Lab5 My method to extract pitch

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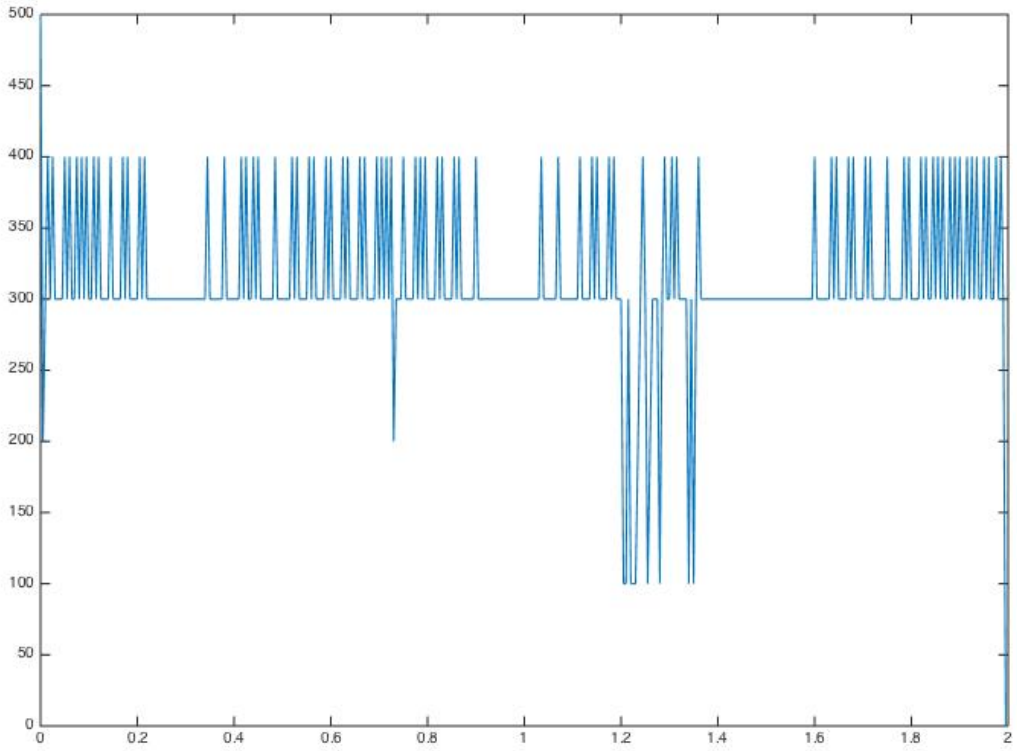
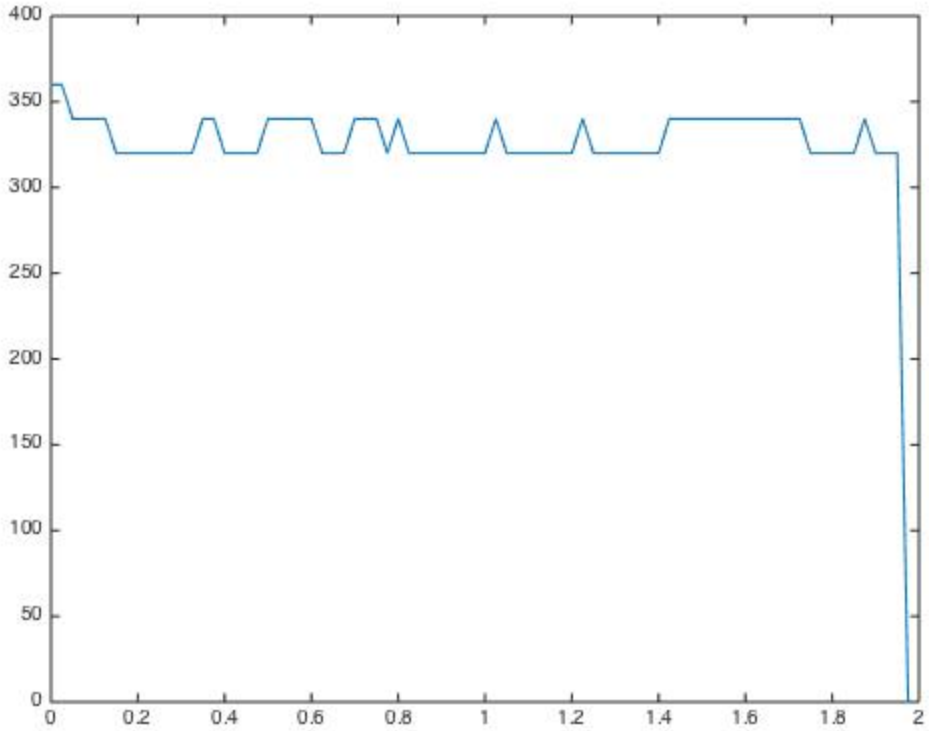
My method to extract pitch:

