实验一　零极点分布对系统频率响应的影响

一、实验目的

1.掌握系统差分方程得到系统函数的方法；

2.掌握系统单位脉冲响应获取系统函数的方法；

3.掌握用系统函数零级点分布的几何方法分析研究系统的频率响应。

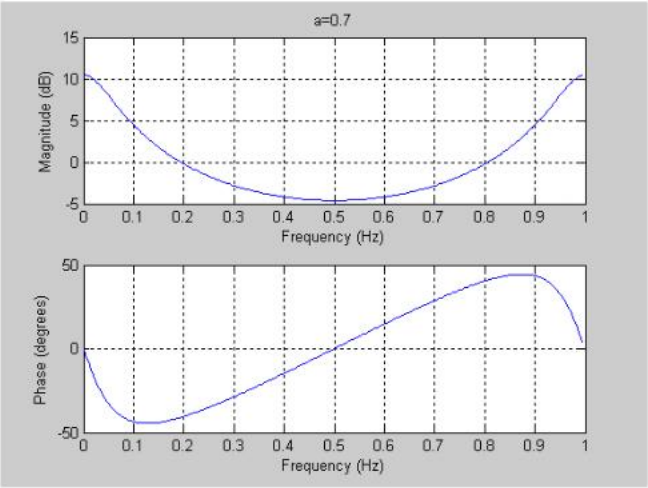
二、实验内容

1、y(n)=x(n)+ay(n-1)

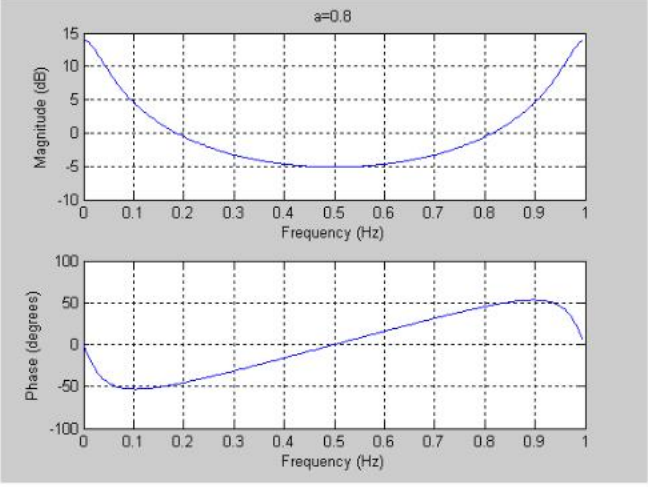
极点主要影响频率响应的峰值，极点愈靠近单位圆，峰值愈尖锐，a=0.7 时峰值较平滑，a=0.9 时峰值较尖锐。

（1）、freqz

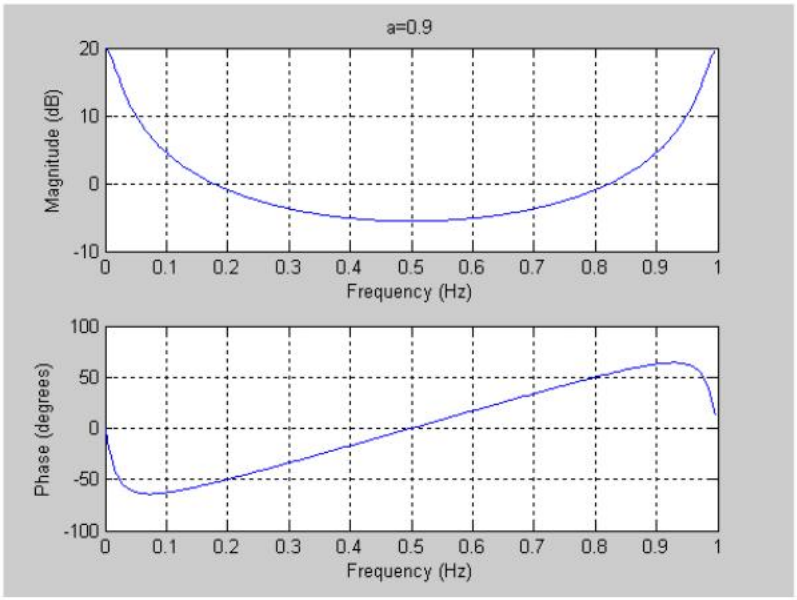
```
>> a=0.7;
>> A=[1，-a];
>> B=1;
>> freqz(B,A,256,'whole',1);
>> title('a=0.7');
```




```
>> a=0.8;
>> A=[1，-a];
>> B=1;
>> freqz(B,A,256,'whole',1);
>> title('a=0.8');
```

