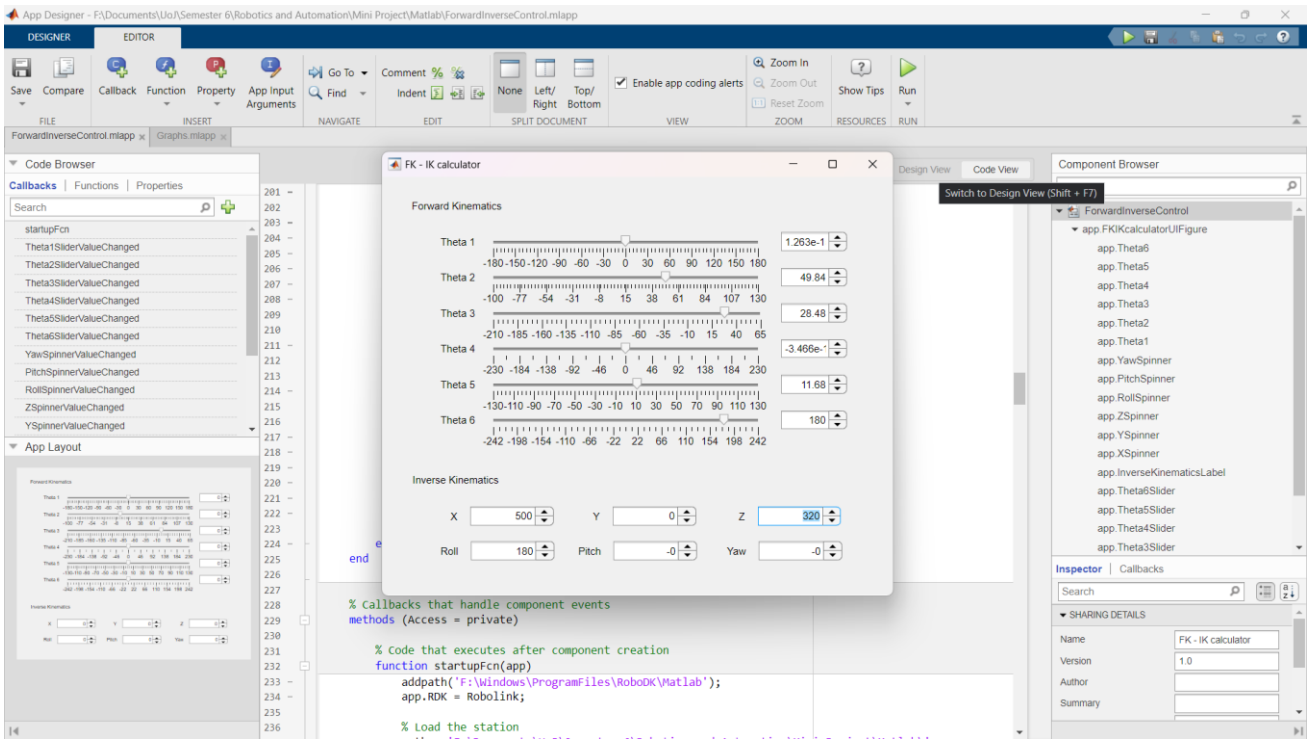


**Figure 8: Forward Kinematics & Inverse Kinematics parameters after changing**

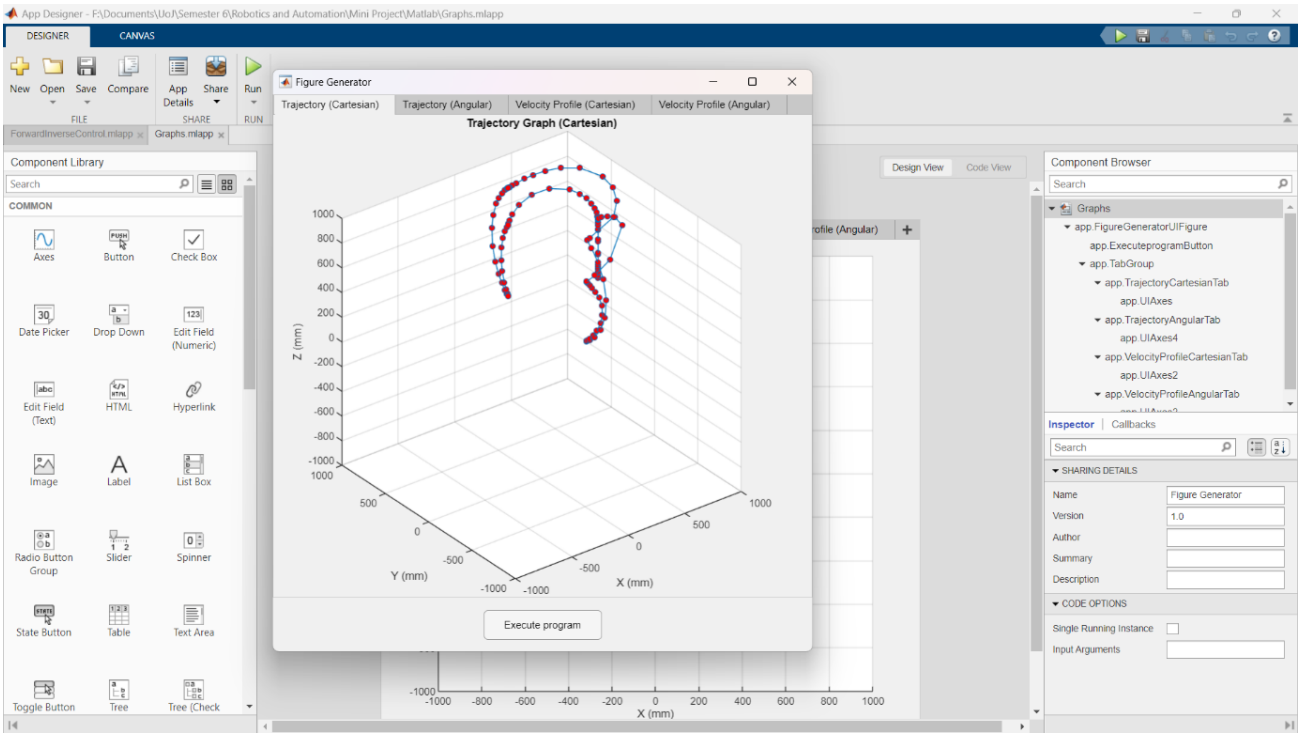


**Figure 9: Trajectory graph(Cartesian) before change parameters**

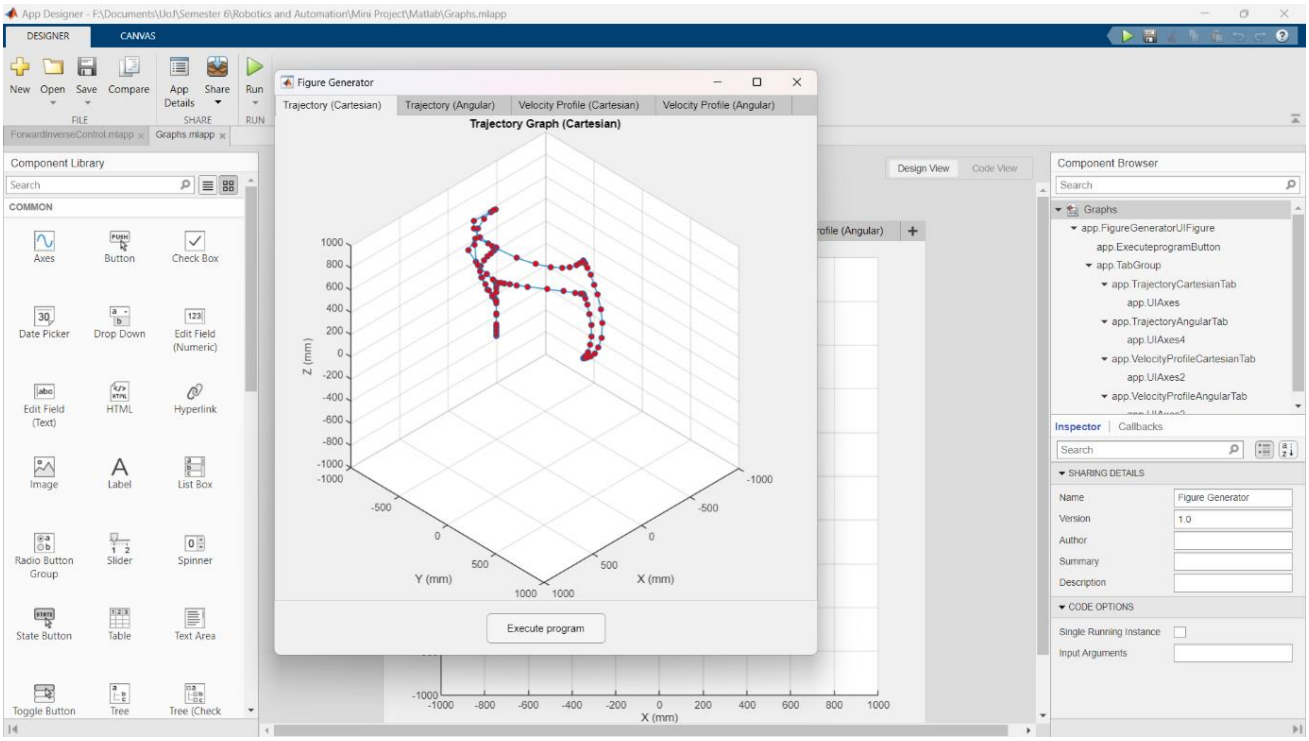


