

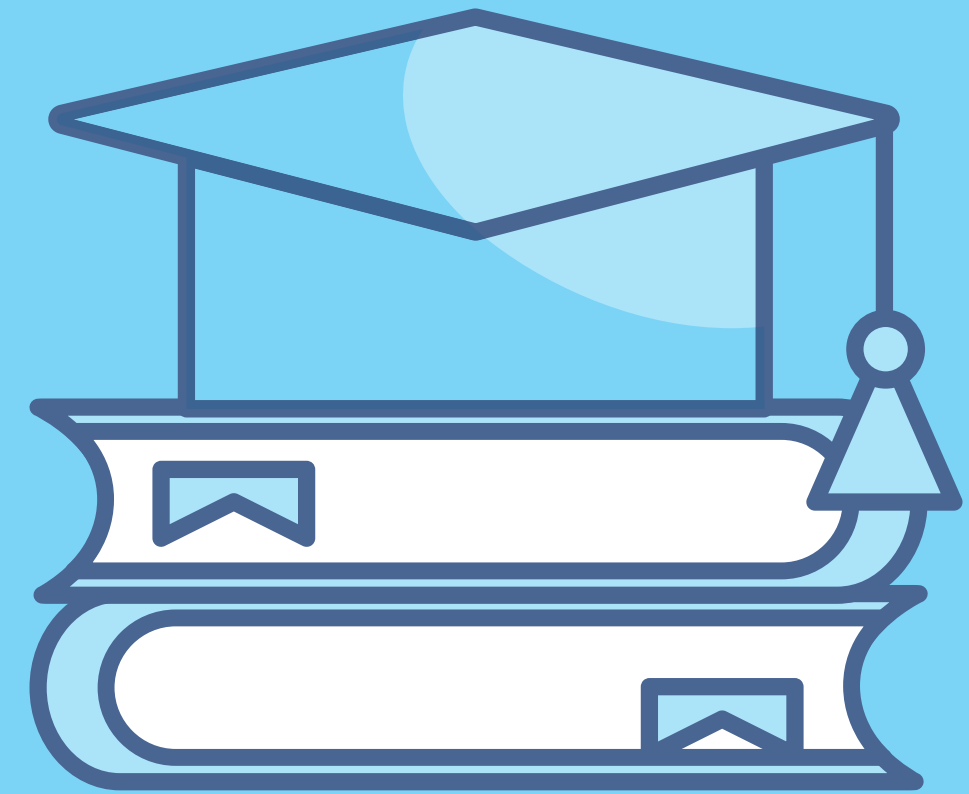


SIGNAL

DIGITAL SIGNAL PROCESSING (EC504)

SOUVIK GHOSH 13000320025

ELECTRONICS & COMMUNICATION ENGINEERING





Contents

 Introduction 

 Classification 

 Analog Signal 

 Digital Signal 

 Examples of Signals 

 Signal Processing 



Introduction

- In electronics and telecommunications, **signal** refers to any time-varying voltage, current, or electromagnetic wave that carries information.
- In signal processing, **signals** are analog and digital representations of analog physical quantities.
- In information theory, a **signal** is a **codified message**, that is, the sequence of states in a communication channel that encodes a message.
- In a communication system, a **transmitter encodes a message to create a signal**, which is carried to a receiver by the communication channel.

For example, the words "Mary had a little lamb" might be the message spoken on a telephone. The telephone transmitter converts the sounds into an electrical signal. The signal is transmitted to the receiving telephone by wires; at the receiver, it is reconverted into sounds.



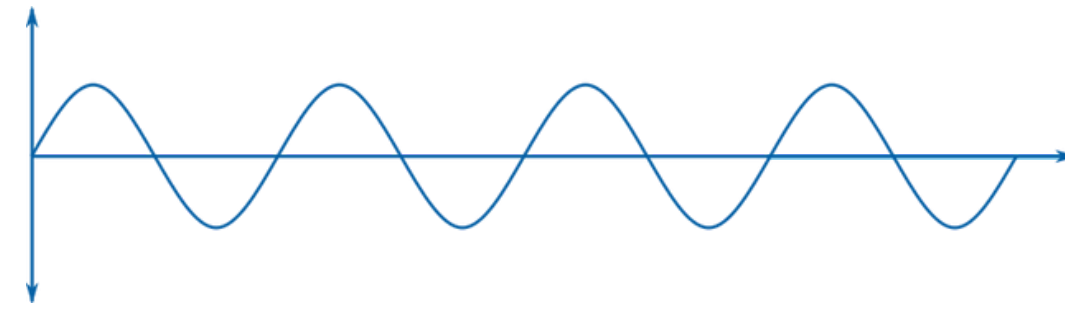
Classification

In Signals and Systems, signals can be classified according to many criteria, mainly:

- According to the different features of values, classified into
 1. Analog signals
 2. Digital signals
- According to the determinacy of signals, classified into
 1. Deterministic signals
 2. Random signals
- According to the strength of signals, classified into
 1. Energy signals
 2. Power signals



