电子科技大学<u>格拉斯哥</u>学院

___Glasgow____ of UESTC

标 准 实 验 报 告

Lab Report

（实验）课程名称:<u>信号与系统</u>

(LAB) Course Name: <u>SIGNAL AND SYSTEM</u>

电子科技大学教务处制表

Glasgow College，UESTC

Lab Report

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指导教师 **Instructor： SHI Chuang**

实验地点 **Location： Main Building A1-305**

实验时间 **Date：2018/12/10**

一、 实验室名称 **Laboratory name：virtual machine laboratory**

二、 实验项目名称 **Project name：SIGNAL AND SYSTEM LAB**

三、 实验学时 **Lab hours：4×4=16**

四、 实验原理 **Theoretical background：**

The concept of sampling, Laplace transform, Z transform are introduced. Moreover, Impulse Responses of Differential Equations by Partial Fraction Expansion are introduced for the following contents (almost every following part includes residue function, however, always in another form).

五、 实验目的 **Objective：**

Freqz fft etc… those have used or learned functions are reviewed. New functions like residue, subplot are introduced to our

knowledge base

The content in chapter 7,9,10 are used in practice(including sampling in 7.1, Laplace transform in both 9.1 and 9.2, Z transform in 10.2).

六、 实验内容 **Description：**

In 4.5, function residue are introduced, aimed at the solution or roots in the polynomial, both in the numerator and the denominator.

In 7.1, this line X(abs(X)<1e-10)=0; are very important. Otherwise, the value we receive are meanness since there are so many noises with moderate amplitude. This line was introduced to remove these noises.

In 9.1 and 9.2, function roots, axis, grid are introduced for the zero-plot diagram in MATLAB way. Moreover, how to get the discrete differential equation 9.2 b) (in other words , matrixes related to the denominator a1, a2, a3, a4) is the key to solve the problem.

In 10.2, theoretical knowledge is very important. In the past, we treated the zeros and poles as just discrete points in the s plane. However, it could be treated as vectors related to unit circle exp(jw) in the s plane. As there are vectors, parameters magnitude and phasor are introduced, providing a new way to analysis.

七、 实验器材（设备、元器件）Required instruments：

A computer with the MATLAB software

八、 实验步骤 Procedures：

Read the book carefully and review the Laplace Transform, especially the zero-plot related to the s plane.

Present the known condition in MATLAB way

九、 实验数据及结果分析 Analysis of Lab data & result：

4.5 b)

```
a1=[1 1.5 0.5];
b1=[0 1 -2];
[r1,p1]=residue(b1,a1);
```

```
     2

>> a1=[1 1.5 0.5];
>> b1=[0 1 -2];
>> [r1,p1]=residue(b1,a1)

r1 =

     6
    -5


p1 =

   -1.0000
   -0.5000
```

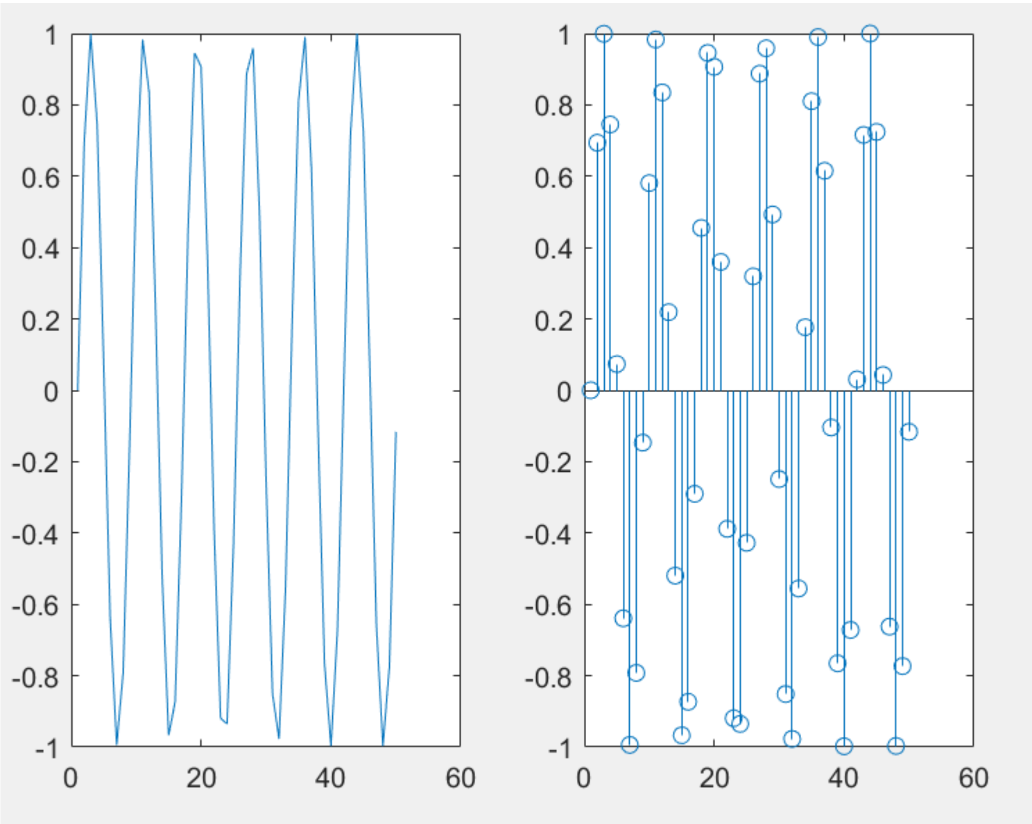
H1(jw)=6/(s+1)+(-5)/(s+1/2)

7.1 a)

```
n=[0:8191];
T=1/8192;
t=n*T;
omega0 = 2*pi*1000;
x=sin(omega0*t);
```

