Re: Fourier analysis Q

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- *From*: "Puppet_Sock" <puppet_sock@xxxxxxxxxxx>

- *Date*: 3 Nov 2005 08:05:44 −0800

bill wrote:
> I have some data that, when I histogram it, shows some degree of
> quantization (i.e. the histogram has definite spikes at regular
> intervals, and this is not an artifact of the histogramming
> procedure). The spikes decay in magnitude roughly exponentially.
> (In between the spikes the hits are few but not zero.)
>
> I don't know much about Fourier analysis, but it seems to me that
> I should be able to apply some type of Fourier technique to this
> data to measure the quantification more precisely, and in a way
> that is not at all affected by the arbitrary choices made in making
> the histogram.
>
> What throws me off is that, in my little experience with Fourier
> analysis, all the techniques are applied to a "signal" relative to
> some variable (usually time). In this case all I have is a list
> of about 100,000 non−negative numbers, which, when histogrammed,
> appear to bunch up at regular intervals. Something *similar* to
>
> 126.380819738467
> 126.283380093841
> 125.748352912939
> 42.4897817871943
> 168.131819727191
> 168.163828641399
> 41.769198680611
> 0.0370432374476124
> 83.828042075852
> 42.2004219487581
> 42.1663080612675
> 167.85268740098
> 84.1654003775314
> 126.075822588658
> 41.6125736396355
>
> where all the numbers are close to a multiple of 42 (actually the
> periodicity become less obvious as the magnitude of the numbers
> increases).
>

> Given that this is nothing like a time−dependent (or space−dependent)
> signal, I'm a bit of at a loss as to how to apply a Fourier
> transformation to the data.
>
> Any suggestions would be much appreciated!

You've opened a large can of worms here.

First, the general subject you are talking about is data analysis, not just
Fourier analysis. It is possible you've got some kind of periodic thing here,
but it's also possible you've got a lot of things.

The ideal would be to have some idea what to expect based on physics of the situation. "I have some data" is a very nebulous start. Unless it's
a puzzle that you are supposed to unravel based on internal clues in the data, you really want some notion of where to start.

Consider: If this were energy of emitted photons, you might be seeing something of a band structure. If the emitting source had several equally spaced bands, you might see a lot of photons at the first band, a lot jumping two bands, a lot jumping three, and so on. Then the rest of the signal might be accounted for on the basis of processes that added noise, such as thermal vibration, scattering before the photon hit the detector, etc. And the band structure might only extend for part of the spectrum, after which you started to see some other form. In that case, a Fourier analysis might not be very useful.

Or as another alternative: If you were looking at time of signal return,
you might be seeing echoes from different parts of your device. This might show some limited periodicity, followed by a range of progressively
more chaotic values, followed by a range that looked nearly continuous. In this case again, a Fourier analysis might not be very useful. Particularly
without some idea of why different frequencies were not equally likely.

Suggestion: Work with somebody who understands your system. See if you can't come up with some kind of indication of what the structure in the data ought to look like. Then take that model and see if it fits the
data. That will give you a start on whether you understand your data.
Socks

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- ***References***:
  - ***Fourier analysis Q***
    - *From:* bill

- Prev by Date: ***Re: Fourier analysis Q***
- Next by Date: ***Re: Quantum Mechanics calculations for an undergraduate?***
- Previous by thread: ***Re: Fourier analysis Q***
- Next by thread: ***Re: Fourier analysis Q***
- Index(es):
  - ***Date***
  - ***Thread***