Discrete Cosine Analysis

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A Mathematica notebook to load in an audio signal (stored in an Excel workbook) and perform a discrete cosine analysis of the frequency content.

Load in and Plot Signal: Stored in file "gong.xlsx", save it somewhere you can access it.

In[86]:=
```
s = Import["Base/gong.xlsx"];
fs = s[[1]];
n = Length[fs];
```

Compute the duration "T" of the signal, and set the sampling rate (16000 Hz).

In[89]:=
```
samprate = 16 000
T = N[n / samprate]
```

A plot of the data

In[93]:=
```
pdat = Table[{(j - 0.5) / samprate, fs[[j, 1]]}, {j, 1, n}];
ListPlot[pdat, AxesLabel → {"Time (seconds)", "Signal Intensity"},
 ImageSize → Scaled[0.8], Joined → True]
```

For time t = 1 to t = 1.01 seconds plot from k = 16000 to k = 16161, roughly

In[95]:=
```
pdat = Table[{(j - 0.5) / samprate, fs[[j, 1]]}, {j, 16 000, 16 161}];
ListPlot[pdat, AxesLabel → {"Time (seconds)", "Signal Intensity"},
 ImageSize → Scaled[0.8], Joined → True]
```

Compute the DCT of the Signal Vector and Plot

Use the built-in FourierDCT command.

In[98]:=
```
Ccoef = FourierDCT[fs];
```

Display the DCT versus frequency (C[k] is frequency (k-1)/(2*T)).

In[110]:=
```
Cdat = Table[{(k - 1) / (2 * T), Abs[Ccoef[[k, 1]]]}, {k, 1, n}];
ListPlot[Cdat, AxesLabel → {"Frequency (hz)", "Coefficient Magnitude"},
 ImageSize → Scaled[0.8], Joined → True, PlotRange → Full]
```