7.1 b)

```
subplot(1,2,1);
plot(x(1:50));
subplot(1,2,2);
stem(xn(1:50));
```

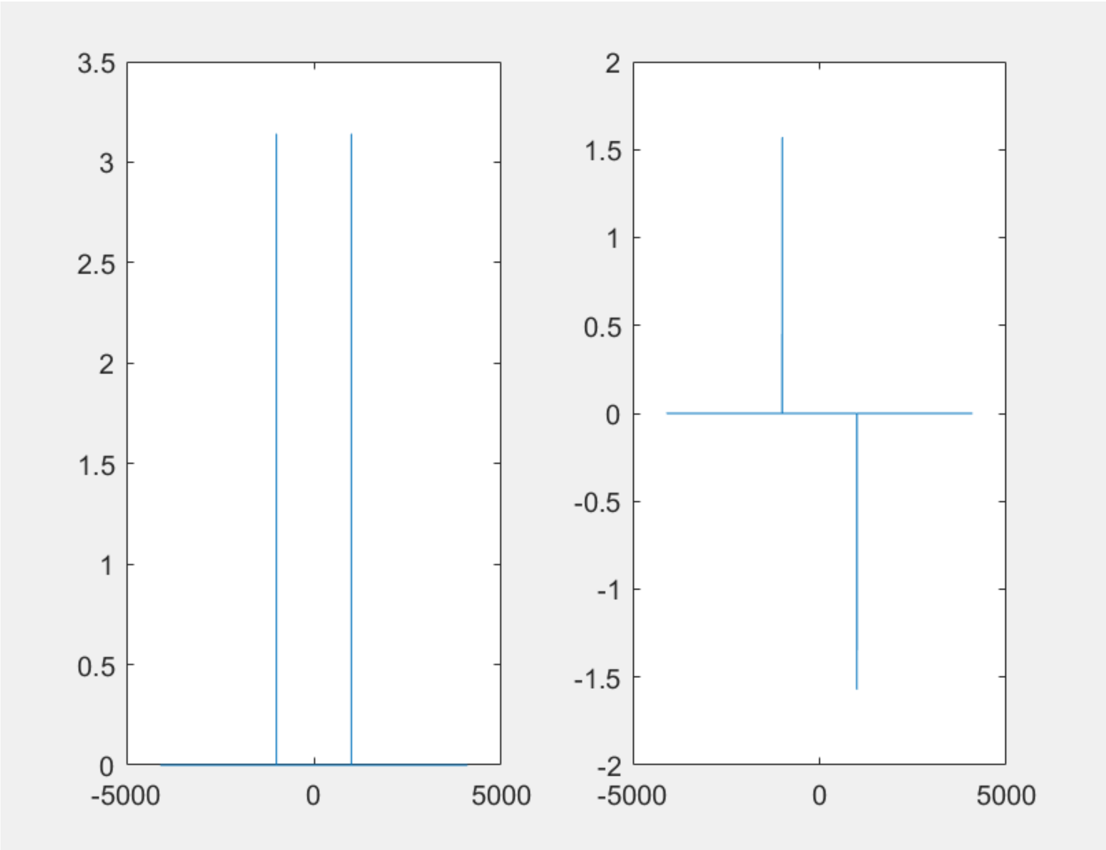



```
N= length(x);
X= fftshift(fft(x,N))*(2*pi/N);
w= linspace(-1,1-1/N,N)/(2*T);
```

7.1 c)

```
X(abs(X)<1e-10)=0;
subplot(1, 2, 1);
```

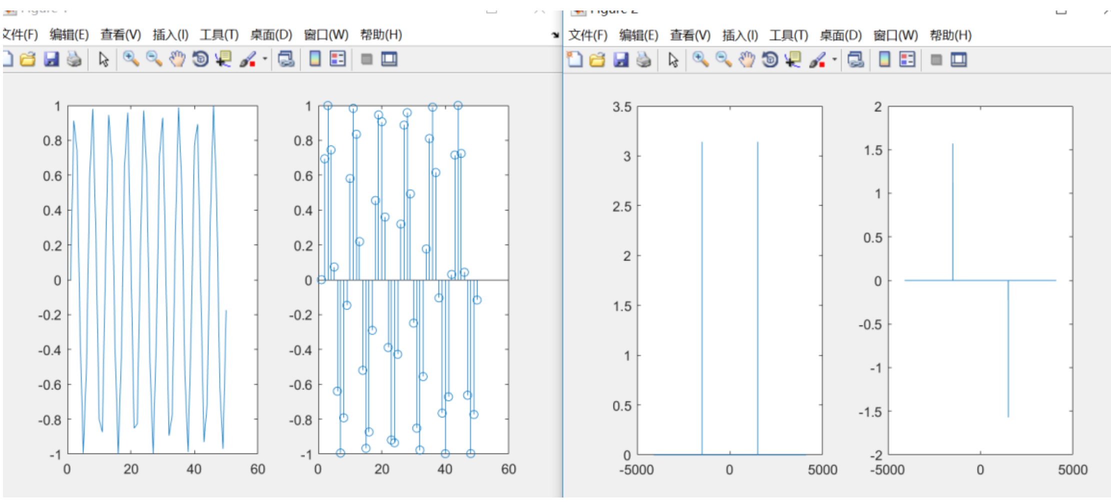
```
plot(w,abs(X));
subplot(1, 2, 2);
plot(w,angle(X));
```



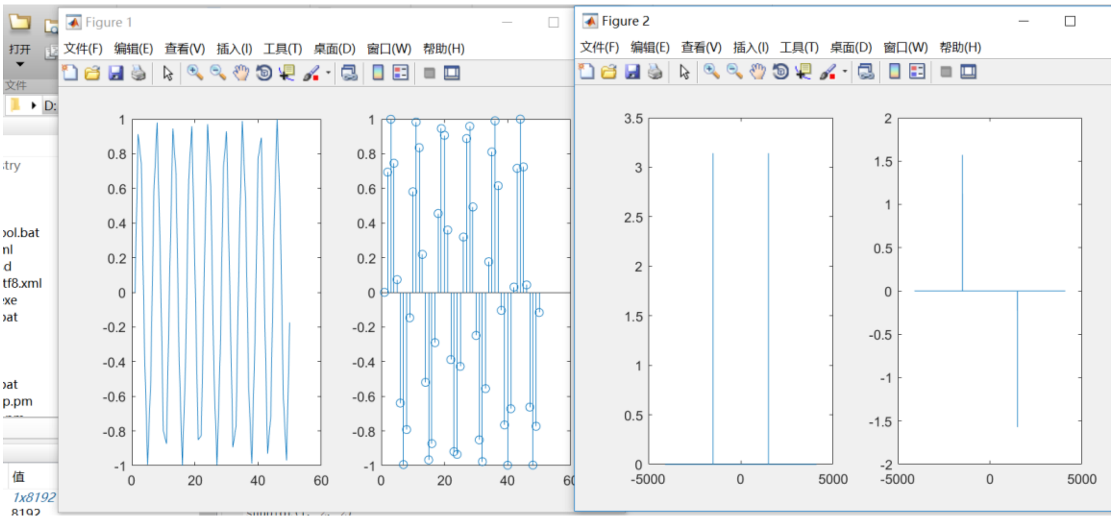
7.1 d)

```
% omega1 = 2*pi*1500;
n=[0:8191];
T=1/8192;
t=n*T;
omega1 = 2*pi*1500;
x=sin(omega1*t);
figure(1);
subplot(1,2,1);
plot(x(1:50));
subplot(1,2,2);
stem(xn(1:50));

N= length(x);
X= fftshift(fft(x,N))*(2*pi/N);
w= linspace(-1,1-1/N,N)/(2*T);
X(abs(X)<1e-10)=0;
```

```
figure(2)
subplot(1, 2, 1);
plot(w,abs(X));
subplot(1, 2, 2);
plot(w,angle(X));
```

