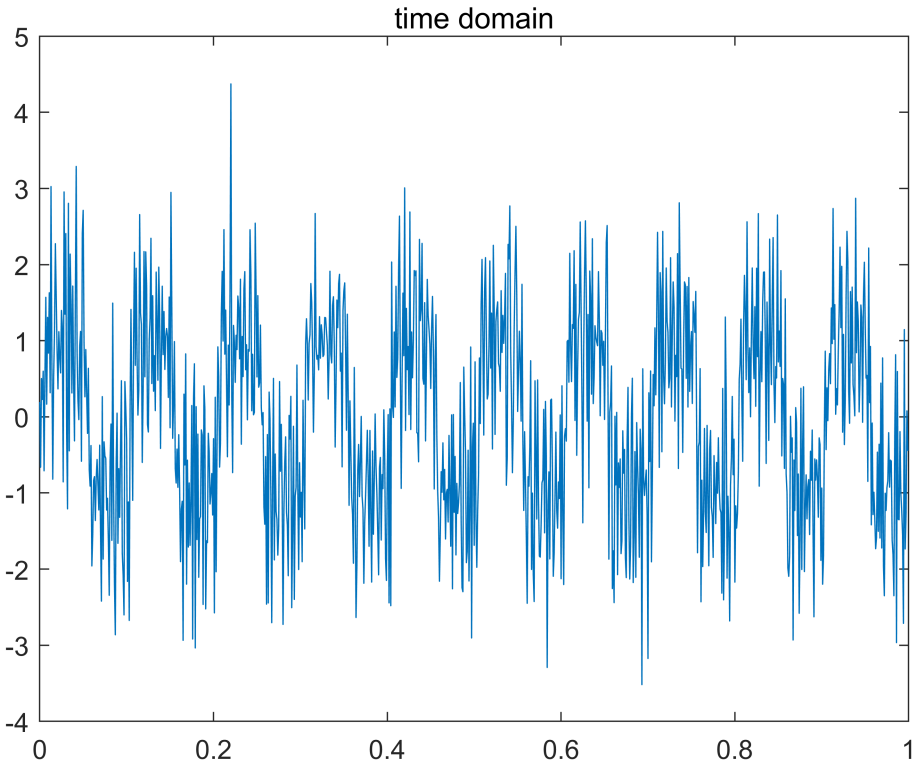
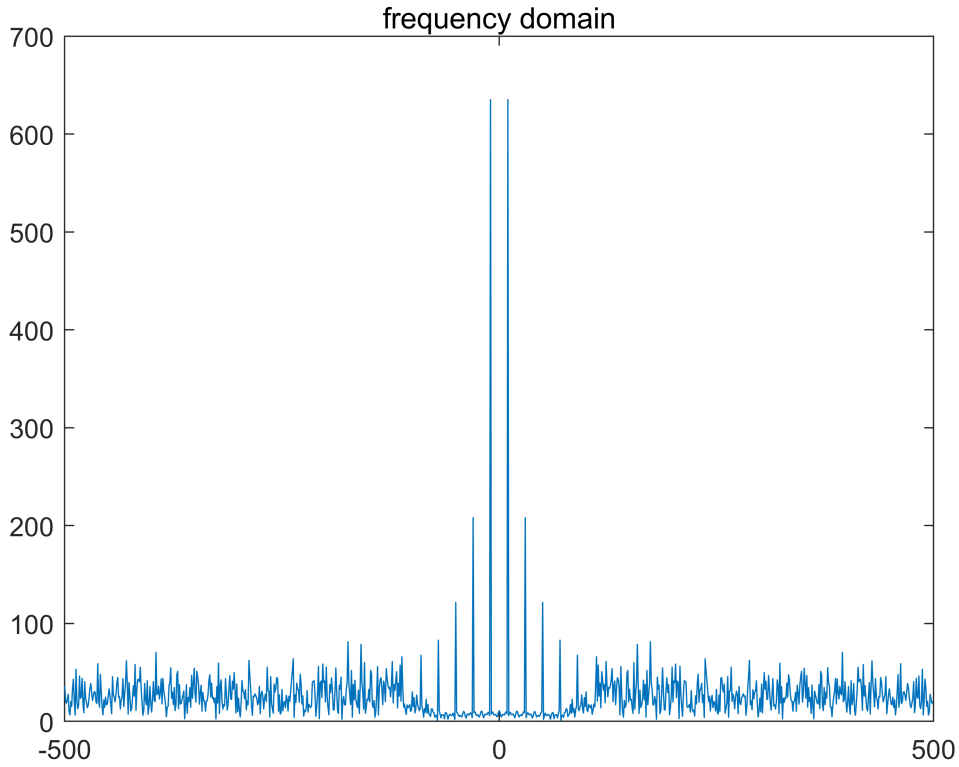
```
%(1)load file
load('Q1\Q1.mat');

%(2)load the measurement and plot it in the time domain
t1=0:1/Fs:1;
t1=t1(1:end-1);
plot(t1,xs_noised);title("time domain");
```



