PDE4431 Dubai Coursework 2 – December 2025

Industrial Manipulator Kinematics Modelling

Deadline: December 11th, 2025 23:59 Dubai time

Aim

The aim of this assignment is to assess your understanding of the principles of robotic manipulators and your ability to model manipulators using Python.

Task

Your task is to design a manipulator that able to pick up three objects from the floor and place them on three shelves on various heights and location above the floor.

The manipulator is to be designed and tested PURELY IN SIMULATION. This is a standard approach in engineering: validating a design before committing to a time-consuming and expensive build. The manipulator is to be modelled as a "stick figure."

At this stage, you are testing the kinematics of the design – the arrangement of links and joints – to see if they can meet the specification. You can model the manipulator as being mounted to a fixed surface. It is not necessary to model the end effector and the puck – you just need to show the location of the end effector is correct.

Select the Denevit-Hartenburg parameters of your robot. The robot design must use at least 4-joints and one of them is prismatic joints, these will be the "Kinematic Parameters" input to the Python. Make sure you choose a sensible links length, coordinate system orientation and origin.

Run a simulation using plot or any other methods to prove that the robot can reach the required positions (floor level and the three shelves). As a bare minimum, this could be implemented as four buttons on the front panel and, as each one is clicked, the robot pose is displayed reaching the required position. More sophisticated representations will gain higher marks (e.g. animated trajectories or visualizing the links and joints to move in 3D space).

Rubric

1-4 (Distinction):

- The D-H parameters describe an appropriate robot.
- The simulation demonstrates the whole animation sequence required to carry out the block-stacking task OR to visualize the links and joints to move in 3D space.
- The video is very clear with appropriate comments.
- Your program demonstrates more advanced features such as inverse kinematics and/or adding extra links.
- Your program demonstrates your independent study by implementing something relevant not taught in class.

5-9 (Merit):

- The D-H parameters describe an appropriate robot.
- The simulation demonstrates the whole animation sequence required to carry out the block-stacking task.
- The video is clear with appropriate comments.

9-16 (Pass):

- The D-H parameters describe a robot that could carry out the task as described.
- The simulation demonstrates that all four positions can be reached.
- The video is unclear or lacks comments.

Failed:

- With resubmission opportunity: Files submitted but the simulation does not demonstrate the robot carrying out the task.
- Without resubmission opportunity: No work submitted Submission

Instructions

1. Upload your code to GitHub, add @judhi as collaborator. Edit the readme.md file and give brief description of your robot.
2. In the readme.md above, include the link to a YouTube video of your program demonstration. Record a voice-over explaining what it is doing or pointing out anything interesting. Aim to make the video so that you can use it as part of your portfolio of work that you may show to a potential employer. Steady camera, landscape format, clear audio, minimum background noise, no distracting music.