

FIR and IIR Filters

▼ Introduction

In this application, audio is filtered with FIR and IIR filters.

```
> restart :
with( SignalProcessing ) :
with( AudioTools ) :
```

▼ Import and Plot Audio

```
> originalSpeech := Read( FileTools:-JoinPath( [ kernelopts( datadir ), "audio",
"MapleSimMono11025.wav" ] ) )
```

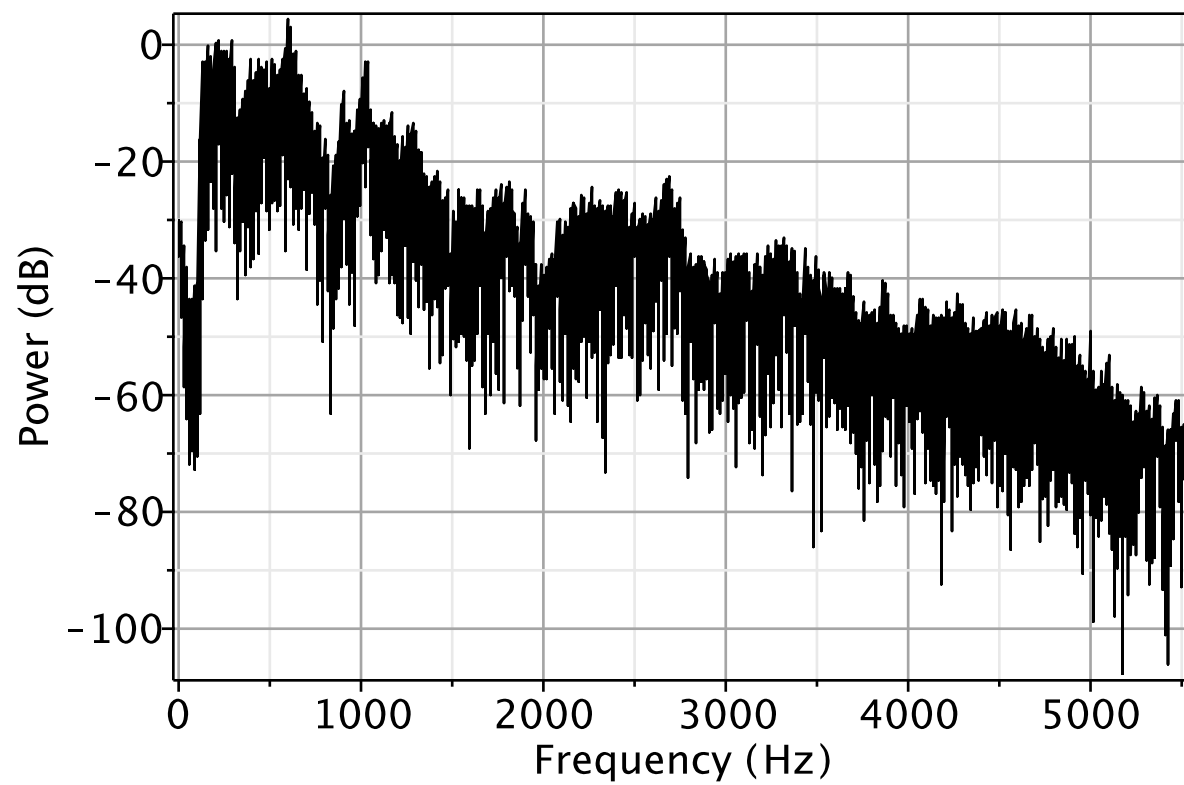
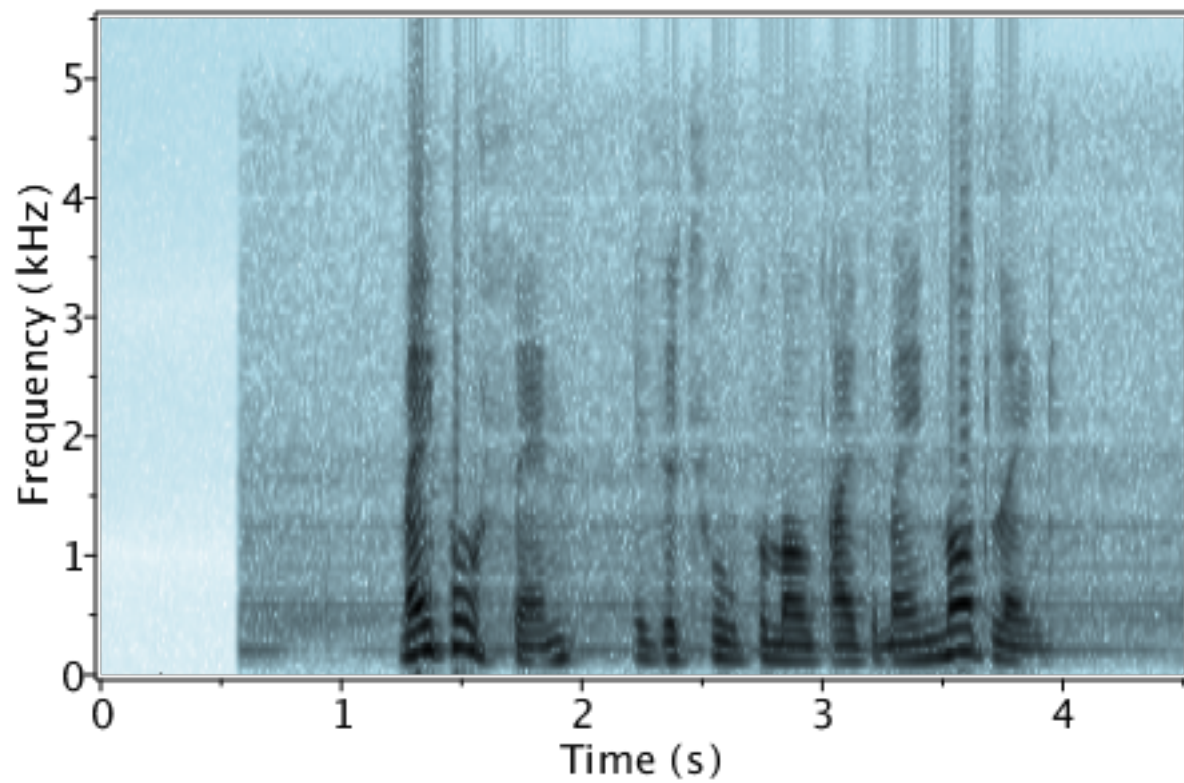
$$originalSpeech := \begin{bmatrix} \text{"Sample Rate"} & 11025 \\ \text{"Bit Depth"} & 16 \\ \text{"Channels"} & 1 \\ \text{"Points/Channel"} & 49664 \\ \text{"Duration"} & 4.50 \text{ s} \end{bmatrix} \quad (1)$$