1. find peak value:
    a. step1. filter out the frequencies that is bigger than 500 or smaller than 50 hz
    b. step2. find the highest intensity of our signal in frequency domain.
2. Autocorrelation:
    a. find the first peak in the autocorrelation function
    b. locate the x-axis coordinate, and the first peak x-axis coordinate should be the fundamental period.
    c. the pitch value F0 should be 1/T

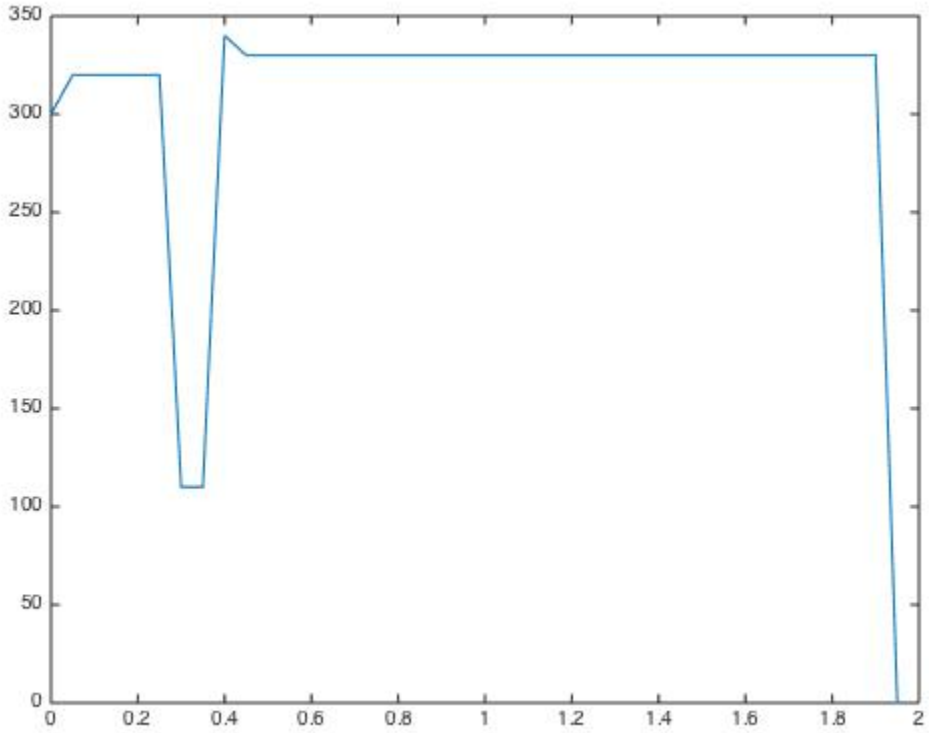
Window select:
The smaller the window, the more sensitive to noise:
find peak:
win_len=0.01:



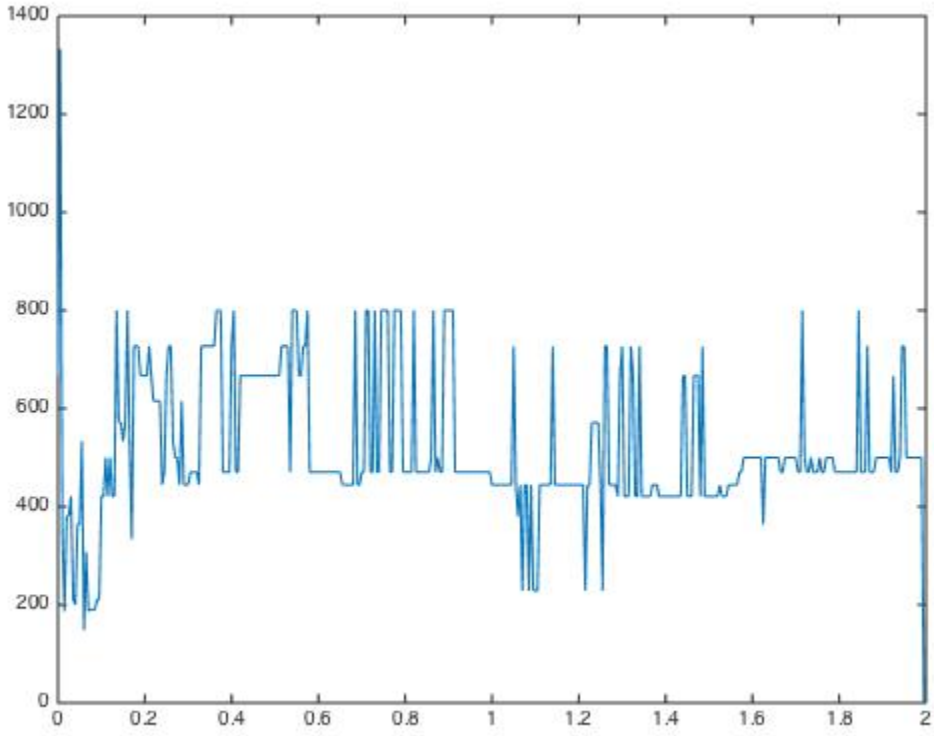
win_len=0.05:


400
350
300
250
200
150
100
50
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

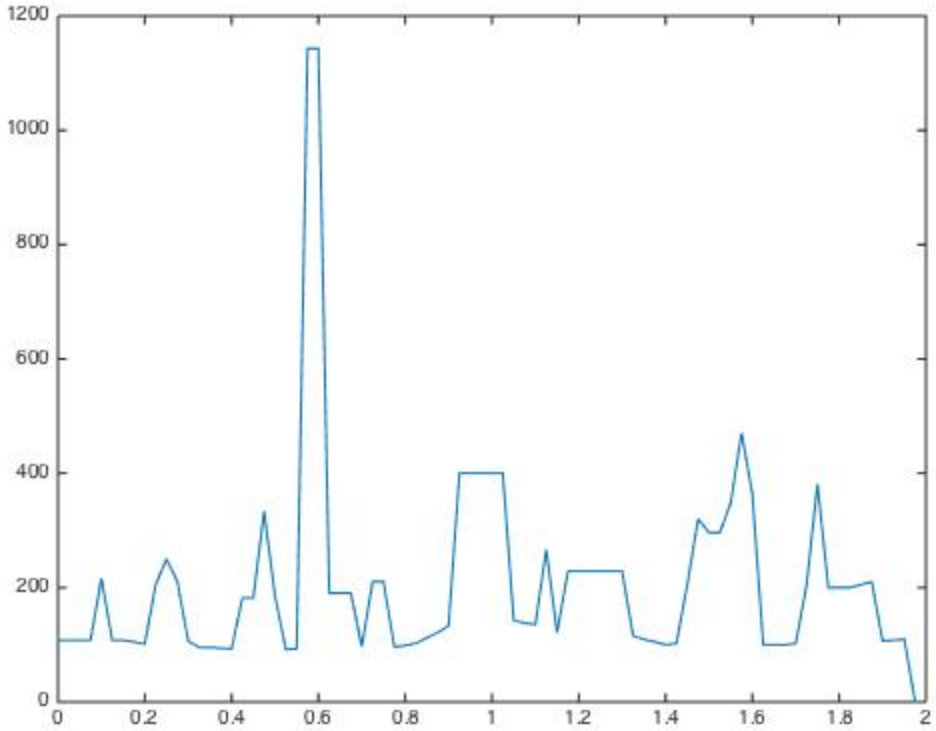
win_len=0.10:


350
300
250
200
150
100
50
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

ACF:
win_len=0.01:



win_len=0.05:


1200
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800
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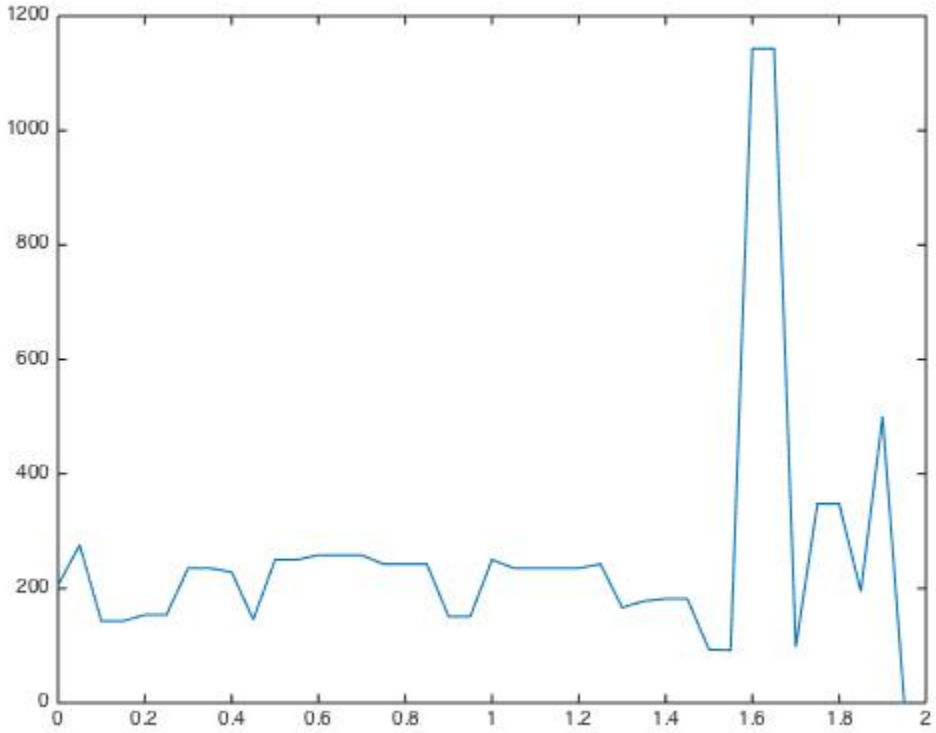
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

win_len=0.10:


1200
1000
800
600
400
200
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

Window selection:
I'll choose the window with window length 0.10 because I want to get smoother value.