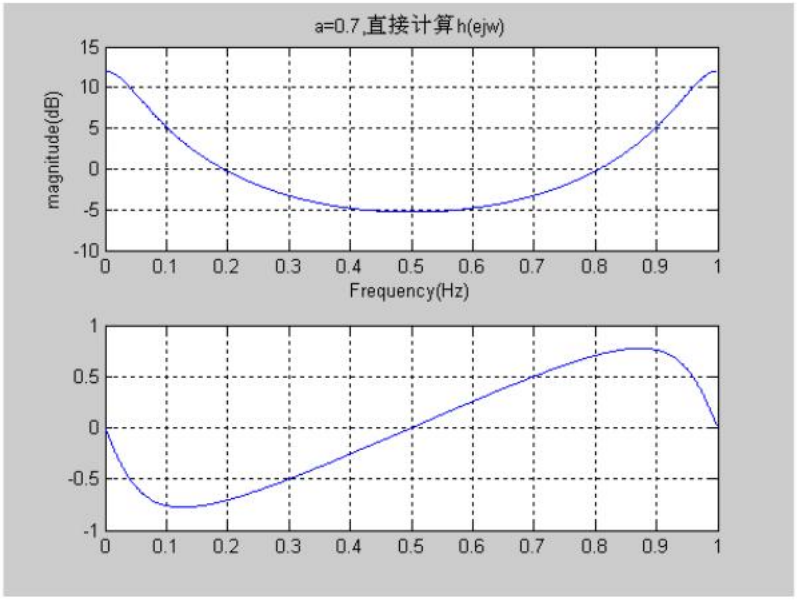


```
>> a=0.9;
>> A=[1，-a];
>> B=1;
>> freqz(B,A,256,'whole',1);
>> title('a=0.9');
```



（2）

```
>> a=0.7;
>> w=0:0.01:2*pi;
>> y=1./(1-a*exp(-j*w));
>> subplot(211);plot(w/2/pi,10*log(abs(y)));
>> xlabel('Frequency(Hz)');
>> ylabel('magnitude(dB)');
>> title('a=0.7,直接计算 h(ejw)');grid on;
>> subplot(212);plot(w/2/pi,unwrap(angle(y)));grid on;
```



