Report for Auto Control Lab12

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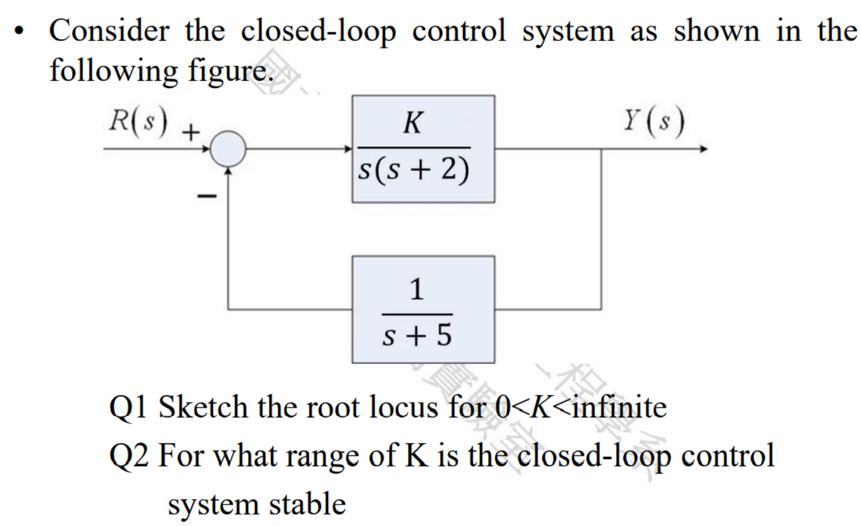
1 Introduction

This is the Experiment of Auto Control Lab where TAs taught us the plot of root locus and the identification of desired K value to keep the system under stable.Also with other specified values including the settling time and percent overshoot.