Sample rate of audio file

```
> sRate := attributes( originalSpeech )1
sRate := 11025 (2)
```

Plot waveform and power spectrum:

```
> Spectrogram( originalSpeech, colorscheme = [ "zgradient", [ white, LightBlue, black ], markers
= [ 0, 0.5, 1 ] ], size = [ 1000, 300 ] );
Periodogram( originalSpeech, size = [ 1000, 300 ] )
```



▼ Apply IIR Filter

Cutoff frequency

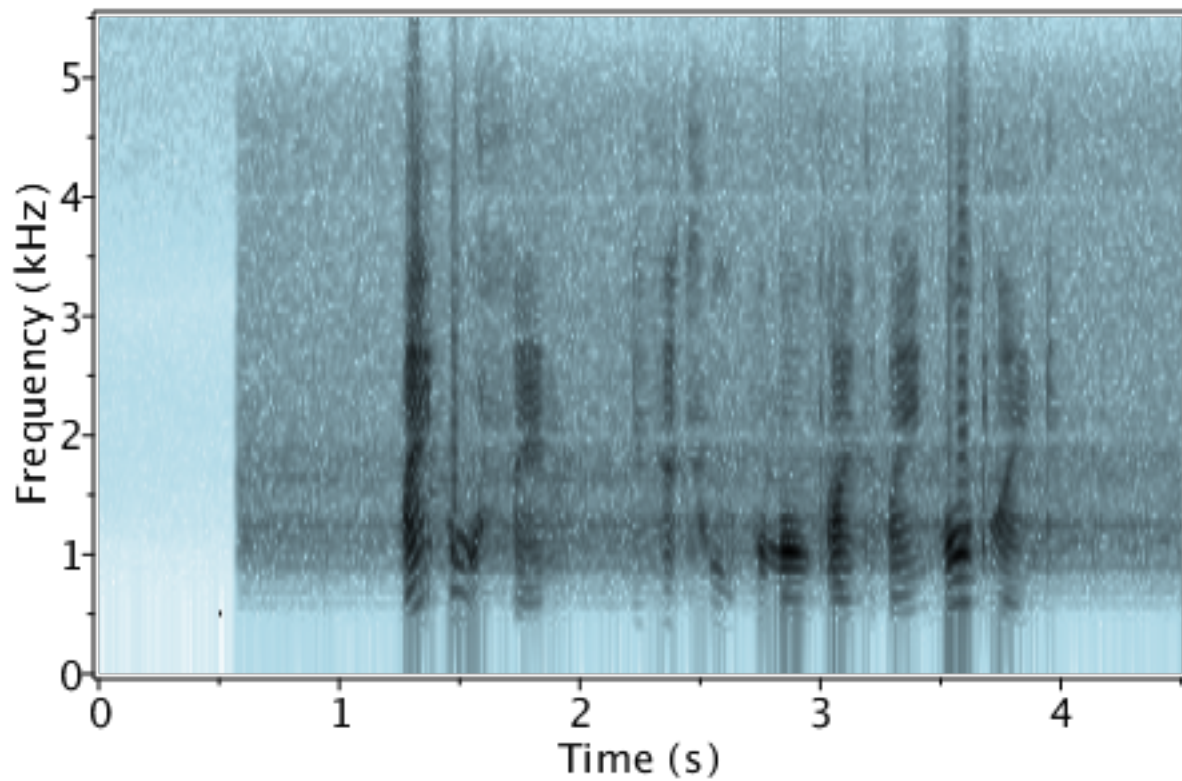
> fc := 1000 :

