Repeatability package

For Paper "On Robust Controlled Invariants for Continuous-time Monotone Systems "

1 Introduction

This directory contains code to recreate Figure 2 and Figure 3 from the paper "On Robust Controlled Invariants for Continuous-time Monotone Systems " (Emmanuel Junior Wafo Wembe et Adnane Saoud) in ADHS.

2 Installation Instruction

The code was written in Python 3.8. The code may also work for Python 3.6 or later. To install Python you may:

- Recommended: install Anaconda Python 3.x distribution
- Alternative: install Miniconda Python 3.x distribution.

Then, open a terminal (or an "anaconda prompt") and enter the directory of this repeatability package. install dependency with:

```
conda env create -f environment.yml
```

Optional: install a code editor as:

- Vscode
- PyCharm Community Edition

3 Code details

1. (a) "two_tanks_problem_lower_closed_1cm.py" generates figure 2
   (b) "two_tanks_problem_lower_closed_0.5cm.py" generates figure 3
   (c) "comp_inv.ipynb" generates both figure 2 and 3 but also gives insight into other experiments we run.
2. in the "Utils" folder
   - "utils.py": auxiliary functions to generate random step of piecewise affine function with either uniform discretisation or random discretisation step.
   - "solving_equation.py": A bunch of simple implementations of numerical methods for solving ode.
   - "Lower_closedset.py": auxiliary functions to define the lower closure or the upper closure of the trajectory of a piecewise linear function.
   - "invariant.py": auxiliary functions to compute invariant for a problem with state space of dimension 2 $X \subseteq \mathbb{R}^2$
   - "feasibility.py": auxiliary functions for checking the feasibility of single trajectory
   - "Computing_invariant_n_dim.py" An extension of the code in "invariant.py" to handle more dimensions for the state space

4 Runing python files

In Vscode, install the Python extension in the marketplace as shown in this figure: Open

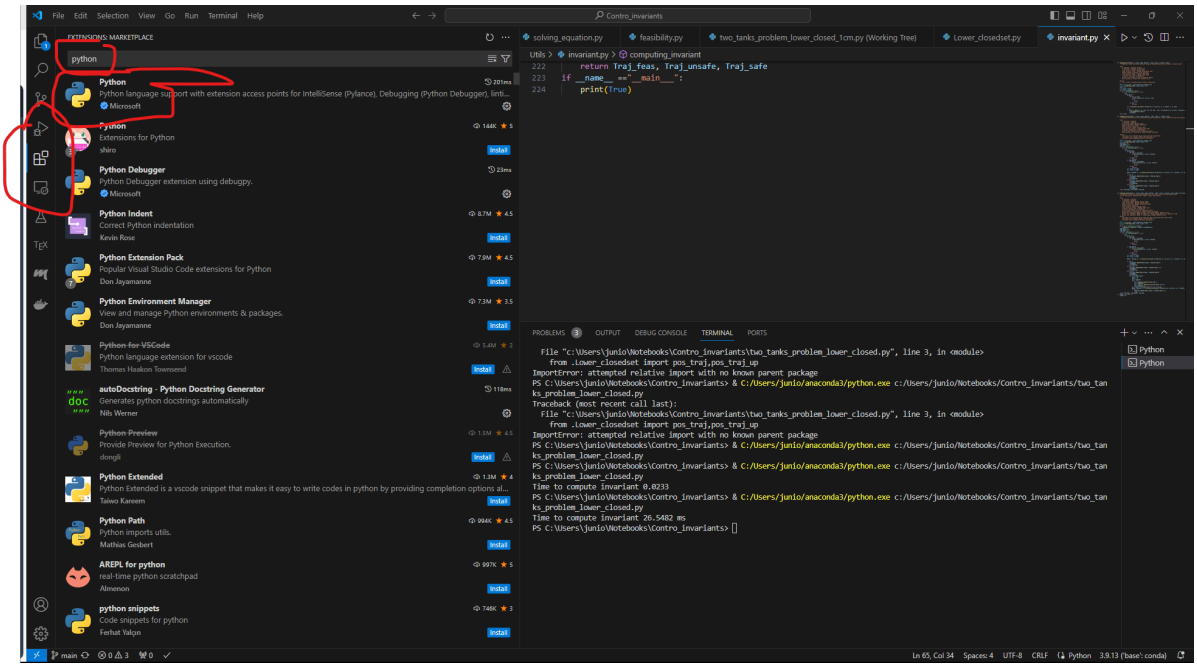

Figure 1: installing python in Vscode

this folder in Vscode and follow the steps described here to select the interpreter with "controlled_invariant". And then click on the play button to run the script. Only "two_tanks_problem_lower_closed_xcm.py" files will run. Others will throw an error.

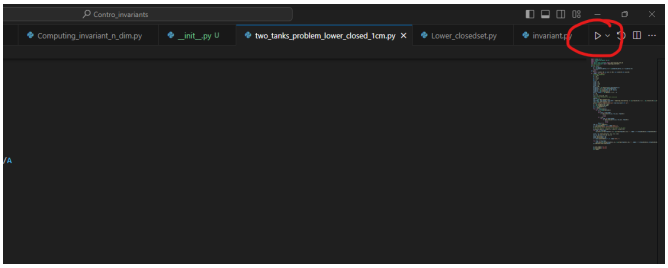

Figure 2: Enter Caption

Another way: Open a terminal (or an "anaconda prompt") and enter the directory of this repeatability package. Activate the environment with the command:

```
conda activate controlled_invariant
```

In the terminal enter the following

```
spyder
```

to open a code editor to run ".py" files. Or

```
jupyter notebook
```

to run "comp_inv.ipynb". If you have problems running the code, you can contact me at the address: "emmanueljunior.wafowembe@um6p.ma"