**Faculty of Engineering - Cairo University**

**Credit Hours System – Computer Engineering Department**

**Fall 2021**


# ELCN100

# LABORATORY

## Digital Spectrum Analyzer

## Project

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**Video link on YouTube for better quality:**
https://www.youtube.com/watch?v=JzfqKZds-cA

**Video link:**
**https://drive.google.com/file/d/1RQpfdvxrwXXyejVgQDtfBWvxuc78AGKh/view?usp=sharing**

# Introduction:

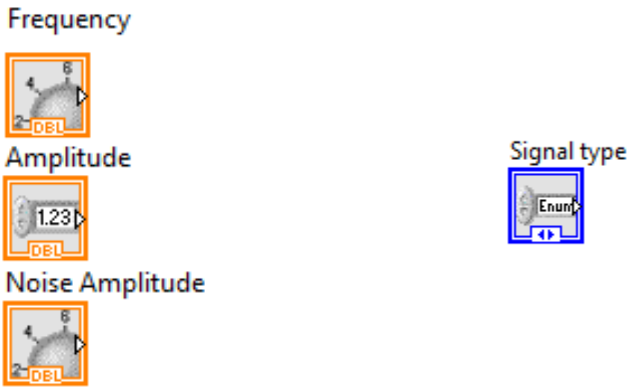
**The following document explains how to create a digital spectrum analyzer measuring instrument in LAB VIEW.**

The function of the digital spectrum analyzer is to measure the magnitude of an input signal versus frequency within the full frequency range of the instrument. So, in simple words an input signal versus time is applied to the spectrum analyzer then using a block called (FFT) Fast Fourier transform this block changes the signal from the time domain to the frequency domain so we can easily make measurements in the frequency domain and we could calculate also the power of the spectrum which is the primary use of the digital spectrum analyzer.

# Steps of implementation:

**1.** We want to add a numeric control for the amplitude, noise amplitude and a knob for the frequency. So, we go the to front panel, and **right click** then press on **Numeric** to add a control, then press on **numeric control**, **knob** and **dial** knobs to add the controls, all the blocks added on the front panel will be shown on the block diagram. **N.B: If block diagram is not visible Press (Ctrl + E).**

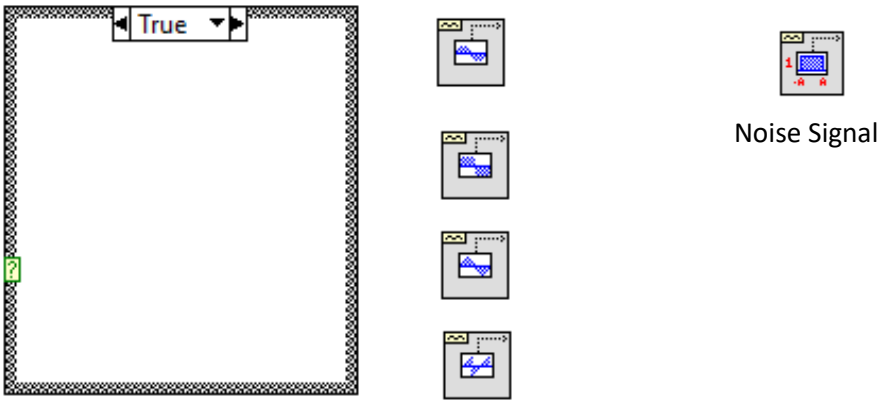
**2.** To add the e-numeric (Enum) control that changes the signal type. So, we go to the front panel, and **right click** then press **Ring & Enum** then press on **Enum. Right Click** on the Enum, then go to properties then edit items and insert the values such as Sine, Square, Sawtooth and Triangle and assign a numeric value ranging from (0 to 3).



**3.** Now we add the **case structure**, to add it **right click** on the block diagram then click express then **execution control** then we choose **case structure**. (Wire up the Enum control to the case structure and right click on the case structure to add different cases by pressing **add case after**.