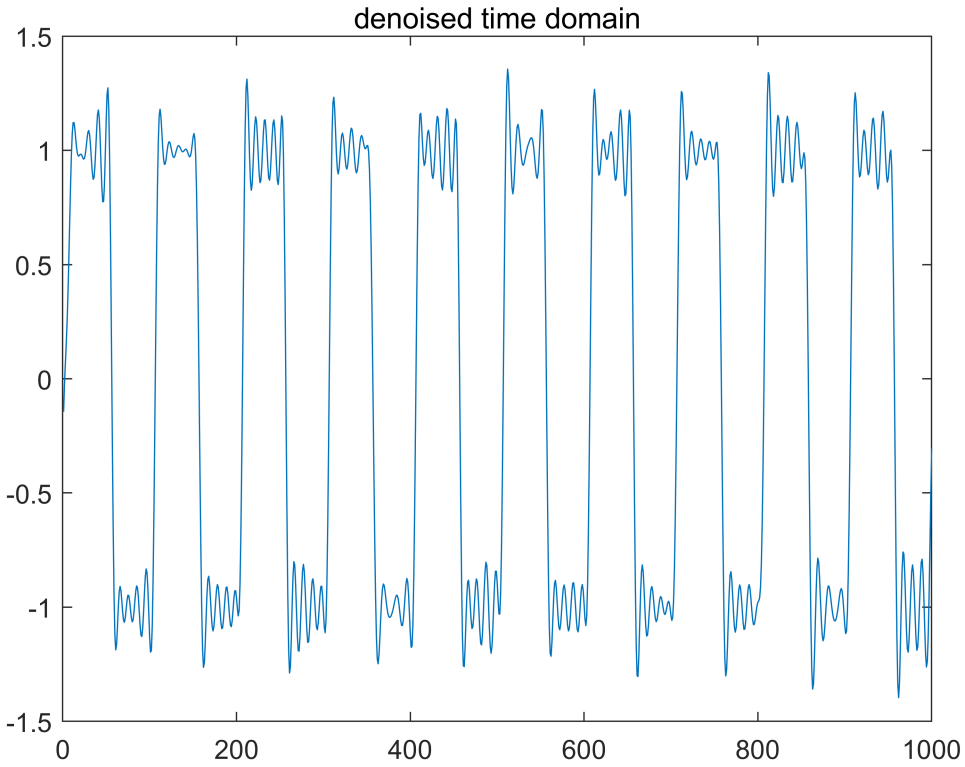

```
%(3)
Y=fft(xs_noised);
N=1000;
f=(0:N-1)*Fs./(N);
fY=fftshift(Y);
t2=(-500:499);
plot(t2,abs(fY));%plot the amplitude spectrum of the measurement in the frequency domain

title("frequency domain");
```