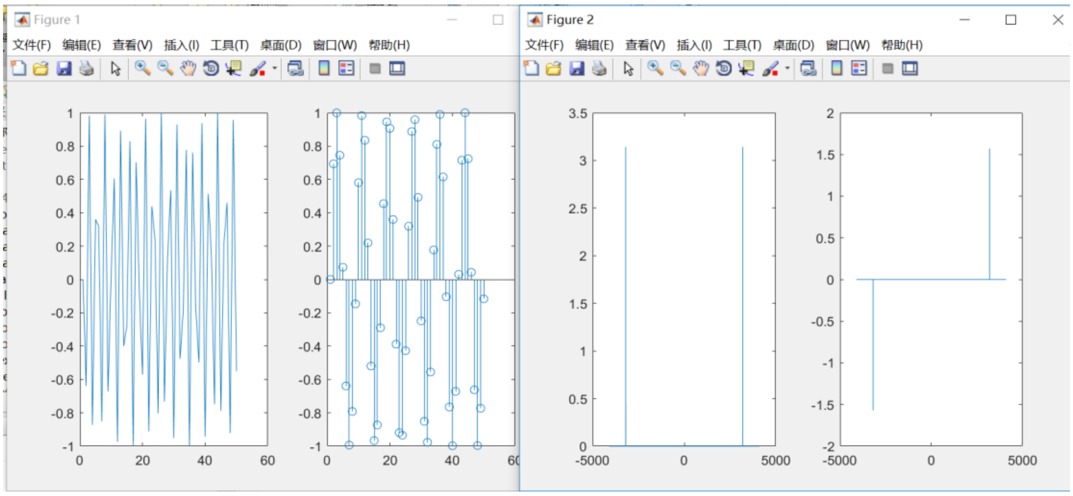



```
% omega2 = 2*pi*2000;
n=[0:8191];
T=1/8192;
t=n*T;
omega2 = 2*pi*2000;
x=sin(omega1*t);
figure(1);
subplot(1,2,1);
plot(x(1:50));
subplot(1,2,2);
stem(xn(1:50));

N= length(x);
X= fftshift(fft(x,N))*(2*pi/N);
w= linspace(-1,1-1/N,N)/(2*T);
X(abs(X)<1e-10)=0;
figure(2);
subplot(1, 2, 1);
plot(w,abs(X));
subplot(1, 2, 2);
plot(w,angle(X));
```




```
% omegaadd = 2*pi*5000;
n=[0:8191];
T=1/8192;
t=n*T;
omegaadd = 2*pi*5000;
x=sin(omegaadd*t);
figure(1);
subplot(1,2,1);
plot(x(1:50));
subplot(1,2,2);
stem(xn(1:50));
```

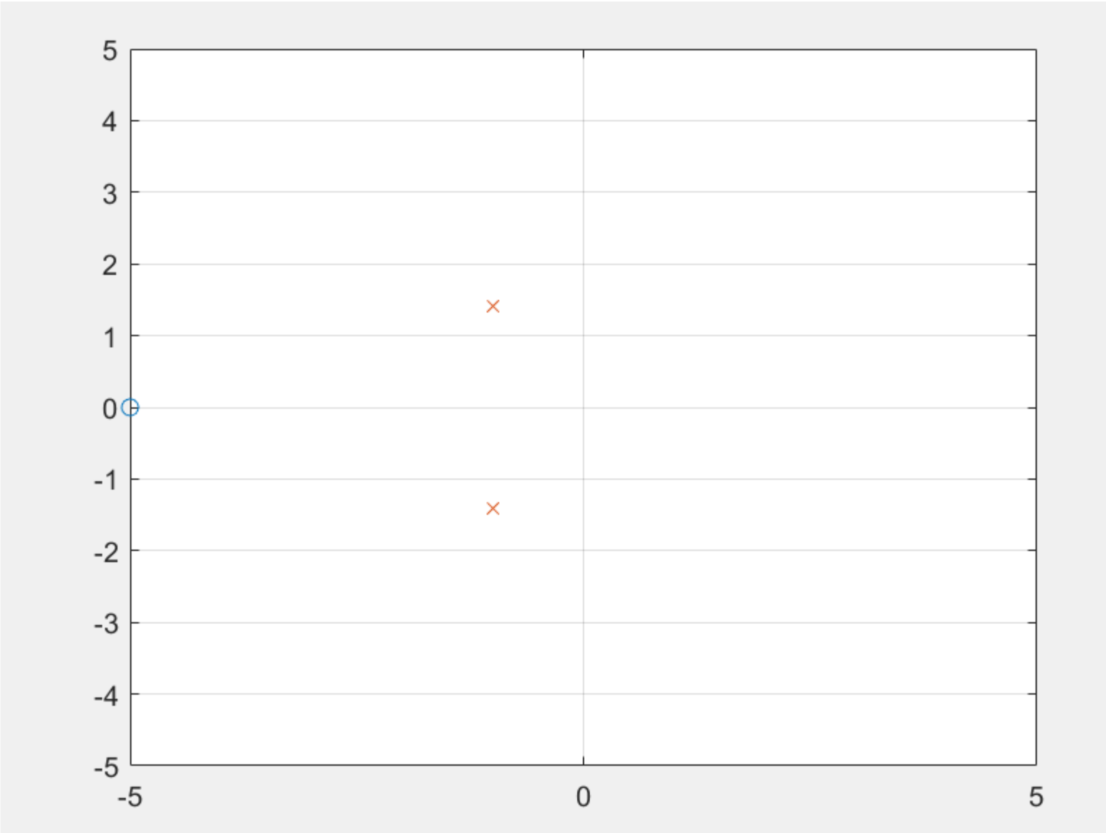
```
N= length(x);
X= fftshift(fft(x,N))*(2*pi/N);
w= linspace(-1,1-1/N,N)/(2*T);
X(abs(X)<1e-10)=0;
figure(2);
subplot(1, 2, 1);
plot(w,abs(X));
subplot(1, 2, 2);
plot(w,angle(X));
```



