

Hi, I looking some advice and assistance on the use of MATLAB/Simulink for spectrum analysis.

I decided to look at a unipolar square wave with amplitude of 1v, a 50% duty cycle and a frequency of 2kHz.

First I used pencil and paper and some mathematics to calculate the Fourier Series to find the spectral content of such a continuous signal.

I then used the discrete Fourier Series equation to calculate the spectral content of such a sampled signal and varied the number of samples taken over one period i.e. $N=32, 64, 128$ expecting to see the discrete spectrum to get closer to the continuous spectrum as the number of samples increased.

With the aid of excel I was able to prove this.

I thought it would be interesting to use MATLAB/Simulink to do the same thing so that I could compare results.

I now have an excel spreadsheet which has 3 columns for the amplitude of line spectra using Fourier Series, discrete Fourier Series (dfs) and MATLAB.

As already stated the discrete Fourier Series converged to the continuous Fourier Series as the number of samples in one period increased. But there was a different story with the MATLAB results :

1. The difference between dfs and MATLAB results for both the dc component and fundamental frequency (2 kHz) was substantially larger than for the other line spectra (bins).
2. The difference between dfs and MATLAB for the fundamental frequency bin appeared to increase as the number of samples increased i.e. it did not converge.
3. Although the difference in the dc component for $N=32$ appeared relatively large, it did reduce and converge as the number samples increased.
4. The difference in the rest of the frequency bins at first converged for $N=32$ to $N=64$ and then began to diverge between $N=64$ and $N=128$.