Report for Auto Control Lab9

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1 Introduction

This is the eleventh Experiment of Auto Control Lab where TAs taught us the plot of more characteristics of the system which includes which includes percentage overshoot, and more precise system plots.

2 LAB9

2.1 Part 1 Homework problems and its codes

Objective:To perform operations to find out the response of the feedback system of a given time interval

These are the stated Homework problems

Lab 9 Homework

- MP5.2

A unity negative feedback system has the open-loop transfer function

$$G(s) = \frac{s+7}{s^2(s+10)}$$

Using lsim, obtain the reponse of the closed-loop system to a unit ramp input,

Consider the time interval $0 \leq t \leq 25$.

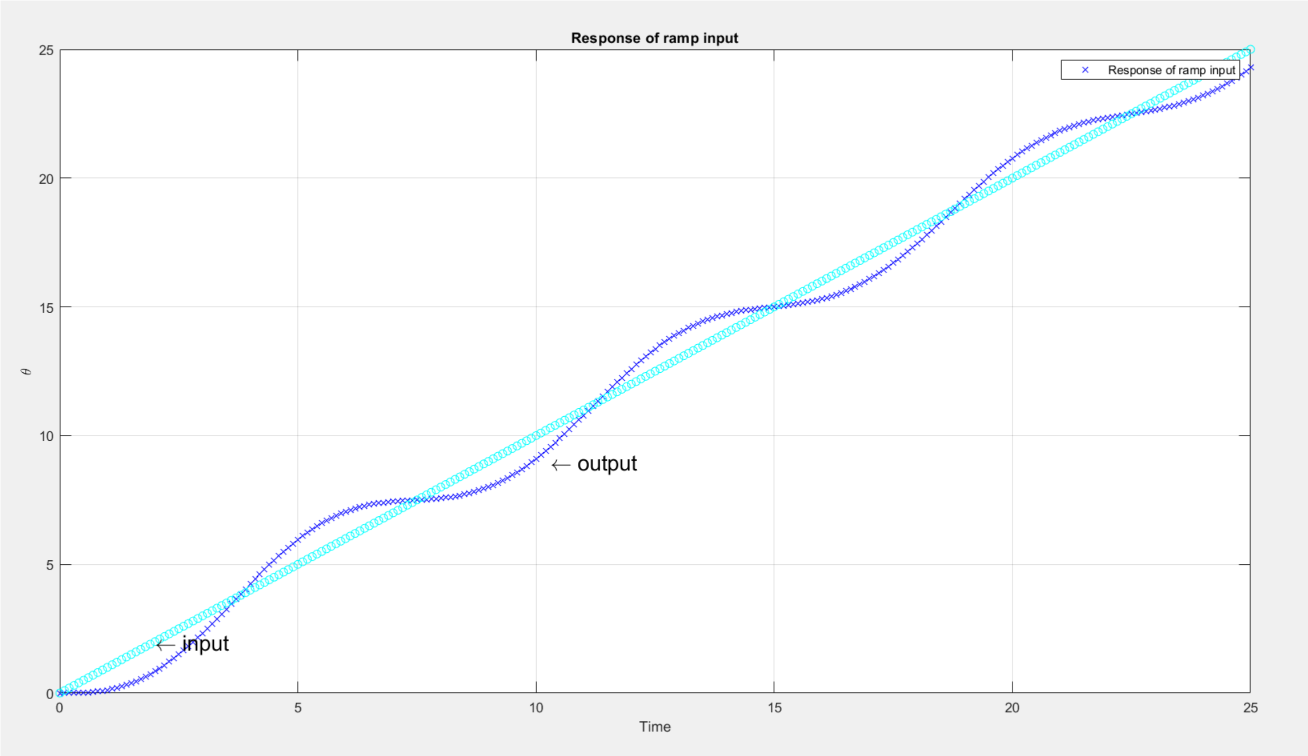
- MatLab code
- The figure shows reslut, label(xlabel:Time,ylabel:theta), title(response of ramp input).
- Text leftarrow at (2,2) Input, and at(10.3,9) Output