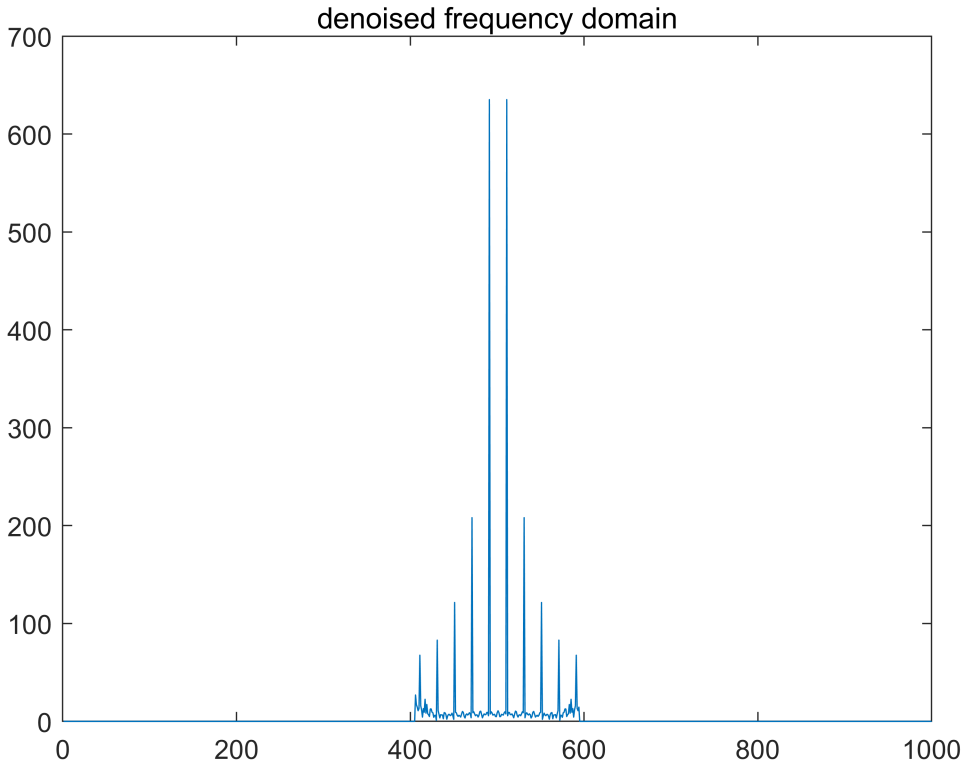

```
%disp(abs(Y));%(3) disp Y to find the frequency
%if the documents are shown,it will take too many pages
%so add "%" to let the output of the code easier to look

disp("the frequency bound of lowpass signal is about 90~100 so let the lowpass be 95");
```

```
the frequency bound of lowpass signal is about 90~100 so let the lowpass be 95
```

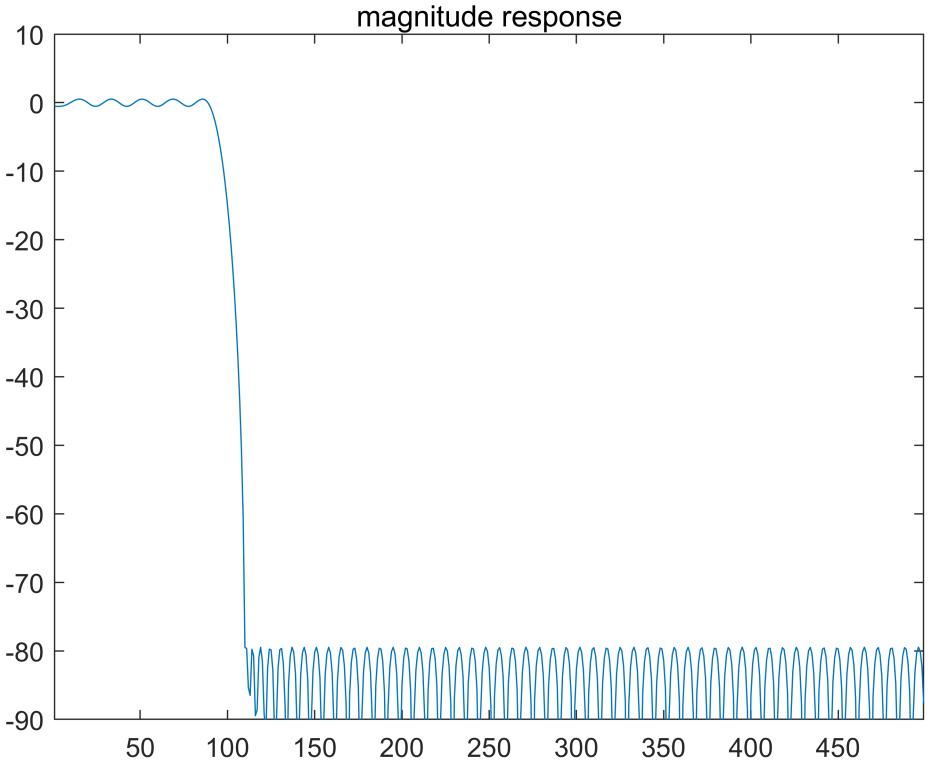
```
%use disp command to give an estimated frequency bound of the desired lowpass signal.

%(4)
for i=[95:905]
    Y(i)=0;
end

x=ifft(Y);%denoise the measurement using FFT through fft command
plot(real(x));%plot the waveform of the denoised signal in time domain
title("denoised time domain");
```



