Report for Auto Control Lab8

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1 Introduction

This is the tenth Experiment of Auto Control Lab where TAs taught us the plot some characteristics of the system which includes steady-state error and also and some optimal value of percent-overshoot.

2 LAB7

2.1 Part 1 Homework problems and its codes

Objective:To perform operations to find out the steady state error plot

These are the stated Homework problems

Lab 8 Homework

- **P1.** Consider the transfer function

$$G(s) = \frac{5}{s^2 + 2s + 25}$$

$$\mathrm{H(s)} = \frac{s+2}{s+25}$$

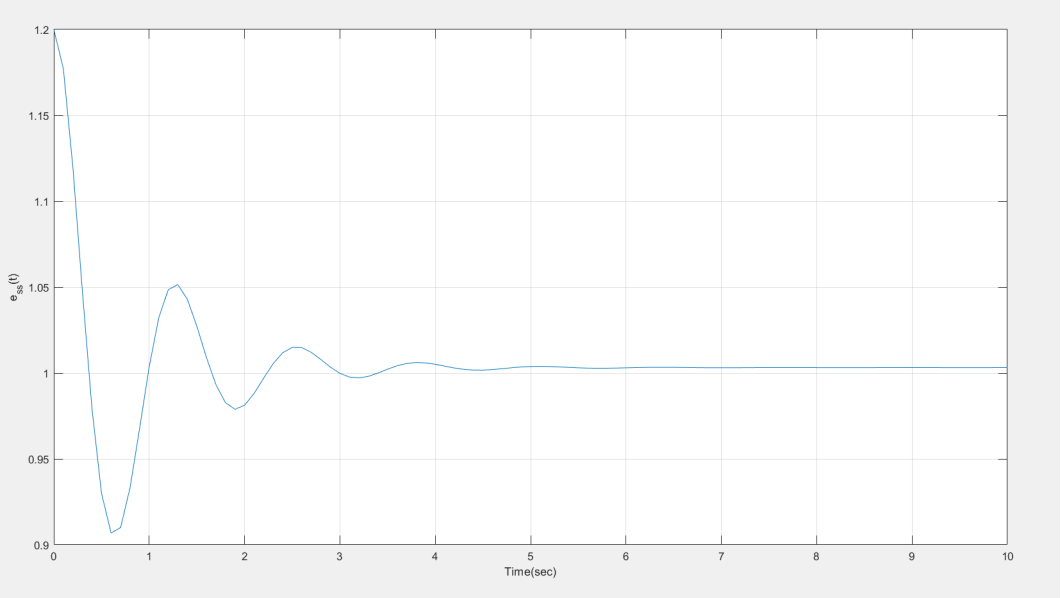
when the input is a unit step, the desired steady-state value of the output is 1.2 Using the MATLAB step function, show that the steady-state error to a unit step input is 1. ($t = 0:0.1:10$)

2.2 CODES FOR PROBLEM1

In order to perform the tasks, Matlab codes are needed. The following is the code needed for finding the steady state error plot which I minus the desired output with my real output

```
for k = 0: 0.1 : 5
    sys_cl = feedback(tf([5],[1,2,25]),tf([1 2],[1 25]));
    t = 0:0.1:5;
    [y,t] = step(sys_cl,t);
    ess = 1.2 - max(y);

    if( ymax > 1.01)&&(ymax < 1.2)
        disp(k);
        disp(ess);
        break
    end
end
plot(t,(1.2-y),[0 5],[1.2 1.2],'--'); grid on
xlabel('Time(sec)');ylabel('e_{ss}(t)');
```

2.3 Result of the given difference of desired output and my real output i.e 1.2-y

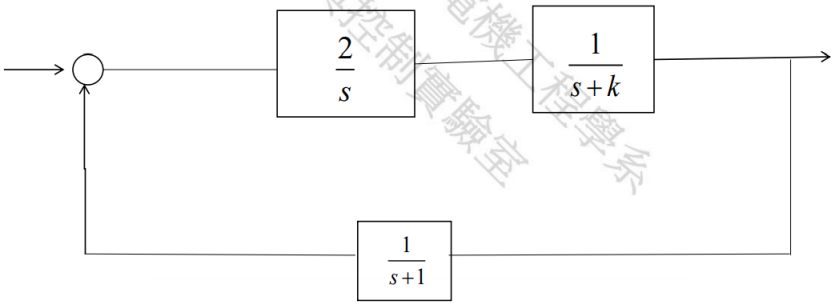


2.4 Part 2 Homework problems and its codes

Objective:To plug in and plot out the response with the given feedback system to a step response and find the optimal value of k to be in the percent overshoot range ,also have to plot out the steady state error for the last value of k

These are the stated HW problems.

- **P2.** Consider the closed-loop control system shown in Figure 1. Develop a MATLAB script to assist in the search for a value of k so that the percent over-shoot to a unit step input is greater than 1 %, but less than 10%. The script should compute the closed-loop transfer function, $T(s)=Y(s)/R(s)$, and generate the step response. Verify graphically that the steady-state error to a unit step input is zero. (Hint: search k within 0:0.1:5 , t=0:0.1:25)



2.5 CODES FOR Part2

In order to perform the tasks, Matlab codes are needed. The following code is used for finding the value k and also to plot the system out with step response also the steady state error