9.1 a)

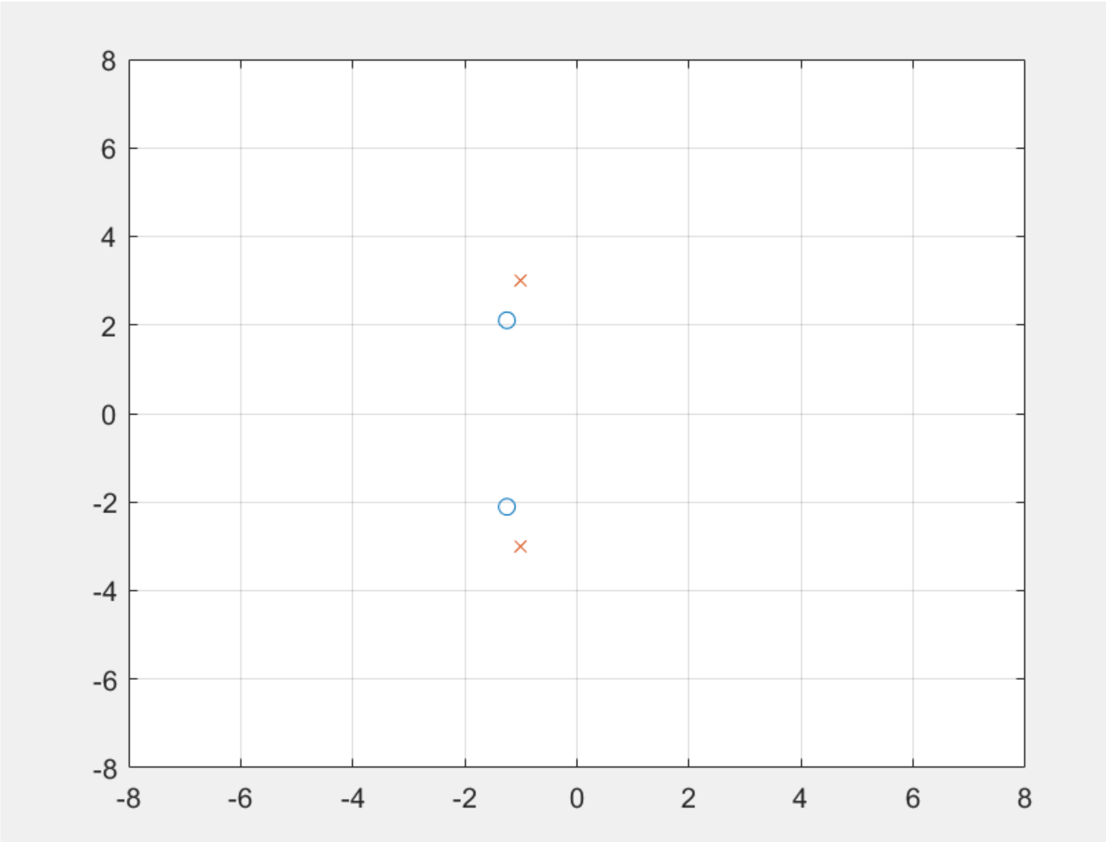
i)

```
b1=[0 1 5];
a1=[1 2 3];
zs=roots(b1);
ps=roots(a1);
plot (real(zs), imag(zs), 'o' );
hold on
plot(real(ps), imag(ps), 'x');
grid
axis([-5 5 -5 5]);
%axis([xmin xmax ymin ymax])
```



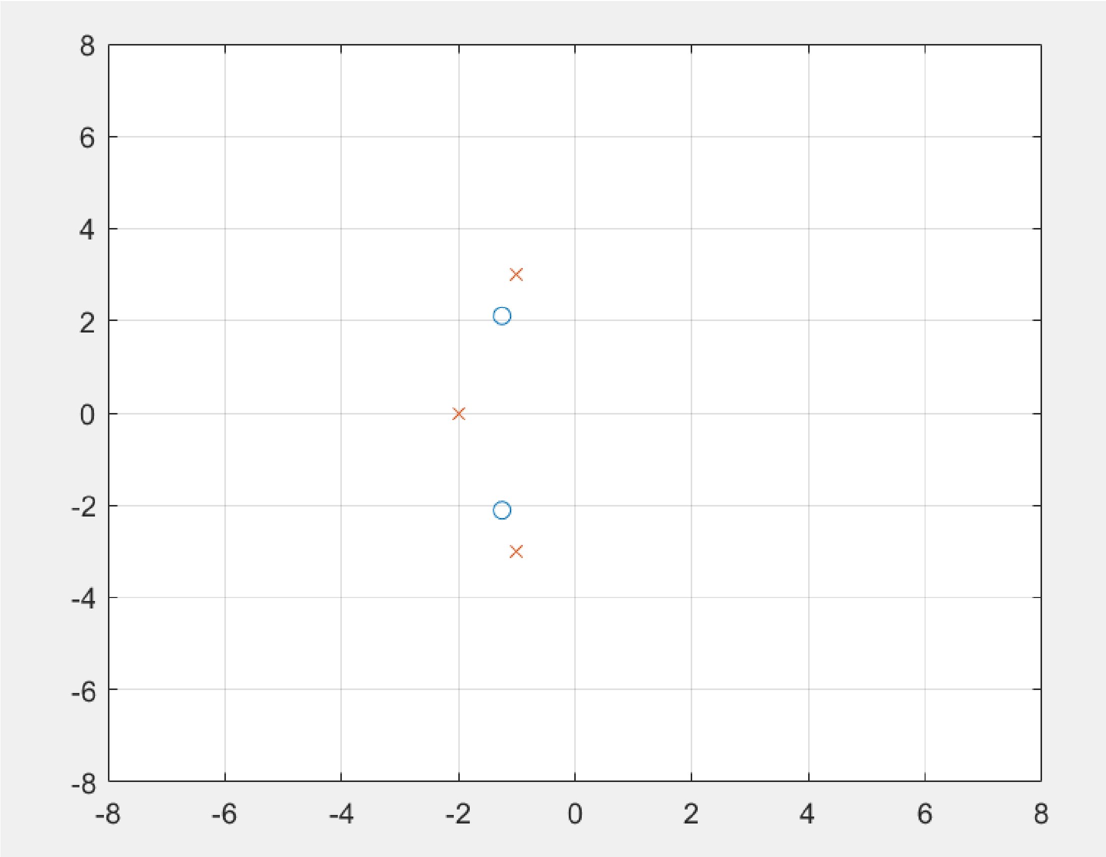
ii)

```
b2=[2 5 12];
a2=[1 2 10];
zs=roots(b2);
ps=roots(a2);
plot (real(zs), imag(zs), 'o' );
hold on
plot(real(ps), imag(ps), 'x');
grid
axis([-8 8 -8 8]);
```