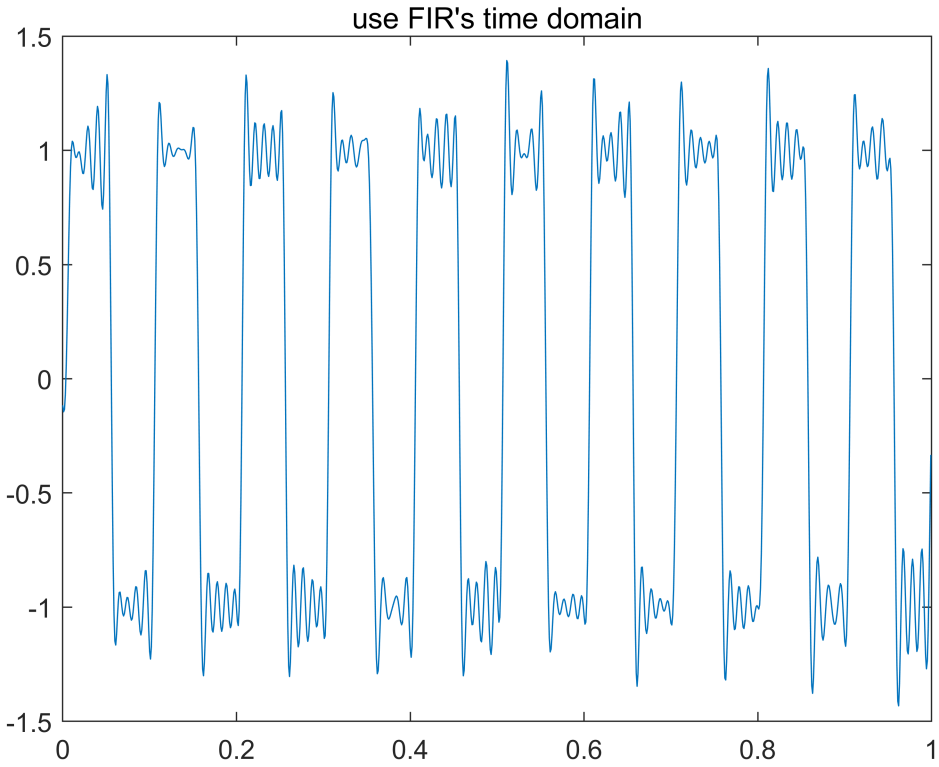

```
plot(abs(fftshift(Y)));%plot the waveform of the denoised signal in frequency domain
title("denoised frequency domain");
```



