Think DSP

Chapter #1 : Sound and Signls

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Periodic Signals

Signal (신호)

시간에 따라 달라지는 양 (Quantity)

- 예) Sound Signal : **시간** 에 따라 달라지는 **공기압**

Periodic Signal

특정 주기마다 반복되어 나타나는 신호.

- Cycle : 신호 내에서 반복되는 모양
- Period : 한 Cycle의 길이(시간)
- Frequency : 초당 발생하는 Cycle의 개수 (단위 : Hz)

> Frequency = 1/(Period)

Exmaple

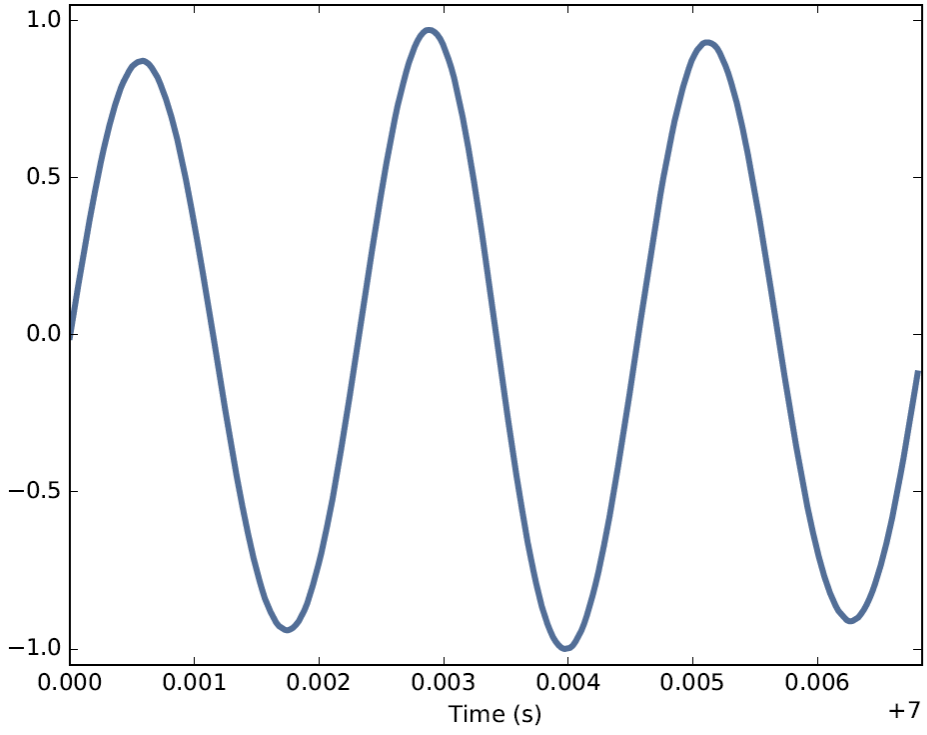


Figure 1.1: Segment from a recording of a bell.

- 3개의 Cycle
- Period : 2.3ms
- Frequency : (1/2.3ms) = 434.78 Hz

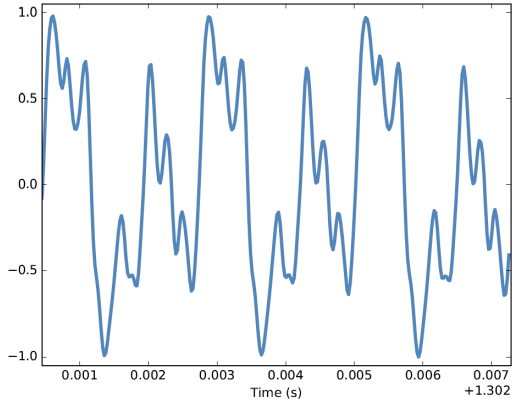
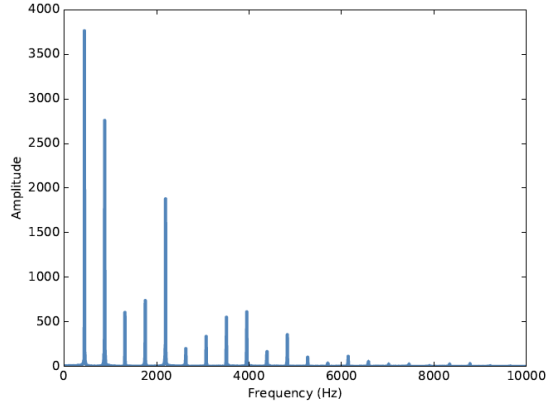
Spectral Decomposition

