

信号作业 (5)

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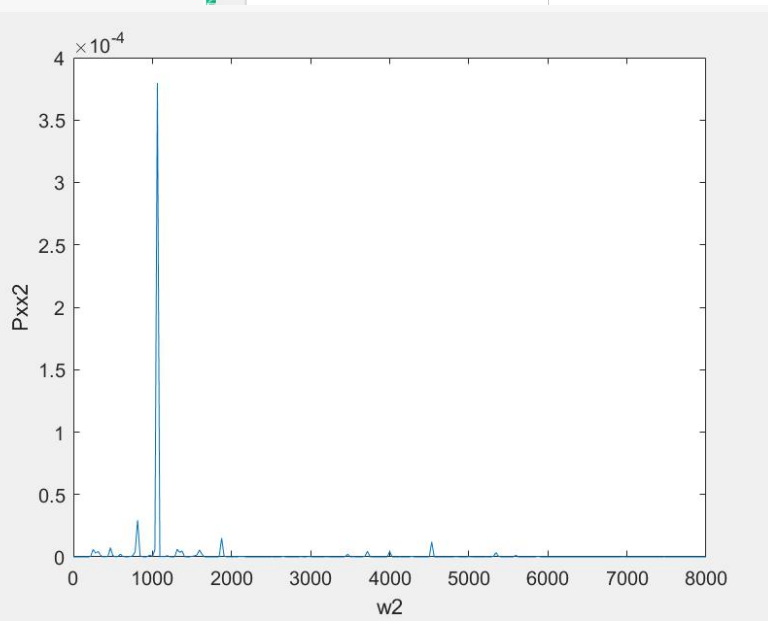
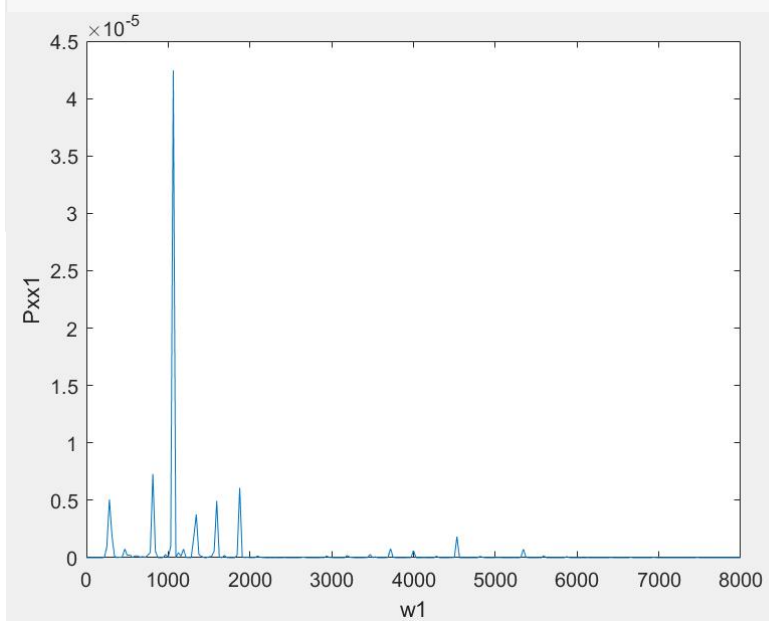
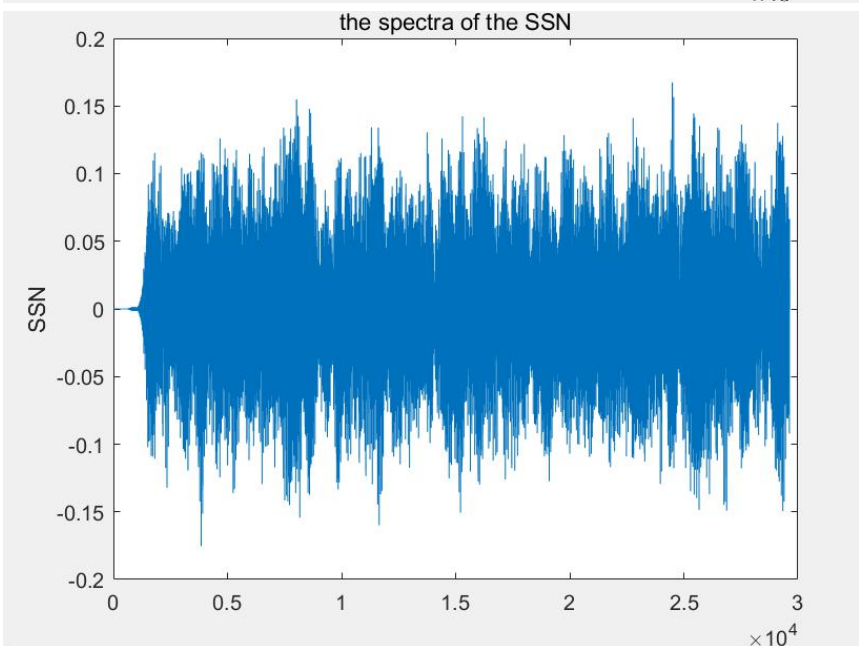
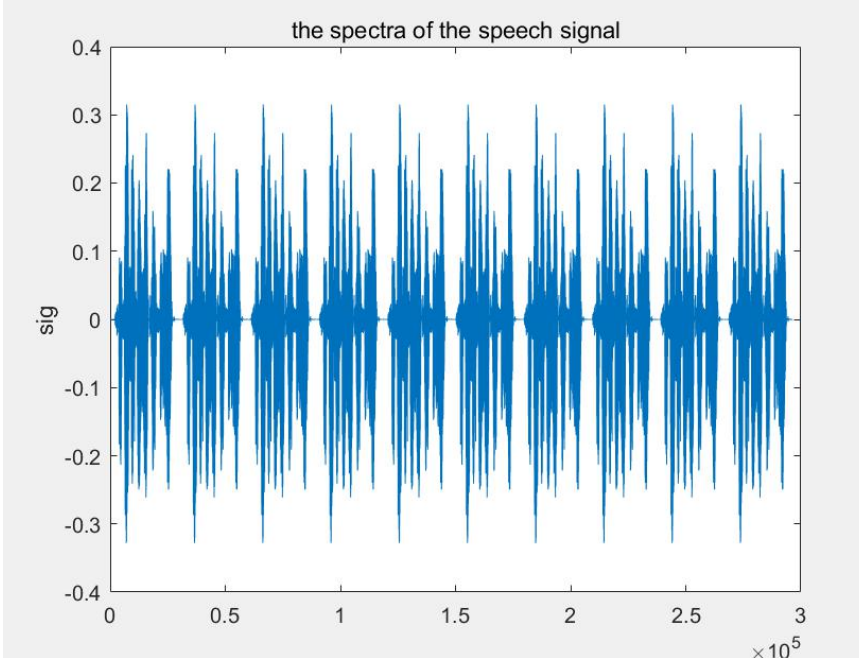
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5.1

```
[x0,fs]=audioread("C_01_02.wav");
sound(x0,fs);
x=x0';%转置的理由: x0 为列向量, 如果不转置会导致 y 的占用内存 过大, 运行不了, 见附图
```

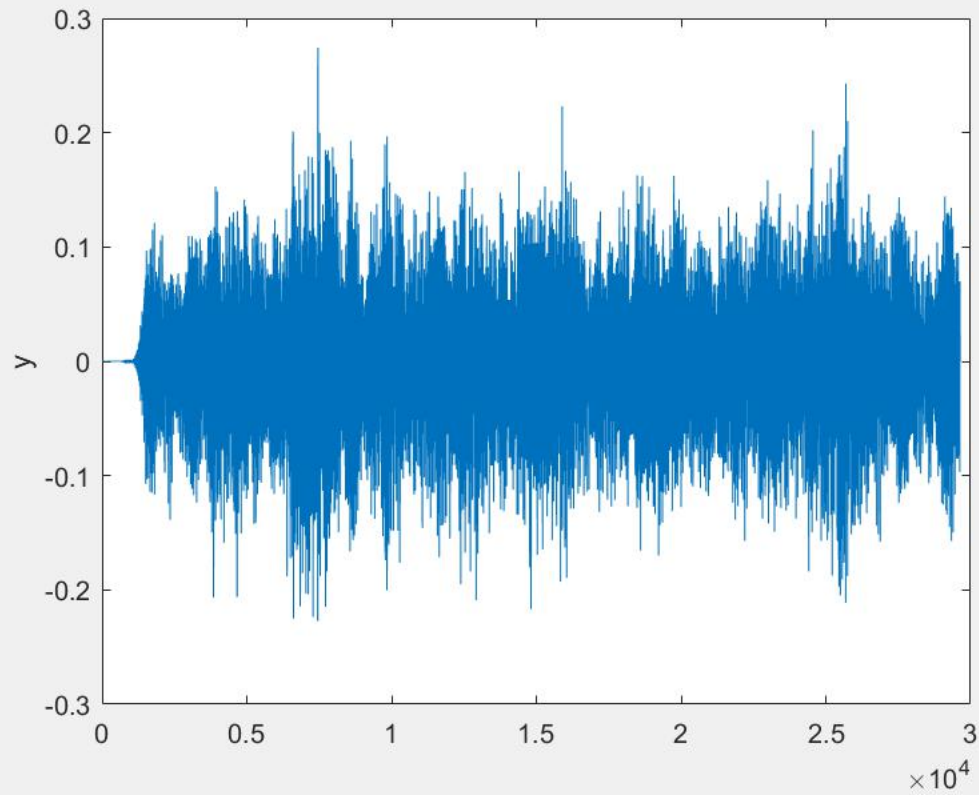
```
N=length(x); noise=1-2*rand(1,N);
sig= repmat(x,1,10);
%sound(sig,fs); [Pxx1,w1]=periodogram(sig,[],512,fs);
plot(w1,Pxx1);