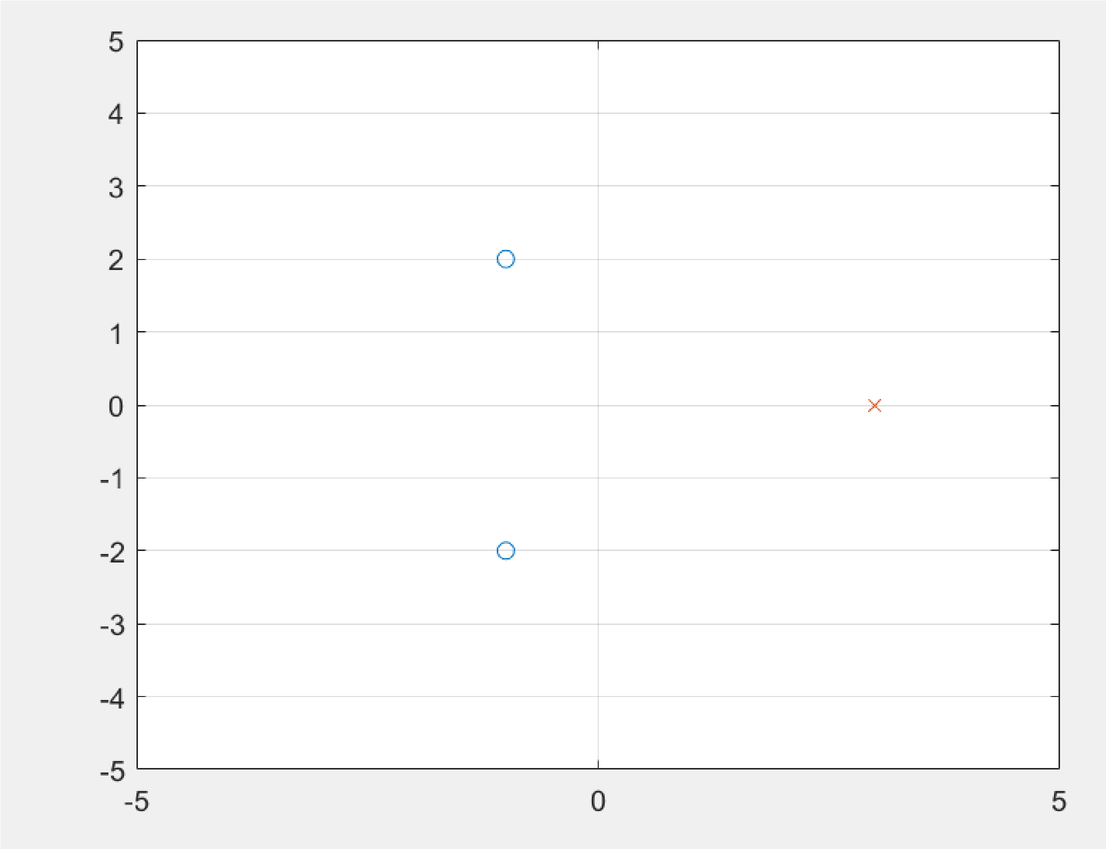
iii)

```
b3=[0 2 5 12];
a3=[1 4 14 20];
zs=roots(b3);
ps=roots(a3);
plot (real(zs), imag(zs), 'o' );
hold on
plot(real(ps), imag(ps), 'x');
grid
axis([-8 8 -8 8]);
```



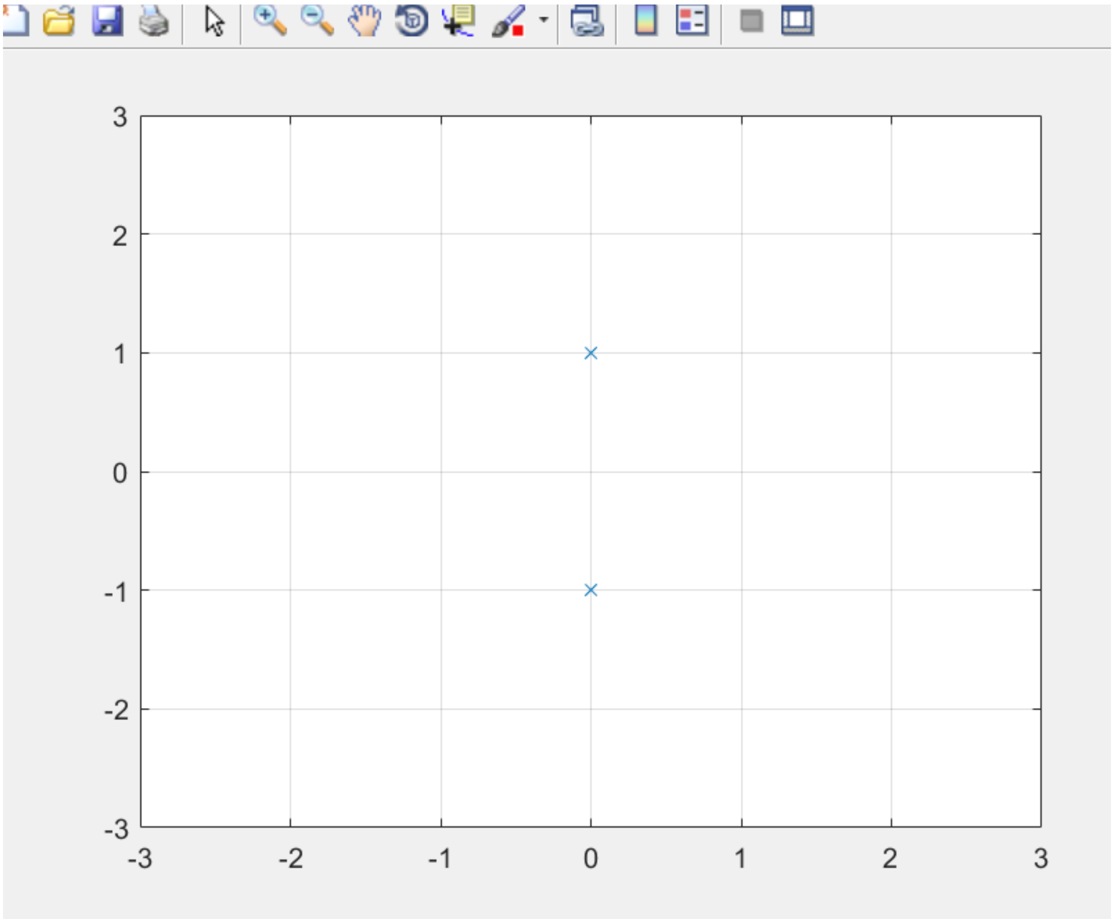
9.1 c)

```
b=[1 2 5 ];
a=[0 1 -3];
zs=roots(b);
ps=roots(a);
plot (real(zs), imag(zs), 'o' );
hold on
plot(real(ps), imag(ps), 'x');
grid
axis([-5 5 -5 5]);
```