- Idea : 어떤 신호라도 서로 다른 주파수의 사인파의 합으로 표현할 수 있다.

Discrete Fourier Transform (DFT)

- 신호를 Spectrum으로 변환
- Spectrum : 신호를 구성하는 사인파들의 집합
- Fast Fourier Transform (FFT) : DFT를 빨리 수행하기 위한 알고리즘

Signal and Spectrum

항목	원본신호	스펙트럼
그래프	 Figure 1.2: Segment from a recording of a violin.	 Figure 1.3: Spectrum of a segment from the violin recording.
Y축	시간	주파수
Y축	신호 크기	주파수 크기 (Amplitude)

Spectrum Example

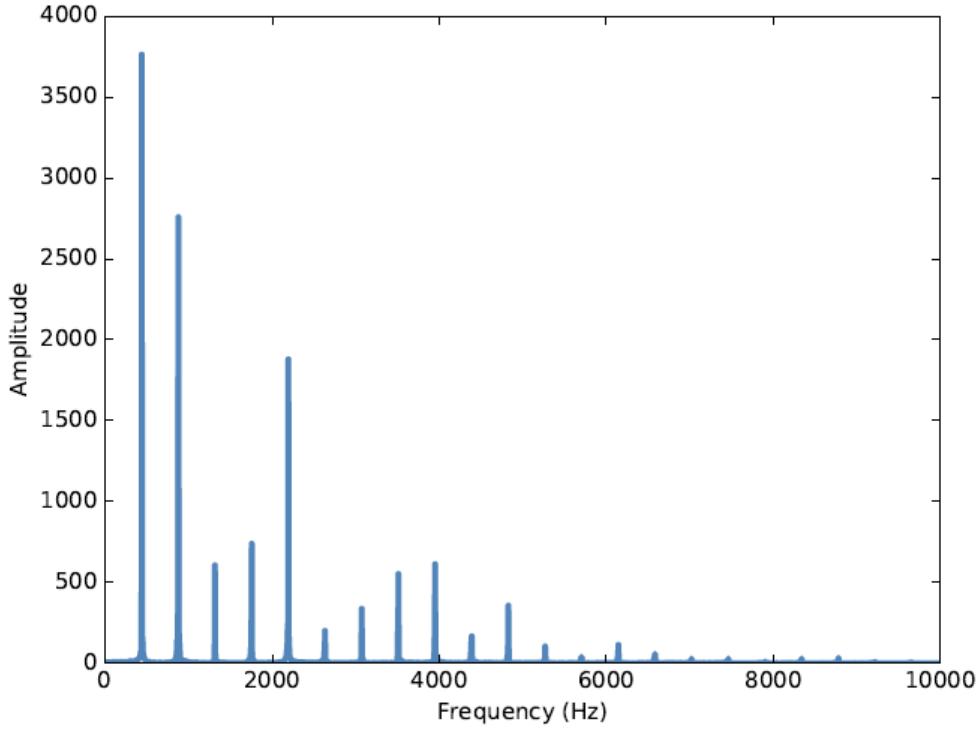


Figure 1.3: Spectrum of a segment from the violin recording.

- Fundamental Frequency : 가장 낮은 값의 주파수 (440Hz)
- Dominant Frequency :가장 크기가 큰 주파수 (440Hz)

> 이 예제에서는 Fundamental / Dominant Frequency가 같다.