2 LAB12

2.1 Part 1 Homework problems and its codes

Objective:Draw the root locus with code
These are the stated Homework problems



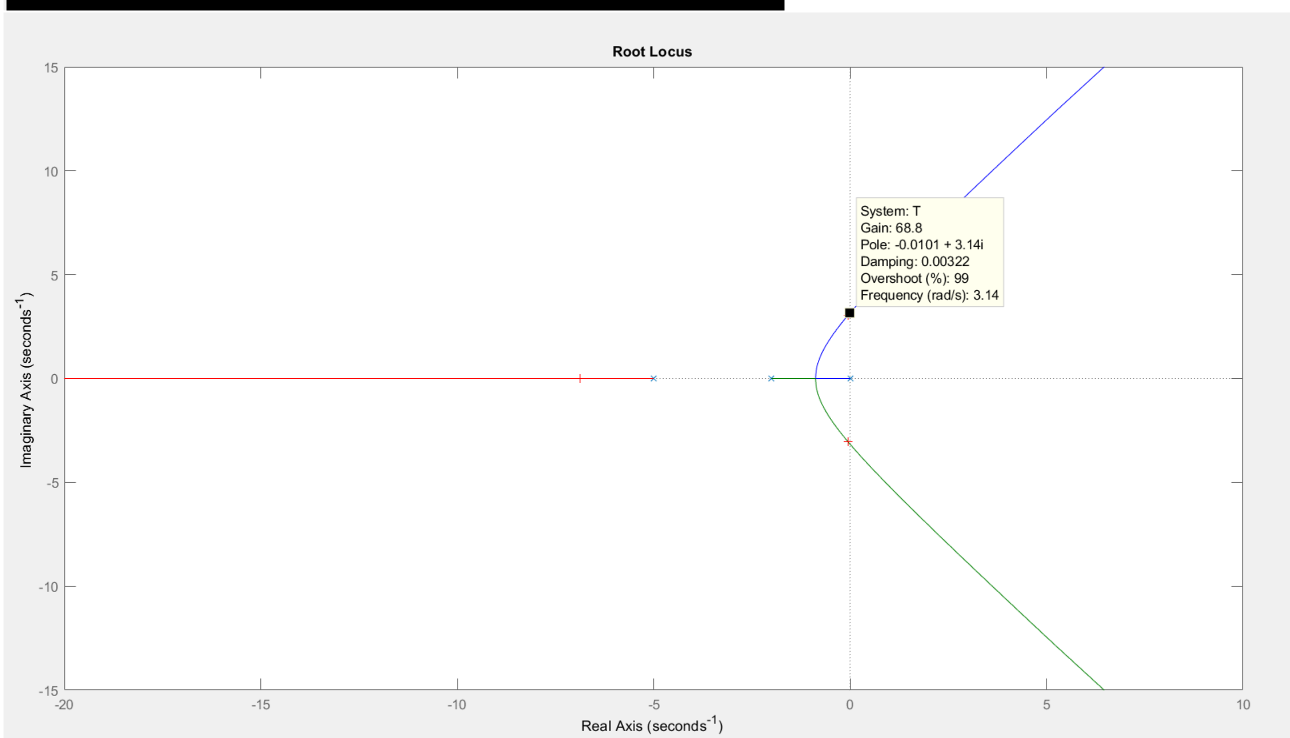
2.2 CODES FOR PROBLEM1

In order to perform the tasks, Matlab codes are needed. The following is the code needed for plotting

```
clc;
clear;
n1 = [1 2 0];
tf1 = tf(1,n1);

n2 = [1 5];
tf2 = tf(1 , n2)

T = tf1*tf2

rlocus(T);
rlocfind(T)
```

2.3 Result of the Code desire gain

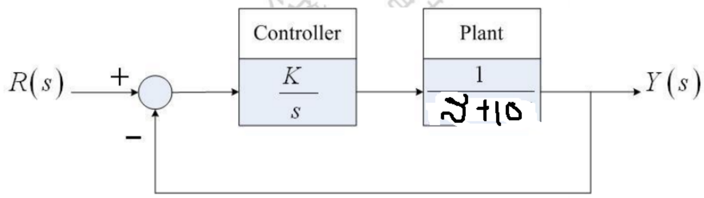
```
Select a point in the graphics window

selected_point =

  -0.0305 + 3.1194i


ans =

   67.5228
```



2.4 Part 2 Homework problems and codes

Lab 12 Homework

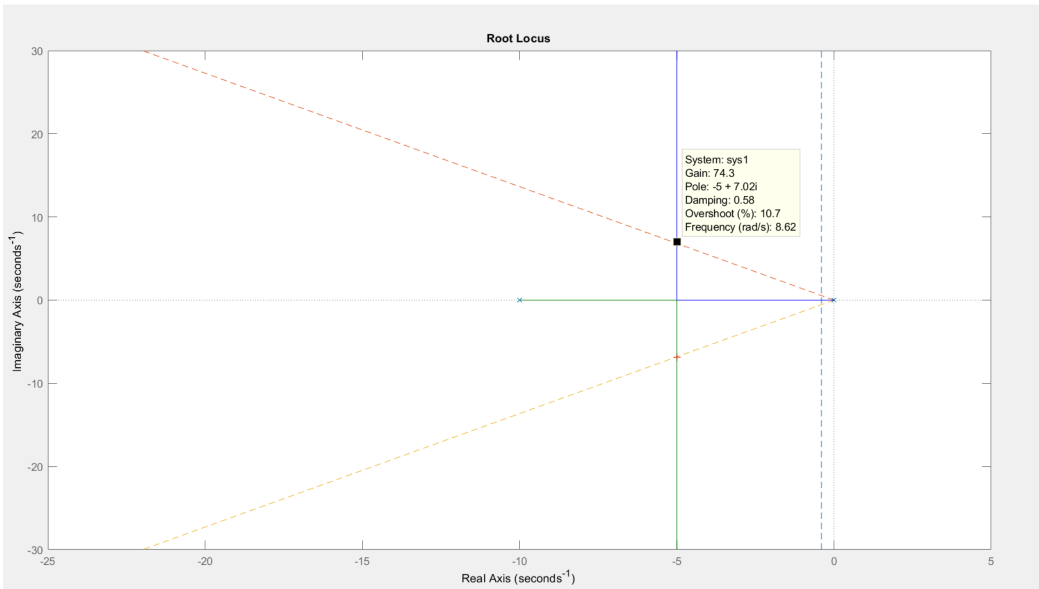
- Consider the feedback control system in figure. The design specifications are Ts<=10 seconds and $P.O.$ <=10% for a unit step input. For the integral controller, sketch the root locus for 0<K<infinite, and determine the maximum value of K so that the design specifications are satisfied. Plot the step response of the maximum value of K.