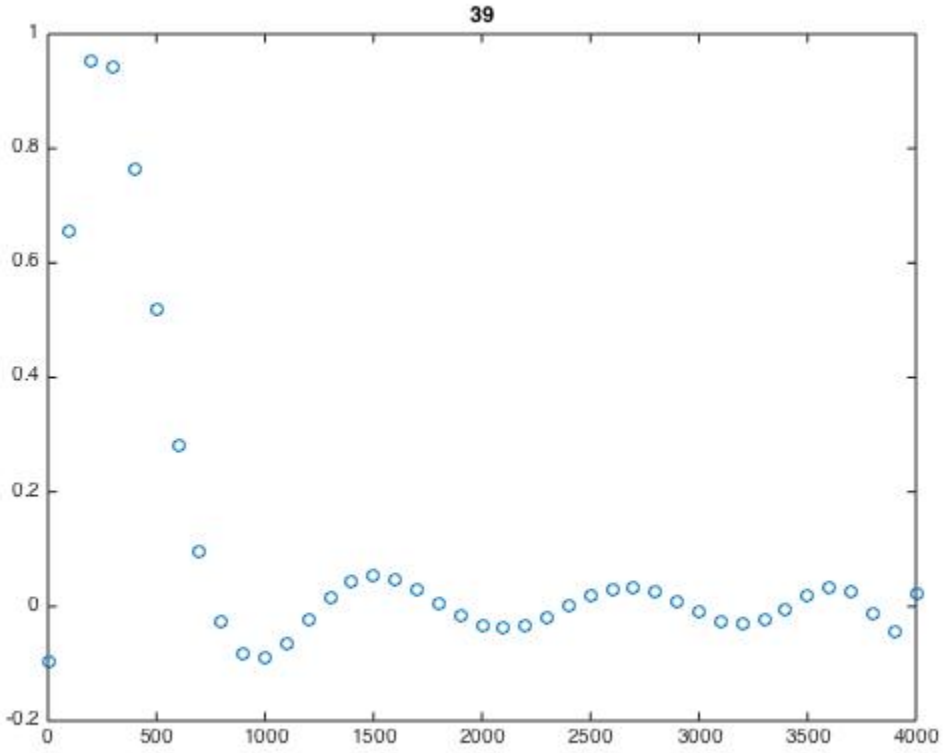
my highest pitch can reach up to, 400 hz i think it's reasonable because it's between 50 t0 500.

Denoising on spectrum:

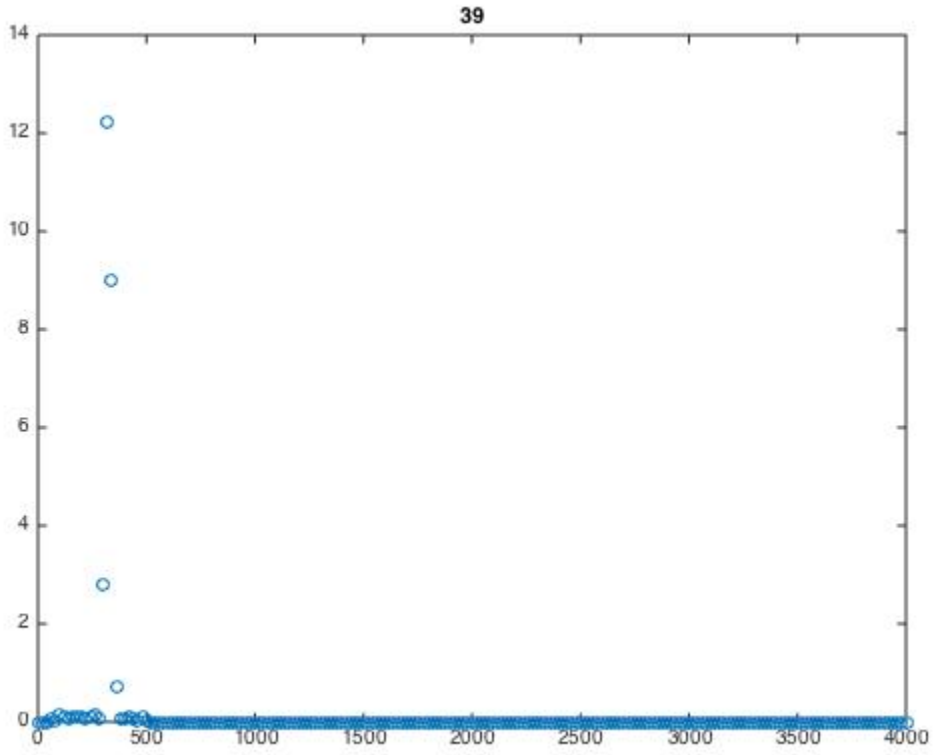
Method:
I used parabolic-interpolation on spectrum with the recursing curve :
cn*x^poly_n+...c1*x^1+c0
where poly_n is the parameter that is tunable, represented as the order of the paranomial.

```
%***matlab function***/////////
p=polyfit(spectra{ii}(:,1),spectra{ii}(:,2),poly_n); %train parameter p
spectra{ii}(:,2)=polyval(p,spectra{ii}(:,1));% use p to reconstruct spectra
%************************/////////
```