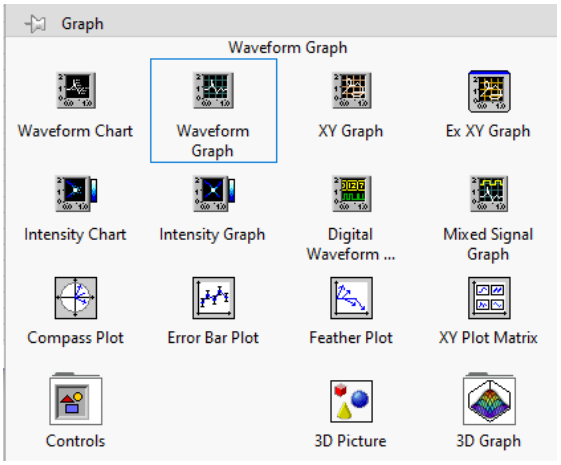
**4.** Now we should add every waveform in the block of the case structure according to our case, to add a waveform, right click on the block diagram, click **signal processing** then click **waveform generation**, then choose a signal you want to add.

**5. To add the noise signal,** click **signal processing** then click **waveform generation,** then click **UniformWfm**

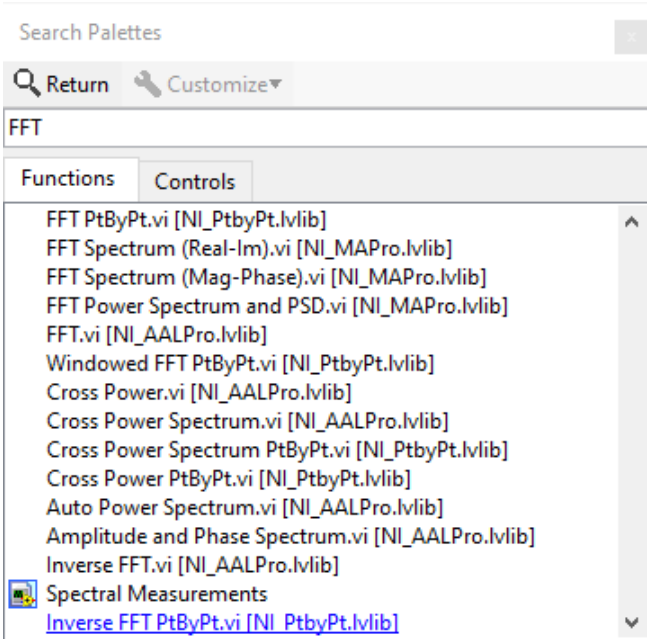


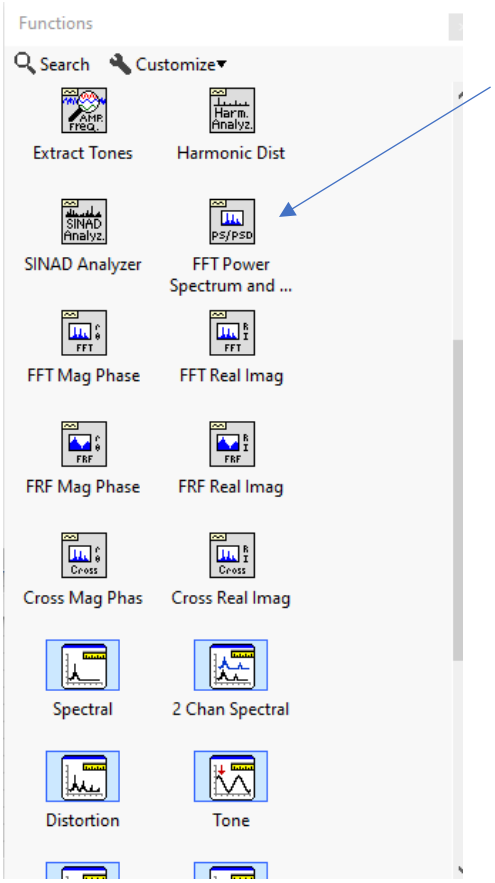

**6.** Now we want to add the two signals, so we right click on block diagram, press **Numeric**, then choose the **add operator**. **Wire up both the outputs of the input signal outputted from the case structure and the output signal from the noise to the inputs of the add operator.** The output of the add operator is **displayed on a waveform graph** (Time Domain) and **taken as an input to out FFT block.**

**7.** To display a waveform graph, right click on the front panel, then choose **graph**, then click **waveform graph.**

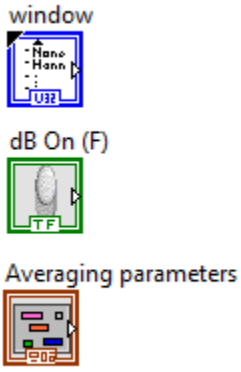



**8. No we need to convert our input signal that is in time domain to the frequency domain. We use the FFT (Fast Fourier Transform) block, to get this block.** Click view on the toolbar to view the **functions palette** then search for "FFT" and press on **FFT Power Spectrum and PSD VI**.