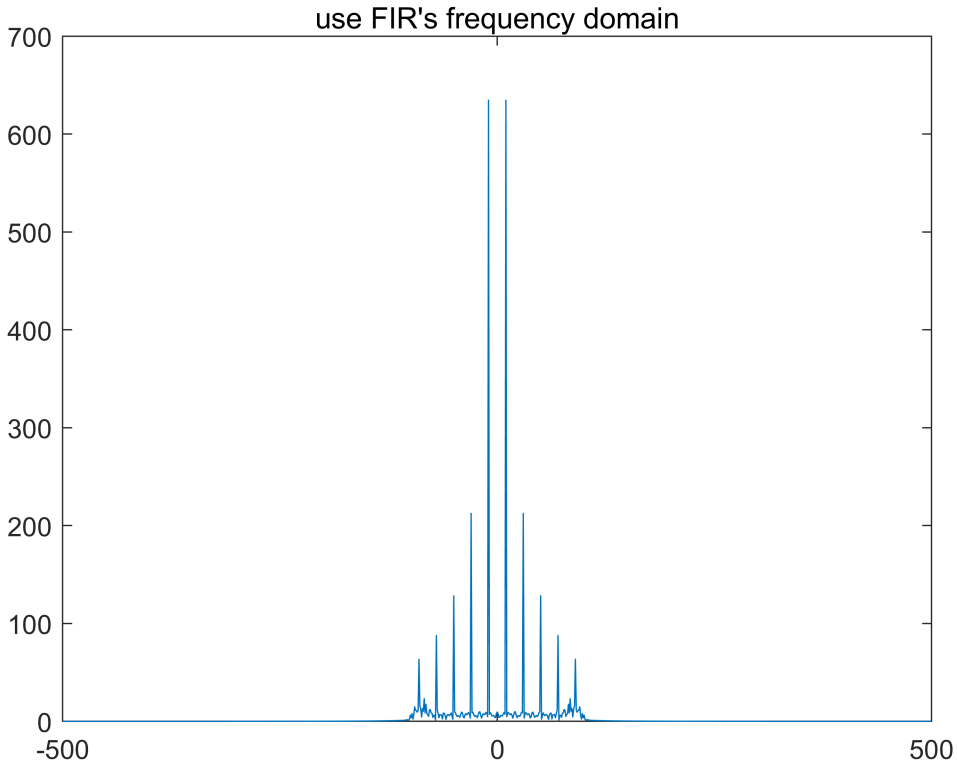
```
%(5)design an FIR filter use fdatool command and filter the signal with filter command
%disp(Num);
[hang,l]=size(Num);
ans=zeros(1,1000);
for i=[1:1000]
    for j=[1:l]
        ans(i)=ans(i)+Num(j)*(exp(2*pi*i*(1i)/1000))^(j-1);
    end
end
ans=ans(1:499);
plot(20*log10(abs(ans)));%(1)plot the magnitude response of the filter in frequency domain
axis([1 499 -90 10]);title("magnitude response");
```



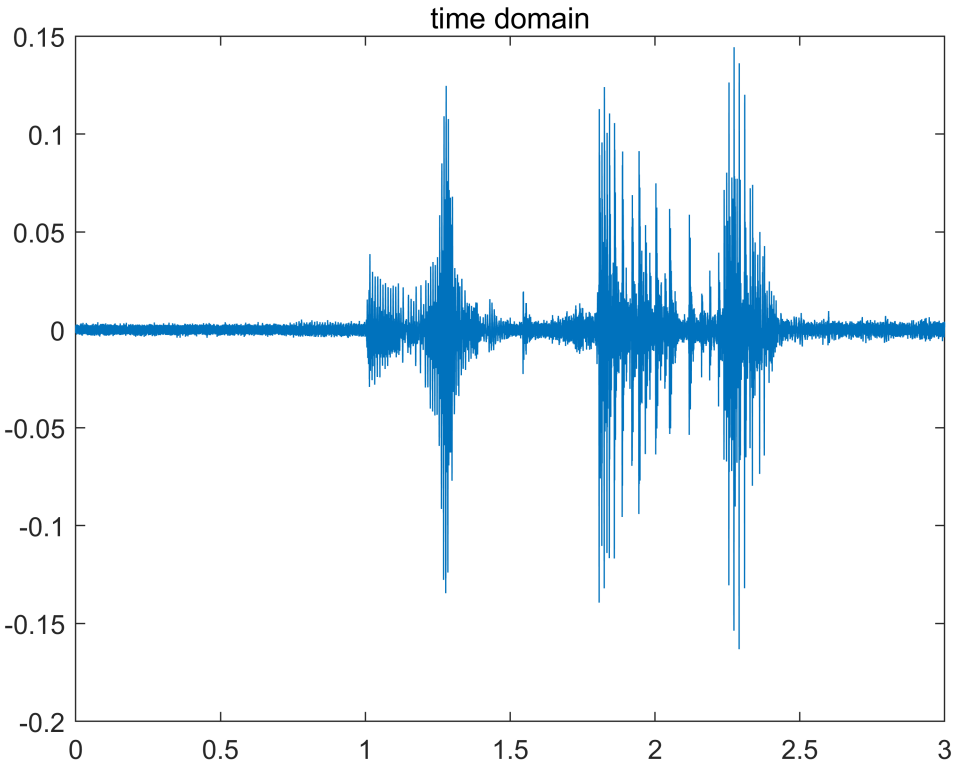

```
%explaination:
%when set the parameters of the fdatool(filterDesigner) ,let the Fs=1000
%because the max frequency is 1000
%set the Fpass=90 because from the graph of the xs_noise signal
%in frequenct domain, we can see that the lowpass signal is 90~100 fs
%and set the Fstop be 110, to have a suitable filtering range

xs_noised=[xs_noised,zeros(1,64)];
f=filter(my_filter1,xs_noised);
f=f(64:1063);
plot(t1,f);%(2)plot the filtered signal in time domain
title("use FIR's time domain");
```




```
plot(t2,abs(fftshift(fft(f))));%(3)plot the amplitude spectrum of the filtered signal in freque
title("use FIR's frequency domain");
```



```
%(1)Load file
load('Q2\human_voice.mat');

%(2)load the waveform and plot it in the time domain
t1=0:1/Fs:3;t1=t1(1:end-1);
plot(t1,xs_noised);title("time domain");
```




```
%(3)
soundsc(xs_noised,Fs);%use soundsc to play
pause(3.5);%use pause command to block the execution until the sound is played over
%identify the time range of the announced characters
disp("the time range of 你 is 1s to 1.5s");%use disp command to annouce the time range
```

