

数字信号处理第一次 Matlab 实验报告

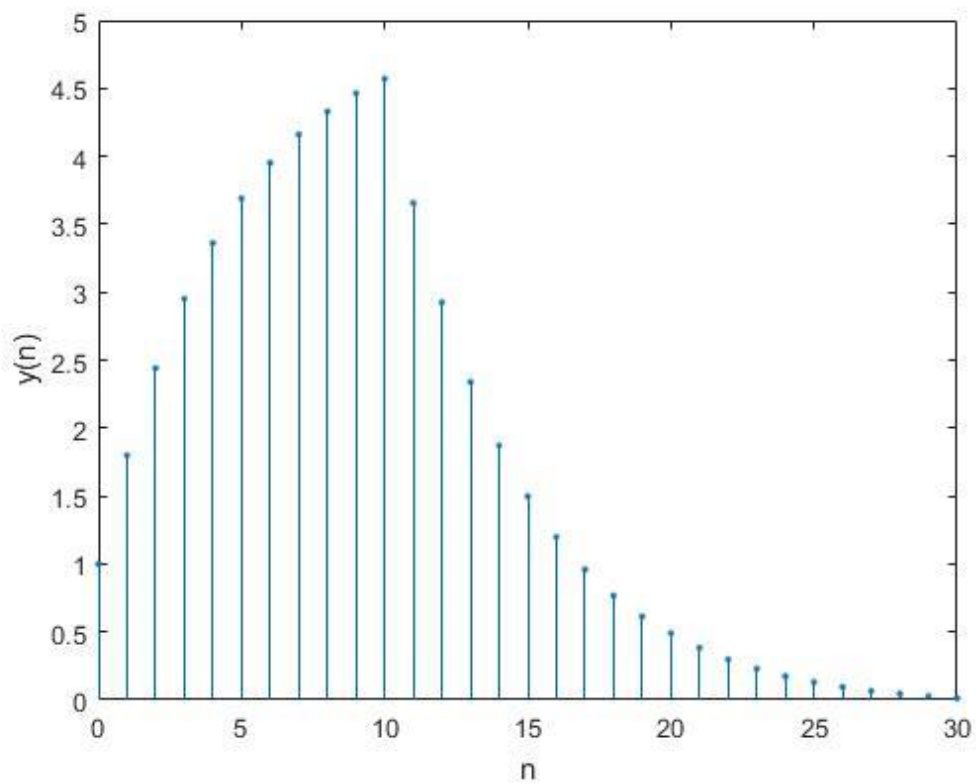
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练习题 1

Matlab 代码：

```
%%  
  
clear;  
close all;  
clc;  
  
%%  
  
nn1 = 0: 20;  
f1 = power(0.8, nn1);  
  
nn2 = 0: 10;  
f2 = heaviside(nn2+1);  
  
y = conv(f1, f2);  
  
%%  
  
l = 0: length(y)-1;  
  
figure(1);  
stem(l, y, 'r');  
xlabel('n');  
ylabel('y(n)');  
  
%%
```