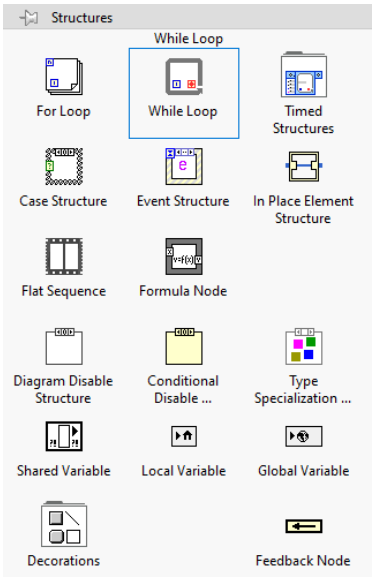
**9.** We added some controls by highlighting the pins of the FFT block then **right click**, **create control**.

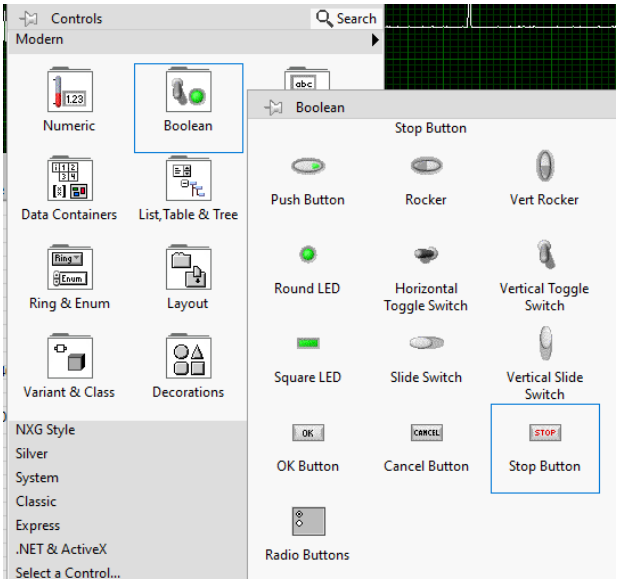


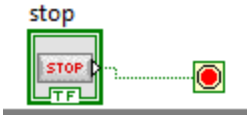

**10.** Finally, the output of the FFT block is displayed on a waveform graph (Frequency Domain) to display a waveform graph use the same step as 7.

**11.** For the signal to keep running on the front panel waveform and doesn't stop we should add a **while loop, to add a while loop,** right click on the block diagram, then click **structures** and choose a **while loop**.

**12.** We should a **stop button,** to add a button, right click on the front panel, click **Boolean**, then **stop button and wire the stop button to the stop icon in the while loop**.