**Figure 10: Trajectory graph(Cartesian) after change parameters**

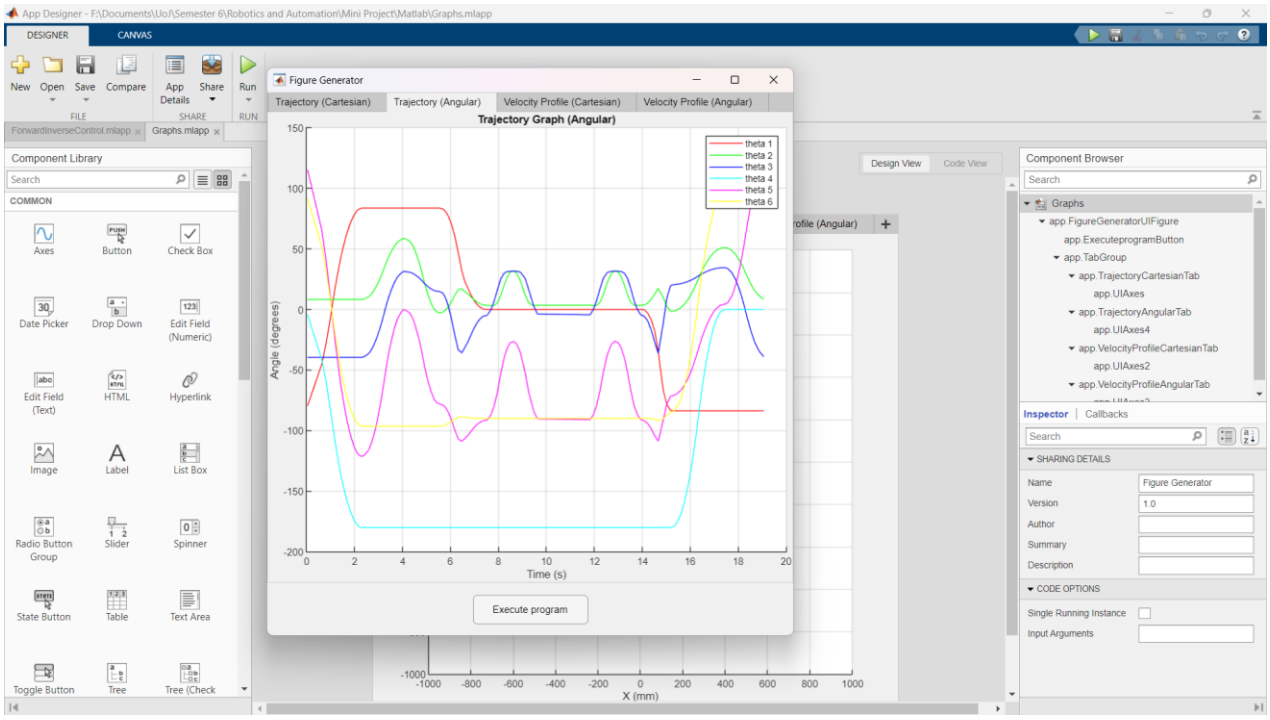


**Figure 11: Trajectory graph(Angular) after change parameters**

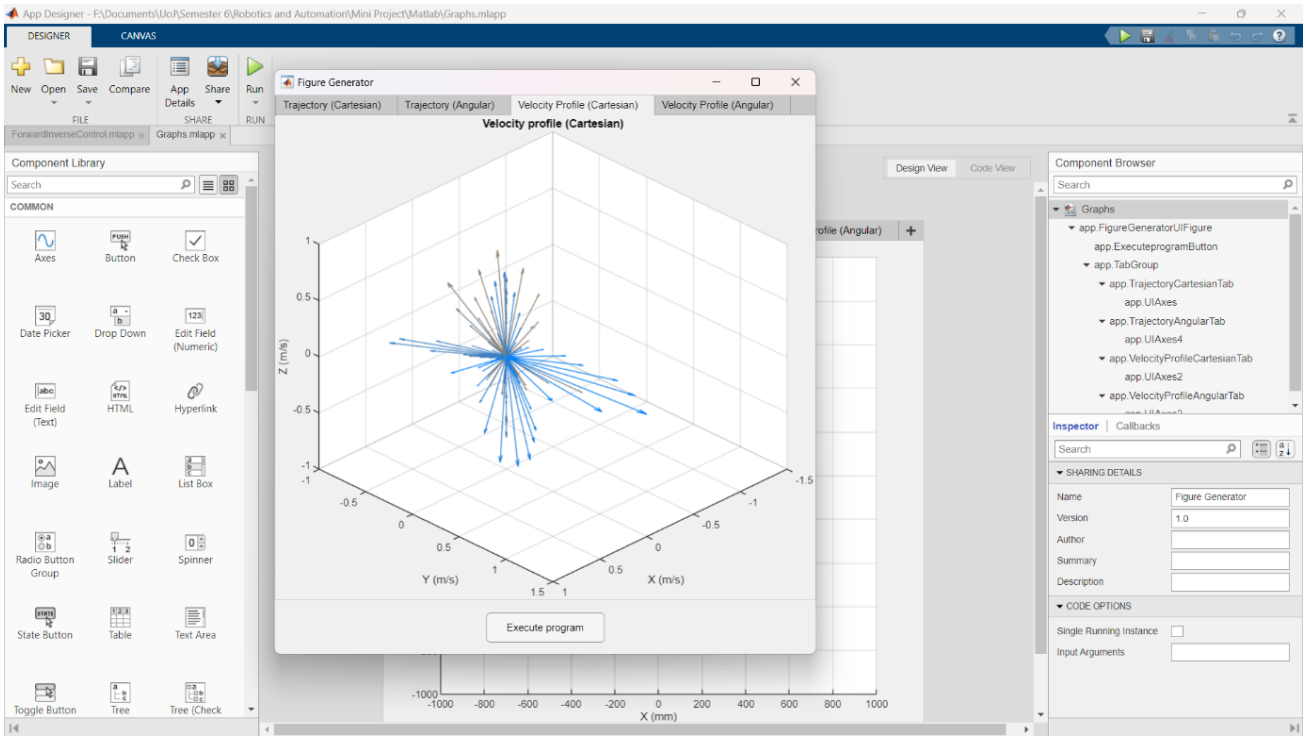


**Figure 12: Velocity Profile(Cartesian) after change parameters**

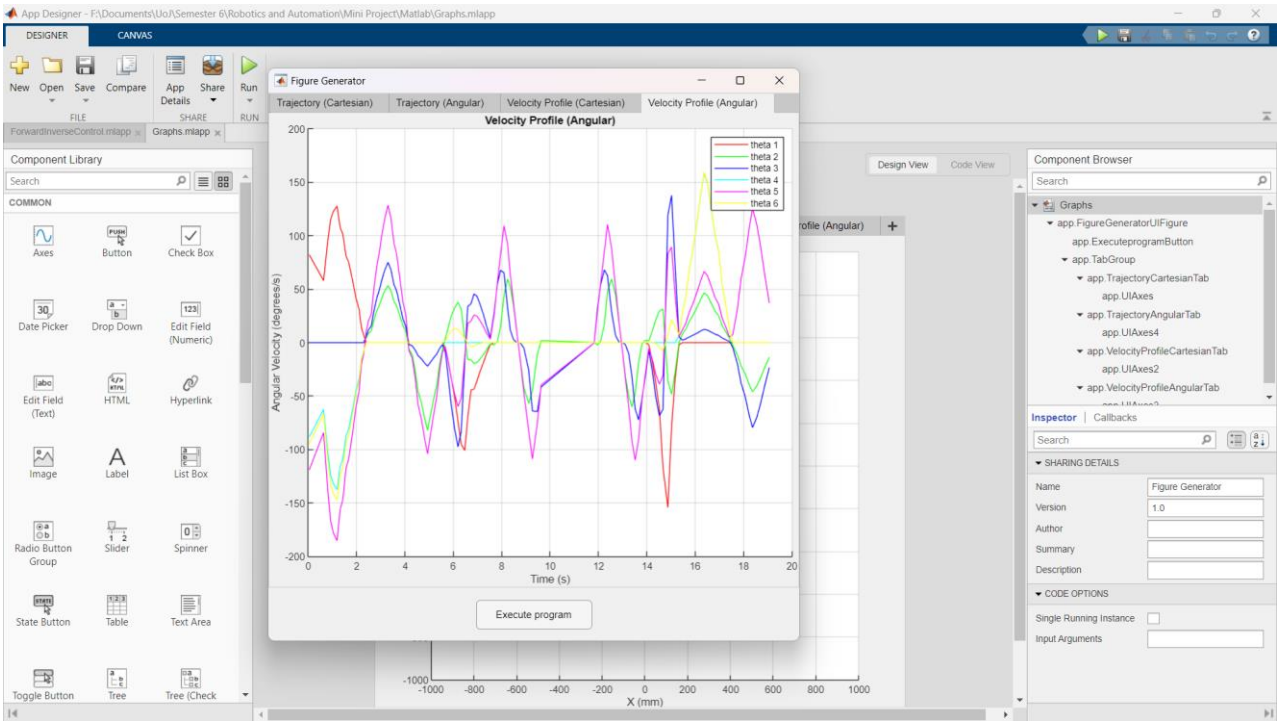


