Subject: Re: Curve Fitting to timeseries using a set of 8 sine and cosine functions
Posted by Yngvar Larsen on Sat, 25 Oct 2014 15:59:25 GMT
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This is actually not a nonlinear system, but a linear one. Thus, in the general case where your sampling vector X is not regular, a linear least squares fit could be done easily with the pseudo inverse of the system matrix:

```
np = 160                    ; Number of samples
nc = 4                      ; Number of even/odd terms

;; Irregular sampling points
x = 2*!dpi*randomu(seed, np)-!dpi
x = x[sort(x)]

;; Generate signal according to model
H = dblarr(np, 2*nc+1)          ; System matrix
H[*,0] = 1                  ; Constant term
for n=1,nc do begin
   H[*,n] = cos(n*x)            ; even terms
   H[*,n+nc] = sin(n*x)         ; odd terms
endfor
coeff = randomn(seed, 2*nc+1)   ; Random coefficents
s = H#coeff                 ; signal
n = randomn(seed, np)           ; noise

;; least squares fit to signal:

Hpinv = invert(transpose(H)#H)#transpose(H) ; pseudoinverse of linear system
coeff_est = Hpinv#s
print, 'RMS: ', sqrt(mean(abs(coeff_est - coeff)^2)) ; Exact within numerical precision

;; least squares estimate of system coefficients
coeff_est = Hpinv#(s+n)
print, 'RMS: ', sqrt(mean(abs(coeff_est - coeff)^2))

;; Fitted signal
s_fit = H#coeff_est

plot, x, s+n, linestyle=1, thick=2. ; Noisy observation
oplot, x, s, color='ff'x            ; True signal
oplot, x, s_fit, color='ff00'x      ; Fitted signal
8<-----------------------
```

If your sample vector X happens to be regular, the solution to your problem is actually nothing more than an FFT, and pick the 5 first complex coefficients. The first coefficient is the constant term A0 (not included in your problem), and real/imaginary parts of the following coefficients corresponds to cosine terms A1-A4 and the sine terms B1-B4, respectively.

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Yngvar

On Saturday, 25 October 2014 07:47:17 UTC+2, siumt...@gmail.com wrote:
> I think you should try to be for specific to ask question here.
>
> Suppose I have a timeseries with the S size.
>
> I want to do nonlinear fitting to the timeseries using the following fourier series (harmonic function)
>

>
> And I would find 8 coefficients such as An and Bn where n = 1,2,3,4
>
> That is.
>
> A1,A2,A3,A4
> B1,B2,B3,B4
>
> I have attempted to understand how it works mpfit by Craig and curvefit . Unfortunately, I did not because I am not IDL expert. So I posted this if anyone can help
>
>
> Best Wishes
>
>
> Thanks for you help