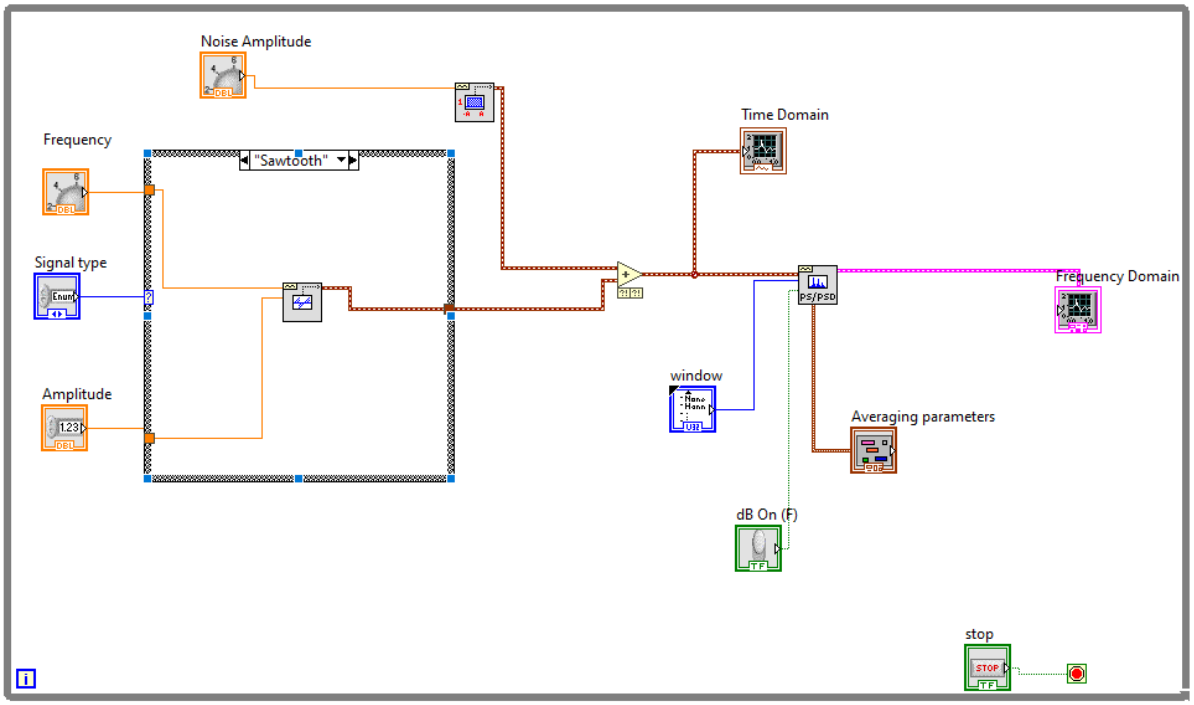



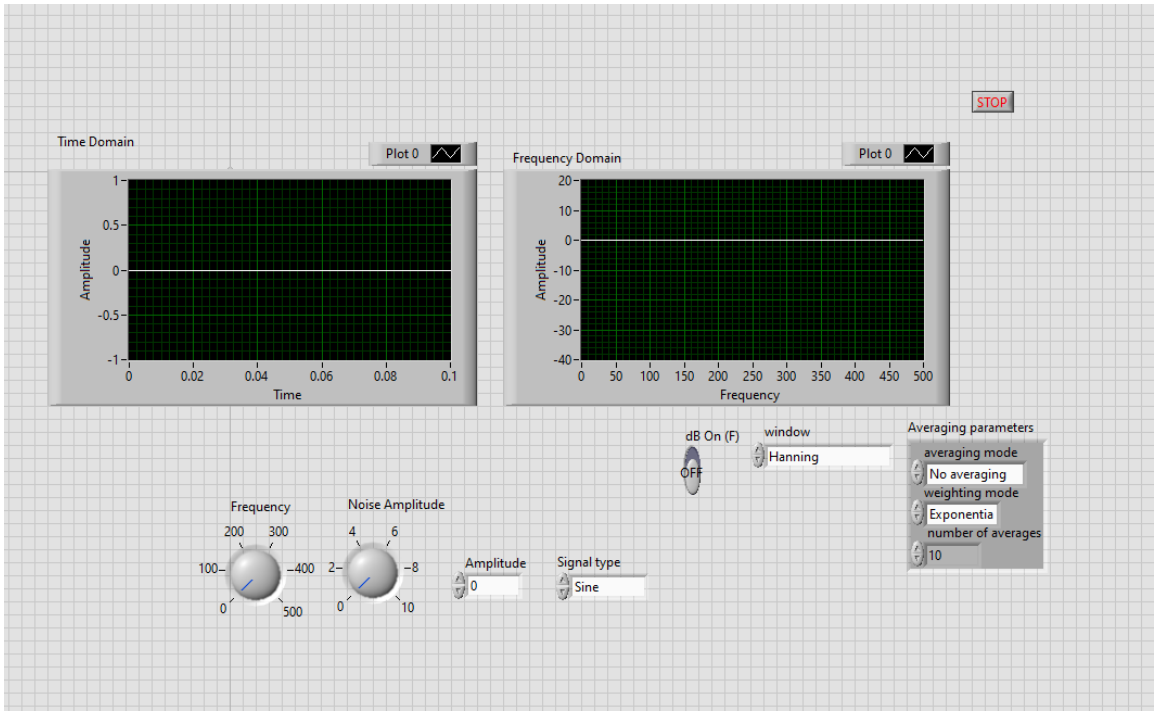

**13. You have successfully created a Digital Spectrum Analyzer. Run it from the front panel, and use the knobs to change frequency, amplitude and noise and observe the result on the waveform graph.**