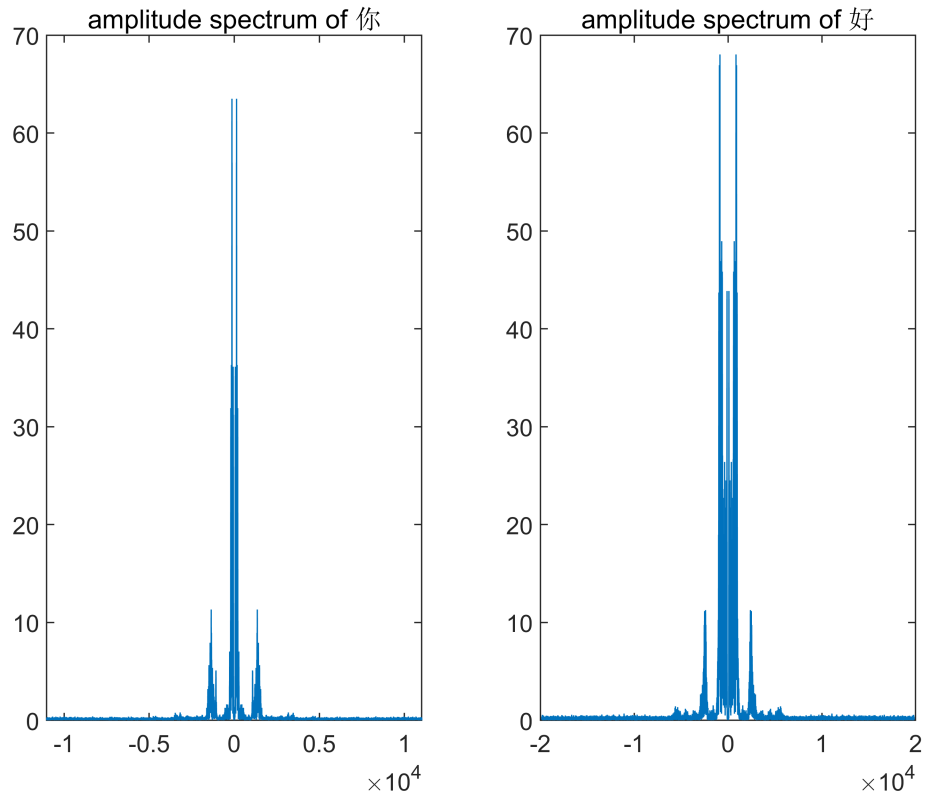
```
the time range of 你 is 1s to 1.5s
```

```
disp("the time range of 好 is 1.6s to 2.5s");
```