figure;plot(sig);title('the spectra of the speech signal');
b=fir2(3000,w1/(fs/2),sqrt(Pxx1/max(Pxx1)));
[h,wh]=freqz(b,1,128);
SSN=filter(b,1,noise);
figure;plot(SSN);title('the spectra of the SSN');
[Pxx2,w2]=periodogram(SSN,[],512,fs);
figure;plot(w2,Pxx2);
```

```
untitled2.mlx
1 %第一问
2 filename='D:\MATLABPractice\C_01_02.wav';
3 [x0,fs]=audioread(filename);
4 %sound(x0,fs);
5 N=length(x0);
6 noise=1-2*rand(1,N);
7 sig= repmat(x0,1,10);
8 %sound(sig,fs);
9 [Pxx1,w1]=periodogram(sig,[],512,fs);
10 subplot(4,1,1);plot(sig);title('the spectra of
11 b=fir2(3000,w1/(fs/2),sqrt(Pxx1/max(Pxx1)));
12 [h,wh]=freqz(b,1,128);
13 SSN=filter(b,1,noise);
14 [Pxx2,w2]=periodogram(SSN,[],512,fs);
15 subplot(4,1,2);plot(SSN);title('the spectra of
16 %第二问
17 SNR=20*log10(norm(x0)/norm(SSN));
18 SSN=SSN*10^((5+SNR)/20);
19 y=x0+SSN;%用tal1防止数据占用内存过大
20 y=y/norm(y)*norm(x0);
21 %第三问
22 y=abs(y);
23 %第二问b问第一小问
24 [b1,a1]=butter(2,100/(fs/2));
25 [h1,wh1]=filter(b1,a1,y);
26 env=abs(h1);
27 subplot(4,1,3);plot(w1,h1);
```



5.2

```
SNR=20*log10(norm(x)/norm(SSN));  
SSN=SSN*10^((5+SNR)/20);%SNR could be adjusted to -5dB by multiplying a certain coefficient.  
