
Subject: Re: Dynamic Spectrum

Posted by [David Fanning](#) on Mon, 02 Jun 2008 03:44:13 GMT

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duxiyu@gmail.com writes:

- > I have a set of data and their measured time.
- > I want to get the similar Dynamic Spectrum which is shown in
- > <http://urap.gsfc.nasa.gov/www/reiner/spectra.html>.
- > Is there any IDL procedure to get the Dynamic Spectrum?

I'm not sure you need a procedure. The picture you reference would take, at most, three IDL commands.

Which have you tried that you are having trouble with?

Cheers,

David

--

David Fanning, Ph.D.

Fanning Software Consulting, Inc.

Coyote's Guide to IDL Programming: <http://www.dfanning.com/>

Sepore ma de ni thui. ("Perhaps thou speakest truth.")

Subject: Re: Dynamic Spectrum

Posted by [lasse](#) on Mon, 02 Jun 2008 08:39:23 GMT

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On 2 Jun, 04:44, David Fanning <n...@dfanning.com> wrote:

- > I'm not sure you need a procedure. The picture you
- > reference would take, at most, three IDL commands.

I'd be interested to see those three commands, if you don't mind.

Cheers

Lasse Clausen

Subject: Re: Dynamic Spectrum

Posted by [duxiyu@gmail.com](#) on Mon, 02 Jun 2008 09:23:37 GMT

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On Jun 2, 11:44 am, David Fanning <n...@dfanning.com> wrote:

- > dux...@gmail.com writes:
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I think you misunderstood my meanings.
The data I have is a time series.
I want to know how to get the dynamic spectrum from the time series
data.

Can three IDL commands achive this purpose?

Du Jian

Subject: Re: Dynamic Spectrum
Posted by [lasse](#) on Mon, 02 Jun 2008 09:59:19 GMT
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On 2 Jun, 10:23, "dux...@gmail.com" <dux...@gmail.com> wrote:
> On Jun 2, 11:44 am, David Fanning <n...@dfanning.com> wrote:
>
>
>
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> data.
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> Can three IDL commands achieve this purpose?
>
> Du Jian

No, I have the feeling we did not misunderstand what you meant. To me it seems that you have not understood what a dynamic spectrum is, if you don't mind me patronising you here. It is pretty straight forward to calculate a dynamic spectrum:

Say you have the data in an array called boogidiboo.
You then extract a certain subset of boogidiboo and calculate the FFT.
Move the subset by a certain number of points and calculate FFT.
Move the subset by a certain number of points and calculate FFT.
Move the subset by a certain number of points and calculate FFT.
...

Or, as IDL code snippet

```
raw_fft = make_array(fft_len, number_of_ffts, /float)
FOR i=0L, number_of_ffts-1L DO BEGIN
  data = boogidiboo[i*fft_len:(i+1L)*fft_len-1L]
  raw_fft[* ,i] = FFT(data, -1)
ENDFOR
```

Ok, you could do that in three lines, I guess. ;-) However, you might want to think about tapering your data. Also, FFT returns complex numbers so if you want the FFT power, you need to do a $ABS(raw_fft)^2$. And also, FFT returns negative frequencies as well, which you can usually throw away. Read the IDL FFT help for more info.

Cheers
Lasse Clausen

Subject: Re: Dynamic Spectrum
Posted by [jdu](#) on Mon, 02 Jun 2008 13:17:00 GMT
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On Jun 2, 5:59 pm, Lasse Clausen <la...@lbnc.de> wrote:
> On 2 Jun, 10:23, "dux...@gmail.com" <dux...@gmail.com> wrote:
>
>
>
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> Ok, you could do that in three lines, I guess. ;-) However, you might
> want to think about tapering your data. Also, FFT returns complex
> numbers so if you want the FFT power, you need to do a $ABS(raw_fft)^2$.
> And also, FFT returns negative frequencies as well, which you can
> usually throw away. Read the IDL FFT help for more info.
>
> Cheers
> Lasse Clausen

Thank you very much!
It is very helpful.

Du Jian

Subject: Re: Dynamic Spectrum
Posted by [R.G. Stockwell](#) on Mon, 02 Jun 2008 16:16:36 GMT
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<duxiyu@gmail.com> wrote in message
news:b89c97e8-2b45-4507-a70b-0f71cdb91a8e@p25g2000pri.google groups.com...
> Dear all,
>
> I have a set of data and their measured time.
> I want to get the similar Dynamic Spectrum which is shown in
> <http://urap.gsfc.nasa.gov/www/reiner/spectra.html>.
> Is there any IDL procedure to get the Dynamic Spectrum?
>
> Best regards,
> Du Jian

Hi Du Jian,
here is a link to a page that has IDL code to do a similar thing.

<http://www.cora.nwra.com/stransform/>

The file you would need is s_trans.pro, here is the direct link:
http://www.cora.nwra.com/~stockwel/rgspages/S-Transform/s_trans.pro

Here is a simple example:

```
ex_len = 512
ex_time = findgen(ex_len)
ex_freq = 5;ex_len/16
ex_ts = cos(2*!Pi*ex_freq*ex_time/ex_len)
ex_ts = cos(2*!Pi*(ex_len/5+2*ex_ts)*ex_time/ex_len)
; crossed chirp example commented out
;ex_ts = cos(2*!Pi*ex_freq*ex_time*(1+2*ex_time/ex_len)/ex_len)
;ex_ts = ex_ts + reverse(ex_ts)
!P.multi=[0,1,2]
plot,ex_ts,xtitle='Time (units)',title='Time Series [h(t) = cos(cos(wt))]'
s = s_trans(ex_ts,/samp, /AMPLITUDE,verbose=verbose) ; returns structure,
amps only returned
nlevels = 14
levels = findgen(nlevels)/(nlevels-1)*1.5

contour,s.st,ex_time,s.freq,levels=levels,/fill,xtitle='Time (units)', $
ytitle='Frequency (1/unit)',title='Amplitude of S-Transform'

end
```

Cheers,
bob

Subject: Re: Dynamic Spectrum
Posted by [russell.grew](#) on Tue, 03 Jun 2008 00:20:53 GMT
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You might want to have a read of

Welch, 'The Use of Fast Fourier Transform for the Estimation of Power Spectra: A Method Based on Time Averaging Over Short, Modified Periodograms', IEEE Trans. Audio & Electroacoust., Volume AU-15, p. 70-73.

It's probably the simplest implementation of what you are trying to do. It provides for overlapping FFT's and discusses windowing and their compensation. Also theres a book by Hayes, 'Statistical Digital Signal Processing and Modeling' that has a good chapter on power spectrum estimation.

To get your y-axis correct you need to know the data sample rate and hence evaluate the Nyquist frequency. For instance if your data is sampled twice per second, you can only plot up to 1 Hz. The kHz data in the link you gave obviously requires large sample rates. You need to choose your FFT length to give an appropriate frequency resolution to see what you are looking for in the data (if you have a 100 point FFT over data with a 1 Hz Nyquist and drop the imaginary half of the FFT, you are left with $1/50 = 0.02$ Hz frequency resolution).

Fun times.

Russell.

Subject: Re: Dynamic Spectrum
Posted by [pgrigis](#) on Tue, 03 Jun 2008 13:24:18 GMT
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RussellGrew wrote:

> [skip]

>

> To get your y-axis correct you need to know the data sample rate and
> hence evaluate the Nyquist frequency. For instance if your data is
> sampled twice per second, you can only plot up to 1 Hz. The kHz data
> in the link you gave obviously requires large sample rates.

Or, actually, a spectrometer... ;-)

Ciao,
Paolo
