HW10

Ex01

In [60]:

```
# Get thinkdsp.py

import os

if not os.path.exists('thinkdsp.py'):
    !wget https://github.com/AllenDowney/ThinkDSP/raw/master/code/thinkdsp.py
```

In [61]:

```
import numpy as np
import matplotlib.pyplot as plt

from thinkdsp import decorate
from thinkdsp import Wave
```

In [62]:

```
if not os.path.exists('180960__kleeb__gunshot.wav'):
    !wget https://github.com/AllenDowney/ThinkDSP/raw/master/code/180960__kleeb__gunshot
.wav
```

In [63]:

```
from thinkdsp import read_wave

response = read_wave('180960__kleeb__gunshot.wav')

start = 0.12
response = response.segment(start=start)
response.shift(-start)

response.normalize()
# response.plot()
# decorate(xlabel='Time (s)')
transfer = response.make_spectrum()
response.make_audio()
```

Out[63]:

Your browser does not support the audio element.

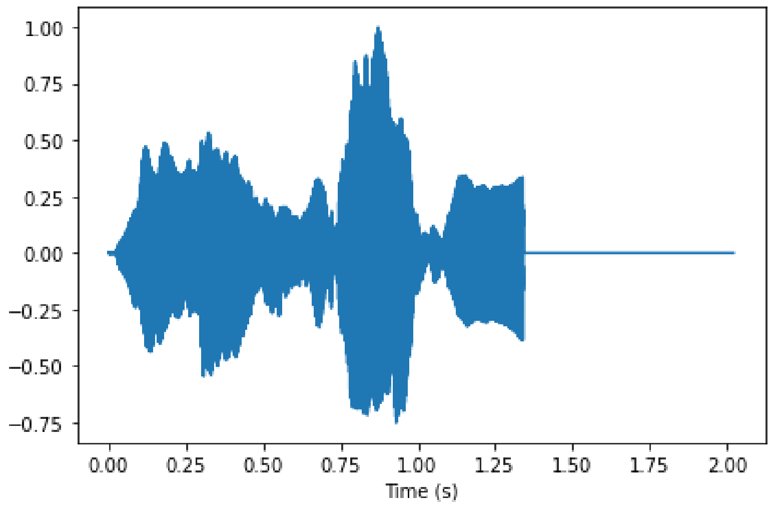
In [64]:

```
if not os.path.exists('92002__jcveliz__violin-origional.wav'):
    !wget https://github.com/AllenDowney/ThinkDSP/raw/master/code/92002__jcveliz__violin
-origional.wav
```

In [65]:

```
violin = read_wave('92002__jcveliz__violin-origional.wav')

start = 0.11
violin = violin.segment(start=start)
violin.shift(-start)
print(len(response))

zero_lens = 30000
violin.truncate(len(response))
violin.ys = violin.ys[:-zero_lens]
violin.ys = np.pad(violin.ys,(0,zero_lens),'constant',constant_values=(0,0))

print(len(violin.ys))
violin.normalize()
violin.plot()
decorate(xlabel='Time (s)')
```

```
89106
89106
```



In [66]:

```
spectrum = violin.make_spectrum()
violin.make_audio()
```

Out[66]:

Your browser does not support the audio element.

In [67]:

```
output = (spectrum * transfer).make_wave()
output.normalize()
output.make_audio()
```

Out[67]:

Your browser does not support the audio element.

在這個例子中，改變**zero_lens**就可以設定音訊最後多少長度為**0**。

當**zero_lens<1000**時，幾乎不會有改變。

而**zero_lens>30000**時，可以明顯聽到生成的音訊比較正常，沒有被大幅影響。

這是因為**dft**計算時會將音訊循環，乘上**filter**時當下的音訊會受到前後值得影響。所以產生的結果開頭會受到結尾音訊的影響。只要補上適當的**0**，在循環卷積時就不會乘到後面的數值，就可以減少影響。

Ex02

upload impulseresponseheslingtonchurch-003.wav to colab

In [68]:

```
from thinkdsp import read_wave

response = read_wave('impulseresponseheslingtonchurch-003.wav')

start = 0.12
response = response.segment(start=start)
response.shift(-start)
response.truncate(89106)
response.normalize()
response.framerate = 44100
# response.plot()
# decorate(xlabel='Time (s)')
transfer = response.make_spectrum()
response.make_audio()
```

Out[68]:

Your browser does not support the audio element.