y=x+SSN;  
y=y/norm(y)*norm(x);  
figure;plot(y);  
sound(y,fs);
```

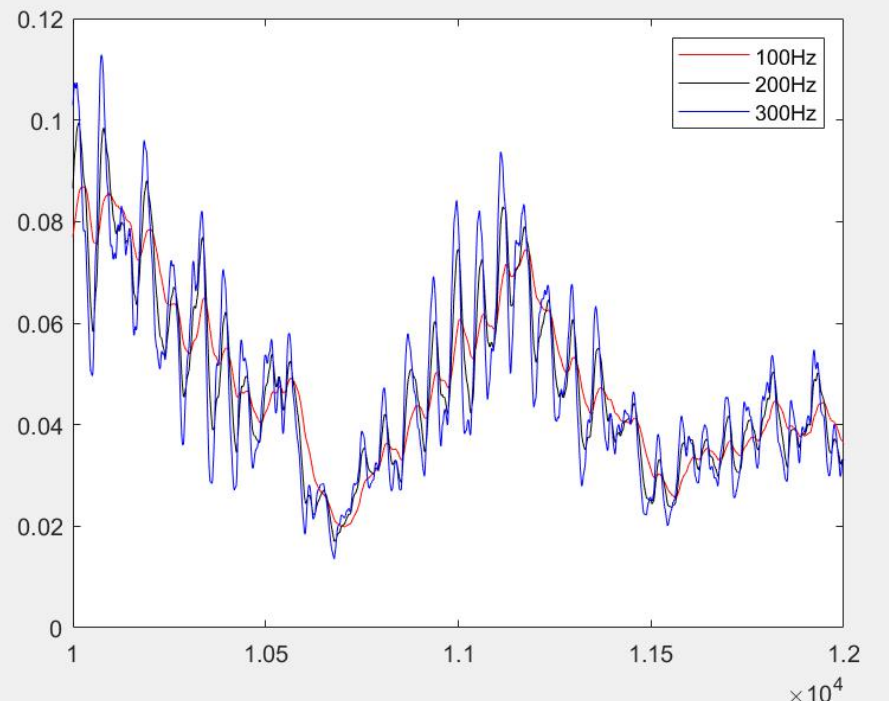
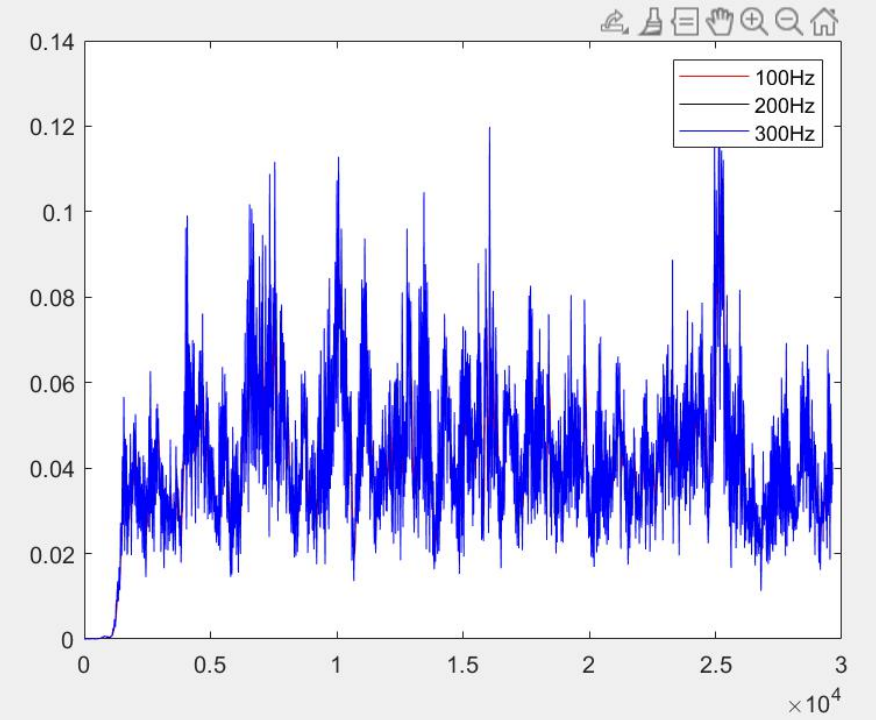


5.3(a)

```
y=abs(y);  
[b1,a1]=butter(2,100/(fs/2));  
env1=filter(b1,a1,y);  
[b2,a2]=butter(2,200/(fs/2));  
env2=filter(b2,a2,y);  
[b3,a3]=butter(2,300/(fs/2));  
env3=filter(b3,a3,y);
```

```
figure;plot(env1,'r');hold on;  
plot(env2,'k');hold on;  
plot(env3,'b');legend('100Hz','200Hz','300Hz');  
figure;plot(10000:12000,env1(10000:12000),'r');hold on;%全画太密，取部分分析  
plot(10000:12000,env2(10000:12000),'k');hold on;  
plot(10000:12000,env3(10000:12000),'b');legend('100Hz','200Hz','300Hz');
```

