

## %第一问

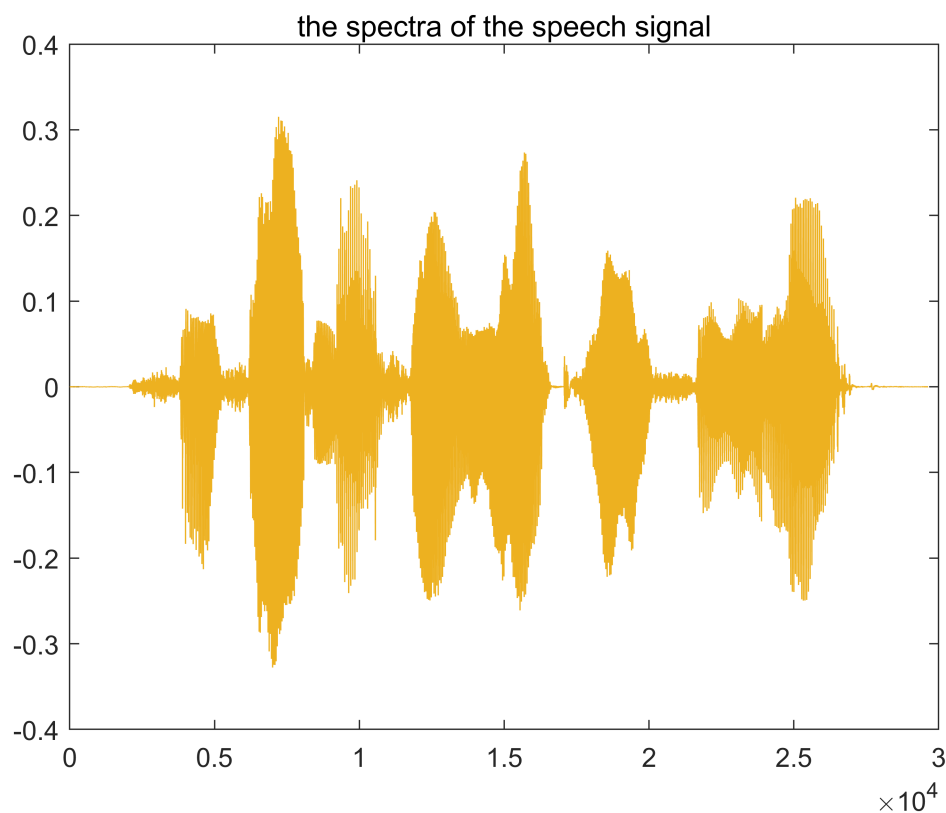
```
filename='D:\MATLABPractice\C_01_02.wav'
```

```
filename =  
'D:\MATLABPractice\C_01_02.wav'
```

```
[x0,fs]=audioread(filename);  
%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)
```

```
noise = 1×29636  
-0.0238 -0.8832 0.7932 0.5321 0.7825 0.9783 0.3960 0.9791 ...
```

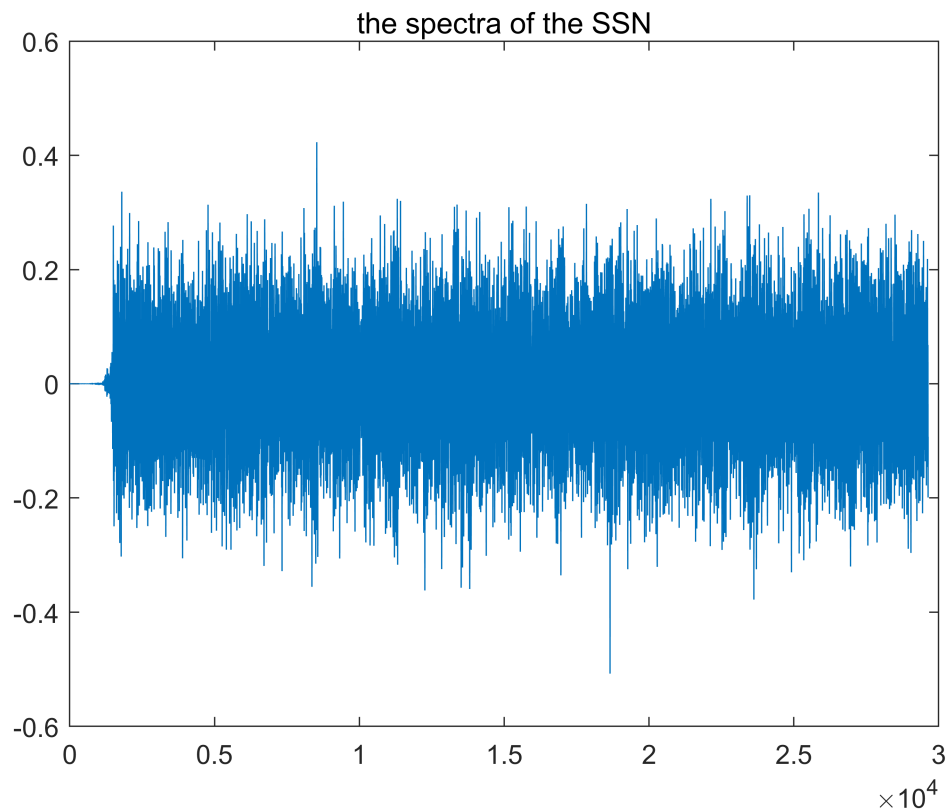
```
sig=repmat(x0,1,10);  
%sound(sig,fs);  
[Pxx1,w1]=periodogram(sig,[],512,fs);  
plot(sig);title('the spectra of the speech signal')
```



```
b=fir2(3000,w1/(fs/2),sqrt(Pxx1/max(Pxx1)));  
[h,wh]=freqz(b,1,128);  
SSN=filter(b,1,noise)
```

```
SSN = 1×29636  
0.0000 0.0000 -0.0000 -0.0000 -0.0000 0.0000 0.0000 0.0000 ...
```

```
[Pxx2,w2]=periodogram(SSN,[],512,fs);  
plot(SSN);title('the spectra of the SSN')
```



