

## Re: Confused by FFTW output

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Tom wrote:

- > *I am trying to get acquainted with the latest FFTW and wrote a small*
- > *test program to ensure correct usage by comparing a computed spectrum*
- > *with an analytical solution. For a start, I chose a Gaussian,*
- >  *$f(t) = \exp(-a \cdot t^2)$ , whose spectrum is a purely real function, namely*
- >  *$F(w) = \sqrt{\pi/(4a)} \cdot \exp(-w^2/(4a))$ . However, when computing the*
- > *spectrum*
- > *with FFTW, I get a nonvanishing imaginary part in the transform,*

As others have pointed out, you have to be more careful with the symmetry in order to get a real output.

However, you have another problem, which is perhaps more symptomatic of your underlying misunderstanding: the FFT computes the discrete Fourier transform (DFT), which is *not the same* as the continuous Fourier transform.

In particular, the DFT implies periodic boundary conditions, which means that even though you think your input is a single Gaussian, it is actually an infinite periodic sequence thereof (with chopped-off tails), which changes its transform. (This periodicity is also why you got the symmetry wrong.)

Steven