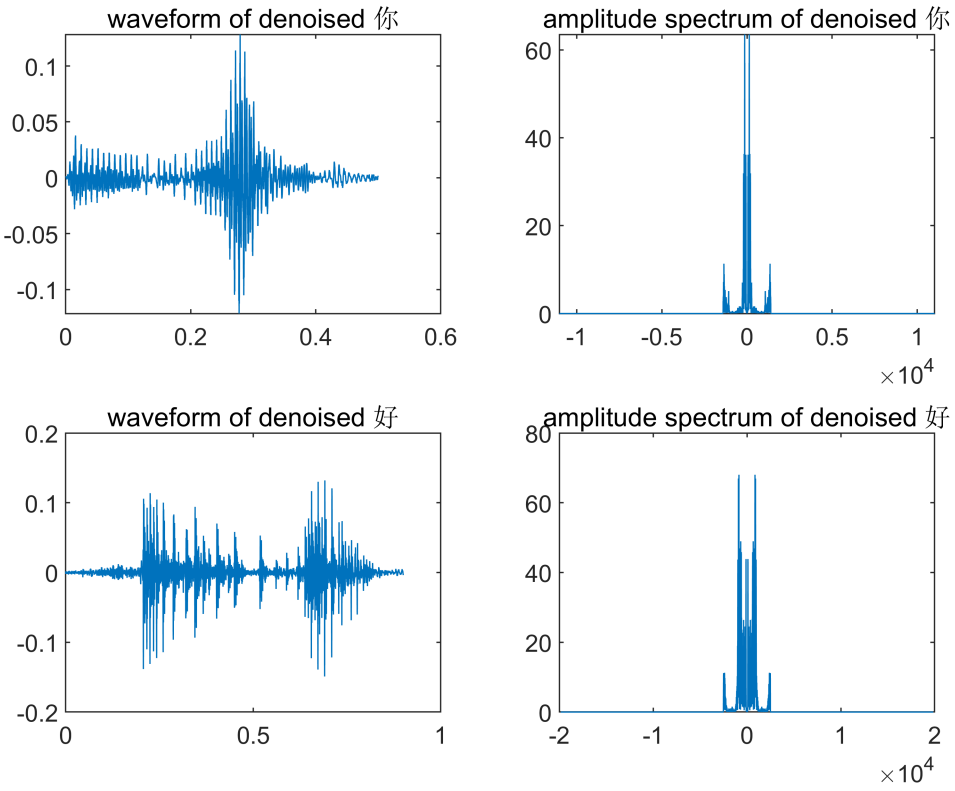
```
the time range of 好 is 1.6s to 2.5s
```

```
%(4)plot the amplitude spectrum of each character in the frequency domain
ni=xs_noised(44100:66150);%the frequency is 44100,so 1s is 44100, 1.5s is 66150
hao=xs_noised(70560:110250);%1.6s is 70560, 2.5s is 110250
ni_Y=fft(ni);
hao_Y=fft(hao);

t2=0:1/Fs:0.5;
t3=0:1/Fs:0.9;
```

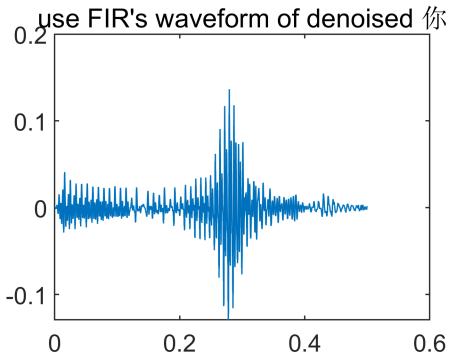
```
t4=(-11025:11025);
t5=(-19845:19845);
figure
subplot(1,2,1);plot(t4,abs(fftshift(ni_Y)));title("amplitude spectrum of 你");
subplot(1,2,2);plot(t5,abs(fftshift(hao_Y)));title("amplitude spectrum of 好");
```

