

Frequency and power spectra

The power spectrum

Is a representation of the magnitude of the various frequency components of a signal. By looking at the spectrum, one can find how much energy or power is contained in the frequency components of the signal. **Power spectrum simply answers the question “How much power is contained in the frequency components of the signal?”**

Frequency spectrum

Frequency spectrum of a time-domain signal, is a representation of that signal in the frequency domain.

Uses of power spectrum of a signal

The concept and use of power spectrum of a signal is fundamental in engineering, in communication systems, microwave and radars. Recently, it is also being used in diverse applications such as gene identification.

How to generate the power spectrum?

There are a couple of techniques for generating the Power spectrum. One is by using the Fourier transform. The other techniques such as the wavelet transform or the maximum entropy method can also be used or by digitizing experimental data and performing a Fast Fourier Transform (FFT) **resulting values are usually presented as amplitude and phase, both plotted versus frequency.**

Spectral analyzing

By performing spectral analysis, some important features of signals can be discovered that are not obvious in the time waveform of the signal. One problem with spectrum analysis is that the duration of the signals is finite, although adjustable. Applying the FFT method to finite duration sequences can produce inadequate results because of “spectral leakage”, to reduce the spectral leakage FFT window function is applied. Power spectrum parameters are window size, window type, window over lap and number of FFT. The aim of this work is to demonstrate the effect of varying window type on the power spectrum using Mat Lab software. Five windows have been compared to study their effect on the spectrum of a typical data.

What is Fourier transform?

- **Fourier series** provides an alternate way of representing data: instead of representing the signal amplitude as a function of time, we represent the signal by how much information is contained at different frequencies. Also note that the Fourier representation is formally periodic, the beginning of the cycle will always equal the end.

If you ever watched the blinking lights on a stereo equalizer then you have seen Fourier analysis at work

- **Fast Fourier transform** (FFT) is a computational tool, which facilitates signal analysis such as power spectrum analysis and filter simulation by mean of digital computer. It is a method for efficiently computing the discrete Fourier transform of series of data samples (refer to as time series).

Window type

To understand how a given window affects the frequency spectrum, the frequency characteristics of each window must be known.

- Hamming window
- Blackman window
- FlatTop
- Kaiser window

Links

Related articles

External links

Bibliography

Frequency spectrum, www.wikipedia.org

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