Model Predictive Control : Setup for Exercises / Project

Follow the steps below to setup your computer for the exercises and project.

Prob 1 | Install MPT3 (Multiparametric Toolbox 3.0) and YALMIP (Yet Another LMI Parser)

Follow instructions on the website `https://www.mpt3.org/Main/Installation`

Run the following commands to confirm correct installation

```
>> tbxmanager restorepath
Toolbox "glpkmex:1.0:maci64" added to the Matlab path.
Toolbox "hysdel:2.0.6:maci64" added to the Matlab path.
Toolbox "lcp:1.0.3:maci64" added to the Matlab path.
Toolbox "sedumi:1.3:maci64" added to the Matlab path.
Toolbox "espresso:1.0:maci64" added to the Matlab path.
Toolbox "mptdoc:3.0.4:all" added to the Matlab path.
Toolbox "cddmex:1.0.1:maci64" added to the Matlab path.
Toolbox "fourier:1.0:maci64" added to the Matlab path.
Toolbox "mpt:dev-bd1663:all" added to the Matlab path.
Toolbox "yalmip:R20180817:all" added to the Matlab path.

% Create a simple optimization problem
>> x = sdpvar
>> optimize(abs(x) <= 1, (x-3)^2)

Minimum found that satisfies the constraints.

Optimization completed because the objective function is non-decreasing in
feasible directions, to within the default value of the optimality tolerance,
and constraints are satisfied to within the selected value of the constraint tolerance.

<stopping criteria details>


ans =

  struct with fields:

     yalmiptime: 0.6892
     solvertime: 0.0863
           info: 'Successfully solved (QUADPROG)'
        problem: 0

>> value(x)

ans =
```

```
     1.0000
```

Note: The output around 'Minimum found...' may be different for you if you already have a different optimizer installed.

Prob 2 | Install optimizer (this step is optional)

You standard Matlab solver is quite slow. In order to speed up your simulation time, we will install a faster commercial solver called Gurobi.

Follow the instructions here `https://www.gurobi.com/academia/academic-program-and-licenses/` to install Gurobi and obtain an "Individual Academic License".

- Go to : `https://www.gurobi.com/downloads/`
    - Download the latest version of "Gurobi Optimizer"
    - You will need to register for a Gurobi account $\rightarrow$ You have to use your EPFL email so that they can verify your academic status
- Go to : `https://www.gurobi.com/downloads/`
    - At the bottom of the page, click on "Request a License" $\rightarrow$ "Academic License"
    - You'll get a license ID that's linked to the physical machine that you're on
    - Follow the Installation instructions at the bottom of the "Academic License Detail" screen
- Setup Gurobi for Matlab following the instruction here
    - `https://www.gurobi.com/documentation/8.1/quickstart_mac/matlab_setting_up_gurobi_f.html`

Test the new solver

```matlab
N = 50; % Number of constraints
n = 5;  % Number of variables

A = sprandn(N,n,0.1); b = ones(N,1);
x0 = 10*randn(n,1);

x = sdpvar(n,1);

opt = optimize(A*(x - x0) <= b, x'*x, sdpsettings('solver','gurobi'));

>> opt

opt =

  struct with fields:

    yalmiptime: 0.1765
```

```
      solvertime: 0.3141
            info: 'Successfully solved (GUROBI-GUROBI)'
20         problem: 0
```

Note: If you have a different solver installed instead of gurobi (perhaps from another class), then you could use that instead, and just specify the name in the line sdpsettings.

Prob 3 | Install CASADI

- Follow installation instruction here: `https://web.casadi.org/get/`

Test correct installation

```
>> addpath <<ENTER PATH WHERE YOU PUT CASADI HERE>>
>> import casadi.*
>> x = MX.sym('x')

x =

x
>> disp(jacobian(sin(x),x))
cos(x)
```