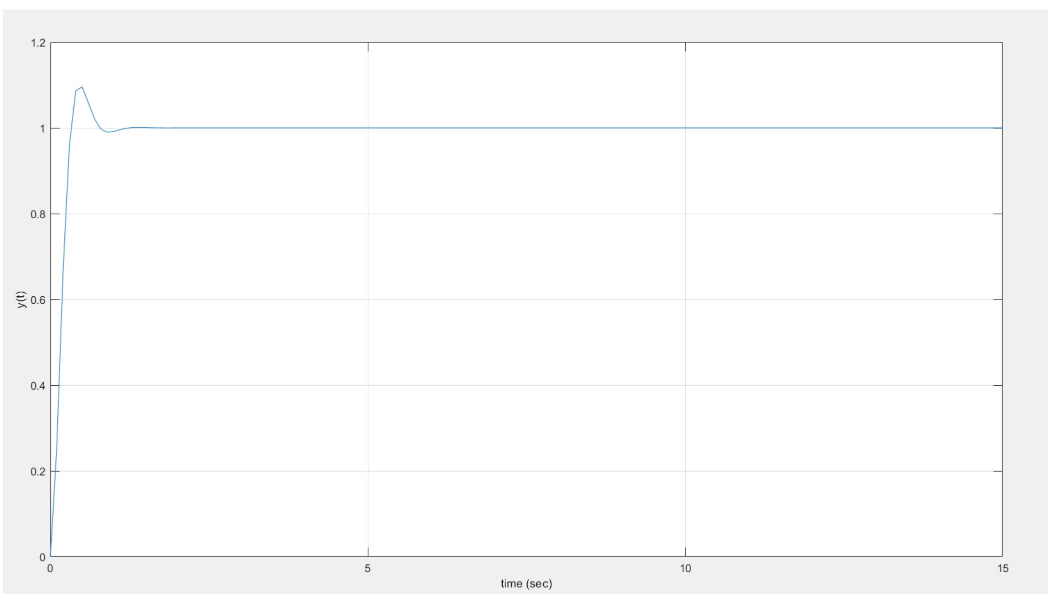



```
zeta=((log(0.1)/pi)^2/(1+(log(0.1)/pi)^2))^0.5; % Find Percent Overshoot <= 10%
theta=acosd(zeta);%find the arcos of the angle, specify in degree {d}
plot([-0.4 -0.4],[-30 30],'--',[0 30/tand(180-theta)],[0 30],'--',[0 -30/tand(180+theta)],[0 -30],'--');
%Find the settling time under 10s which is given by formula T=4/ZETA*Wn
%[-6 6] is the array for y axis then plot for x = [-0.4 -0.4] y = [-6 6] it
%will connect the graph
%Then for 6/tand(180-theta), it is to draw the real axis line, then plot
%the y axis array to make it a cone shape line graph to specify the right
%area for the requirement. 45deg here so it would be 180 - 45.
hold on
numg=[1];deng=[1 10 0];sys1=tf(numg,deng);
rlocus(sys1)
[kp,poles]=rlocfind(sys1)

figure
t=0:0.1:15;
sys1_o=kp*sys1; %Kp given by rlocfind, then we can find the K value we want from rlocfind(sys1)
%And then we can specify the openloop system we want.
sys1_cl=feedback(sys1_o,[1]); %The system we want to plot is the closed loop feedback system we want
[y1,t]=step(sys1_cl,t);
plot(t,y1),grid
xlabel('time (sec)'),ylabel('y(t)')
```

2.5 Plot Response OF the given systems with the desire K

The following is the systems out given





3 Conclusion

Today we learn the plot of root locus which shows the powerful utility of Matlab which enable us to bypass the complicated calculation with root locus, makes us be able to easily find the desired K for the system, thus keep the system under our desired design condition.

This concludes this Week's Auto Control LAB