Spectrum Example

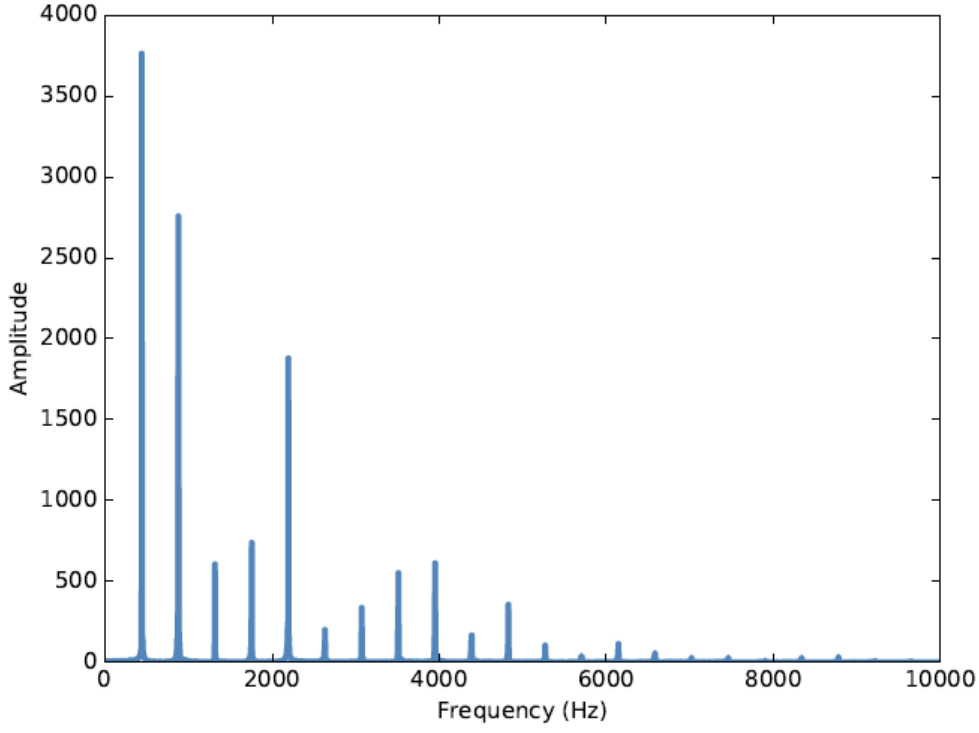


Figure 1.3: Spectrum of a segment from the violin recording.