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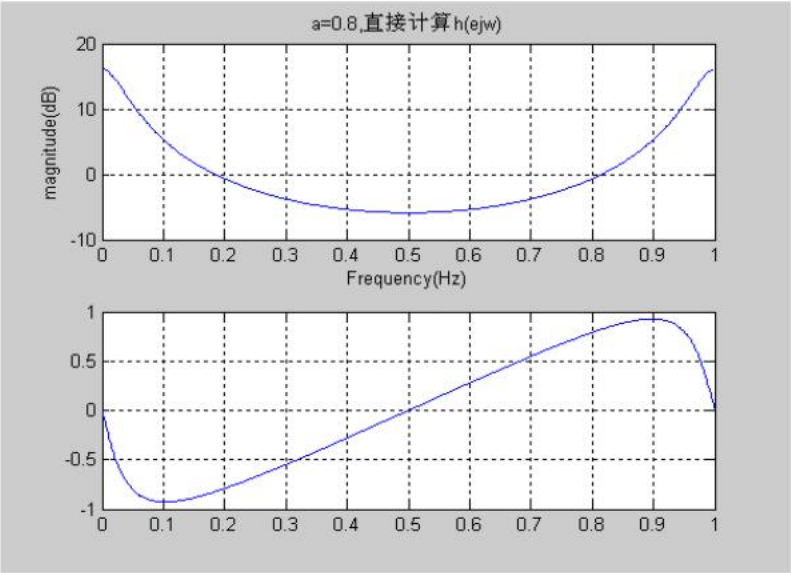
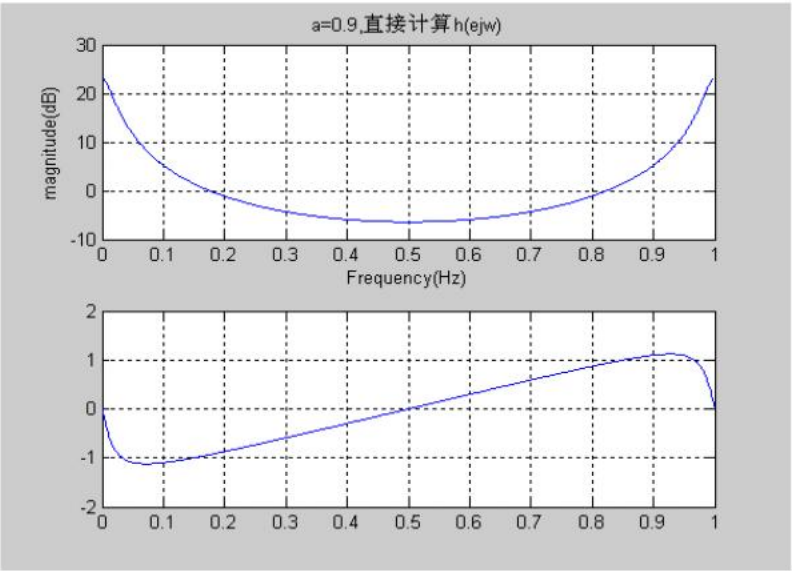
>> title('a=0.8,直接计算 h(ejw)');grid on;
>> subplot(212);plot(w/2/pi,unwrap(angle(y)));grid on;
```

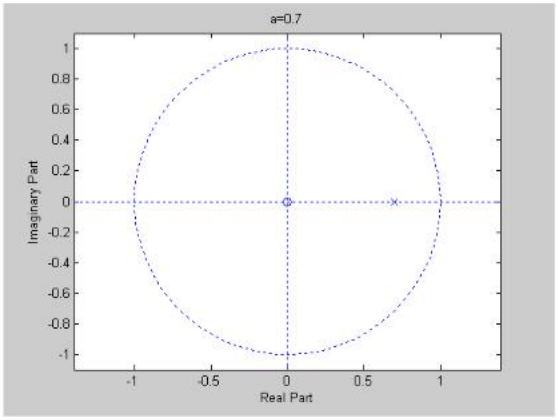



```
>> a=0.9;
>> w=0:0.01:2*pi;
>> y=1./(1-a*exp(-j*w));
>> subplot(211);plot(w/2/pi,10*log(abs(y)));
>> xlabel('Frequency(Hz)');
>> ylabel('magnitude(dB)');
>> title('a=0.9,直接计算 h(ejw)');grid on;
>> subplot(212);plot(w/2/pi,unwrap(angle(y)));grid on;
```



（3）零极点

```
>> a=0.7;
>> A=[1,-a];
>> B=1;
>> zplane(A,B);
```

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>> a=0.8;
>> A=[1,-a];
>> B=1;
>> zplane(A,B);
```

