

Introduction to Signals and Systems

Signals • Information • Electrical Engineering Applications

Introduction

The concepts and theory of signals and systems are needed in almost all electrical engineering fields. Every electrical engineer must have a thorough knowledge of signals and systems. It is used in different parts of engineering like communication, control, power generation, signal processing etc. Also signals and systems have diverse applications in the areas of science and technology such as circuit design, power generation and distribution, speech processing, biomedical engineering, and so on.

The world of science and technology filled with many signals: radio & TV signals, telephone & computer signals, biomedical engineering signals, speech signals, images from satellites, voltages generated by heart and brain, RADAR & SONAR signals, seismic vibrations, signals from human genes etc. Note that each of these signals carries lot of information.

KEY IDEA

A signal is a function that carries information.

SIGNAL

A signal can be defined as a function that carries information. Anything that conveys information is a signal. The signals are mathematically represented as a function of one or more independent variables.

One-dimensional signal

If the function depends on a single variable, the signal is one-dimensional. A speech signal is mathematically represented as a function of time. Thus, a signal is a quantity that varies with time. In case of speech signal, the amplitude of signal depends on LOUDNESS of the signal. If we speak loudly, the value of the signal (i.e. amplitude) will be high and vice-versa.

Signal is a function of time, distance, temperature, position etc. Some signals in daily life are: music, speech, video signals. A signal can be defined as a function of one or more independent variables which contain some information. In electrical sense, a signal can be voltage or current. Note that voltage or current is a function of time as an independent variable.

Multi-dimensional signal

If the function depends on two or more variables, the signal is multi-dimensional. Example: Image and video signals. Image signal occupies X and Y co-ordinates on the computer screen. So, it's a 2D signal. Video is a 3D signal, where time (t) is the 3rd dimension.

Quick Points

- In daily life, we see many electrical signals such as: TV signal, FM radio signal, computer signals, telephone signals, biomedical engineering signals, etc.
- In mathematics, a signal is a function that conveys some information.
- In electrical engineering, it is the fundamental quantity of representing some information.

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