

INDIAN INSTITUTE OF SCIENCE AND TECHNOLOGY, KANPUR

**VIRTUAL
LAB**

**SPECTRUM ANALYZER
(EXPERIMENT NO :- 2)**

**TRANSDUCER AND INSTRUMENTATION
VIRTUAL LAB |**

Experiment No: - 2

Aim:-

To Study of Spectrum Analyzer.

Requirement: -

- Computer Facility.
- Lab view 2009 Runtime engine
- Internet facility for on-line experiment, or executable file of the particular experiment can be downloaded through download link on the website.

Theory: -

Spectroscopy is the study of the interaction between matter and radiated energy. Historically, spectroscopy originated through the study of visible light dispersed according to its wavelength, e.g., by a prism. Later the concept was expanded greatly to comprise any interaction with radiative energy as a function of its wavelength or frequency. Spectroscopic data is often represented by a spectrum, and the device used to analyze these spectrums is known as **Spectrum Analyzers**.

A spectrum analyzer or spectral analyzer is a device used to examine the spectral composition of some electrical, acoustic, or optical waveform. It may also measure the power spectrum. A spectrum analyzer displays a power spectrum over a given frequency range, changing the display as the properties of the signal change.

With Fourier transform analysis in a digital spectrum analyzer, it is necessary to sample the input signal with the sampling frequency that is at least twice the highest frequency that is present in the signal that is the Nyquist limit.

Two principal types of spectrum analyzers exist, the Fast Fourier Transform (FFT) analyzer and the swept spectrum analyzer.

Fast Fourier Transform (FFT)

The FFT algorithm is calculated from time records. Each record contains a finite number of discrete points. The FFT converts these time domain points into a finite number of frequency domain points. The frequency resolution, or spacing between the bins, must be such that the acquired frequencies are represented properly. In order to increase the frequency resolution the number of samples must increase. This is because the frequency resolution is inversely proportional to the length of time record.

Swept Spectrum Analyzer

The swept spectrum is based on a different configuration than the FFT analyzer. It uses what is termed as a super-heterodyne configuration. Heterodyne refers to mixing and super refers to super-audio frequencies and above. An important parameter of the swept analyzer is resolution bandwidth.. Two errors can result from sweeping through the frequency range too quickly. First, the amplitude is at a lower level than if it were swept at a slower speed. Second, the signal shifts up in frequency.

Procedure:-

- 1) Start the experiment through run button, its initiation is indicated through **LED**.
- 2) Now the type of **signal** is selected among the options given as,
 - a) Sine wave.
 - b) Square wave.
 - c) Triangular wave.
 - d) Saw tooth wave.
- 3) For a particular wave chosen, desired amplitude and frequency is been inserted through **knob**, well a numeric indicator is also there to indicate the value of **amplitude** and **frequency** inserted.
- 4) Now the type of **window** is selected among the option given i.e.
 - a) Hanning window
 - b) Hamming window
 - c) Blackman Harris window
 - d) Exact Blackman
 - e) Blackman
 - f) Flat top window
 - g) 4 term B-Harris
 - h) 7 term B-Harris
 - i) Low side lobe window
- 5) Now as per the choice **Averaging Parameters** are selected, which has its attribute as given below,
 - a) **Averaging Mode :-**
Now, averaging mode is again having four options i.e.
 - 1) No averaging.
 - 2) Vector averaging.
 - 3) Rms averaging.
 - 4) Peaks hold averaging.

b) **Weighing Mode :-**

Weighing Mode also has two options i.e.

- 1) Linear
- 2) Exponential

c) **Number of averages.**

As per the time domain signal taken, we will get the **Power Spectrum** in term of frequency.

Observation:-

For different window selected, we will get the different trend of power spectrum.

Result:-

As per the selected window and the averaging parameters, we will get the desired **Power spectrum** in frequency domain of the type of signal selected in time domain.

Precaution:-

- Follow instructions carefully.
- For fetching correct value, wait until the process gets complete.
- Runtime engine should be properly installed.