%第二问

```
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);
```

%第三问

```
y=abs(y);
```

%第三问 b 问第一小问

```
[b1,a1]=butter(2,100/(fs/2));
```

```
h1=filter(b1,a1,y);
```

```
env1=abs(h1);
```

```
[b2,a2]=butter(2,200/(fs/2));
```

```
h2=filter(b2,a2,y);
```

```
env2=abs(h2)
```

```
env2 = 1x29636
```

```
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ...
```

```
[b3,a3]=butter(2,300/(fs/2));
```

```
h3=filter(b3,a3,y);
```

```
env3=abs(h3)
```

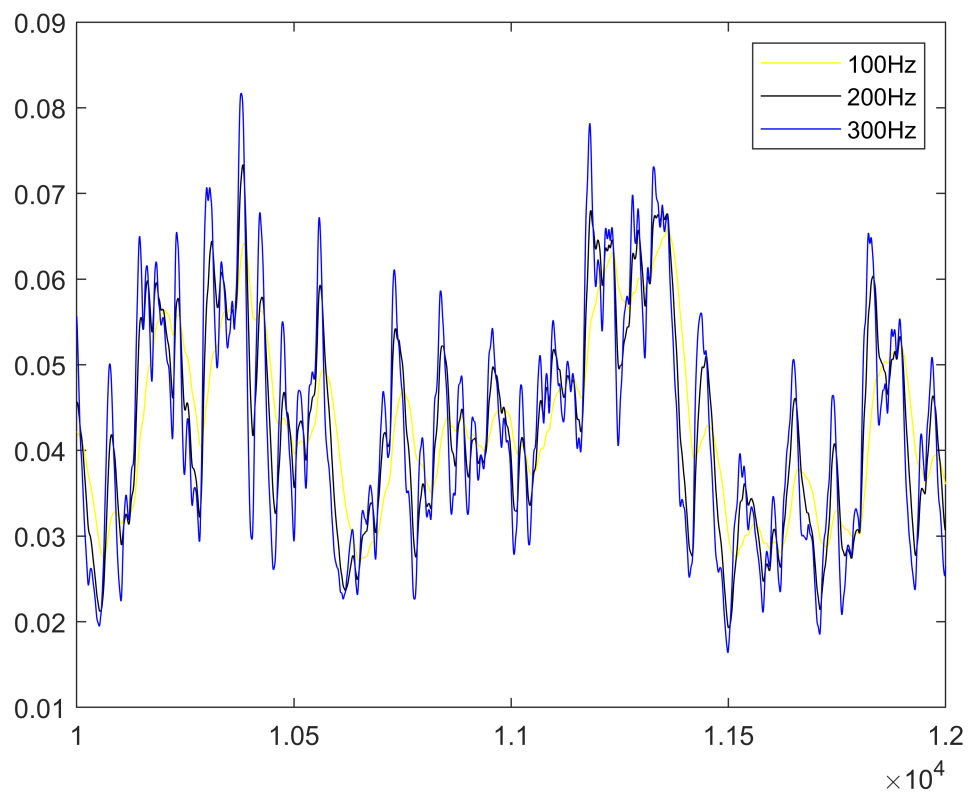
```
env3 = 1x29636
```

```
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ...
```

```
plot(10000:12000,env1(10000:12000),'y');hold on;
```

```
plot(10000:12000,env2(10000:12000),'k');hold on;
```

```
plot(10000:12000,env3(10000:12000),'b');legend('100Hz','200Hz','300Hz');%黄色代表 100Hz, 黑色代表
```



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