Subject: Re: 2D FFT help
Posted by Randall Skelton on Tue, 08 Oct 2002 16:37:13 GMT
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On Tue, 8 Oct 2002, Randall Skelton wrote:

> So, in the first case, the answer looks correct and is a slight deviation
> from the standard textbook example of the FFT of a cylinder. In the second
> case, however, the results looks to be rotated by 90 degrees in the plane,
> i.e. I think the result and input should look identical. Can someone
> explain what I have done wrong? I am also somewhat troubled by the spike
> currently at (0,0)?

I take back what I wrote above... it seems my intuition was wrong... the
story of my week.

Cheers,
Randall

Subject: Re: 2D FFT help
Posted by Stein Vidar Hagfors H[1] on Tue, 08 Oct 2002 20:41:23 GMT
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Randall Skelton <rhskelto@atm.ox.ac.uk> writes:

> Greetings all,
>
> I am trying to perform a multi-dimensional FFT in IDL. I thought I had
> this figured out (example 1) but I am now feeling (example 2) that this
[..]
> ; Shift the array (correct element 0 being the zero frequency component)
> b_fixed = shift(b, -1*64, -1*64)
[..]
> ; Shift the array (correct element 0 being the zero frequency component)
> spec_fixed = shift(spec_cov, -1*64, -1*64)
[..]
> So, in the first case, the answer looks correct and is a slight deviation
> from the standard textbook example of the FFT of a cylinder. In the second
> case, however, the results looks to be rotated by 90 degrees in the plane,
> i.e. I think the result and input should look identical. Can someone
> explain what I have done wrong? I am also somewhat troubled by the spike
> currently at (0,0)?

The two IDL lines above are slightly wrong... After the fft, [0,0] contains
the zero frequency component, so if you want to shift it to pixel [n/2,n/2],
you should do "just that", i.e.:

```
b_fixed = shift(b,64,64)
spec_fixed = shift(spec_cov,64,64)
```

Note that the choice of n/2 versus n/2-1 as a "center point" may seem arbitrary for visualization purposes (there's no *center* of a 2^n-sized array!). However, if you choose n/2-1 instead, (i.e. shift(..,63,63)), you're making sure that the (degenerate) highest-frequency point (found at [64,64] in the original fft result) does not get wrapped around to [0,0], so this is obviously the correct choice.

The rotation by 90 degrees is exactly as it should be. Just think: what would a 1d transform of the line along the diagonal look like? A single entry at 0 frequency, right? Well, that's what you get if you "integrate away 1 dimension" (summing strips that are normal to your original line, collapsing 2d to 1d). Works in both domains!!

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