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Subject: Re: What are the errors in the FFT?

Posted by [Vince Hradil](#) on Thu, 08 Feb 2007 17:38:47 GMT

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On Feb 8, 10:53 am, m...@lanl.gov wrote:

- > For a given function  $f(t)$  I am finding:
- >
- >  $\text{FFT}(\text{FFT}(f(t), -1), 1) - f(t)$  varies between about  $10^{-7}$  to  $10^{-8}$  for
- > floating point
- > and about  $10^{-14}$  to  $10^{-16}$  for double precision
- >
- > (I.e. the inverse transform of the transform deviates from the
- > original function)
- >
- > Is this a problem with the IDL implementation of the FFT, or is this a
- > more fundamental issue with the algorithm itself?
- >
- > -Monty Wood

Wow, one part in 10-100 million?? Why do you care?

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Subject: Re: What are the errors in the FFT?

Posted by [Kenneth Bowman](#) on Thu, 08 Feb 2007 18:24:52 GMT

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In article <1170953635.505681.59040@v33g2000cww.googlegroups.com>, monty@lanl.gov wrote:

- > For a given function  $f(t)$  I am finding:
- >
- >  $\text{FFT}(\text{FFT}(f(t), -1), 1) - f(t)$  varies between about  $10^{-7}$  to  $10^{-8}$  for
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- > (I.e. the inverse transform of the transform deviates from the
- > original function)
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- > Is this a problem with the IDL implementation of the FFT, or is this a
- > more fundamental issue with the algorithm itself?
- >
- > -Monty Wood

That is simply roundoff error. Unavoidable with floating-point calculations, I'm afraid.

Ken Bowman

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Subject: Re: What are the errors in the FFT?  
Posted by [Haje Korth](#) on Thu, 08 Feb 2007 18:37:45 GMT  
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Monty,  
Congratulations, you have just discovered you machine's precisions in doing floating point mathematics. :-)

BTW: I have uploaded an FFTW3 implementation to the ITTVIS codebank. Should be ready for grabs there in a few days. You can double check just for grins.

Cheers,  
Haje

<monty@lanl.gov> wrote in message  
news:1170953635.505681.59040@v33g2000cww.googlegroups.com...  
> For a given function  $f(t)$  I am finding:  
>  
>  $\text{FFT}(\text{FFT}(f(t), -1), 1) - f(t)$  varies between about  $10^{-7}$  to  $10^{-8}$  for  
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>  
> (I.e. the inverse transform of the transform deviates from the  
> original function)  
>  
> Is this a problem with the IDL implementation of the FFT, or is this a  
> more fundamental issue with the algorithm itself?  
>  
> -Monty Wood  
>

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Subject: Re: What are the errors in the FFT?  
Posted by [Paul Van Delst\[1\]](#) on Thu, 08 Feb 2007 18:43:23 GMT  
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monty@lanl.gov wrote:  
> For a given function  $f(t)$  I am finding:  
>  
>  $\text{FFT}(\text{FFT}(f(t), -1), 1) - f(t)$  varies between about  $10^{-7}$  to  $10^{-8}$  for  
> floating point  
> and about  $10^{-14}$  to  $10^{-16}$  for double precision

What are the magnitudes of the original  $f(t)$ ? If close to one, sounds like "simple" accumulation of precision errors.

> (I.e. the inverse transform of the transform deviates from the  
> original function)

Depends on your definition of "deviates".

> Is this a problem with the IDL implementation of the FFT, or is this a  
> more fundamental issue with the algorithm itself?

Depending on your input function magnitudes, it's more likely a (the? :o) fundamental issue with floating point arithmetic. There are ways of minimising this sort of error accumulation (and I assume FFT algorithms do it already), but you can't remove it entirely.

cheers,

paulv

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Paul van Delst            Ride lots.  
CIMSS @ NOAA/NCEP/EMC            Eddy Merckx

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Subject: Re: What are the errors in the FFT?  
Posted by [Paul Van Delst\[1\]](#) on Thu, 08 Feb 2007 18:45:49 GMT  
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Haje Korth wrote:

> Monty,  
> Congratulations, you have just discovered your machine's precision in doing  
> floating point mathematics. :-)

ha ha. but wouldn't

IDL> help, machar(),machar(/double),/struct

have been much faster? :o) Not as much fun, though.

paulv

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Paul van Delst            Ride lots.  
CIMSS @ NOAA/NCEP/EMC            Eddy Merckx

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