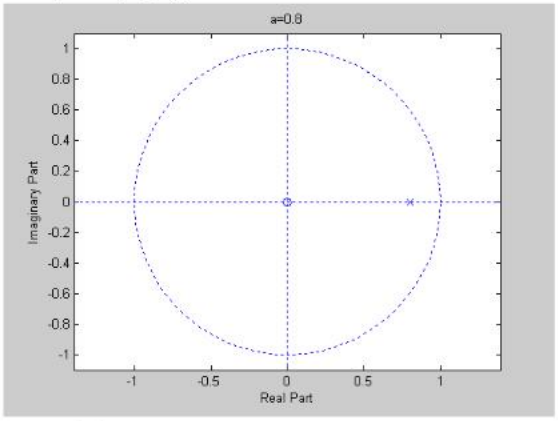


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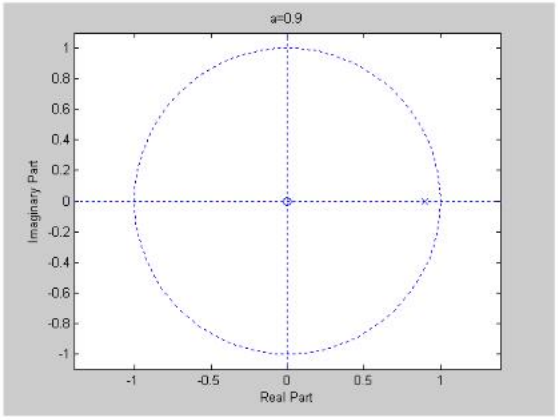
>> a=0.9;
>> A=[1,-a];
>> B=1;
>> zplane(A,B);
```

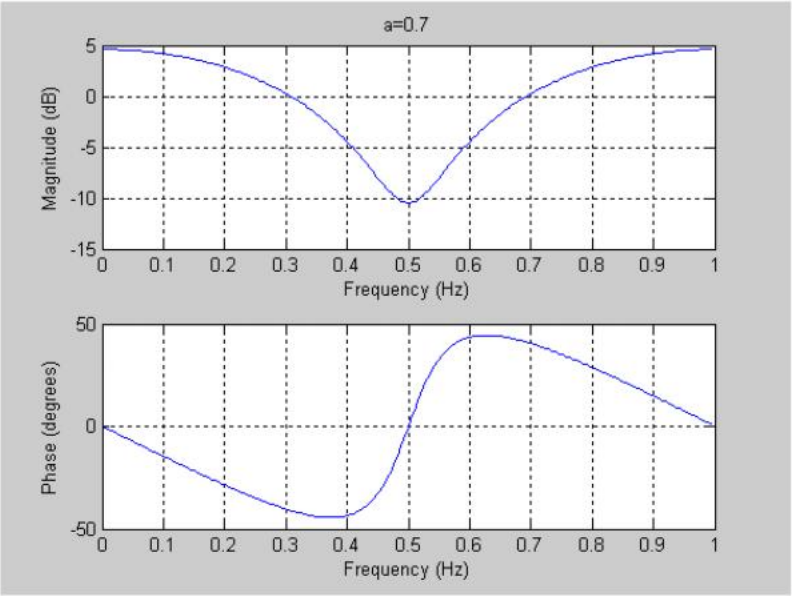


2、y(n)=x(n)+x(n-1)

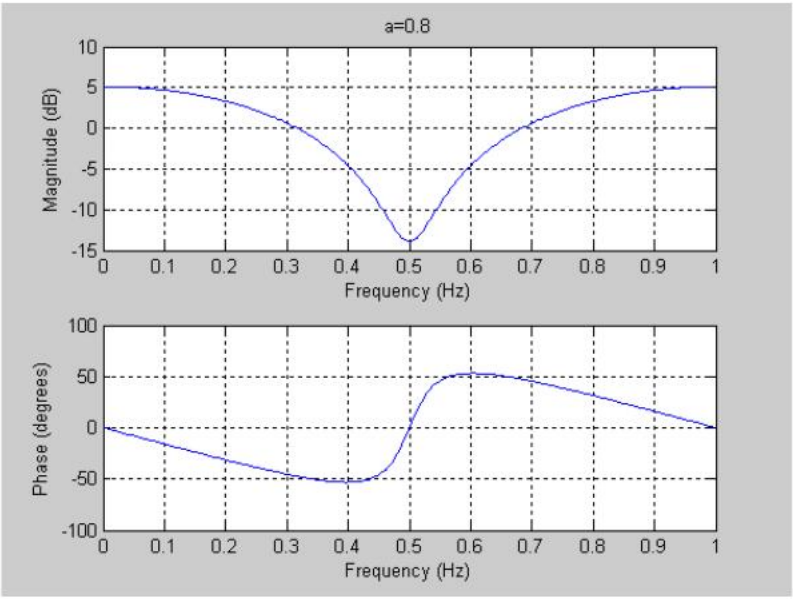
零点主要影响频率响应的谷值，零点愈靠近单位圆，谷值愈深，如果零点在单位圆上，频率特性为零，a=0.7 时幅度谷值较浅，a=0.9 时幅度谷值较深

（1）幅度特性