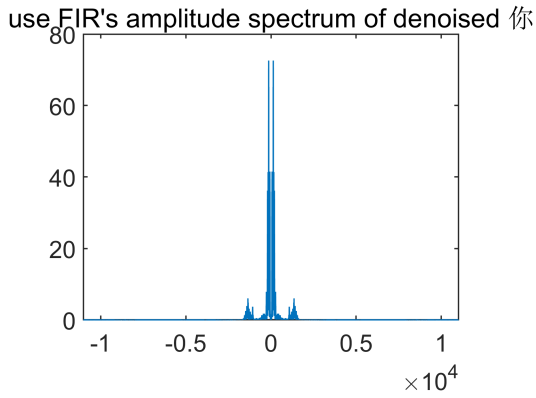


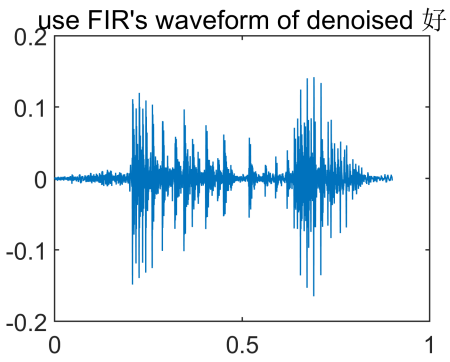

```
%(5)denoise the signal use FFT per character
ni_Y(1400:20650)=0;
ni_denoised=ifft(ni_Y);%denoise 你
hao_Y(2500:37190)=0;
hao_denoised=ifft(hao_Y);%denoise 好

figure
subplot(2,2,1);plot(t2,real(ni_denoised));title("waveform of denoised 你");
subplot(2,2,2);plot(t4,abs(fftshift(ni_Y)));title("amplitude spectrum of denoised 你");
subplot(2,2,3);plot(t3,real(hao_denoised));title("waveform of denoised 好");
subplot(2,2,4);plot(t5,abs(fftshift(hao_Y)));title("amplitude spectrum of denoised 好");
```

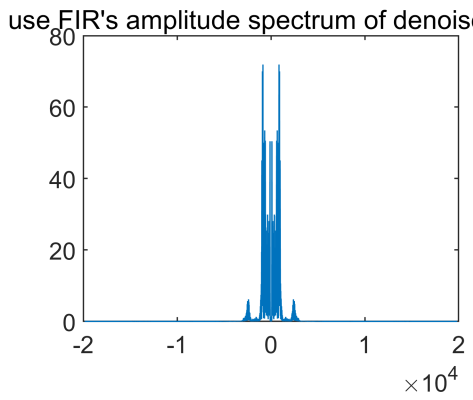



```
soundsc(real(ni_denoised),Fs);%use soundsc to play the denoised signal of 你
pause(1.0);%pause more than 0.5s
soundsc(real(hao_denoised),Fs);%use soundsc to play the denoised signal of 好
pause(1.5);%pause more than 0.9s

%(6)Filter the signal use with FIR per character
f_ni=filter(my_filterni,ni);
y_ni=fft(f_ni);
f_hao=filter(my_filterhao,hao);
y_hao=fft(f_hao);

soundsc(f_ni,Fs);%use soundsc to play the FIR's denoised signal of 你
pause(1.0);
soundsc(f_hao,Fs);%use soundsc to play the FIR's denoised signal of 好
pause(1.5);

figure
subplot(2,2,1);plot(t2,f_ni);title("use FIR's waveform of denoised 你");
subplot(2,2,2);plot(t4,abs(fftshift(y_ni)));title("use FIR's amplitude spectrum of denoised 你"
subplot(2,2,3);plot(t3,f_hao);title("use FIR's waveform of denoised 好");
subplot(2,2,4);plot(t5,abs(fftshift(y_hao)));title("use FIR's amplitude spectrum of denoised 好
```


use FIR's waveform of denoised 你
0.2
0.1
0
-0.1
0
0.2
0.4
0.6


use FIR's amplitude spectrum of denoised 你
80
60
40
20
0
-1
-0.5
0
0.5
1
×10^4


use FIR's waveform of denoised 好
0.2
0.1
0
-0.1
-0.2
0
0.5
1


use FIR's amplitude spectrum of denoised 好
80
60
40
20
0
-2
-1
0
1
2
×10^4