Subject: Re: FFT confusion
Posted by K. Bowman on Thu, 15 May 2003 15:38:52 GMT
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In article <7126861e.0305150615.29c97045@posting.google.com>,
 jefield@taz.qinetiq.com (Julian Field) wrote:

> Hi,
>
> I'd be enormously grateful if anyone could help me with this.
>
> I'm looking at the power spectra of "chirp" radio signals and am
> having problems getting sensible plots. The following code should
> generate a complex sinusoidal chirp whose frequency runs from 100 to
> 150 Hz and then plot its power spectrum:
>
> However I'm getting a frequency spectrum running from 100 to *200* Hz
> and I'm really confused. This problem has been bugging me for ages and
> I'd be very grateful if anyone could point out my mistake(s).

Your signal is not a linear combination of frequencies between 100 and
150 Hz.  If it were you would get something like this.

```
pro spec
  time = (2.0/1000)*findgen(1001)  ; time (s). NB 1001 samples in 2s
                    ; so sampling freq is 500 Hz thus
                        ; Nyquist freq is 250 Hz
  i = complex(0,1)

  freq1 = REPLICATE(100.0, 1001)        ; single frequency #1
  freq2 = REPLICATE(150.0, 1001)        ; single frequency #2

  theta1 = 2*!pi*freq1*time ; chirp phase angle
  theta2 = 2*!pi*freq2*time ; chirp phase angle
  signal = exp(i*theta1) + exp(i*theta2)

  neg_freq_axis = reverse(-((250.0/500)*findgen(501)))
  pos_freq_axis = ((250.0/499)*findgen(500)) + 1.0
  freq_axis = [neg_freq_axis,pos_freq_axis]        ; x-axis for plot

  window,2,xsize=500,ysize=250
  plot,freq_axis,alog10(shift(((abs(fft(signal)))^2),500)),$
  xrange=[0,260],$
  /xstyle,$
  xticklen=1,$
  xgridstyle=1,$
  yticklen=1,$
  ygridstyle=1
```

end

Even in this case you do not get perfect delta-function spikes in the power spectrum due to finite signal length and sampling.

To construct your frequency-swept chirp, you have to use frequencies over a larger range than the "pure" frequencies contained in your signal.

Ken Bowman

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