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Signal Analysis of Real Time Signals

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Abstract- ***Removal of noise is very important branch in Digital Signal Processing. This paper addresses the analysis of real time signals to finally remove noise from the signals. In the proposed technique these signals are analyzed by comparing the results in Spectrum Analyzer and MATLAB. This is performed by evaluating the FFTs first and Hanning window is applied to it. Similar process is done in MATLAB. By analyzing these real time signals we can say that the results in Spectrum Analyzer are almost same with the results in MATLAB.***

Keywords: Real Time Signal , Analysis, MATLAB, FFT, Windowing, Spectrum Analyzer

I. INTRODUCTION

A signal is a physical quantity that varies with time space or any other independent variable. By which information can be conveyed. A real discrete-time signal is defined as any time-ordered sequence of real numbers. The Fast Fourier Transform is an algorithm optimization of the DFT—Discrete Fourier Transform. It is an algorithm to compute the Discrete Fourier Transform (DFT) and its inverse. A Fourier Transform converts time (or space) to frequency and vice versa. A FFT rapidly computes such transformations. As a result, Fast Fourier Transforms are widely used for many applications in engineering, science, and mathematics. It takes a part of time called a frame (a certain number of samples) and considers that part to be a single period of a repeating waveform. The fourier transform aims to decompose a cycle of an arbitrary waveform into its sine components. Windowing is a technique used to shape the time portion of a measured data, to minimize edge effect that result in spectral leakage in the FFT spectrum. By using the windowing function correctly, the spectral resolution of frequency-domain result will increase. Agilent Intuilink removes the barrier between instruments and PCs, allowing measurement data to be accessed instantly, easily, whenever and wherever it's needed—in design verification, manufacturing test, process control, and data acquisition. Here, it is used to interface with PC to capture the images in Spectrum Analyzer. It also provides with the respective data sheets with which further coding is done in MATLAB.

II. METHODOLOGY

In this paper, three real time signals are considered, i.e. Sine, Square and Triangular waves. Apparatus needed are

1) A Spectrum Analyzer,
2) A Signal Generator and
3) Agilent Intuilink Software

These signals are observed in the Spectrum Analyzer with 10KHz frequency each.FFT of the signals are calculated in the analyzer. The frequency spectrum is windowed for a certain range using Hanning Window.

The Spectrum Analyzer is then interfaced with PC by Agilent Intuilink. With the help of this software, images of the signals with their FFT are captured. Data sheets of each of these signal are obtained. The data sheets are read in MATLAB using the appropriate command.First FFT is evaluated and then the frequency spectrum is windowed. The steps followed here are same as that in Spectrum Analyzer. The results are compared with the result in Spectrum Analyzer. Both the outputs are not exactly same and they almost resemble with each other.

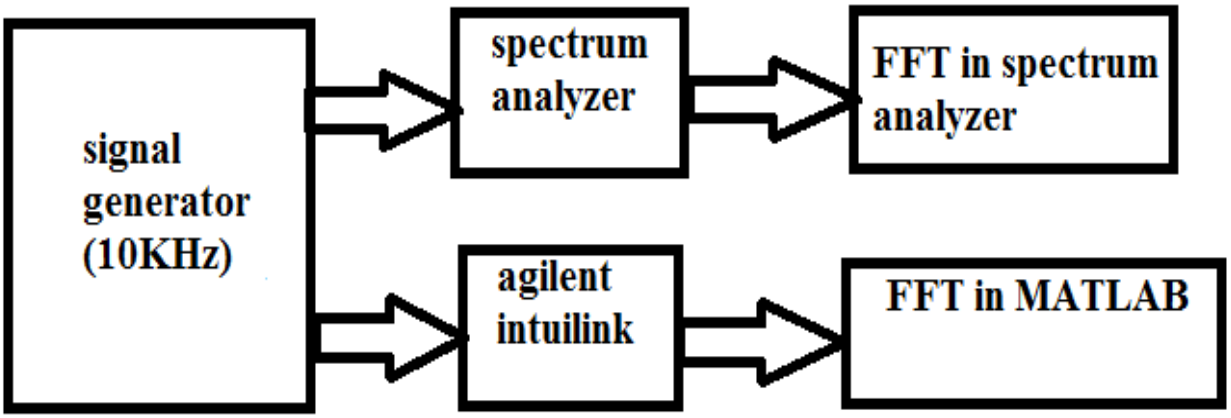

Figure 1. Block Diagram of analysis of the signals using Spectrum Analyzer and MATLAB

III. RESULTS

The following figures show the outputs of the signals. As can be observed from the results:

1. Figure.2 is the Original Sine Wave in MATLAB
2. Figure 3. is the FFT of Sine Wave After Windowing in MATLAB
3. Figure 4. is the Captured Sine wave in Spectrum Analyzer with its FFT
4. Figure 5. is the Original Square Wave in MATLAB
5. Figure 6. is the FFT of Square Wave After Windowing in MATLAB
6. Figure 7. is the Captured Square wave in Spectrum Analyzer with its FFT
7. Figure 8. is the Original Triangular Wave in MATLAB
8. Figure 9. is the FFT of Triangular Wave After Windowing in MATLAB
9. Figure 10. is the Captured Triangular Wave in Spectrum Analyzer with its FFT

(A) SINE WAVE :-

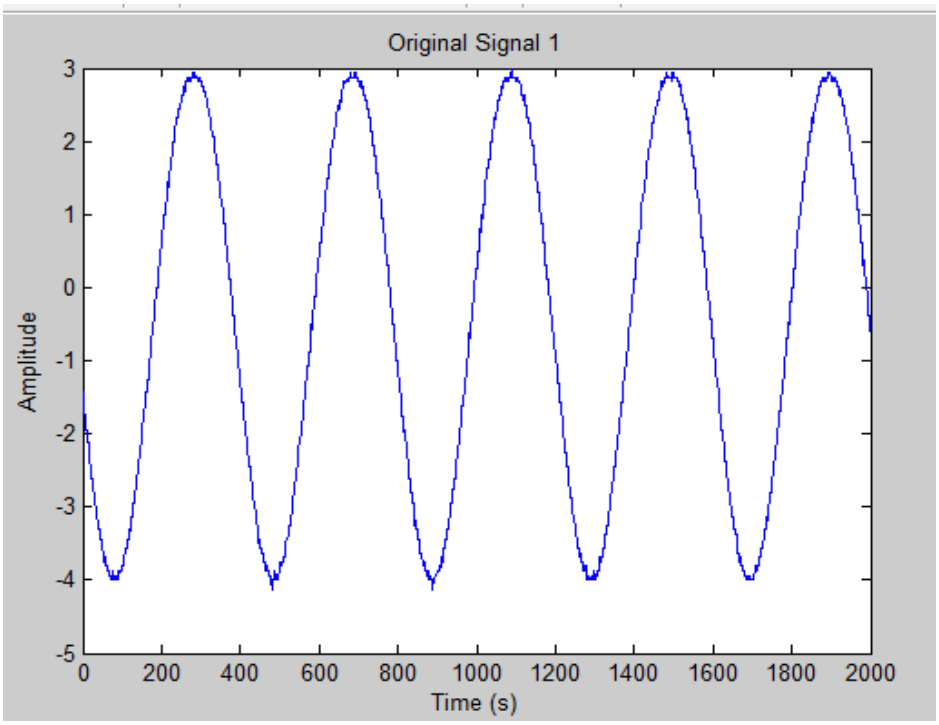

Figure.2 Original Sine Wave in MATLAB

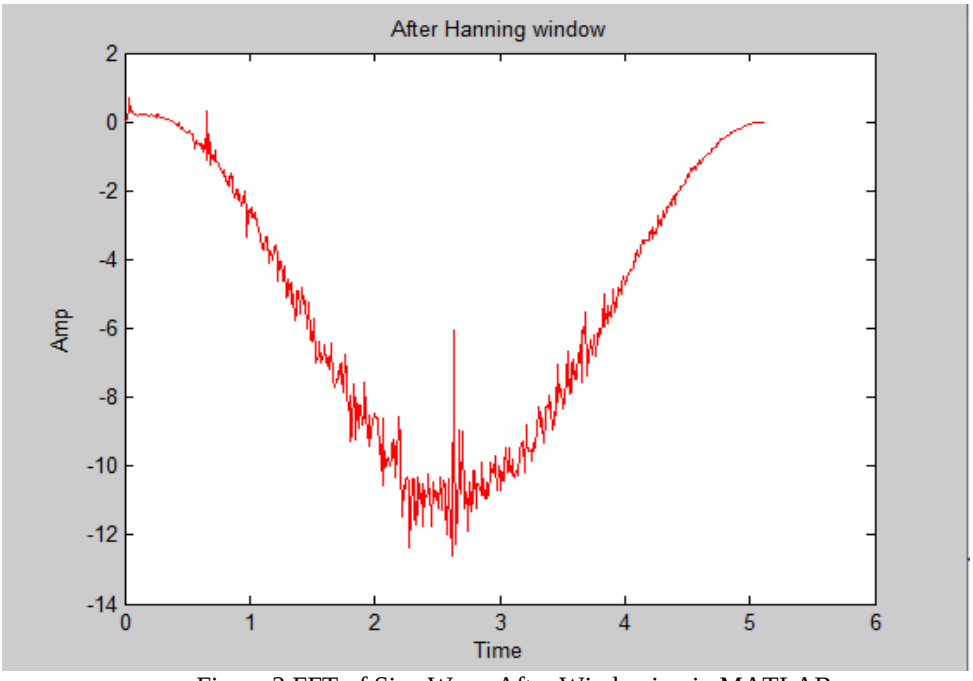

Figure 3.FFT of Sine Wave After Windowing in MATLAB

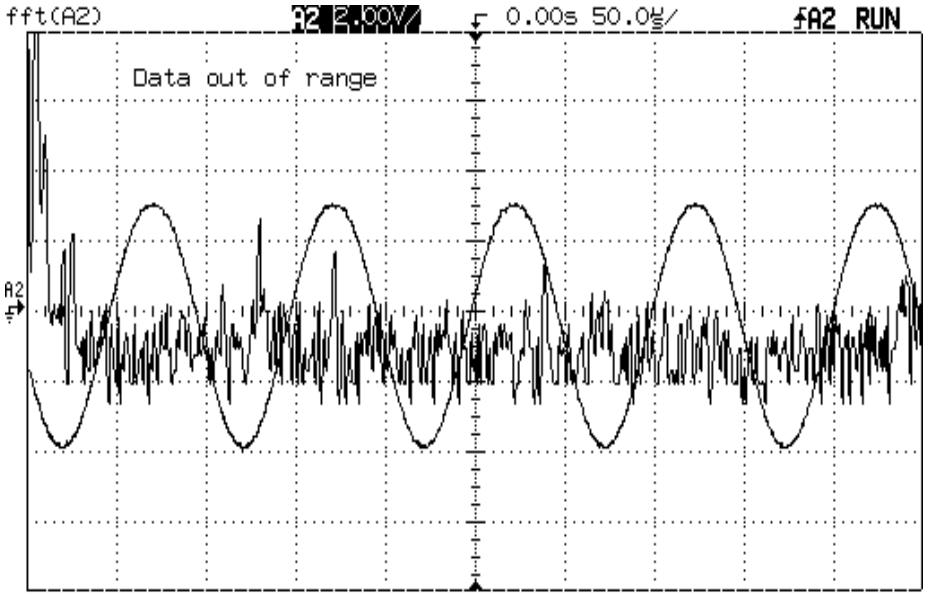

Figure 4.Captured Sine wave in Spectrum Analyzer with its FFT

(B) SQUARE WAVE :-

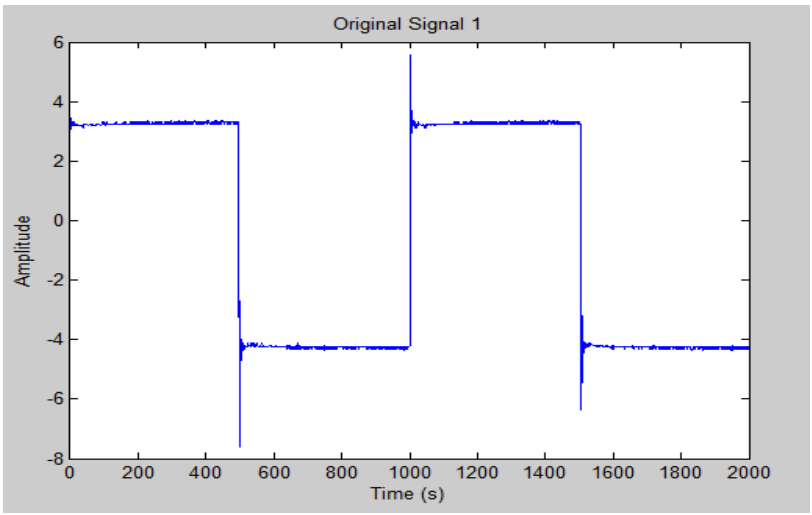

Figure 5.Original Square Wave in MATLAB

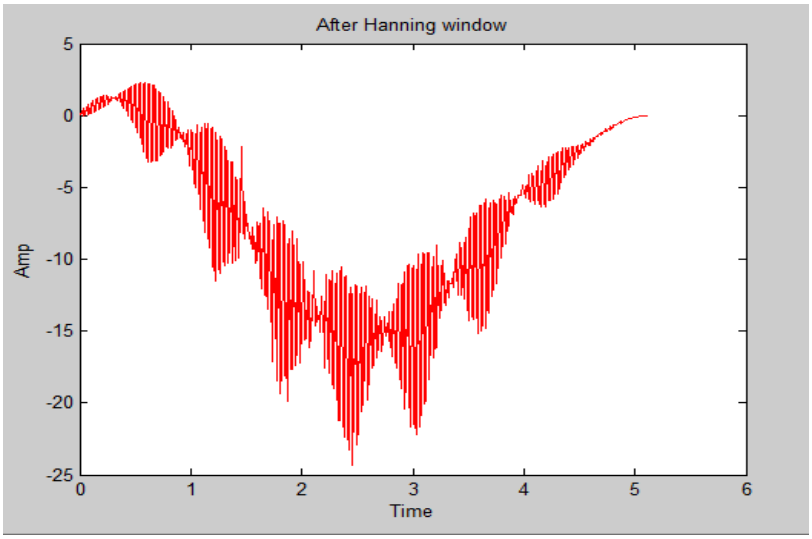

Figure 6. FFT of Square Wave After Windowing in MATLAB

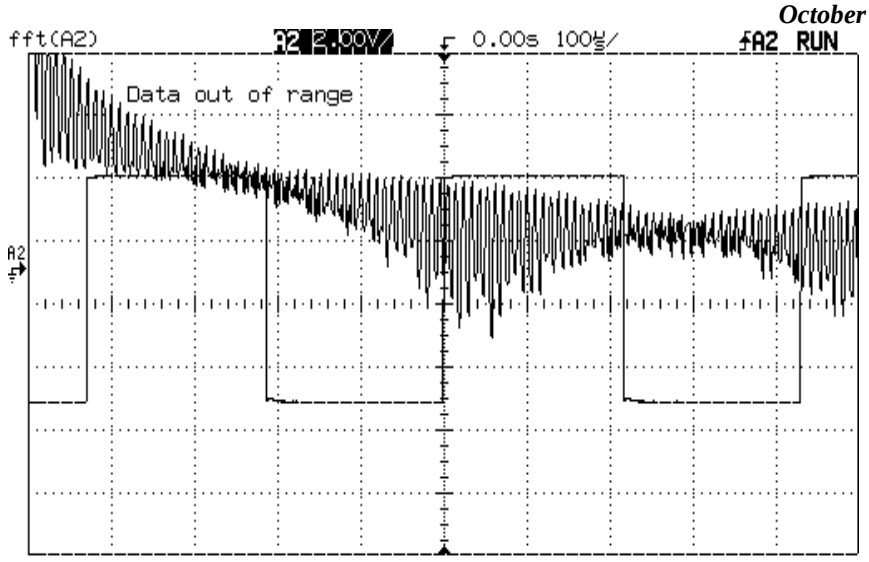

Figure 7. Captured Square wave in Spectrum Analyzer with its FFT

(C) TRIANGULAR WAVE :-

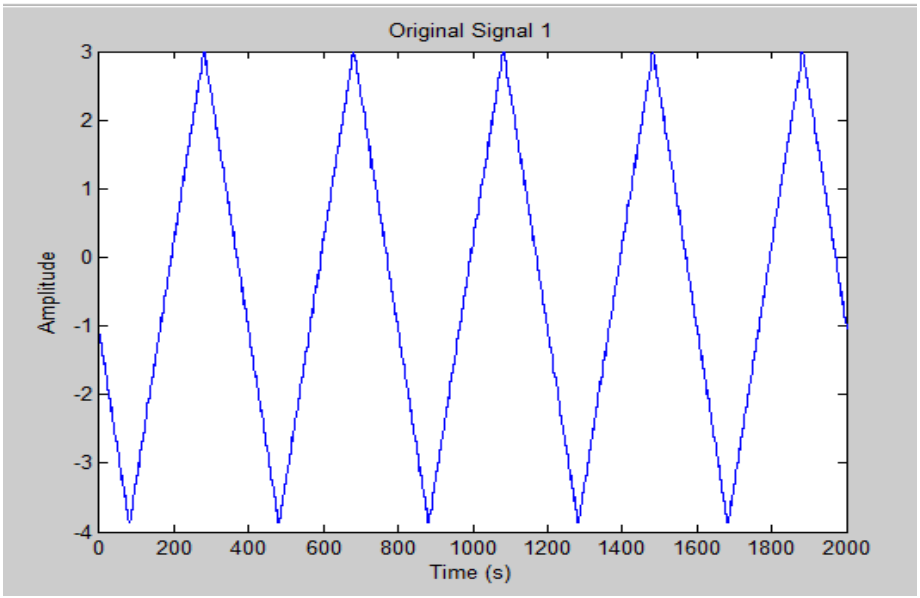

Figure 8. Original Triangular Wave in MATLAB

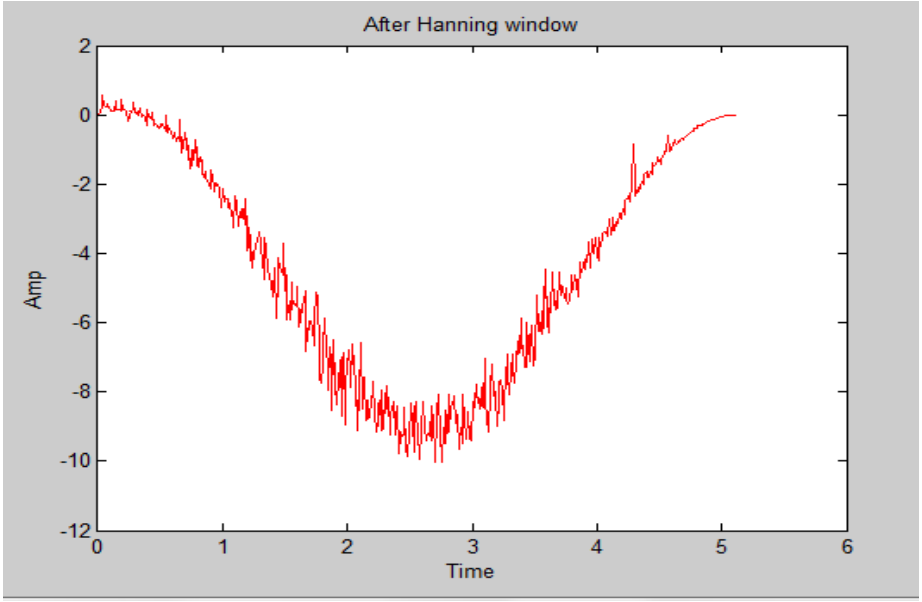

Figure 9. FFT of Triangular Wave After Windowing in MATLAB

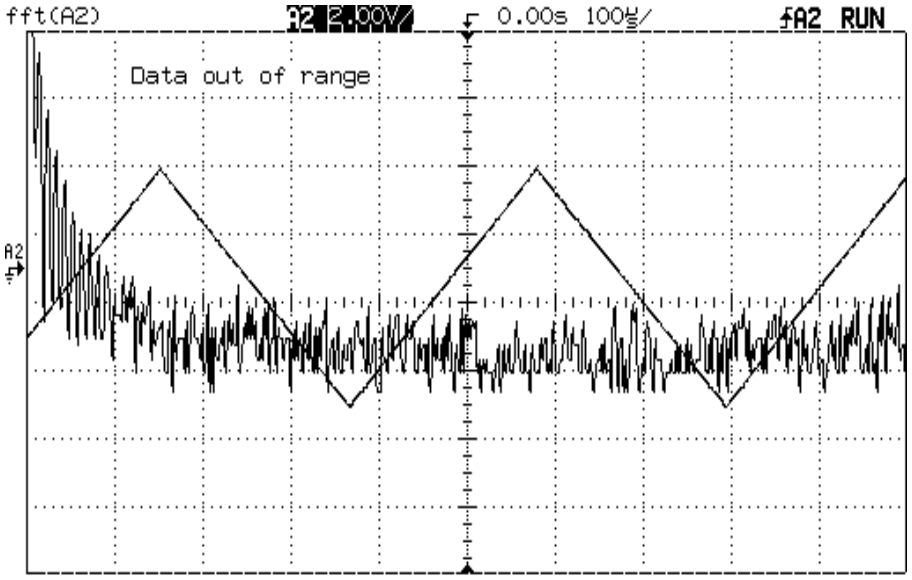

Figure 10. Captured Triangular Wave in Spectrum Analyzer with its FFT

IV. CONCLUSION

For signal analysis of real time signals, Spectrum Analyzer, Agilent Intuitent software and MATLAB are used for obtaining desired results. The FFT was performed on all the three signals and the frequency spectrum was windowed. The results obtained in Spectrum analyzer and MATLAB have got resemblance. They are almost same.

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