2.2 CODES FOR PROBLEM1

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

```
ng = [1 7]; dg1 = [ 1 0 0 ]; dg2 = [ 1 10 ]; dn1 = conv(dg1,dg2);



sys_g = feedback(tf(ng , dn1),1);

t1 = [0:0.1:25];
u = t1;
[y,T]=lsim(sys_g,u,t1);

plot(T,y,'bx',T,u,'co');legend on; legend('Response of ramp input');xlabel('Time');ylabel('\theta');grid on;title('Response of ramp input');
text(2,2,'\leftarrow input','Fontsize',16);
text(10.3,9,'\leftarrow output','Fontsize',16);
```

2.3 Result of the given system's plot



2.4 Part 2 Homework problems and its codes

Objective:To plug in and plot out the response with the given 2nd order system to an impulse response. We here needs different system response with different damping ratio w_n and natural frequency ζ

- MP5.3

A working knowledge of the realtionship between the pole locations of the second-order system shown in Fig. MP5.3 and the transient response is importantion control design. With that in mind, consider the following four cases.

1. $\omega_n = 2, \quad \zeta = 0,$
2. $\omega_n = 2, \quad \zeta = 0.1,$
3. $\omega_n = 1, \quad \zeta = 0,$
4. $\omega_n = 1, \quad \zeta = 0.2,$

Using the impulse ans subplot functions, create a plot containing four subplots, with each subplot depicting the impulse of one of the four case listed.
Consider the time interval $0 \le t \le 15$.

- MatLab code
- The figure shows reslut, label, title.

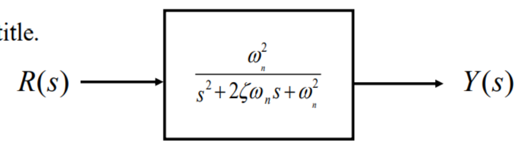


Fig. MP5.3

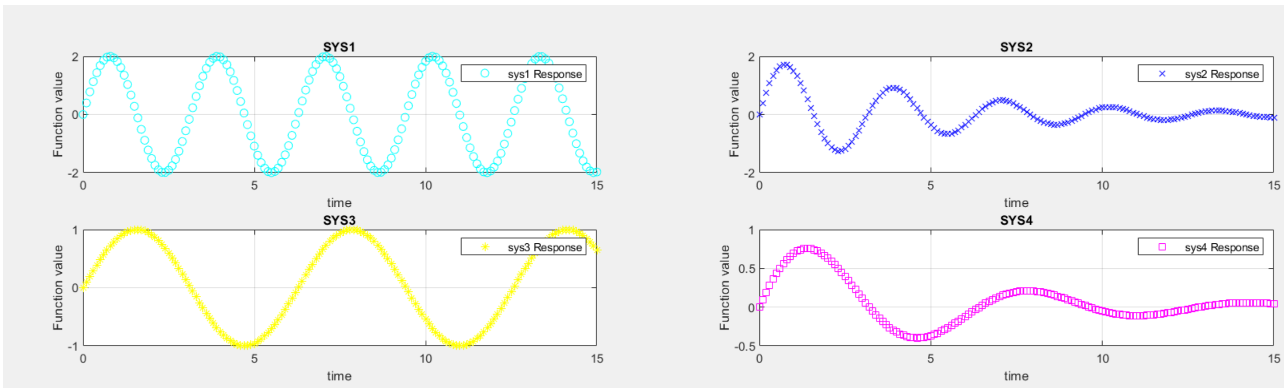
2.5 CODES FOR Part2

In order to perform the tasks, Matlab codes are needed. The following code is used for plotting the system with different damping ratios and natural frequency

```
w1 = 2 ;z1 = 0;
w2 = 2 ;z2 = 0.1;
w3 = 1 ;z3 = 0;
w4 = 1 ;z4 = 0.2;

t1 = [0 : 0.1 : 15];

sys1 = tf(w1^2,[1 2*z1*w1 , w1^2]);
sys2 = tf(w2^2,[1 2*z2*w2 , w2^2]);
sys3 = tf(w3^2,[1 2*z3*w3 , w3^2]);
sys4 = tf(w4^2,[1 2*z4*w4 , w4^2]);

[y1,T1] = impulse(sys1,t1);
[y2,T2] = impulse(sys2,t1);
[y3,T3] = impulse(sys3,t1);
[y4,T4] = impulse(sys4,t1);

subplot(4,2,1),plot(T1,y1,'co');legend on; legend('sys1 Response');xlabel('time');ylabel('Function value');grid on;title('SYS1');
subplot(4,2,2),plot(T2,y2,'bx');legend on; legend('sys2 Response');xlabel('time');ylabel('Function value');grid on;title('SYS2');
subplot(4,2,3),plot(T3,y3,'y*');legend on; legend('sys3 Response');xlabel('time');ylabel('Function value');grid on;title('SYS3');
subplot(4,2,4),plot(T4,y4,'ms');legend on; legend('sys4 Response');xlabel('time');ylabel('Function value');grid on;title('SYS4');
```