**Figure 13: Velocity Profile(Angular) after change parameters**

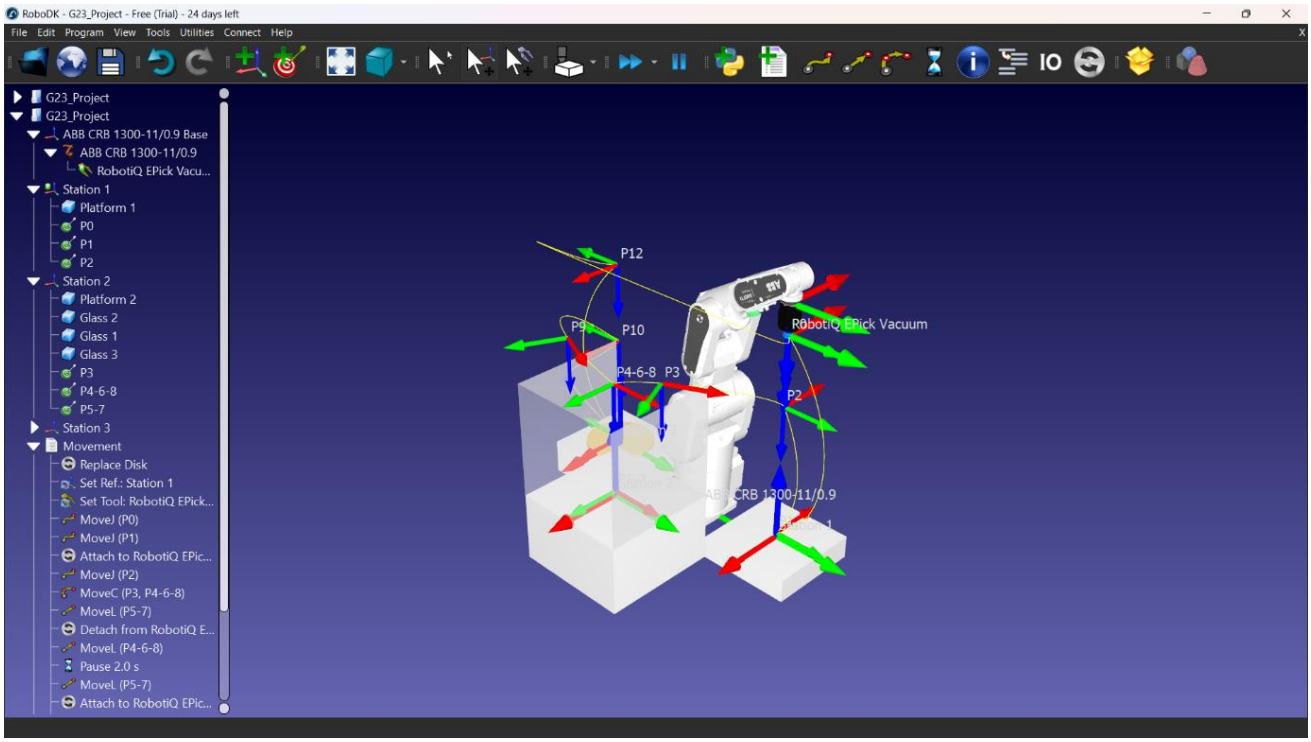


**Figure 14: Final design of Robot**

## Output Of Matlab robotic tool box

```
Current robot joints:
    7.2569    7.8721  -15.2415 -180.0000  -97.3694  -89.9373

Calculated pose for current joints:
   -0.1252    0.9921    0.0000  520.3660
    0.9921    0.1252    0.0000   66.2627
    0.0000    0.0000   -1.0000  969.1773
         0         0         0    1.0000

Calculated robot joints from pose:
    7.2569    7.8721  -15.2415 -180.0000  -97.3694  -89.9373

All solutions available for the selected position:
    7.2569    7.2569 -172.7431 -172.7431    7.2569 -172.7431
    7.8721    7.8721  -23.0041  -23.0041    7.8721  -23.0041
  -15.2415  -15.2415 -134.7360 -134.7360  -15.2415 -134.7360
 -180.0000    0.0000 -180.0000    0.0000  180.0000  180.0000
  -97.3694   97.3694  112.2599 -112.2599  -97.3694  112.2599
  -89.9373   90.0627   90.0627  -89.9373  -89.9373   90.0627
   10.0000   10.0000   10.0000   10.0000         0         0
         0  194.7387  209.6293  180.0000  360.0000  360.0000
```