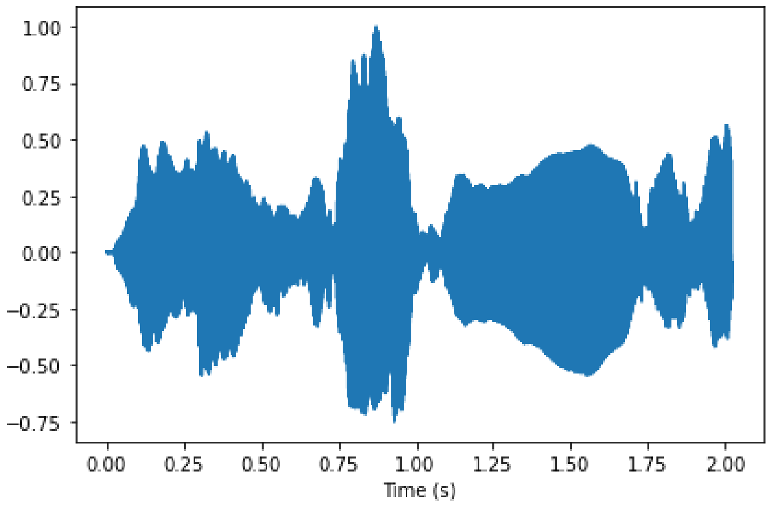
In [69]:

```
if not os.path.exists('92002__jcveliz__violin-origional.wav'):
    !wget https://github.com/AllenDowney/ThinkDSP/raw/master/code/92002__jcveliz__violin
-origional.wav
```

In [70]:

```
violin = read_wave('92002__jcveliz__violin-origional.wav')

start = 0.11
violin = violin.segment(start=start)
violin.shift(-start)
print(len(response))

# zero_lens = 30000
violin.truncate(len(response))
# violin.ys = violin.ys[:-zero_lens]
# violin.ys = np.pad(violin.ys,(0,zero_lens),'constant',constant_values=(0,0))

spectrum = violin.make_spectrum()

print(len(violin.ys))
violin.normalize()
violin.plot()
decorate(xlabel='Time (s)')
```

```
89106
89106
```



In [71]:

```
print(violin.framerate)
print(response.framerate)
```

```
44100
44100
```

Way I, 頻譜相乘

In [72]:

```
output = (spectrum * transfer).make_wave()
output.write('audio1.wav')
output.normalize()
output.make_audio()
```

```
Writing audio1.wav
```

```
c:\Users\a9876\Documents\MEGA\CGU\110-2 Signal and System\code\hw10\thinkdsp.py:1173: Use
rWarning: Warning: normalizing before quantizing.
  warnings.warn("Warning: normalizing before quantizing.")
```

Out[72]:

Your browser does not support the audio element.

Way II, 脈衝響應卷積

In [73]:

```
violin = violin.convolve(response)
violin.write('audio2.wav')
violin.normalize()
violin.make_audio()
```

```
Writing audio2.wav
```

Out[73]:

Your browser does not support the audio element.

可以聽出兩者結果大致相同。為小提琴聲在開放環境撥放的聲音。事實上這個脈衝響應數據來自於一個教堂式的開闊環境，所以可以聽出類似回音。

惟頻譜相乘牽涉到DFT的週期運算，導致開頭部分受到干擾，聽得到雜音。

In [1]:

```
from IPython.display import Image
Image('bg/images/heslington_church_impulse_response-5075.jpg')
```

Out[1]: