

## Re: FFT result evaluation

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**From:** Richard Mathar ([mathar\\_at\\_amer.strw.leidenuniv.nl](mailto:mathar_at_amer.strw.leidenuniv.nl))

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In article <cmsmtc\$lv2\$1@lnx107.hrz.tu-darmstadt.de>, "Alexander Rentschler" <arentschler@ew.tu-darmstadt.de> writes:  
>I have a signal with harmonics that are not integer multiples of the  
>fundamental frequency. So it is not possible to guarantee that the FFT –  
>Window get a full period of each harmonic of the analysed signal. The result  
>of the FFT is a distributed spectrum for each harmonic and it is not  
>possible to find out the correct magnitude of the harmonics. Is it possible  
>to calculate the correct signal magnitude from the distributed spectrum for  
>each harmonic ? I found a way to calculate the magnitude for each  
>distributed spectrum, but I don't find the correct mathematical description  
>for this problem. Has anybody an idea how to define this mathematically.  
>

The FFT (or any other DFT) is covering a finite range in the time domain and equivalent to multiplication of the time series by a "boxcar" function. The standard convolution theorem of Fourier analysis describes this in the frequency domain as a convolution with the DFT of the boxcar, known as the sinc-function. To avoid that the convolution with the "negative" pieces of the oscillatory sinc-function in the frequency domain "removes" or partially "cancels" the area under the "correct" peak in the frequency domain, one usually modifies the boxcar function to "round up" the "sharp" edges in the time domain and avoid the Gibb's oscillations of the sinc-function; the keywords to search for these techniques are "apodisation", "Norton-Beer" ... This way one can to a good extend ensure that the area under the "dispersed" peaks in the frequency domain represents the original's series amplitudes.

<http://www.strw.leidenuniv.nl/~mathar>