```
>> a=0.7;
>> A=1;
>> B=[1,a];
>> freqz(B,A,256,'whole',1);
>> title('a=0.7');
```




```
>> a=0.8;
>> A=1;
>> B=[1,a];
>> freqz(B,A,256,'whole',1);
>> title('a=0.8');
```



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>> a=0.9;
>> A=1;
>> B=[1,a];
>> freqz(B,A,256,'whole',1);
>> title('a=0.9');
```
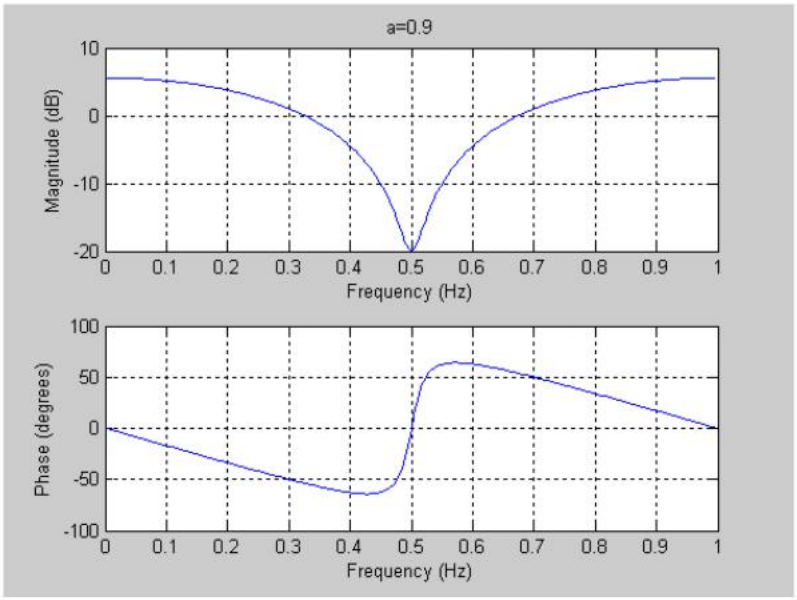
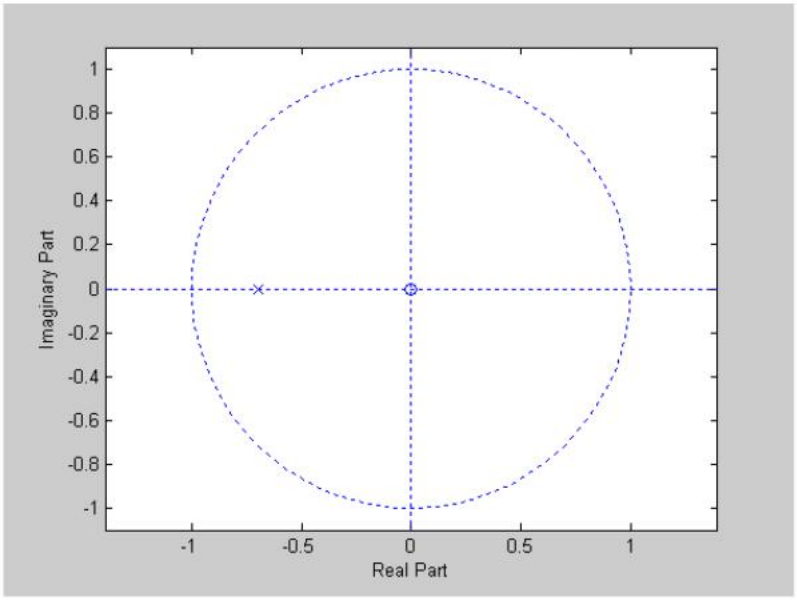
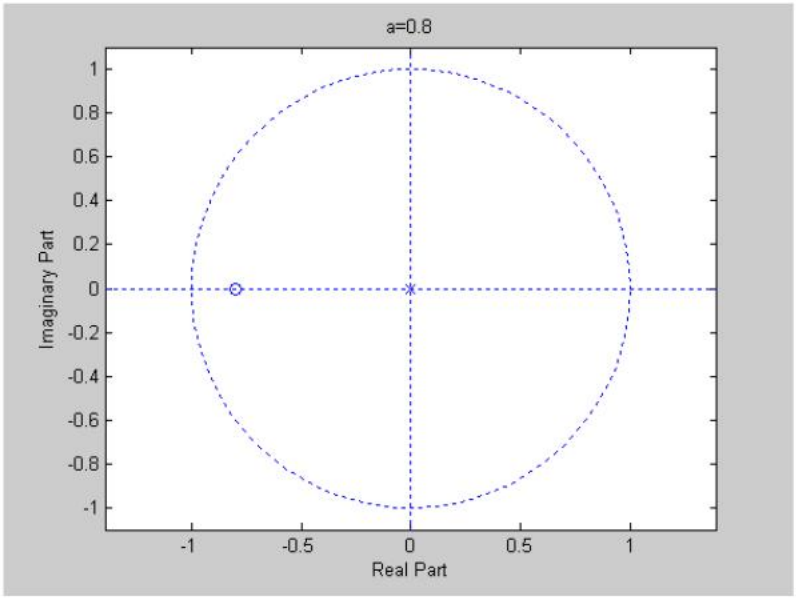