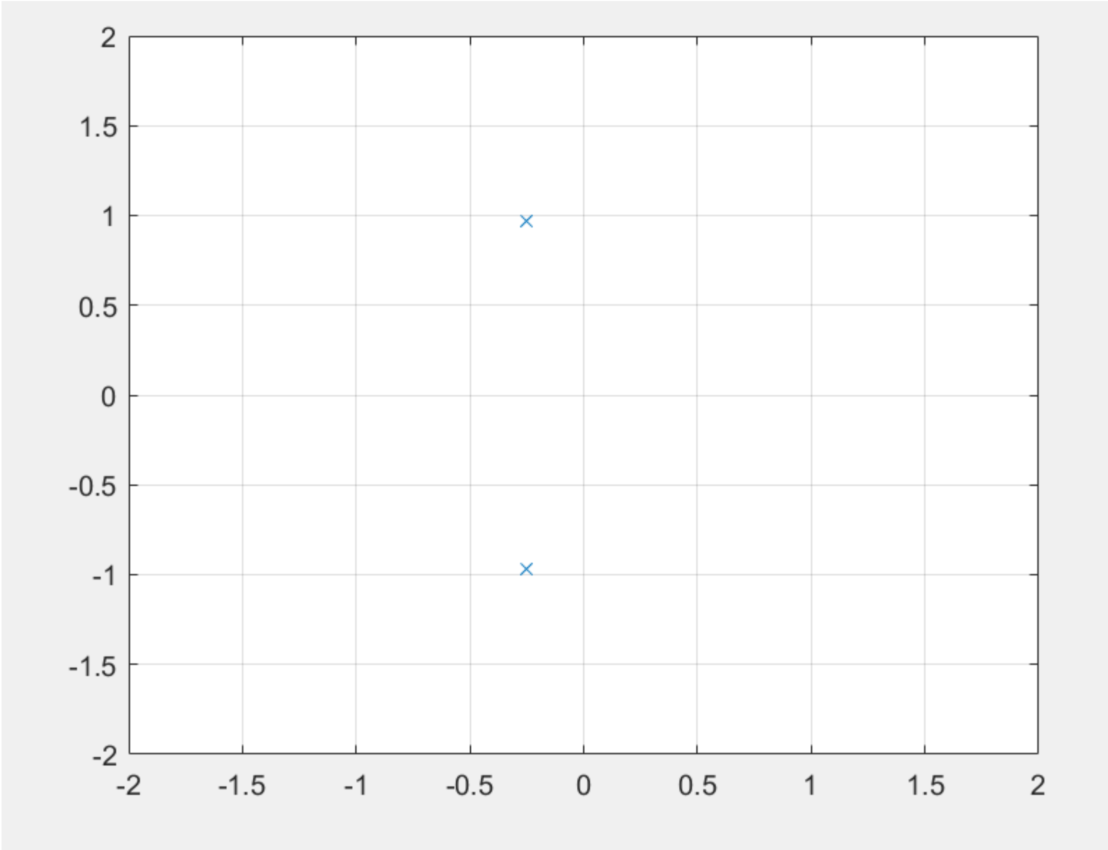


9.2 a)

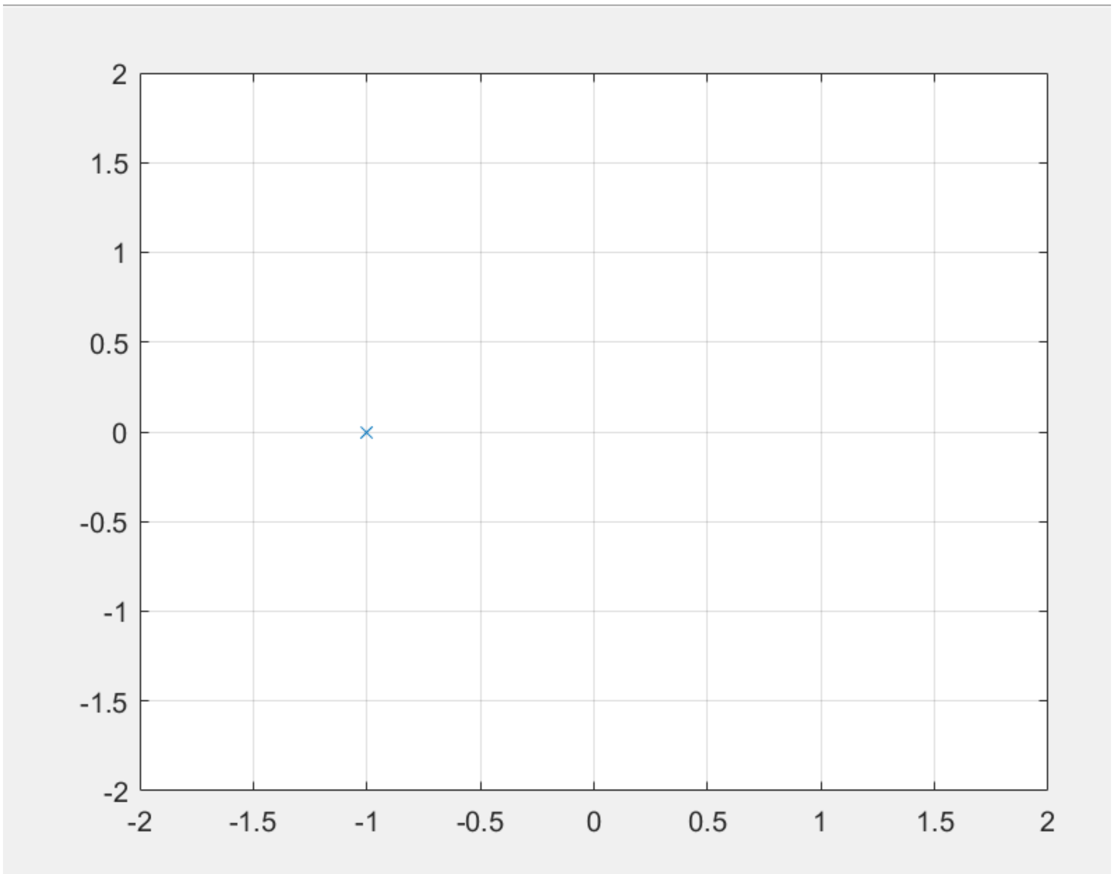
```
a1=[1 0 1];
a2=[1 0.5 1];
a3=[1 2 1];
a4=[1 4 1];
ps=roots(a1);
plot(real(ps), imag(ps), 'x');
grid
axis([-3 3 -3 3]);
```