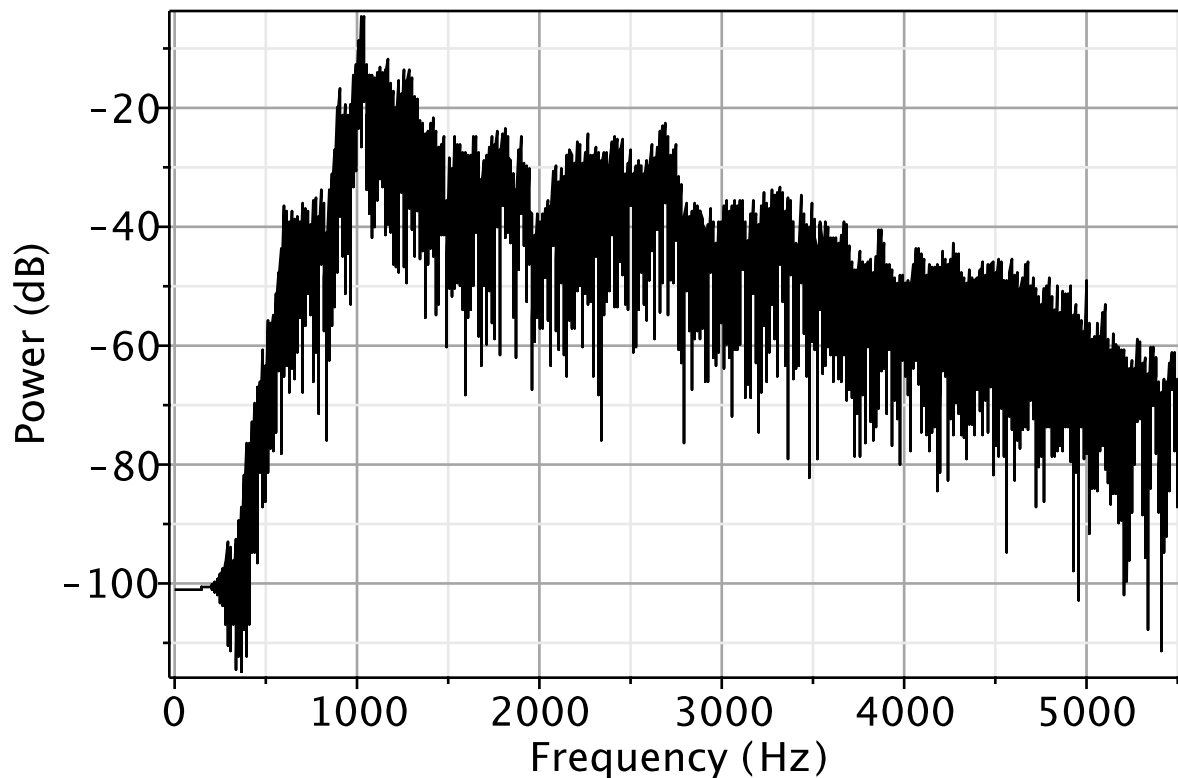
Apply filter

> taps := GenerateButterworthTaps(9, fc/sRate, 'filtertype' = 'highpass') :
filteredSpeech := InfiniteImpulseResponseFilter(originalSpeech, taps) :

Visualize filtered audio

> Spectrogram(filteredSpeech, samplerate = sRate, colorscheme = ["zgradient", [white,
LightBlue, black], markers = [0, 0.5, 1]], size = [1000, 300]);
Periodogram(filteredSpeech, samplerate = sRate, size = [1000, 300])





▼ Apply FIR filter

Cutoff frequencies for bandpass filter

```
> flow := 1000 :  
    fhigh := 2000 :
```

Apply filter

```
> taps := GenerateFinitImpulseResponseFilterTaps( 100, [flow/sRate, fhigh/sRate], filtertype  
    = bandpass ) :  
    filteredSpeech2 := FinitImpulseResponseFilter( originalSpeech, taps ) :
```

Visualize filtered audio

```
> Spectrogram( filteredSpeech2, samplerate = sRate, colorscheme = [ "zgradient", [ white,  
    LightBlue, black ], markers = [ 0, 0.5, 1 ] ], size = [ 1000, 300 ] );  
    Periodogram( filteredSpeech2, samplerate = sRate, size = [ 1000, 300 ] )
```