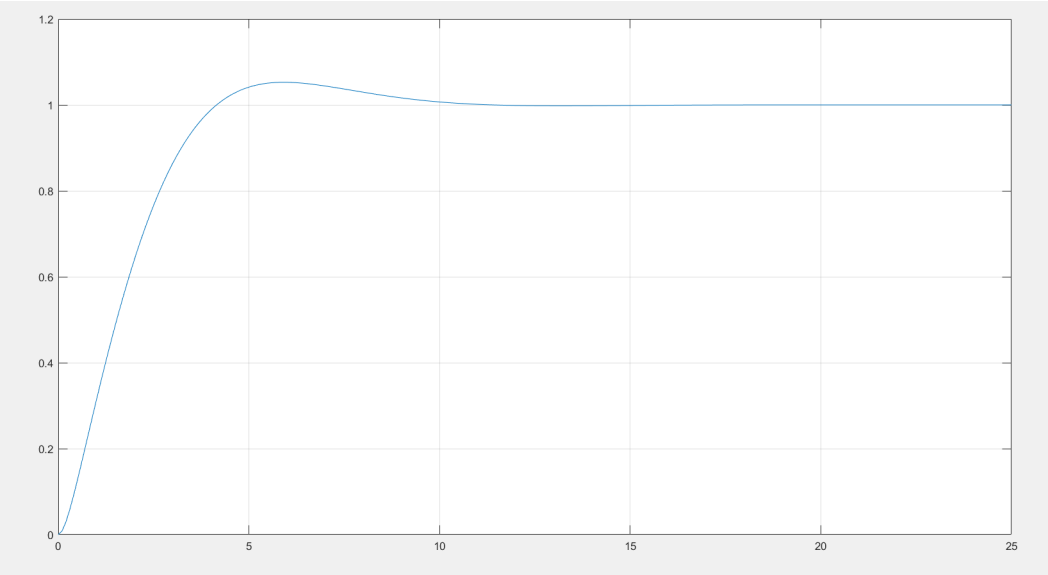
```
for k = 1 :0.1 : 5
    t = 0:0.1:25;
    tf1 = tf([2],[1 0])*tf([1],[1 k]);
    sys = feedback(tf1,tf([1],[1 1]));
    [y,t] = step(sys,t);
    S = stepinfo(y,t);

    if( (S.Overshoot>=1 )&&(S.Overshoot<=10)&&(k>1))
        disp("Value of k is for suitable overshoot range is");
        disp(k)
    end
end

disp("The plot of last k");
sys

plot(t,y);grid on
```

2.6 Plot Response OF the given system and the state transition matrix PHI

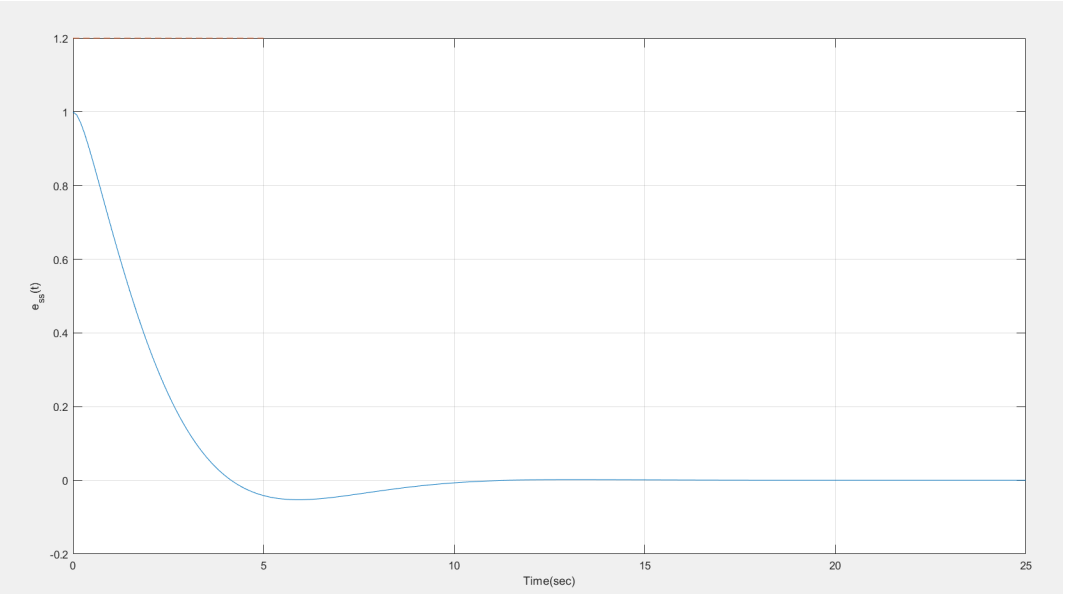
Optimal value of k's

```
Value of k is for suitable overshoot range is
    4.3000

Value of k is for suitable overshoot range is
    4.4000

Value of k is for suitable overshoot range is
    4.5000

Value of k is for suitable overshoot range is
    4.6000

Value of k is for suitable overshoot range is
    4.7000

Value of k is for suitable overshoot range is
    4.8000

Value of k is for suitable overshoot range is
    4.9000

Value of k is for suitable overshoot range is
     5

The plot of last k

sys =

         2 s + 2
  ---------------------
  s^3 + 6 s^2 + 5 s + 2

Continuous-time transfer function.
```

The following is the system out given



The following is the system steady state error which approach to zero



3 Conclusion

Today we learn how to find the characteristics of a certain system to some certain inputs. Which includes some important concept about percent overshoot and also steady state error plot. However, some materials shall also be included which are the peak time,settling time and rise time etc.... Anyways, with the help of the auto control course, it is easier for me to grasp those idea, and also help me cement the ideas of features of the system learnt in control system course.

This concludes the tenth Week of Auto Control LAB