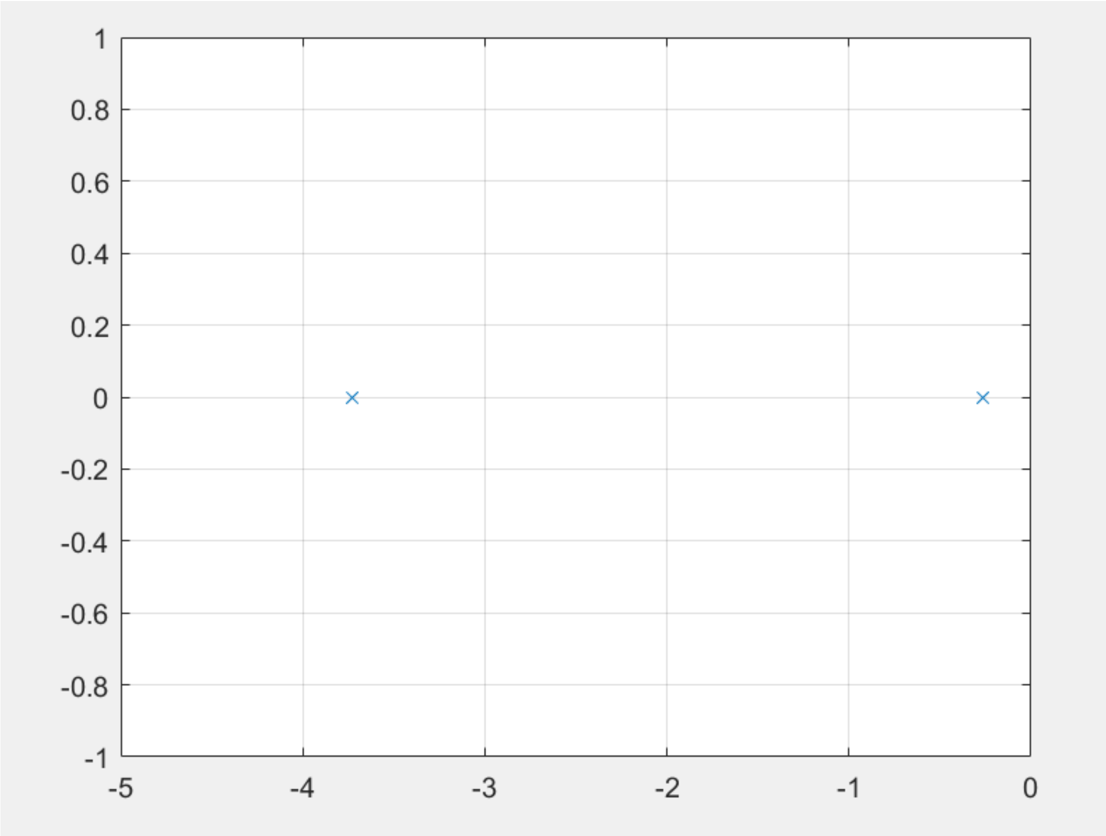

```
ps=roots(a2);
plot(real(ps), imag(ps), 'x');
grid
axis([-2 2 -2 2]);
```




```
ps=roots(a3);
plot(real(ps), imag(ps), 'x');
grid
axis([-2 2 -2 2]);
```



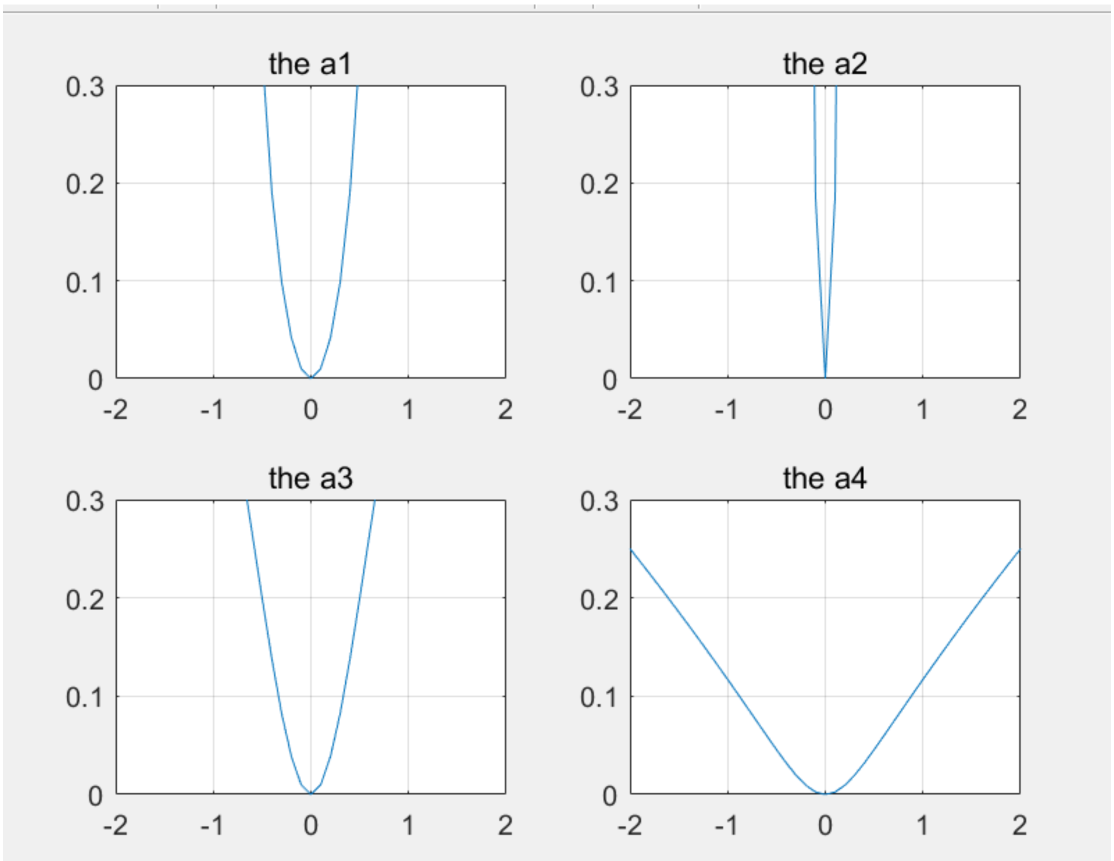

```
ps=roots(a4);
plot(real(ps), imag(ps), 'x');
grid
axis([-5 0 -1 1]);
```



