Lab 1: Trajectory Generation & Cube Manipulation

Deadline: 9/25/2024 11:59pm

In Lab 1, you will practice how to control the simulated robot arm and record its movements. You will use the **PickCube-v0** environment in Maniskill.

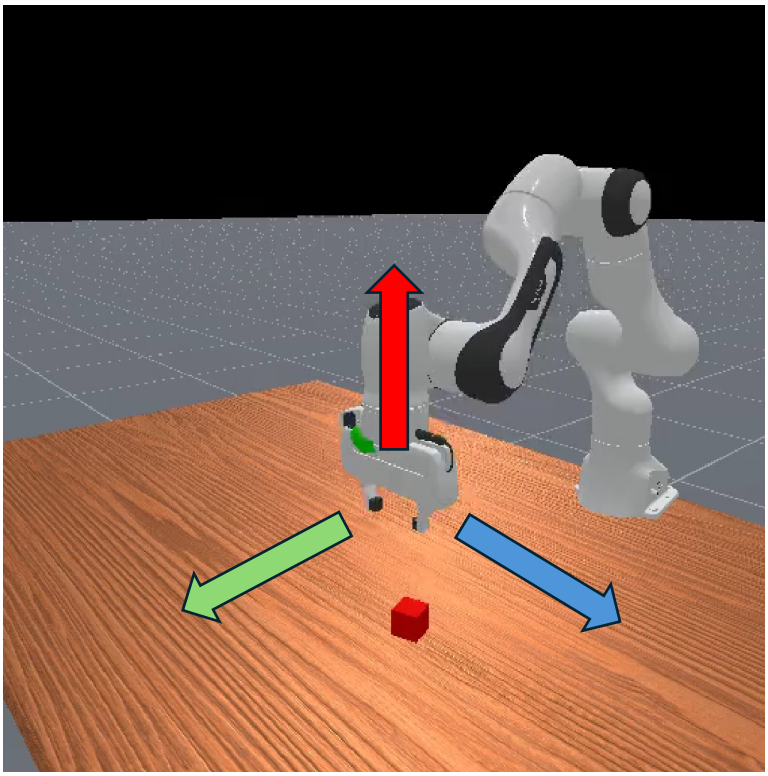

Figure 1. PickCube-v0 Task

Problem 1: Generate and Record Trajectories (60 points total)

1. **Generate Trajectories (30 points total):**
    - (10 points) Save a video of robot moving the end-effector forward (colored in green in Figure 1). Name the video as forward.mp4
    - (10 points) Save a video of robot moving the end-effector upwards (colored in red in Figure 1). Name the video as up.mp4
    - (10 points) Save a video of robot moving the end-effector to the right (colored in blue in Figure 1). Name the video as right.mp4
2. **Record and Visualize Joint Positions (30 points total):**

- (10 points each) For each of the three motions, record the joint positions of the 7 joints and the gripper state. Create three time series plots (x-axis: time, y-axis: joint positions and gripper state) for each trajectory. These 3 plots should be included in a single PDF document. Ensure that the PDF contains clear and labeled plots for each joint and the gripper state. Name your script to record and visualize the positions as trajectory.py

Problem 2: Cube Position and Pick Trajectory (40 points total)

1. **Obtain Cube Position (10 points):**
    - Make a script for printing out the position of the cube. Name it position.py
2. **Pick the Cube (30 points total):**
    - (10 points) Generate a trajectory to pick the cube using the end-effector. Save the video as pick.mp4
    - (20 points) Record the x, y, z positions of the end-effector throughout this trajectory and store the data for analysis. Create a 3D plot of (x, y, z) positions of the end-effector showing the movement of the end-effector over time as it picks the cube. Include this plot in a PDF document. Name your script to record and visualize the positions as pick.py

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Submission Requirements:

Please directly upload the following files to Canvas.

1. **Script:**
    - trajectory.py, position.py, pick.py (3 scripts)
2. **Video**:
    - forward.mp4, up.mp4, right.mp4, pick.mp4 (4 videos)
3. **PDF File:**
    - A single PDF file named lab1.pdf including:
        1. Three 2D plots for Problem 1.2
        2. One 3D plot for Problem 2.2