Harmonics

- Fundamental Frequency의 정수배의 주파수들
- 440, 880, 1320, 1760 Hz

Excercises

공통 코드

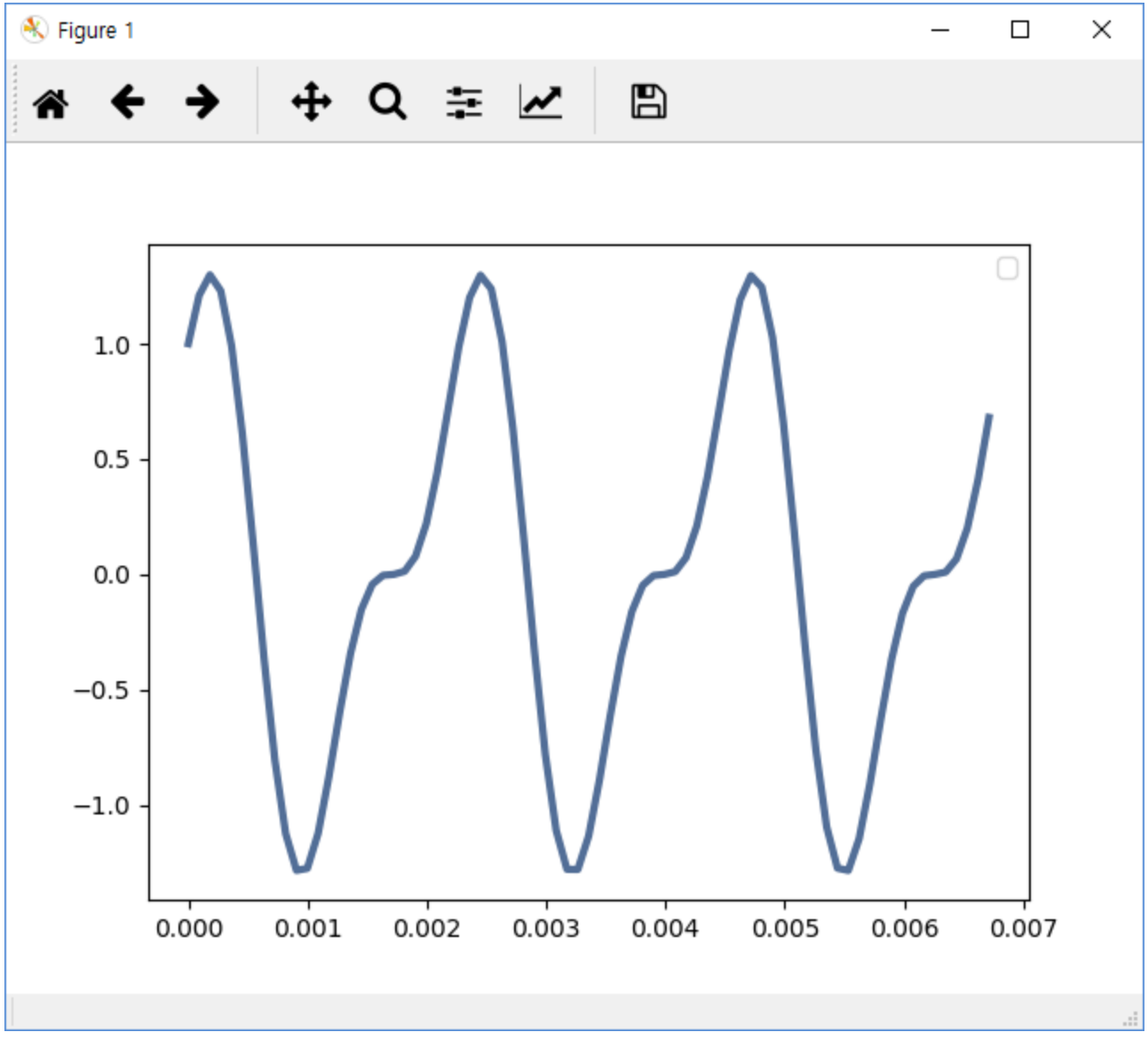
이 코드를 맨 위에 넣은 후 이후 코드들을 추가

```
from __future__ import print_function, division

# We don't need this link. Comment Out
# %matplotlib inline

import thinkdsp
import thinkplot

import numpy as np

from ipywidgets import interact, interactive, fixed
import ipywidgets as widgets
from IPython.display import display
```

Excercise 1 : Signal Plotting

```
# Generate COS and SINE signals
cos_sig = thinkdsp.CosSignal(freq=440, amp=1.0, offset=0)
sin_sig = thinkdsp.SinSignal(freq=880, amp=0.5, offset=0)

# Mix them
mix = sin_sig + cos_sig

# Plot
mix.plot()
thinkplot.show()
```

Excercise 1 : Signal Plotting (Cont'd)