9.2 b)

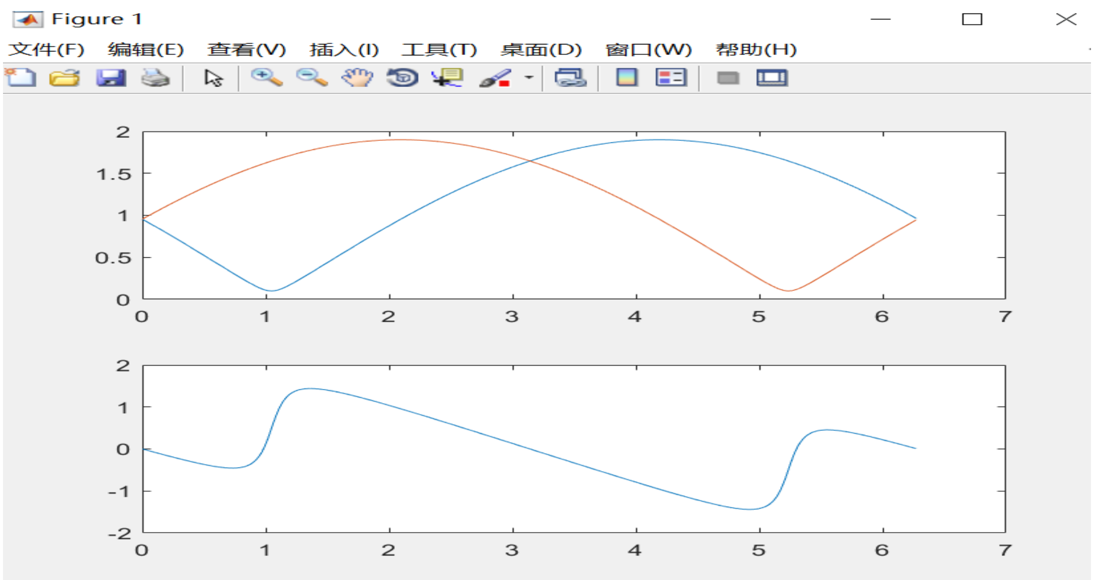
```
omega=[-5:0.1:5];
b=[1 0 0];
a1=[1 0 1];
a2=[1 1/8 1/16];
a3=[1 2 1];
a4=[1 8 4];
H1=freqs(b,a1,omega);
H2=freqs(b,a2,omega);
H3=freqs(b,a3,omega);
H4=freqs(b,a4,omega);

figure(1);
subplot(2,2,1);
plot(omega, abs(H1));
title('the a1');
grid
axis([-2 2 0 0.3]);

subplot(2,2,2);
```

```
plot(omega, abs(H2));
title('the a2');
grid
axis([-2 2 0 0.3]);

subplot(2,2,3);
plot(omega, abs(H3));
title('the a3');
grid
axis([-2 2 0 0.3]);


subplot(2,2,4);
plot(omega, abs(H4));
title('the a4');
grid
axis([-2 2 0 0.3]);
```



10.2

```
b1=[1  0  0];
a1=[1  -0.9  0.81];
zs=roots(b1);
ps=roots(a1);
zplane(b1,a1);

omega=[0:511]*pi/256;
unitcirc=exp(j*omega);
polevectors1=ones(2,1)*unitcirc-ps*ones(1,512);
polelength1=abs(polevectors1);
poleangle1=atan2(real(polevectors1),imag(polevectors1));
zerovectors1=ones(2,1)*unitcirc-zs*ones(1,512);
zerolength1=abs(zerovectors1);
zeroangle1=atan2(real(zerovectors1),imag(zerovectors1));
subplot(2,1,1);
plot(omega,polelength1);
subplot(2,1,2);
plot(omega,zerolength1);

geomH1mag=prod(zerolength1)./prod(polelength1);
geomH1phase=sum(zeroangle1)-sum(poleangle1);
geomH1phase(geomH1phase>pi)=geomH1phase(geomH1phase>pi)-4*pi;
plot(omega,geomH1mag);
plot(omega,geomH1phase)
```



十、 实验结论 Lab conclusion：

Results are shown above.

十一、总结及心得体会 Summary and comments：

Personally, I suffered a lot in the 10.2 and 9.2 b). In 9.2 b), I do not really know about how those four matrixes from a1 to a4 come from by myself. In 10.2, I failed since I cannot really introduce the function dpzplot in 10.1 into 10.2 (the code could not be copied from both pdf and the website, so I have to type them by hand.), which means I can solve the question theoretically, stuck in practice.

十二、对本实验过程及方法、手段的改进建议 Suggestion for this lab：

Theoretical knowledge is very important for 10.2. the thought that treated those discrete points into vectors can be important. As a result, if it is possible, previewing the lab question is beneficial in many ways.

报告评分 **Score：**

指导教师签字 **Instructor：**