MAE C163C / C263C Mini-Lab #2 Simulation

(Due via Gradescope by 11:59pm on Friday, 5/16)

Mini-Lab #2: Design of a joint space PD controller with gravity compensation in simulation

1. Open development container

Download, extract, and open the `minilab2_simulation.zip` file. Open the *extracted* `minilab2_simulation` folder in Visual Studio Code and open the development container contained inside.

2. Implement a joint space PD controller with gravity compensation

In the `update_output_torque` method of the `PDwGravityCompensationController` class in the `minilab2_simulation.py` file, complete the steps labeled with **TODO** in order to implement a joint space PD controller with gravity compensation (more specific instructions are provided in the `minilab2_simulation.py` file).

3. Tune controller gains and plot joint position time histories

In the `minilab2_simulation.py` file, complete the remaining sections labeled with **TODO.** The initial and desired joint configurations of your manipulator should be specified in **units of degrees** to be [65.0, 25.0] and [45.0, 45.0], respectively. Tune your K_P and K_D gain matrices so that your controller achieves and maintains the desired joint configuration with less than 1° absolute error in each joint and in less than 1.5 sec.

Plot the joint position time histories for both joints of the manipulator on individual subplots. Each plot should have a purple black dotted line at 1.5 sec and two blue dashed lines above and below the corresponding desired joint angle by 1° (i.e. at 44° and 46° for joints 1 and 2).

Each member of the team must tune and report distinct gains for their own individual Mini-Lab #2 submissions.

Summary of deliverables:

Your submission should include:

- Your K_P and K_D gain matrices
- Labeled time history plots
- Your **completed** `minilab2_simulation.py` file converted to a PDF

NOTE: Each student must submit their own independent work. **For full credit, you must submit to Gradescope all underline custom Python code** (e.g. `minilab2_simulation.py`) **and requested plots with labels.** You may save this content to PDF or take screenshots for electronic submission via Gradescope. Files of the *.py* and *.toml* format cannot be directly uploaded to Gradescope and should not be e-mailed to instructors for grading. The more intermediate results and comments you provide, the greater the opportunity for partial credit.