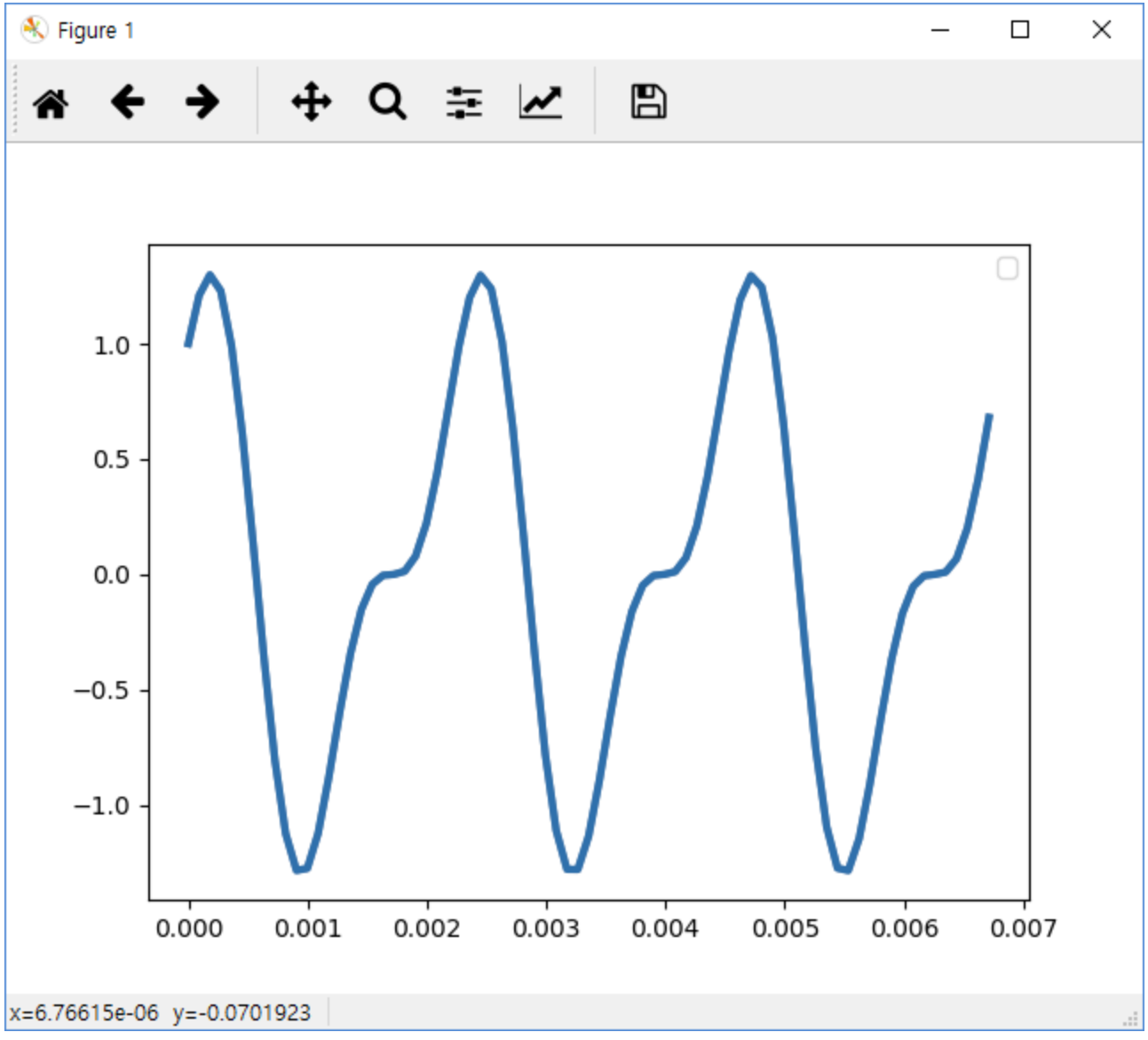


Excercise 2 : Wave

Wave : 연속적인값을 갖는 Signal을 Sampling하여 얻은 값의 집합

```
# Convert signal into Wave
wave = mix.make_wave(duration=0.5, start=0, framerate=11025)
period = mix.period
segment = wave.segment(start=0, duration=period*3)
segment.plot()
thinkplot.show()
```