结果：



练习题 2

Matlab 代码：

```
%%

clc;
clear;
close all;

%% p1 = 0.2

z = [0]'; k = 1;
n = (0: 500)*pi/500;
p1 = [0.2]';

[b1, a1] = zp2tf(z, p1, k);
[h1, w1] = freqz(b1, a1, n);

%% p2 = 0.5
```

```

p2 = [0.5]';

[b2, a2] = zp2tf(z, p2, k);
[h2, w2] = freqz(b2, a2, n);

%% p3 = 0.8

p3 = [0.8]';

[b3, a3] = zp2tf(z, p3, k);
[h3, w3] = freqz(b3, a3, n);

%%

figure(1);

subplot(3,2,1);
zplane(b1, a1);
subplot(3,2,2);
plot(w1/pi, abs(h1));
xlabel('\omega/\pi');
ylabel('|H(e^{j\omega})|');

subplot(3,2,3);
zplane(b2, a2);
subplot(3,2,4);
plot(w2/pi, abs(h2));
xlabel('\omega/\pi');
ylabel('|H(e^{j\omega})|');

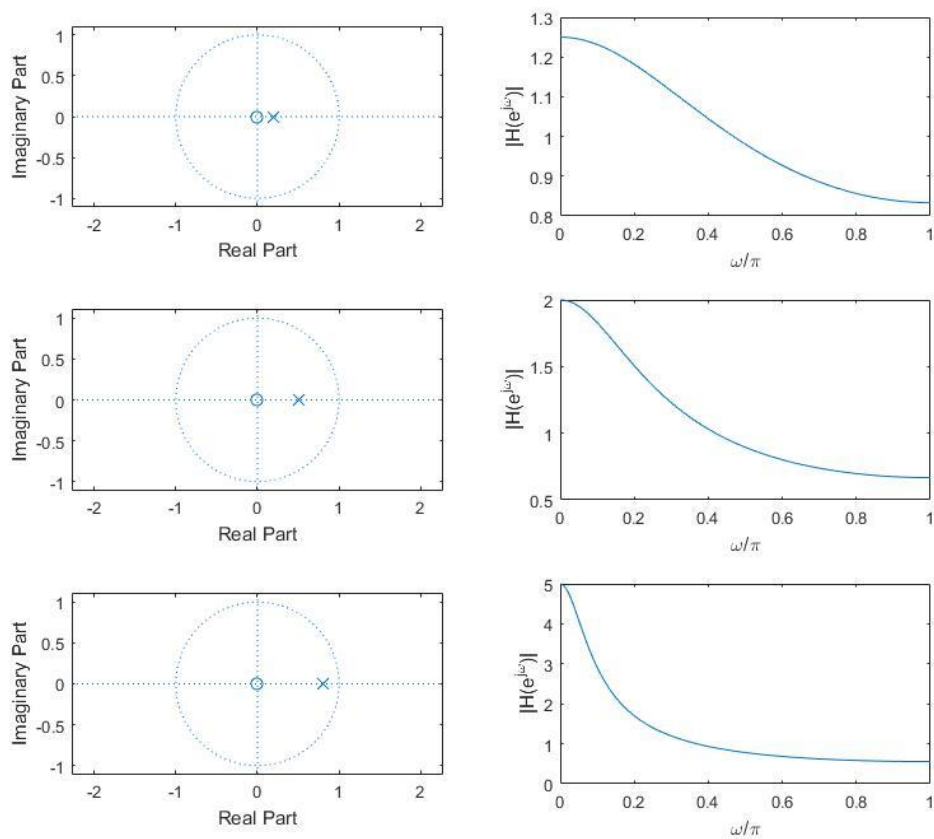
subplot(3,2,5);
zplane(b3, a3);
subplot(3,2,6);
plot(w3/pi, abs(h3));
xlabel('\omega/\pi');
ylabel('|H(e^{j\omega})|');

%%

```

结果：

(从上到下极点依次为 $p=0.2$; $p=0.5$; $p=0.8$) 1



练习题 3

Matlab 代码 :

```
%%

clc;
close all;
clear;

%%

xn = [0 1 2 3 4 5 6 7];
N = length(xn);
n = 0: (N-1);
k = 0: (N-1);
```

```
Xk = xn*exp(-1i*2*pi/N).^(n'*k);  
x = (Xk*exp(1i*2*pi/N).^(n'*k))/N;
```

```
%%
```

```
figure(1);
```

```
subplot(2, 2, 1);  
stem(n, xn);  
title('x(n)');
```