（2）、零极点

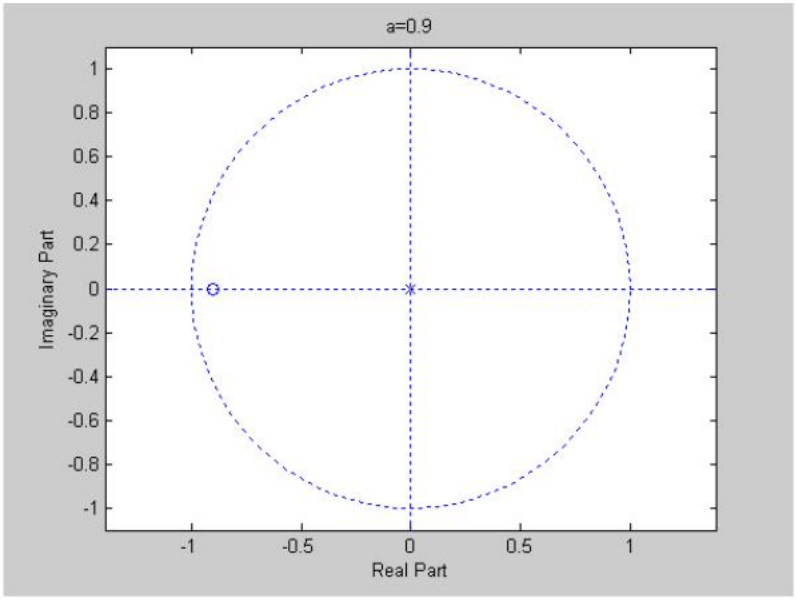
```
>> a=0.7;
>> A=1;
>> B=[1,a];
>> zplane(A,B);
```




```
>> a=0.8;
>> A=1;
>> B=[1,a];
>> zplane(A,B);
```




```
>> a=0.9;
>> A=1;
>> B=[1,a];
>> zplane(A,B);
```

