CODE:

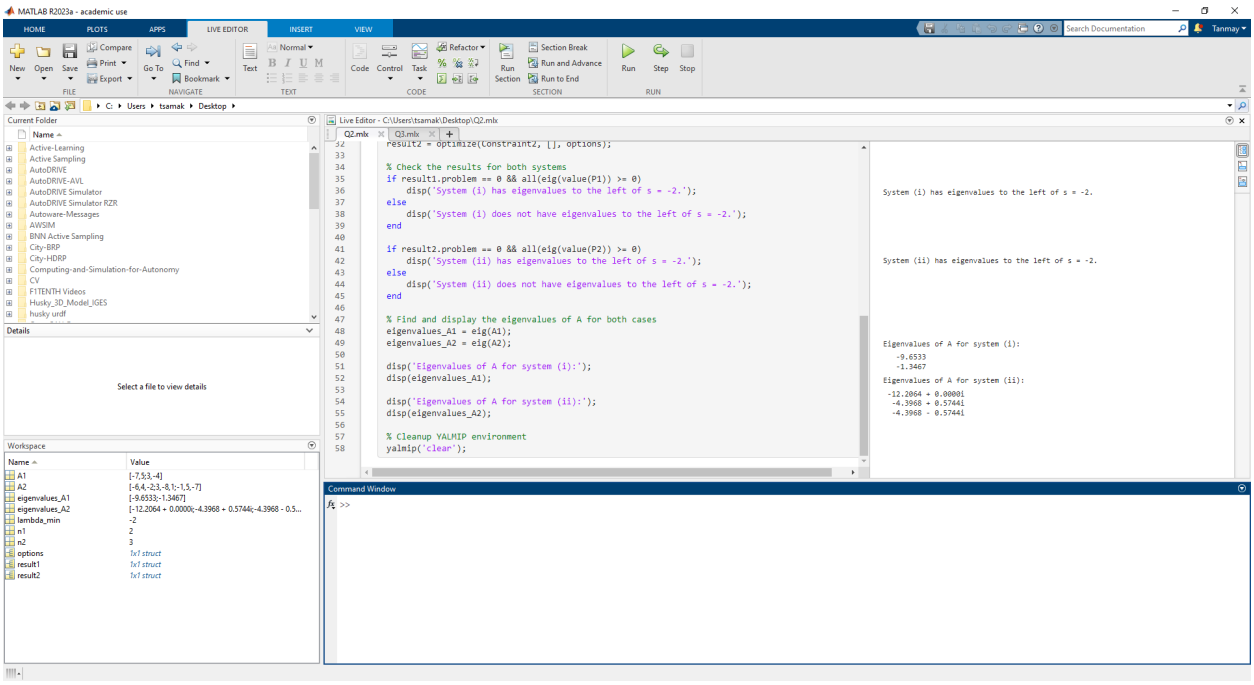
```
% Clear workspace
clear
clc


% Add parser and solver to path
addpath(genpath('C:\Users\tsamak\Downloads\MathWorks\Toolboxes\archives\required\
YALMIP'))
addpath(genpath('C:\Users\tsamak\Downloads\MathWorks\Toolboxes\archives\required\
SeDuMi'))


% Define the A matrices for the two systems
A1 = [-7 5; 3, -4]; % System matrix for case (i)
A2 = [-6, 4, -2; 3, -8, 1; -1, 5, -7]; % System matrix for case (ii)


% Initialize the YALMIP optimization environment
yalmip('clear');


% Define the variables: X (symmetric matrices)
n1 = size(A1, 1);
P1 = sdpvar(n1, n1, 'symmetric');
n2 = size(A2, 1);
P2 = sdpvar(n2, n2, 'symmetric');


% Define the constraint for eigenvalues to the left of s = -2 using Schur
complement
lambda_min = -2; % Desired minimum eigenvalue


% Define the LMI constraints for both systems
Constraint1 = [P1 >= 0, A1'*P1 + P1*A1 - lambda_min*eye(n1) <= 0];
Constraint2 = [P2 >= 0, A2'*P2 + P2*A2 - lambda_min*eye(n2) <= 0];


% Check the feasibility of the LMIs for both systems
options = sdpsettings('verbose', 0);
result1 = optimize(Constraint1, [], options);
result2 = optimize(Constraint2, [], options);


% Check the results for both systems
if result1.problem == 0 && all(eig(value(P1)) >= 0)
```

```
    disp('System (i) has eigenvalues to the left of s = -2.');
else
    disp('System (i) does not have eigenvalues to the left of s = -2.');
end


if result2.problem == 0 && all(eig(value(P2)) >= 0)
    disp('System (ii) has eigenvalues to the left of s = -2.');
else
    disp('System (ii) does not have eigenvalues to the left of s = -2.');
end


% Find and display the eigenvalues of A for both cases
eigenvalues_A1 = eig(A1);
eigenvalues_A2 = eig(A2);


disp('Eigenvalues of A for system (i):');
disp(eigenvalues_A1);


disp('Eigenvalues of A for system (ii):');
disp(eigenvalues_A2);


% Cleanup YALMIP environment
yalmip('clear');
```