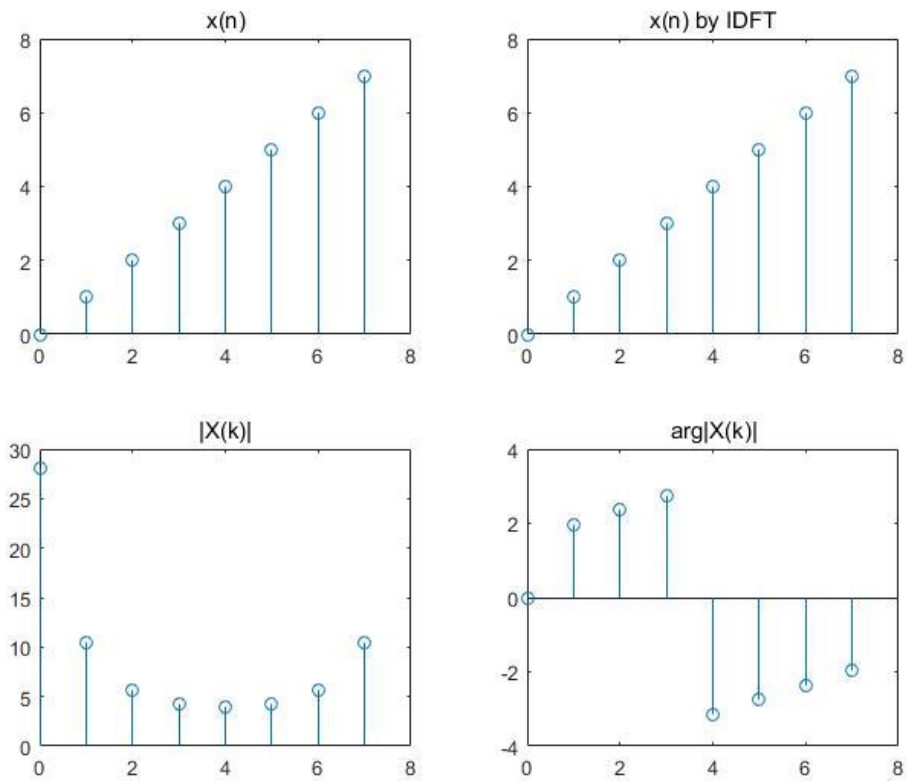
```
subplot(2, 2, 2);  
stem(n, x);  
title('x(n) by IDFT');
```

```
subplot(2, 2, 3);  
stem(k, abs(Xk));  
title('|X(k)|');
```

```
subplot(2, 2, 4);  
stem(k, angle(Xk));  
title('arg|X(k)|');
```

```
%%
```