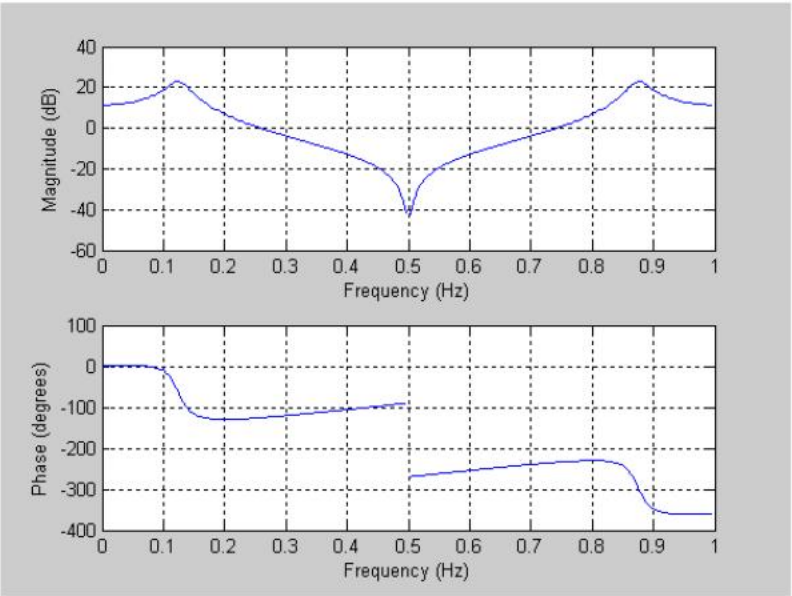


3、y(n)=1.273y(n-1)-0.81y(n-2)+x(n)+x(n-1)

零极点一般化，幅度响应出现多个波峰波谷。

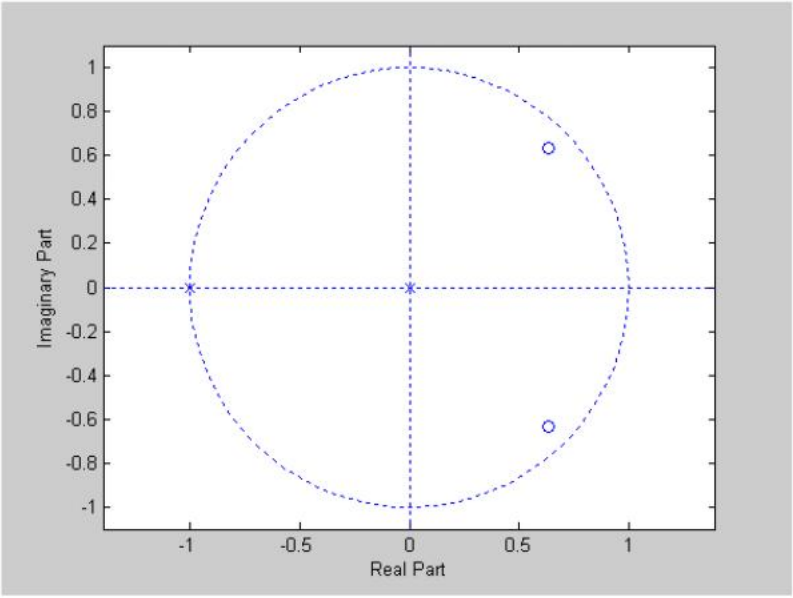
（1）系统的幅频特性曲线

```
>> A=[1,-1.273,0.81];
>> B=[1,1];
>> freqz(B,A,256,'whole',1);
```



(2)、零极点

```
>> A=[1,-1.273,0.81];
>> B=[1,1];
>> zplane(A,B);
```



三、总结

极点主要影响频率响应的峰值，极点愈靠近单位圆，峰值愈尖锐；零点主要影响频率特性的谷值，零点愈靠近单位圆，谷值愈深，当零点在单位圆上时，频率特性为零，一个传递函数有几个极点幅度响应就有几个峰值，对应出现一些谷值。频率特性还要受零点影响。