# Screenshots and Results:

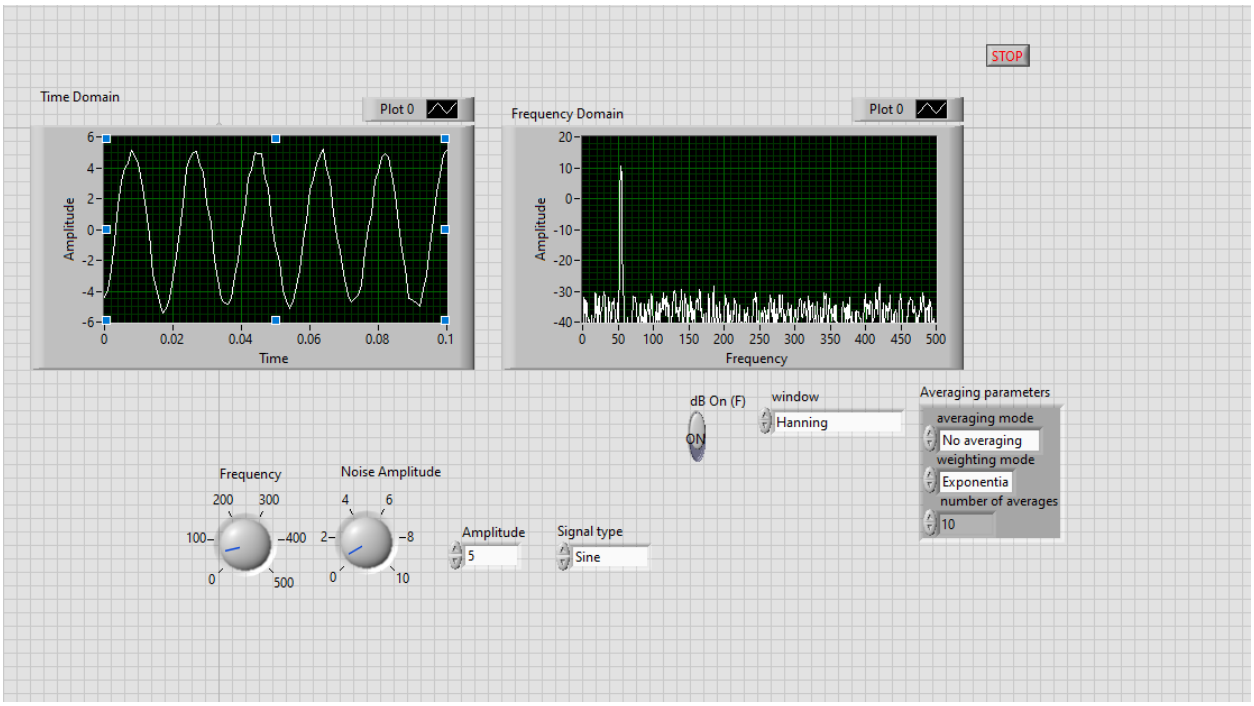
## Block diagram:

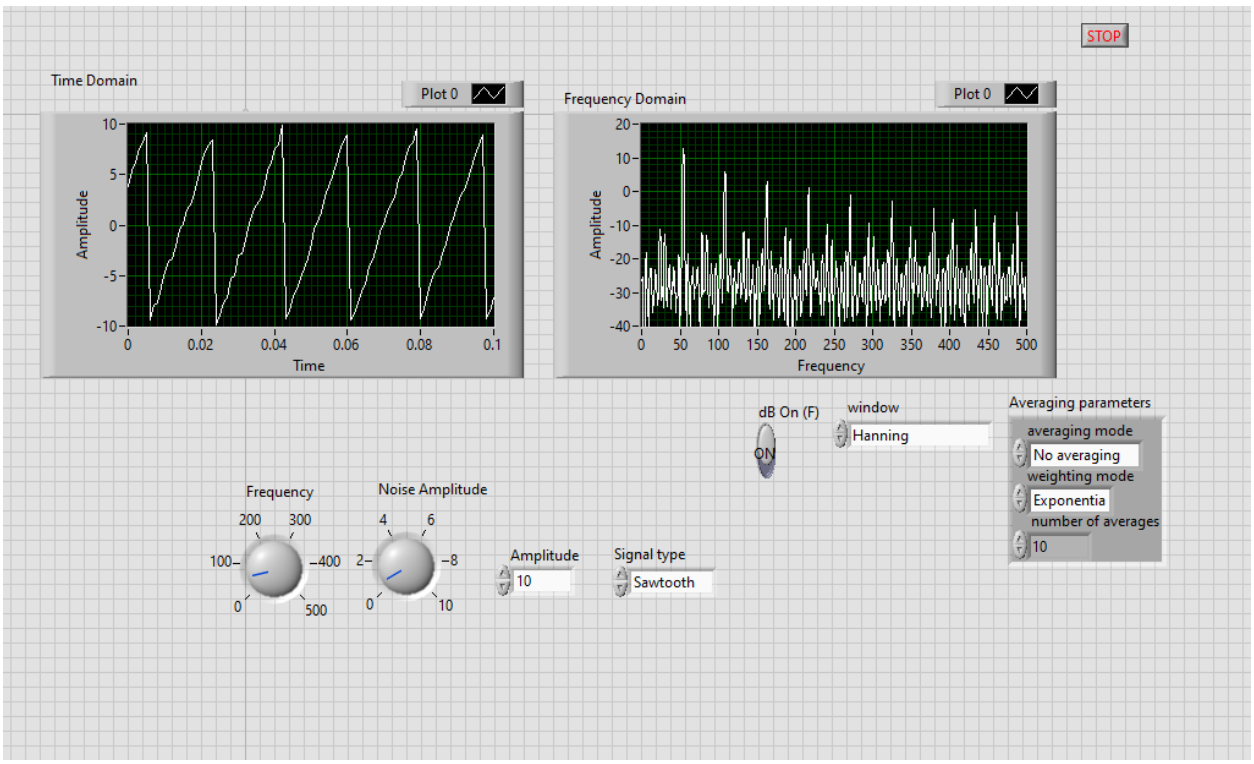


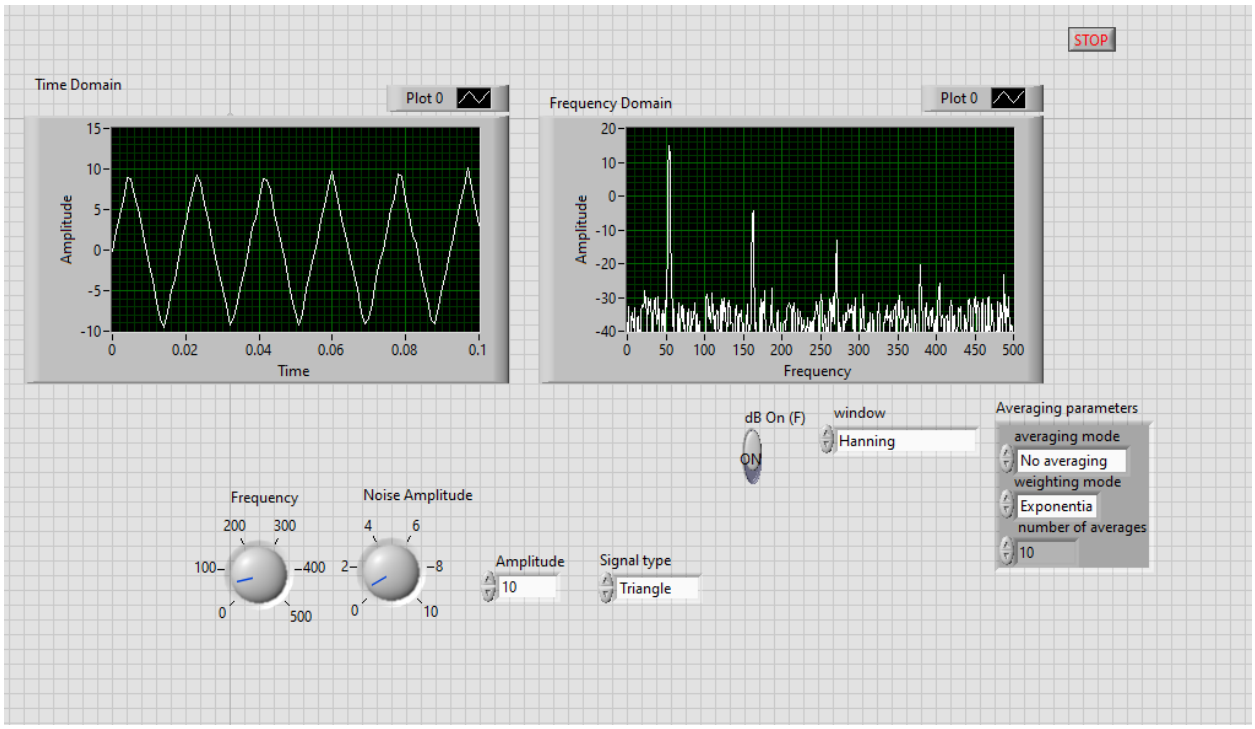

## Front Panel:



# Simulation Examples:




STOP
Time Domain
Plot 0
Amplitude
Time
Frequency Domain
Plot 0
Amplitude
Frequency
dB On (F)
ON
window
Hanning
Averaging parameters
averaging mode
No averaging
weighting mode
