EN.530.626: Trajectory Generation for Space Systems
Homework 1
Due Sep 11th 11:59PM

The code for this assignment can be found on GitHub and can be downloaded by running `git clone https://github.com/JHU-ACEL/trajdesign_hw.git` from a terminal window. While you may directly download the repository as a zip file, we recommend that you clone it using `git` as we plan on releasing future problem sets and any bug fixes directly via this repository. Homework submissions and grading will be managed through Gradescope.

Introduction

This homework will focus on the following technical concepts:

1. Different schemes for functional differentiation (e.g., numerical, symbolic, automatic).
2. Propagating linear and nonlinear dynamical systems.
3. Solving simple optimization problems using gradient-based approaches.

To accomplish this, the software development learning goals include,

- Writing Python code in an object-oriented fashion.
- Using a `Docker` environment for standardizing software packages.
- Using `marimo` notebooks for testing and prototyping code.

Problem 1: Setting up the Docker Environment

To set up the Docker image locally, you can either run the `docker_build.sh` script locally or simply download the Docker image on this website. We note that this website provides different `docker` images for different architectures (e.g., `arm`, `x86`, etc.); check which architecture your computer has first and download the correct image accordingly.

Once you have the image ready, you can launch a container by running:

```
$ bash docker/docker_run.sh trajdesign:v1
```

These instructions and the commands to startup the Docker container are all updated on the `docker/README.md` instructions.

Once you have the `docker` container loaded, run,

```
$ python hw1/test_docker.py
```

and check if the packages are imported correctly.

Problem 2: Propagating Dynamical Systems

In this problem, read the instructions provided in `hw1/problem_2.py`. There is no additional write-up required for this problem.

Problem 2: Computing Gradients

In this problem, read the instructions provided in `hw1/problem_3.py`. There is no additional write-up required for this problem.

Problem 4: Simple Optimization

In this problem, read the instructions provided in `hw1/problem_3.py`. There is no additional write-up required for this problem.

References