**Figure 15: Output of Forward Inverse Kinematic calculation**

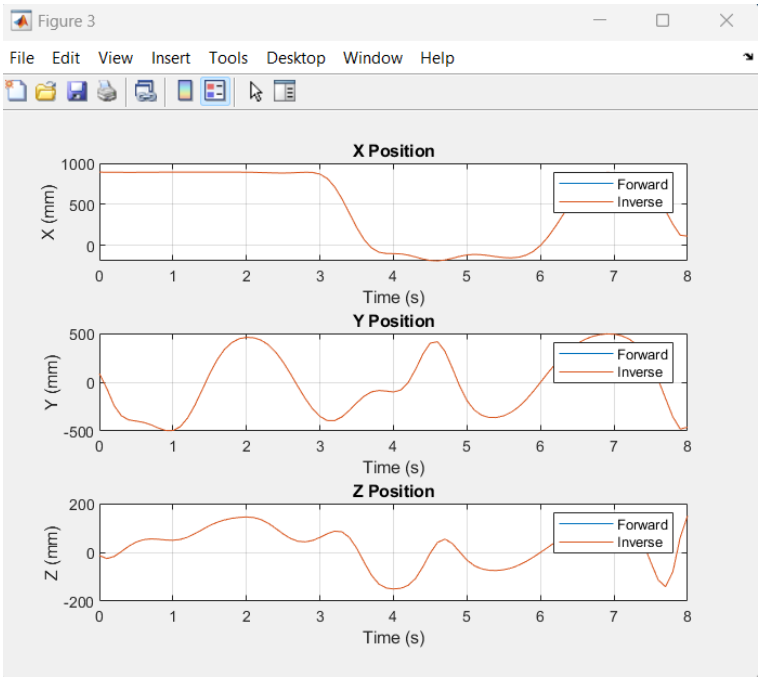


**Figure 16: Output Of X,Y,Z positions**

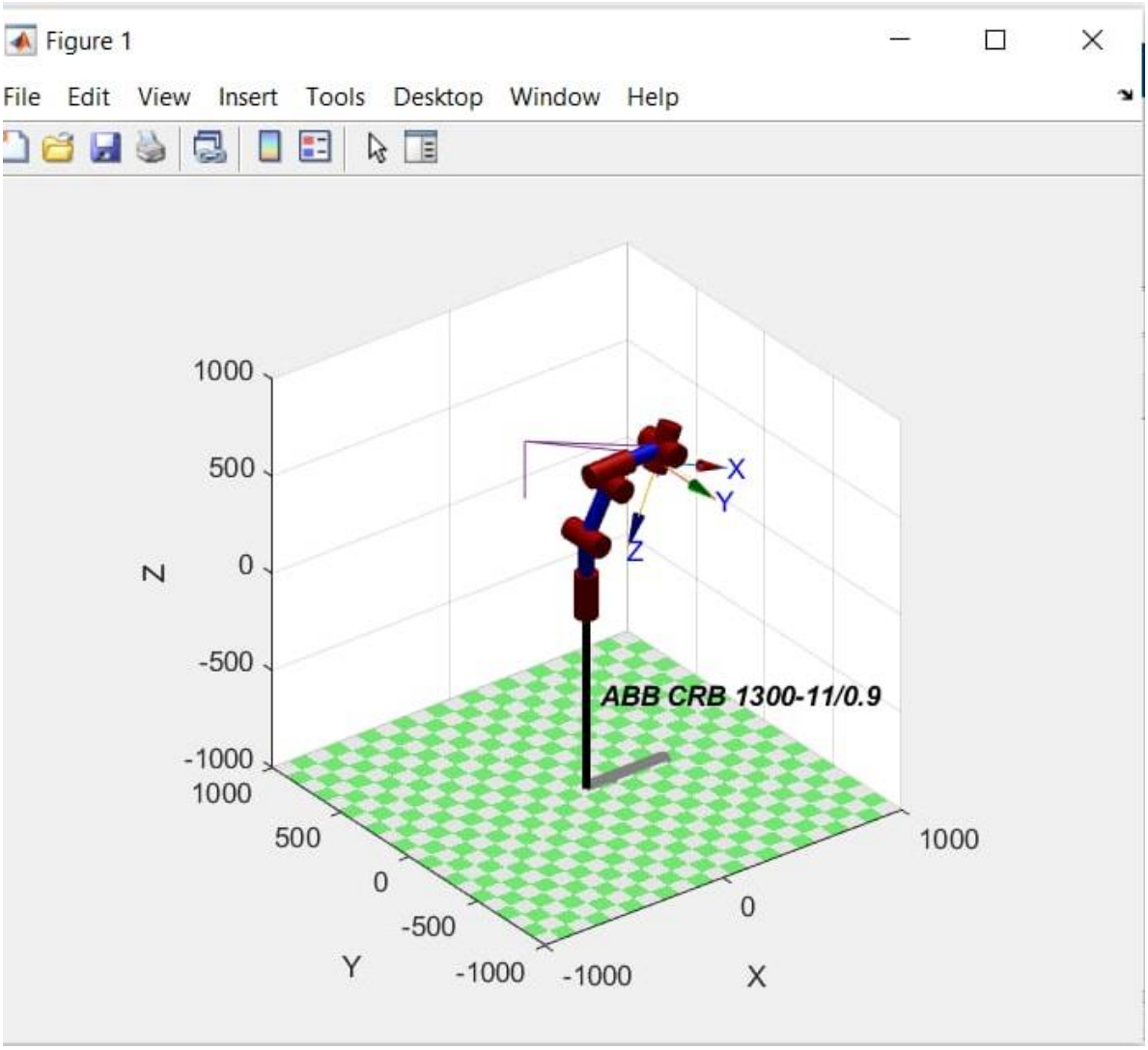


**Figure 17: Trajectory form Robotics Tool Box**