2.6 Plot Response OF the given systems with different ζ and w_n

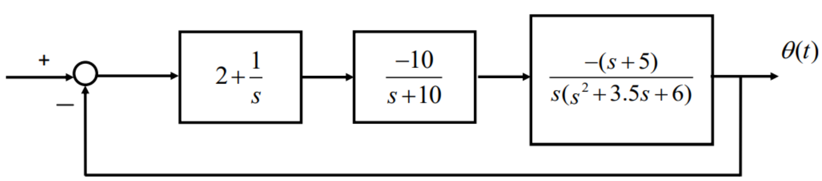
The following is the systems out given



2.7 Part 3 Homework problems and its codes

Objective:To plug in and plot out the response for impulse responses using lsim function

- MP5.6



Please plot impulse response using the lsim function.

Consider the time $0 \le t \le 15$

- MatLab code
- The figure shows reslut, label, title.

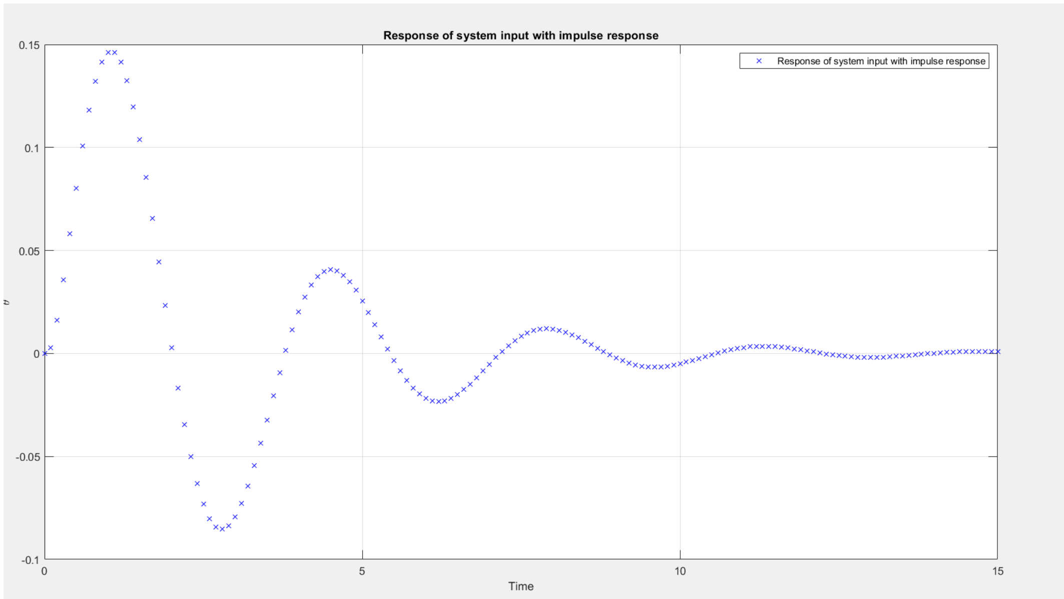
2.8 CODES FOR Part3

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

```
SYS1 = tf([2 1],[1 0]);
SYS2 = tf((-10),[1 10]);
SYS3 = tf(-[1 5],[1 3.5 6 0]);
SYS123 = SYS1*SYS2*SYS3;
SYS = feedback(SYS123,1);

t = [0 : 0.1 : 15]';

impulse = t==0;

y = lsim(SYS,u,t);
plot(t,y,'bx');legend on; legend('Response of system input with impulse response');xlabel('Time');ylabel('\theta');grid on;title('Response of system input with
```

2.9 Plot of the system

The following is the system out given



3 Conclusion

Today we learn how to plot more system response using the techniques we just used. And add more details to the system plots including more labels, results and titles. Also more characteristics for the response like percent overshoot, settling time, peak time and others more. Reviewing what I've just learnt in the Auto Control course.

This concludes the eleventh Week of Auto Control LAB