OUTPUT:

```
System (i) has eigenvalues to the left of s = -2.
System (ii) has eigenvalues to the left of s = -2.
Eigenvalues of A for system (i):
   -9.6533
   -1.3467
Eigenvalues of A for system (ii):
 -12.2064 + 0.0000i
  -4.3968 + 0.5744i
  -4.3968 - 0.5744i
```

SCREENSHOT:


MATLAB R2023a - academic use
HOME
PLOTS
APPS
LIVE EDITOR
INSERT
VIEW
Search Documentation
Tanmay
New
Open
Save
Compare
Print
Export
Go To
Find
Bookmark
Text
Normal
Code
Control
Task
Refactor
Run Section
Section Break
Run and Advance
Run to End
Run
Step
Stop
FILE
NAVIGATE
TEXT
CODE
SECTION
RUN
C: ▸ Users ▸ tsamak ▸ Desktop ▸
Current Folder
Name
Active-Learning
Active Sampling
AutoDRIVE
AutoDRIVE-AVL
AutoDRIVE Simulator
AutoDRIVE Simulator RZR
Autoware-Messages
AWSIM
BNN Active Sampling
City-BRP
City-HDRP
Computing-and-Simulation-for-Autonomy
CV
F1TENTH Videos
Husky_3D_Model_IGES
husky urdf
Details
Select a file to view details
Workspace
Name
Value
A1
[-7,5;3,-4]
A2
[-6,4,-2.3,-8,1;-1,5,-7]
eigenvalues_A1
[-9.6533;-1.3467]
eigenvalues_A2
[-12.2064 + 0.0000i;-4.3968 + 0.5744i;-4.3968 - 0.5...
lambda_min
-2
n1
2
n2
3
options
1x1 struct
result1
1x1 struct
result2
1x1 struct
Live Editor - C:\Users\tsamak\Desktop\Q2.mlx
Q2.mlx
Q3.mlx
result2 = optimize(Constraint2, [], options);
% Check the results for both systems
if result1.problem == 0 && all(eig(value(P1)) >= 0)
disp('System (i) has eigenvalues to the left of s = -2.');
else
disp('System (i) does not have eigenvalues to the left of s = -2.');
end
if result2.problem == 0 && all(eig(value(P2)) >= 0)
disp('System (ii) has eigenvalues to the left of s = -2.');
else
disp('System (ii) does not have eigenvalues to the left of s = -2.');
end
% Find and display the eigenvalues of A for both cases
eigenvalues_A1 = eig(A1);
eigenvalues_A2 = eig(A2);
disp('Eigenvalues of A for system (i):');
disp(eigenvalues_A1);
disp('Eigenvalues of A for system (ii):');
disp(eigenvalues_A2);
% Cleanup YALMIP environment
yalmip('clear');
System (i) has eigenvalues to the left of s = -2.
System (ii) has eigenvalues to the left of s = -2.
Eigenvalues of A for system (i):
-9.6533
-1.3467
Eigenvalues of A for system (ii):
-12.2064 + 0.0000i
-4.3968 + 0.5744i
-4.3968 - 0.5744i
Command Window
>>