

Matlab 编程第五次作业

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1 画出 $a[n]$ 和 $x[n]$ 的实部和虚部序列

图:

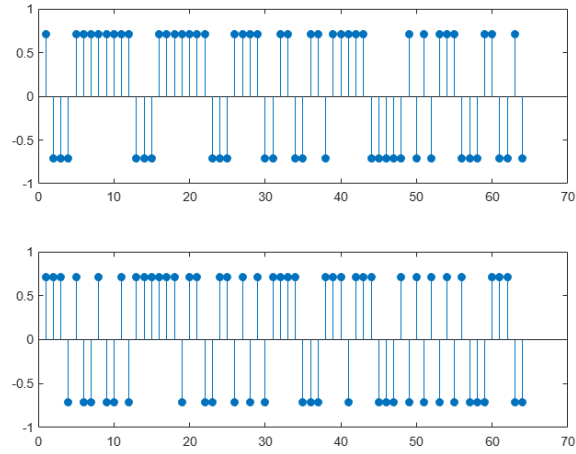


图 1: $a[n]$ 实部以及虚部

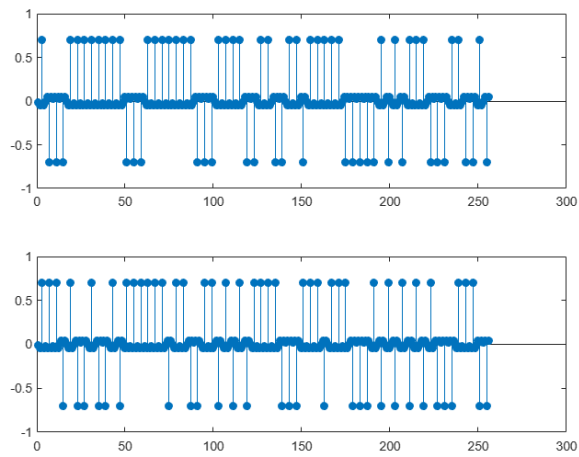


图 2: $x[n]$ 实部以及虚部

2 试利用 DFT 实现循环卷积与线性卷积关系、DFT 时频域卷积与相乘关系、逆系统、上下采样等性质

```
y = conv(h,x);  
Y = fft(y);  
H = fft(h',271);  
X_r = Y./H;  
x_r = ifft(X_r);  
x_r = x_r(1:256);
```

3 从 $y[n]$ 中获得 $a[n]$ 的估计值 $a1[n]$, (注意下采样序号对齐)

$$\begin{aligned}
 &[\\
 &a1 = \\
 &\quad -0.0112 - 0.0112i \ 0.0000 - 0.0223i \ 0.0223 - 0.0223i \ 0.0223 + 0.0000i \ 0.0000 + 0.0000i \\
 &\quad -0.0223 + 0.0000i \ -0.0223 + 0.0223i \ -0.0223 + 0.0000i \ -0.0223 + 0.0000i \ -0.0223 + 0.0223i \\
 &\quad -0.0223 + 0.0000i \ -0.0223 + 0.0000i \ 0.0000 + 0.0000i \ 0.0223 - 0.0223i \ 0.0223 - 0.0223i \ 0.0000 \\
 &\quad - 0.0223i \ -0.0223 - 0.0223i \ -0.0223 - 0.0223i \ -0.0223 + 0.0000i \ -0.0223 + 0.0000i \ -0.0223 - \\
 &\quad 0.0223i \ -0.0223 + 0.0000i \ 0.0000 + 0.0223i \ 0.0223 + 0.0000i \ 0.0223 - 0.0223i \ 0.0000 + 0.0000i \\
 &\quad -0.0223 + 0.0000i \ -0.0223 + 0.0000i \ -0.0223 + 0.0000i \ 0.0000 + 0.0000i \ 0.0223 + 0.0000i \\
 &\quad 0.0000 - 0.0223i \ -0.0223 - 0.0223i \ 0.0000 - 0.0223i \ 0.0223 + 0.0000i \ 0.0000 + 0.0223i \ -0.0223 \\
 &\quad + 0.0223i \ 0.0000 + 0.0000i \ 0.0000 - 0.0223i \ -0.0223 - 0.0223i \ -0.0223 + 0.0000i \ -0.0223 + \\
 &\quad 0.0000i \ -0.0223 - 0.0223i \ 0.0000 - 0.0223i \ 0.0223 + 0.0000i \ 0.0223 + 0.0223i \ 0.0223 + 0.0223i \\
 &\quad 0.0223 + 0.0000i \ 0.0000 + 0.0000i \ 0.0000 + 0.0000i \ 0.0000 + 0.0000i \ 0.0000 + 0.0000i \ 0.0000 \\
 &\quad + 0.0000i \ -0.0223 + 0.0000i \ -0.0223 + 0.0000i \ 0.0000 + 0.0000i \ 0.0223 + 0.0000i \ 0.0223 + \\
 &\quad 0.0223i \ 0.0000 + 0.0223i \ -0.0223 + 0.0000i \ 0.0000 - 0.0223i \ 0.0223 - 0.0223i \ 0.0000 + 0.0000i \\
 &\quad 0.0000 + 0.0223i \\
 &]
 \end{aligned}$$

4 画出 $a1[n]$ 的实部和虚部序列

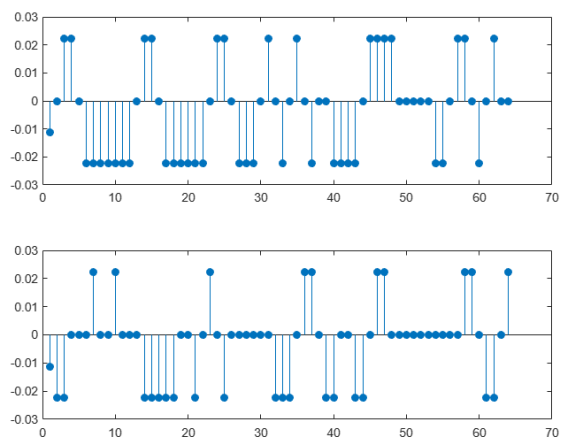


图 3: $a[n]$ 实部以及虚部

5 计算 $a[n]$ 与 $a1[n]$ 的均方误差

$$error = 0.0060 - 0.0922i$$

程序：

```
%% generate the signal
h = [1 0 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0.25];
N = 64;
ModuA = [-1,1]/sqrt(2);
a = randsrc(N,1,ModuA,12345) + i *randsrc(N,1,ModuA,54321);
upFactor = 4;
a_up = upsample(a, upFactor);
rolloff = 1;
span = 4;
rcosFilter = rcosdesign(1,4,1);
x = filter(rcosFilter, 1, a_up);

%% a[n] and x[n] series
%第一题
figure(1)
subplot(2,1,1)
stem(real(a),'filled');
subplot(2,1,2)
stem(imag(a),'filled');

figure(2)
subplot(2,1,1)
stem(real(x),'filled');
subplot(2,1,2)
stem(imag(x),'filled');

%% recover the signal
%第二题
y = conv(h,x);
Y = fft(y);
H = fft(h',271);
X_r = Y./H;
x_r = ifft(X_r);
x_r = x_r(1:256);

x_rup = filter(1, rcosFilter, x_r);

%第三题
```

```
a1 = downsample(x,4);

%第四题
figure(3)
subplot(2,1,1)
stem(real(a1),'filled');
subplot(2,1,2)
stem(imag(a1),'filled');

%第五题
error = mse(a,a1);
error
```
