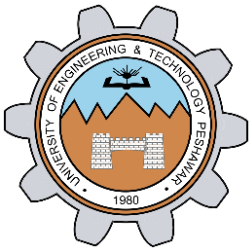
System Design using Sisotool

LAB # 12



Fall 2024

CSE-310L Control Systems Lab

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Class Section: **C**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Submitted to:

Dr. Muniba Ashfaq

Date:

31st December 2024

Department of Computer Systems Engineering

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Task:

For K<2, design a system (second order) with the following characteristics:

- Percent overshoot < 50
- Damping ratio > 0.2
- Stable system

Introduction:

Percent overshoot: Systems may be stable system, unstable system and marginally stable system. A stable system may overshoot for some values at the start before coming to the stable level. Similarly in this lab a system is designed whose percent overshoot is <50.

Damping ratio:

Damping ratio is a parameter that indicates that whether system is over damped(ς>1),under damped((ς<1) or critically stable((ς=1). In this lab a system is designed which must have damping ratio > 0.2.

Stable system:

Third condition which the system must satisfy is it must be stable for K<2, also all the values (damping ratio and % overshoot) are set. It must be unstable for K>=2.

Task:

Code:

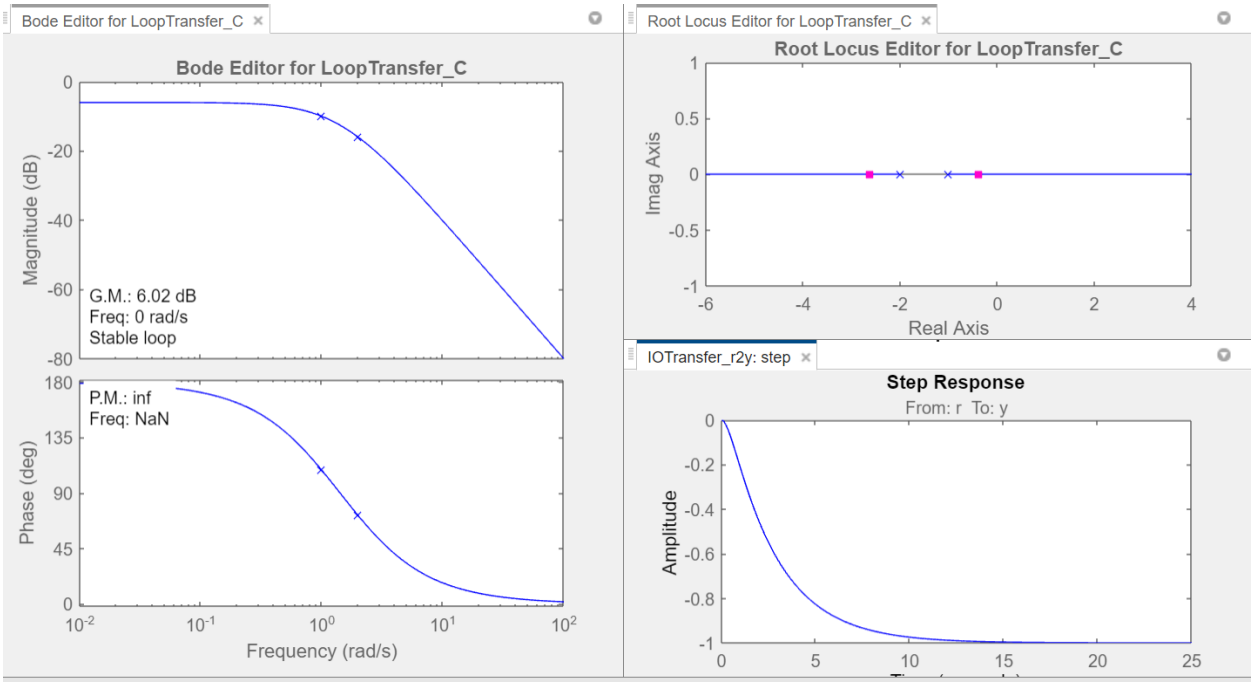
MatlabCode.m | Tasks.m

```
num=[0 0 -1];
den=[1 3 2];

sys = tf(num,den)
sisotool(sys)
```

Output:

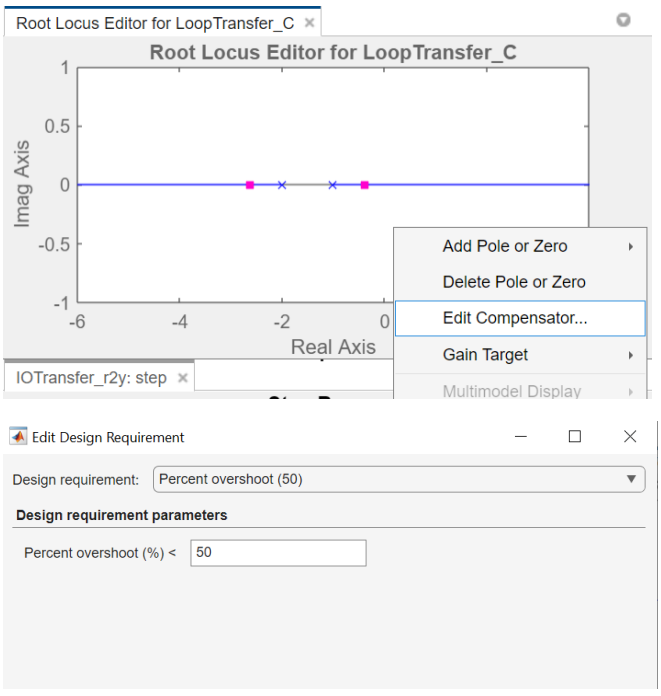
```
sys =

       -1
  -------------
  s^2 + 3 s + 2

Continuous-time transfer function.
Model Properties
>>
```

Sisotool Output:

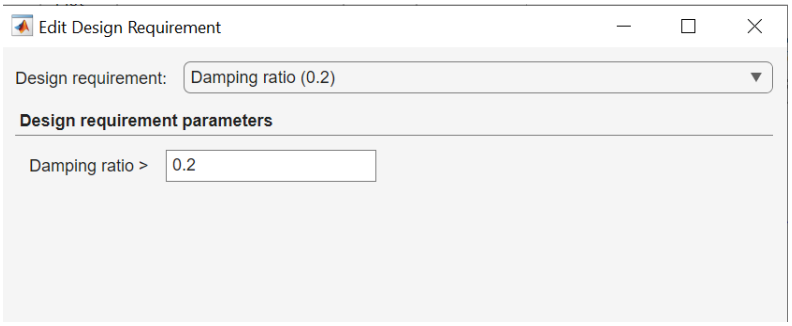


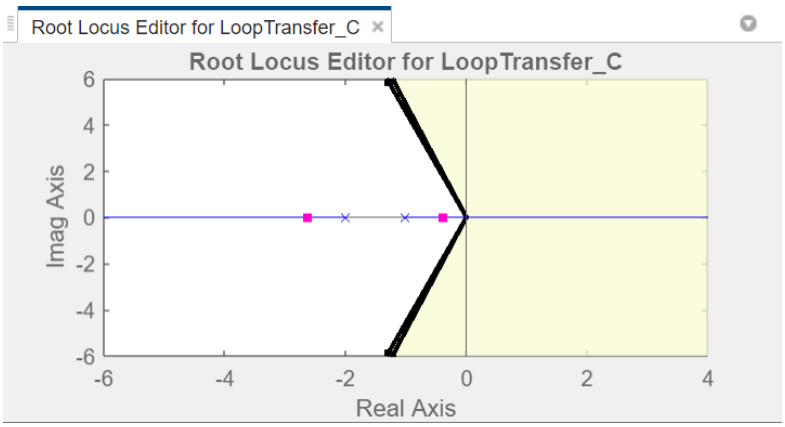
For k=1

Setting %Overshoot to <50:



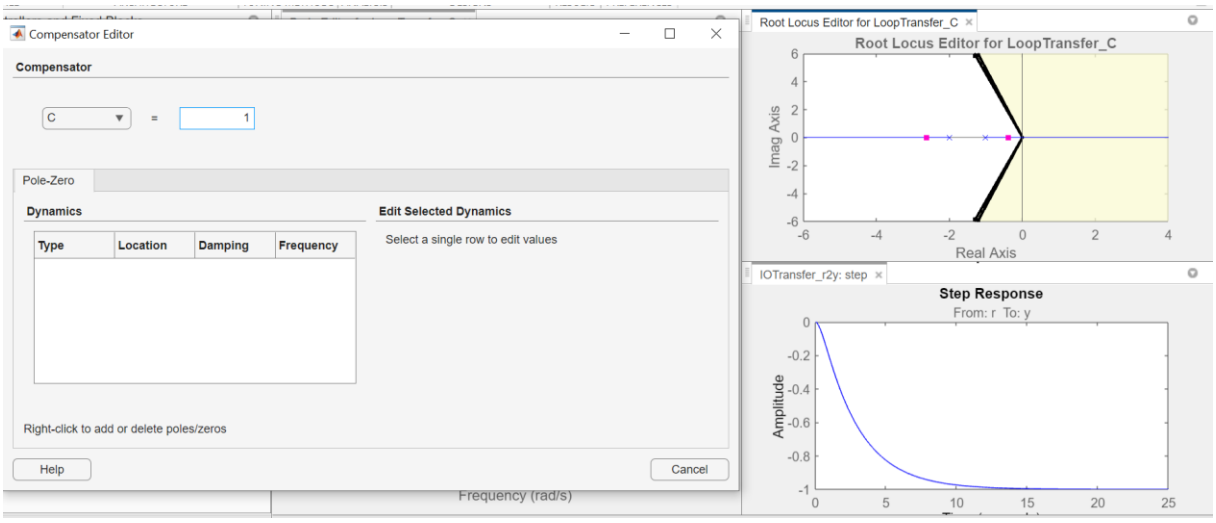
Setting Damping Ratio to >0.2:

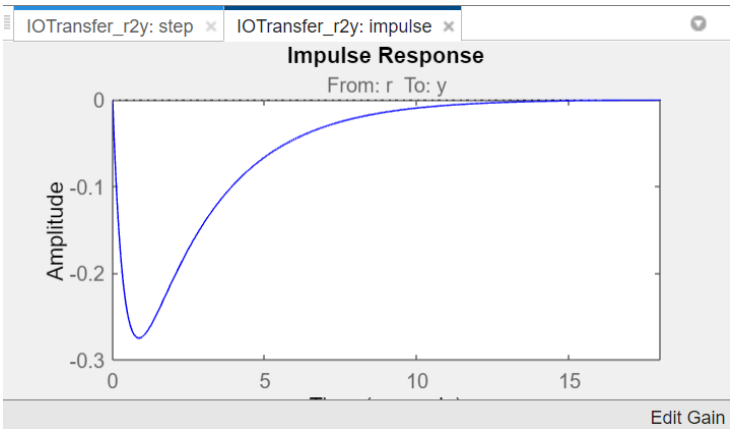




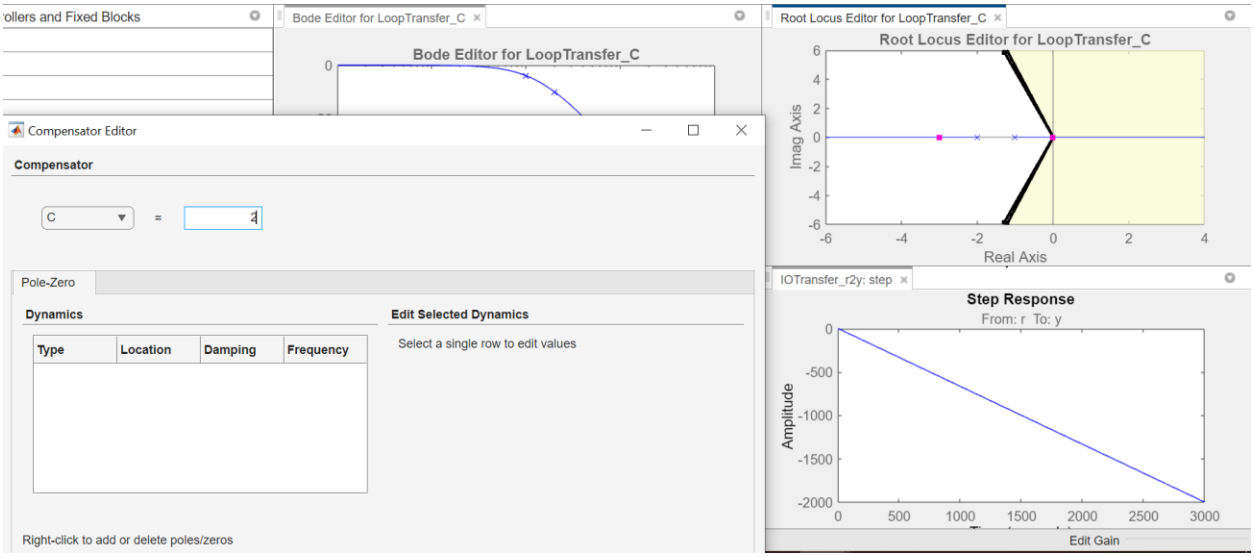
Checking Stability for different k values:

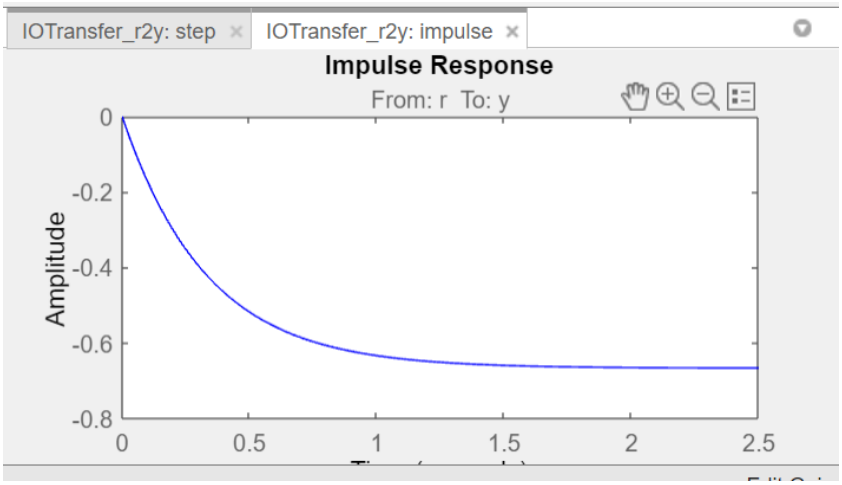
For k = 1 (Stable System)



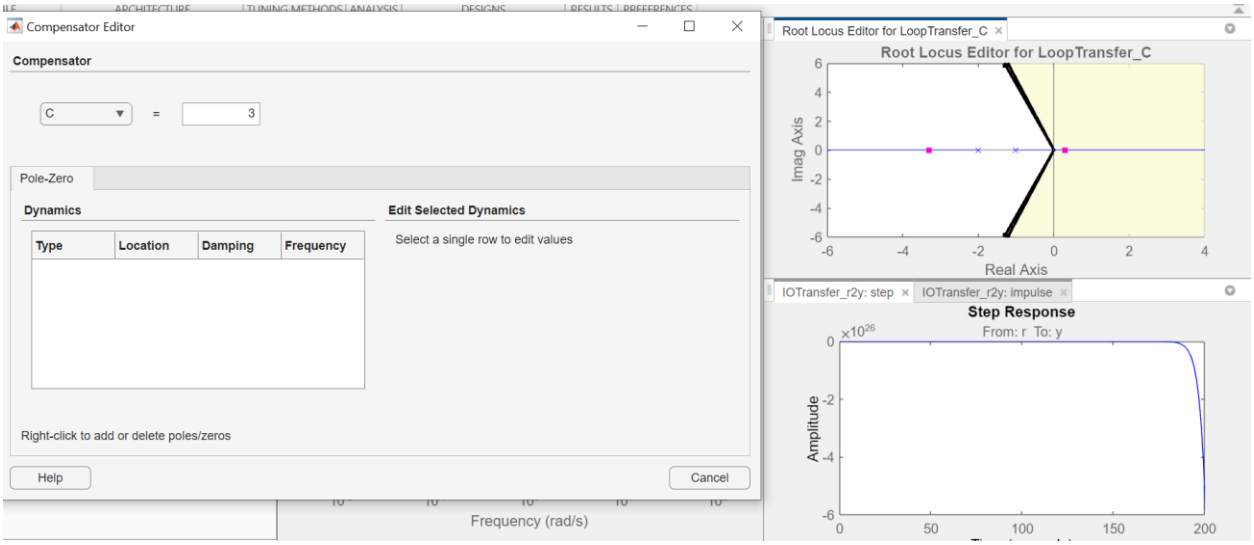


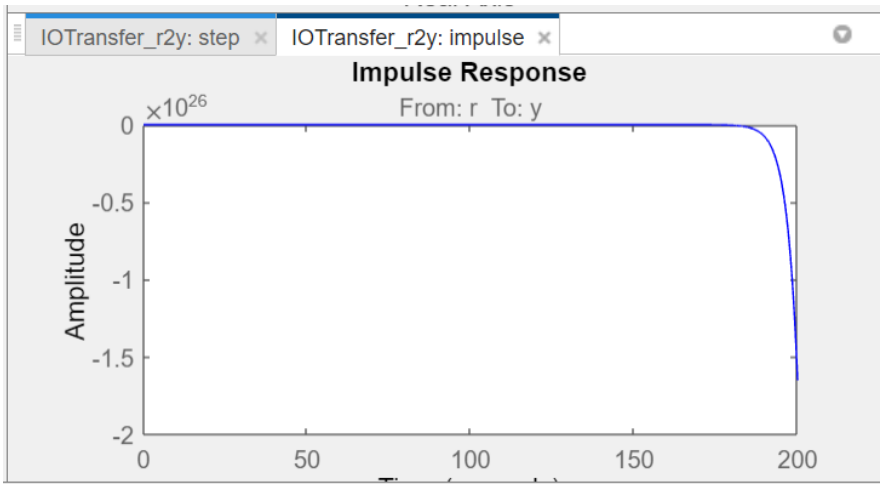
For k = 2 (Marginally Stable System)





For k = 3 (Unstable System)





Conclusion:

All the requirements for system are satisfied. The System is stable for all K=2. So this system fulfills all the conditions.