

DSP Notes: Sound I/O and Spectrums

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Sound File I/O and Spectral Analysis in SciLab

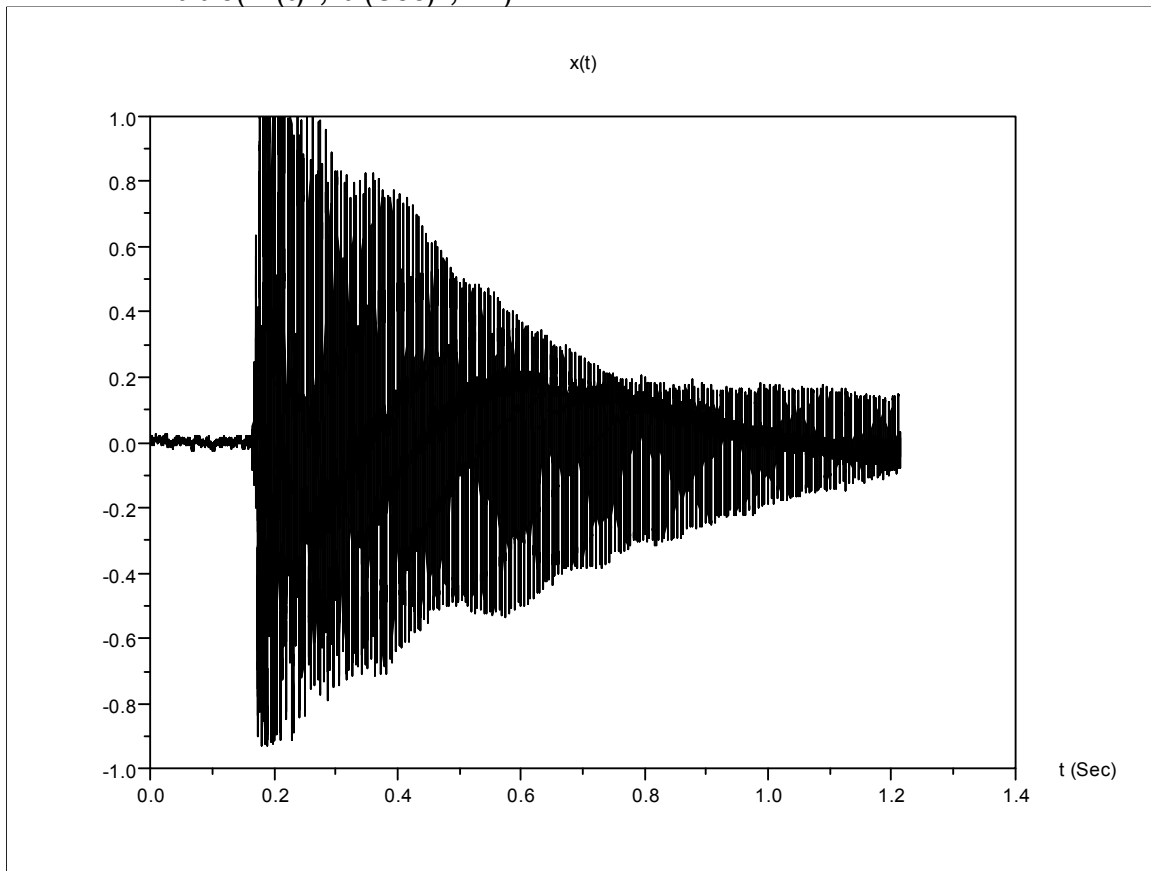
To load one a WAV file such as 'guitar.wav' into SciLab, use

```
--> [x,S,bits]=wavread('guitar.wav');
```

This will initialize the vector x with the WAV signal data, it will also store the sample rate (S , in Hz) that was used when the file was captured. The variable 'bits' above will receive the number of bits associated with each sample – which is typically either 8 or 16.

The signal may be plotted, versus seconds, via:

```
--> t = 0:(N-1);  
--> t = t / S;  
--> plot2d(t,x);  
--> xtitle("x(t)", "t (Sec)", " ")
```



The above signal, x , was digitized from a guitar (sample rate 16 kHz). It is the open G string. The true analog frequency is 220 Hz (assuming correct tuning). To compute the magnitude of the spectrum of x , use:

```
--> X = fft(x,-1);  
--> Xmag = abs(X)
```

To display positive frequencies, trim the second half of the Xmag array

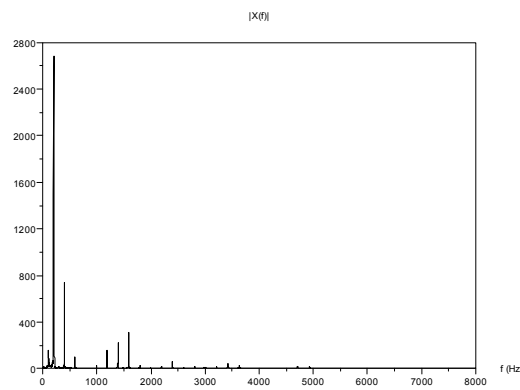
```
--> N = length(x)  
--> Xmag = Xmag(1:N/2);
```

Values for the horizontal frequency axis may be setup using:

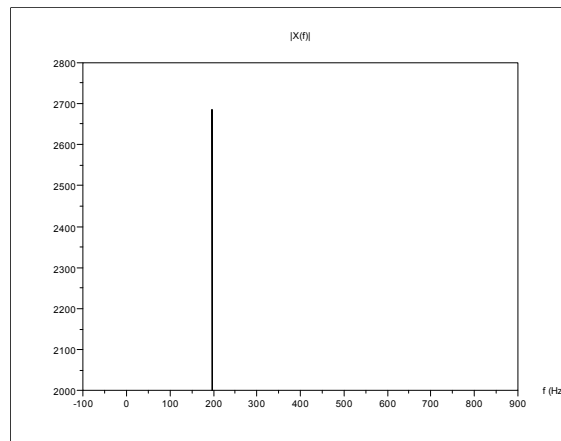
```
--> F = 0:(N/2)-1;  
--> F = F * S/N;
```

Finally the plot of the spectrum, with title are generated with:

```
--> plot2d(F,Xmag);  
--> xtitle("|X(f)|", "f (Hz)", " ")
```



SciLab permits zooming within its graphics window, for example:



This spectrum is consistent with the frequency of the original analog signal, 196 Hz. Additional harmonics are revealed in the previous plot.