结果：



练习题 4

Matlab 代码：

```
%%

clc;
close all;
clear;

%%

B = [1, -1];
A = [1, -2.5, 1];

[Hk, w] = freqz(B, A, 'whole');

%%

figure(1);
```

```

subplot(1, 2, 1);
zplane(B, A);

subplot(1, 2, 2);
plot(w/pi, abs(Hk));
xlabel('\omega/\pi');

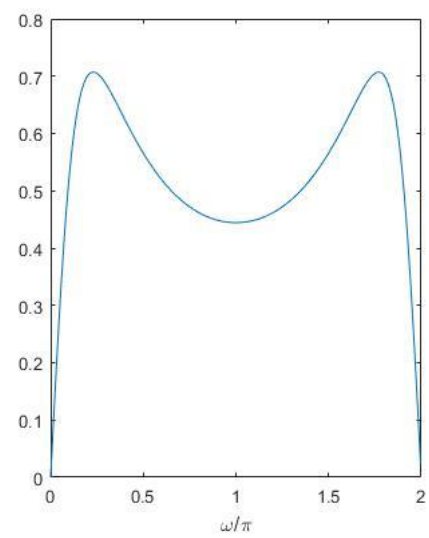
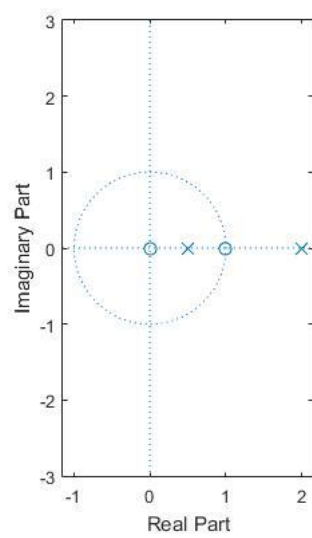
figure(2);

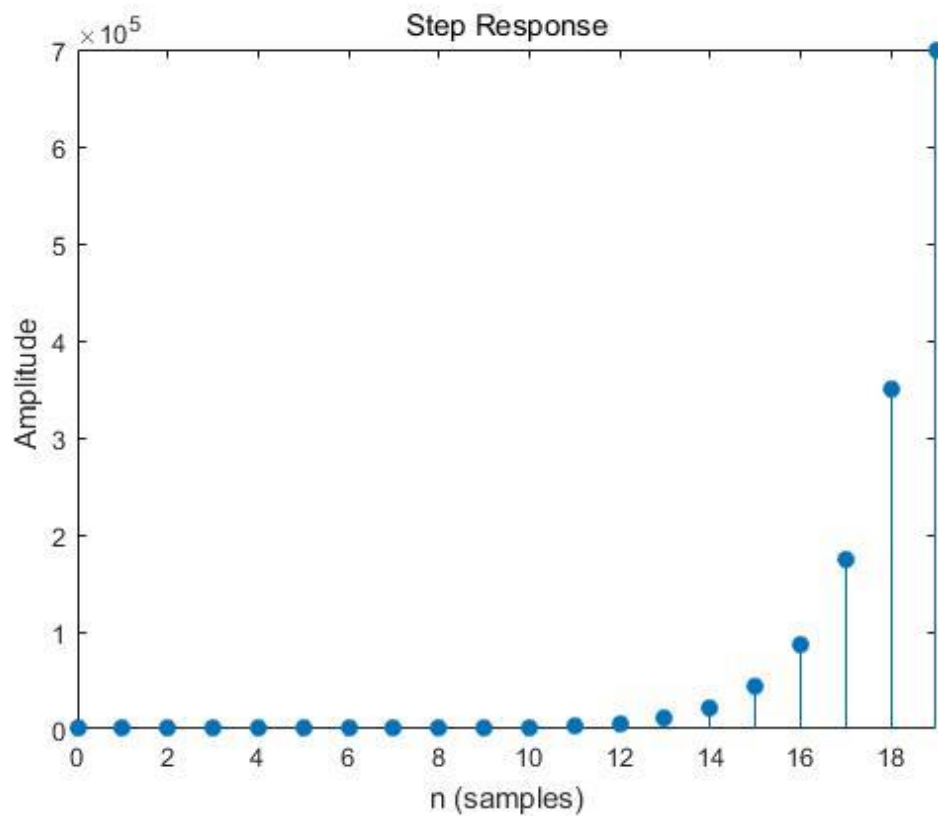
stepz(B, A, 20);

%%

```

结果：





根据图像，有一个极点位于单位圆外，且单位阶跃响应图有向无限延伸的趋势，所以该系统不稳定。

练习题 5

Matlab 代码：

```
%%

clc;
close all;
clear;

%%

B = [4, -1, 7, -2];
A = [1, -1.5, 0.5, -0.75];

%%
```



```
Hz1 = filt(B, A)
```

```
[sos, G] = tf2sos(B, A)
```

```
[c, b, a] = tf2par(B, A)
```

```
%%
```

结果：

Hz1 =

$$\frac{4 - z^{-1} + 7z^{-2} - 2z^{-3}}{1 - 1.5z^{-1} + 0.5z^{-2} - 0.75z^{-3}}$$

sos =

1.0000	-0.2841	0	1.0000	-1.5000	0
1.0000	0.0341	1.7597	1.0000	0.0000	0.5000

G =

4

c =

2.6667

b =

-3.4545	-2.1818
4.7879	0

a =

1.0000	0.0000	0.5000
1.0000	-1.5000	0

根据结果可以写出原传递函数的级联型和并联型如下：

$$H(z) = 4 * \frac{1 - 0.2841z^{-1}}{1 - 1.5z^{-1}} * \frac{1 + 0.0341z^{-1} + 1.7597z^{-2}}{1 + 0.5z^{-2}}$$

$$H(z) = 2.6667 + \frac{-3.4545 - 2.1818z^{-1}}{1 + 0.5z^{-2}} + \frac{4.7879}{1 - 1.5z^{-1}}$$