Subject: mpfit of parametric data?
Posted by jamiesmyth_uni@yahoo. on Wed, 28 Jul 2004 15:45:08 GMT
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I suppose this is really a question for Craig but I figure here is as good a place to ask as any... Does anyone know how I can go about fitting parametric data using MPFIT? I have done a fair bit of 1d fitting with mpfit (MPFITEXPR) but I'm really stumped on this one. I want to fit to the following parametric parameterisation:

x = (a0+a1*t) + sin(a2*t+phase)
y = (b0+b1*t) + cos(b2*t+phase)

where, a0, a1, a3, b0, b1, b2 and phase are all fit parameters.

The intention is to try and fit the motion of a spinning top that precesses. I have very long running (but noisy) time series data for the x and y values. Alternatively, you can think of me having x(t) and y(t) sampled at identical times. I am mainly interested in the phase parameter.

This is proving considerably more difficult than I expected it to be!
Thanks.
Jamie

Subject: Re: mpfit of parametric data?
Posted by jamiesmyth_uni@yahoo. on Thu, 12 Aug 2004 22:00:50 GMT
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After two weeks of vacation I'm back at this. I've de-trended the original time series by fitting to a quadratic, and estimated the frequencies of the components by looking at the power spectrum. Unfortunately, I still cannot fit the amplitude and phase of a trivial sinusoid such as 'A*sin(2*!dpi*w*t+phi)'. How do I go about estimating the phase of the following trivial example?

```
IDL> n = 2048
IDL> t = dindgen(n) * 0.125 ; time
IDL> freq = dindgen(n)/(n*0.128)
IDL> p0 = [0.03, 0.06923, 2.3]
IDL> data =  p0(0)*sin( 2*!dpi*p0(1)*t + p0(2) )
IDL> plot, t, data
IDL> Ft_data = fft(data)
IDL> plot, freq, abs(Ft_data)^2, xrange=[0,0.5] ; frequency estimate
IDL> plot, freq, atan(double(Ft_data),imaginary(Ft_data)),
xrange=[0,0.5] ; ?phase estimate?
```

I think I understand what Craig said about a local-minimum but I'm a little surprised that such a simple problem (i.e. estimating the amplitude, frequency and phase of a sine wave) would be so difficult? How is it that my Lecroy/Tektronix scope can solve this in real time but I cannot do it with IDL and a dual xeon? Surely I must be missing something...

Any help is greatly appreciated!
Jamie

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Subject: Re: mpfit of parametric data?
Posted by Paolo Grigis on Mon, 16 Aug 2004 15:36:06 GMT
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When you get your starting guess for the frequency (let's call it guessfreq) from the FFT you should be able to use mpfitfun with starting parameters, say, [1.,guessfreq,0.] and obtain a good fit...

```
IDL> dummy=max(abs(Ft_data),count)
IDL> guessfreq=freq[count]
IDL> print,guessfreq
      0.068664548

IDL> par=mpfitfun('yoursinusoid',t,data,errors,[1.,guessfreq,0.])

Iter      1   CHI-SQUARE =   1.0754572E+09
    P(0) =            1.00000
    P(1) =           0.0686645
    P(2) =            0.00000

[...]

Iter      7   CHI-SQUARE =   1.1268491E-23
    P(0) =          -0.0300000
    P(1) =           0.0692300
    P(2) =           -0.841593
```

You may obtain a negative amplitude and/or phase sometimes, but if this bothers you, you can use the PARINFO structure in mpfitfun for constraining them to positive values.

In this simple case it looks like you can fit your data
without needing good guesses on the amplitude or the phase.
But possibly more work is needed for the real data...

Ciao,
Paolo

jamiesmyth_uni@yahoo.ca wrote:
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> Any help is greatly appreciated!
> Jamie
>

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Subject: Re: mpfit of parametric data?
Posted by Craig Markwardt on Mon, 16 Aug 2004 18:14:12 GMT
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"jamiesmyth_uni@yahoo.ca" <jamiesmyth_uni@yahoo.ca> writes:

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> something...

Jamie, since you don't have any call to MPFIT here, I am a little confused about how your question relates to MPFIT.

Also, you have a mismatch in your FREQ and T variables, right?

The 2-argument version of ATAN accepts variables as ATAN(Y,X), not ATAN(X,Y), so shouldn't you swap the order of the imaginary and real components?

Finally, you are plotting the spectrum of phases. Don't you want the phase at the maximum Fourier power? And, how do you know the phase is wrong?

Craig

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Astrophysics, IDL, Finance, Derivatives | Remove "net" for better response
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