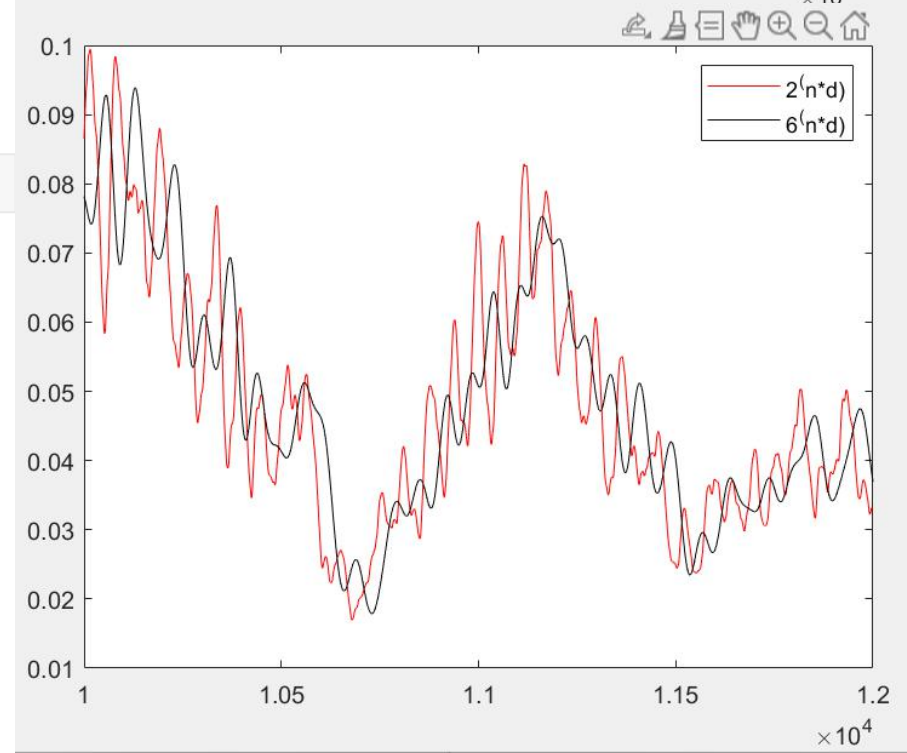
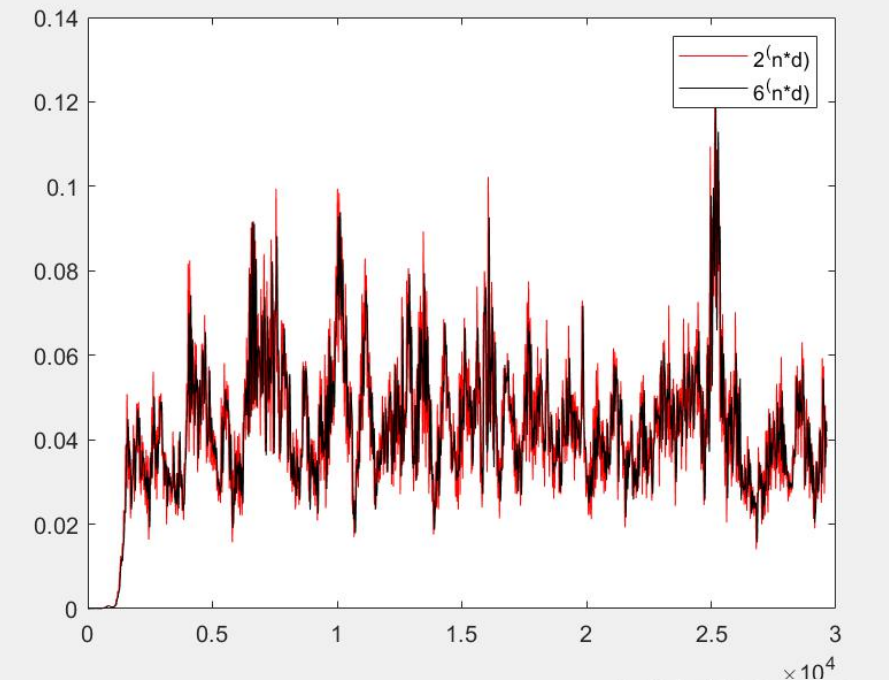
%the higher cutoff frequency is, the steeper and the denser the envelope is.



5.3(b)

```
[b4,a4]=butter(2,200/(fs/2));  
env4=filter(b4,a4,y);  
[b5,a5]=butter(6,200/(fs/2));  
env5=filter(b5,a5,y);  
figure;plot(env4,'r');hold on;  
plot(env5,'k');  
legend('2^(n*d)','6^(n*d)');  
figure;plot(10000:12000,env4(10000:12000),'r');hold on;%全画太密, 取部分分析  
plot(10000:12000,env5(10000:12000),'k');  
legend('2^(n*d)','6^(n*d)');
```

%the higher the order of filter is,the flatter and looser the envelope is.



5.4

```
[x0,fs]=audioread("C_01_02.wav");
sound(x0,fs);
x=x0';%转置的理由: x0 为列向量, 如果不转置会导致 y 的占用内存过大, 运行不了, 见附图
N=length(x);
noise=1-2*rand(1,N);
sig= repmat(x,1,10);
%sound(sig,fs);
[Pxx1,w1]=periodogram(sig,[],512,fs);
plot(w1,Pxx1);
plot(sig);title('the spectra of the speech signal');
b=fir2(3000,w1/(fs/2),sqrt(Pxx1/max(Pxx1)));
[h,wh]=freqz(b,1,128);
SSN=filter(b,1,noise);
figure;plot(SSN);title('the spectra of the SSN');
[Pxx2,w2]=periodogram(SSN,[],512,fs);
figure;plot(w2,Pxx2);
SNR=20*log10(norm(x)/norm(SSN));
SSN=SSN*10^((5+SNR)/20);%SNR could be adjusted to -5dB by multiplying a certain coefficient.
y=x+SSN;
y=y/norm(y)*norm(x);
figure;plot(y);
sound(y,fs);
audiowrite("C_01_02+noise.wav",y,fs);%在y被破坏前录制
```