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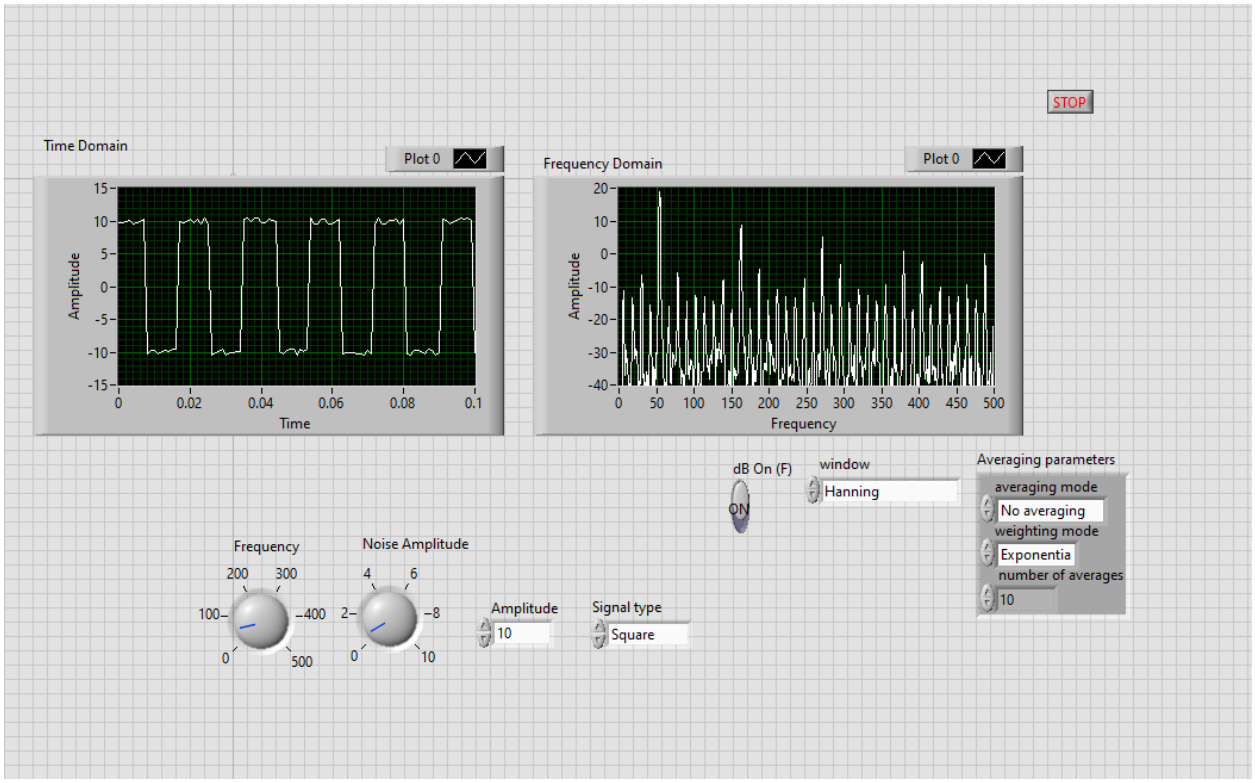
number of averages
10
Frequency
Noise Amplitude
Amplitude
10
Signal type
Triangle


STOP
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Frequency
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Signal type
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