**Lab 2：Linear Time-Invariant Systems**

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| **Introduction**  1.  2.learning to use MATLAB function to verity whether system is linear or time-invariant  3.  **Lab results & Analysis**：    A(1):    A(2):    A(3):    b.  use the figure with the difference between w3(f.3)and w1+2\*w2(f.4)in a could find that system 1 and system 3 is linear but system 2 is not linear. because f.4 in a(2) show that it is not linear.  c.  use the figure with the difference between w1(f.1)and w2(f.2)in a could find that system 1 and system 2 is linear but system 3 is not linear. The reason of that is when n=0 y3n will output zero instead of 1 that make it not time-invariant    D    E    F    G    In f.1(left s1 and z1) you could find that it is totally similar because of the exchange law of convolution that un\*x1\*y1=x1\*y1\*un .  Inf.2(right s2 and z2) the (0.6 )^n break the similarity and make difference in the figure, which also made by for loop. | |
| **Experience**  2.function as conv and filter is easy to use but sometimes, they do not work well, you need to pay attention to signal and use code to solve the question.  3.linear and time invariant could be easy find with figure . | |
| **Score** | 2.5 9/10 |

Code in 2.5

clear;

clc;

x1n=[1 ,zeros(1,5)];

x2n=[0 1 ,zeros(1,4)];

x3n=[1 2 ,zeros(1,4)];

n=[0:5];

ss1=[1];

ss2=[1 -1 -1];

w1=filter(ss2,ss1,x1n);

w2=filter(ss2,ss1,x2n);

w3=filter(ss2,ss1,x3n);

figure

title('system 1')

subplot(1,4,1);

stem(n,w1);

subplot(1,4,2);

stem(n,w2);

subplot(1,4,3);

stem(n,w3);

subplot(1,4,4);

stem(n,w1+2\*w2);

clear;

clc;

x1n=[cos(1) 1 1 1 1 1];

x2n=[1 cos(1) 1 1 1 1];

x3n=[cos(1) cos(2) 1 1 1 1];

n=[0:5];

ss1=[1];

ss2=[1];

w1=filter(ss2,ss1,x1n);

w2=filter(ss2,ss1,x2n);

w3=filter(ss2,ss1,x3n);

figure

title('system 1')

subplot(1,4,1);

stem(n,w1);

subplot(1,4,2);

stem(n,w2);

subplot(1,4,3);

stem(n,w3);

subplot(1,4,4);

stem(n,w1+2\*w2);

clear;

clc;

x1n=[0 ,zeros(1,5)];

x2n=[0 1 ,zeros(1,4)];

x3n=[0 2 ,zeros(1,4)];

n=[0:5];

ss1=[1];

ss2=[1 -1 -1];

w1=filter(ss2,ss1,x1n);

w2=filter(ss2,ss1,x2n);

w3=filter(ss2,ss1,x3n);

figure

title('system 1')

subplot(1,4,1);

stem(n,w1);

subplot(1,4,2);

stem(n,w2);

subplot(1,4,3);

stem(n,w3);

subplot(1,4,4);

stem(n,w1+2\*w2);

clear;

clc;

n=[0:19];

x1=[1,zeros(1,19)];

a1=[1,-0.6];

b1=[1];

h1=filter(b1,a1,x1);

subplot(1,2,1);

stem(h1);

h2(1)=1;

for i=2:20

h2(i)=0.6^i\*h2(i-1);

end

subplot(1,2,2);

stem(h2);

clear;

clc;

n=[0:19];

x1=[1,zeros(1,19)];

for i=1:20

x1(i)=1;

end

a1=[1,-0.6];

b1=[1];

s1=filter(b1,a1,x1);

subplot(1,2,1);

stem(s1);

s2(1)=1;

for i=2:20

s2(i)=0.6^i\*s2(i-1)+x1(i);

end

subplot(1,2,2);

stem(s2);

n=[0:19];

x1=[1,zeros(1,19)];

un1=[1];

for i=1:20

un1(i)=1;

end

a1=[1,-0.6];

b1=[1];

h1=filter(b1,a1,x1);

h2(1)=1;

for i=2:20

h2(i)=0.6^(i-1)\*h2(i-1);

end

z1=conv(h1,un1);

z2=conv(h2,un1);

subplot(1,2,1);

plot(s1,'r');

hold on;

plot(z1,'g');

subplot(1,2,2);

plot(s2,'r');

hold on;

plot(z2,'g')