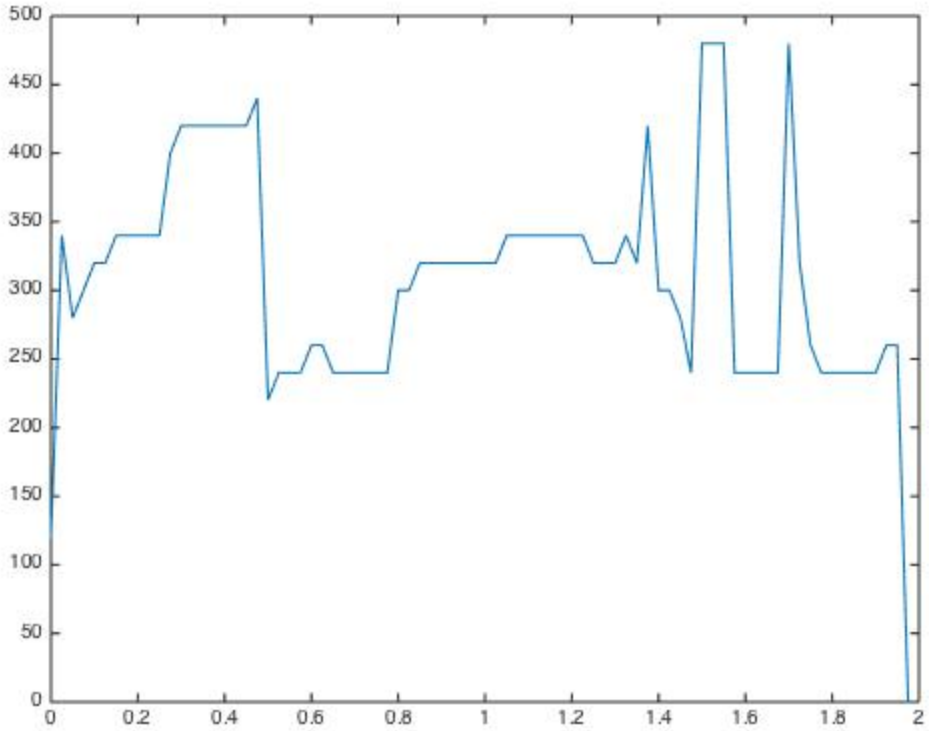
the effect of this method:



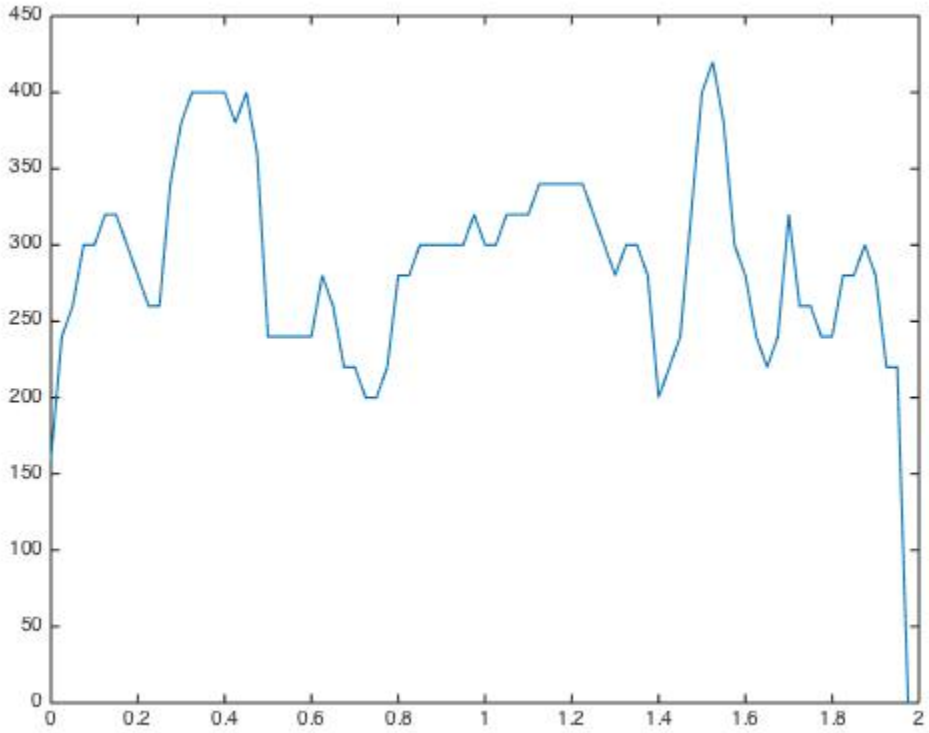
In contrary, the spectrum without parabolic interpolation will be



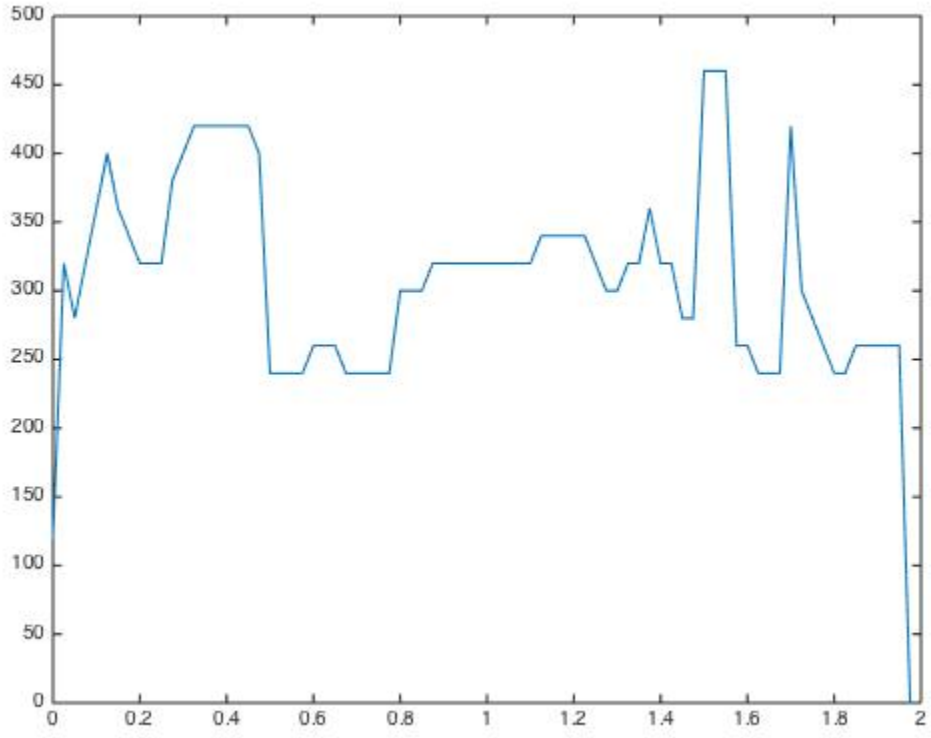
Then I'll show the final result with and without interpolation:
My voice pitch without interpolation:



with interpolation, whose poly_n=10:



with interpolation, whose poly_n=20:



we then get a conclusion that using parabolic interpolation can get a smoother curve