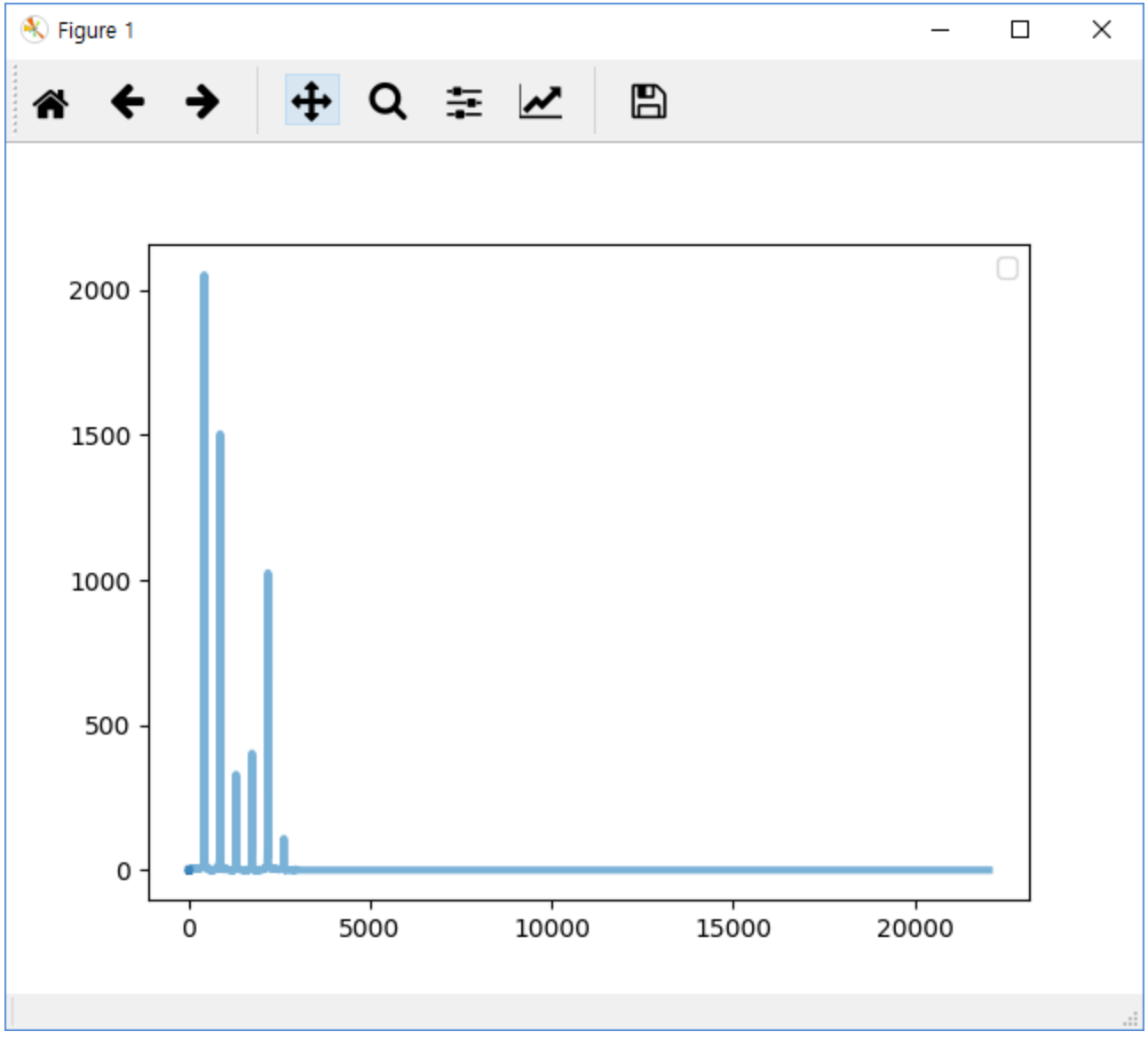
Excercise 2 : Wave (Cont'd)



Excercise 3 : Spectrum

```
# Excercise 3 : Spectrum

# Read wave from wav file
wave = thinkdsp.read_wave('92002__jcveliz__violin-origional.wav
start = 1.2
duration = 0.6
segment = wave.segment(start, duration)

# Convert segment into spectrum
spectrum = segment.make_spectrum()


# Low Pass
spectrum.low_pass(3000)

# Plot
spectrum.plot()
thinkplot.show()
```

Excercise 3 : Spectrum (Cont'd)



Questions

- Excercise 1.2~1.4