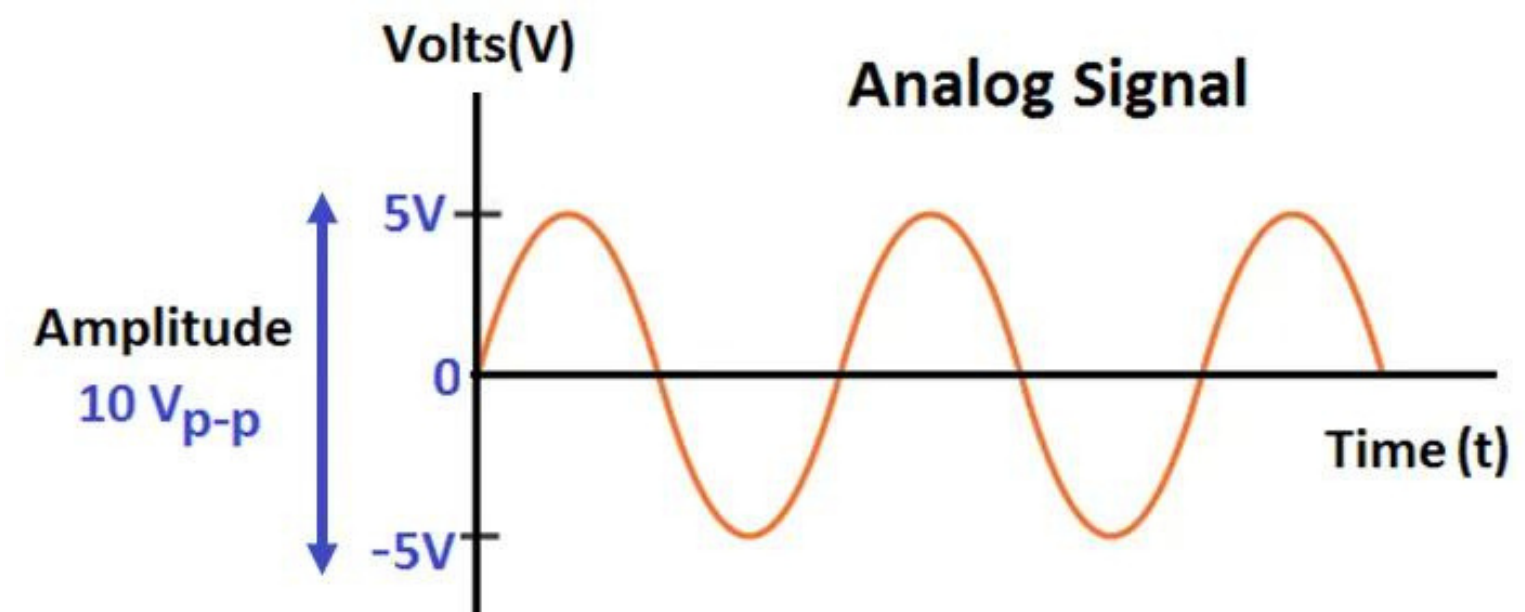
Analog Signal



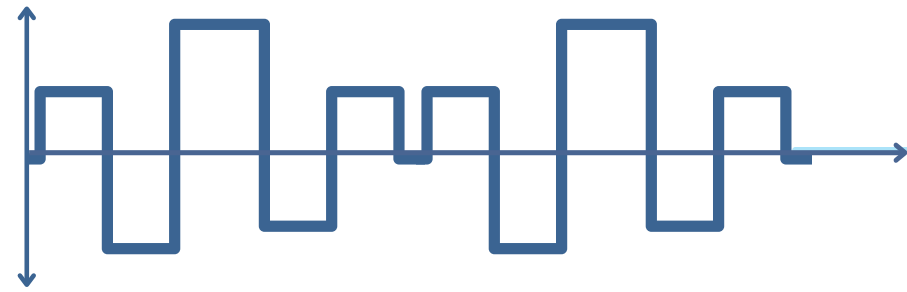
Two main types of signals encountered in practice are analog and digital.

Analog signal

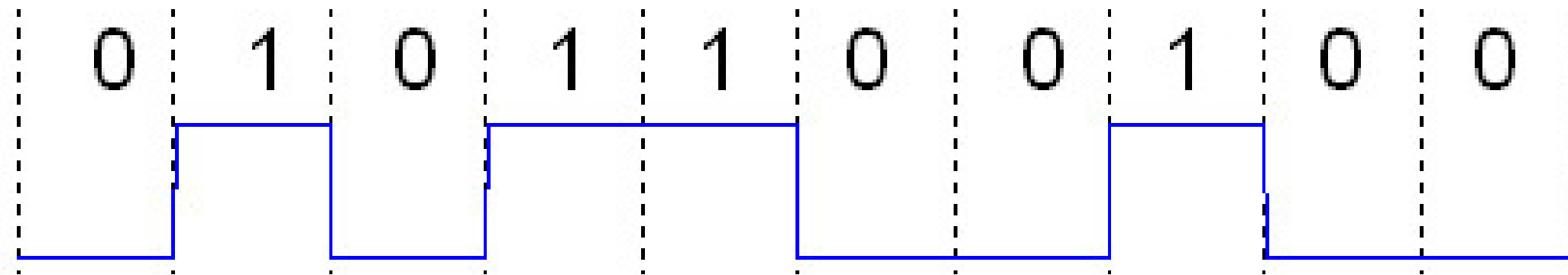
- An analog signal is any **continuous signal** for which the time-varying feature of the signal is a representation of some other time-varying quantity.
- The term analog signal usually refers to **electrical signals**; however, analog signals may use other mediums such as **mechanical, pneumatic or hydraulic**.
- Any information may be conveyed by an analog signal; often such a signal is a measured response to changes in physical phenomena, such as **sound, light, temperature, position, or pressure**.



Digital Signal



- A digital signal is a signal that is constructed from a **discrete set of waveforms** of a physical quantity so as to represent a sequence of discrete values.



A binary signal, also known as a logic signal, is a digital signal with two distinguishable levels

- A digital signal may be considered to be the sequence of codes represented by such a physical quantity.
- The physical quantity may be a variable electric current or voltage, the intensity, phase or polarization of an optical or other electromagnetic field, etc.
- Digital signals are present in all digital electronics, notably computing equipment and data transmission.



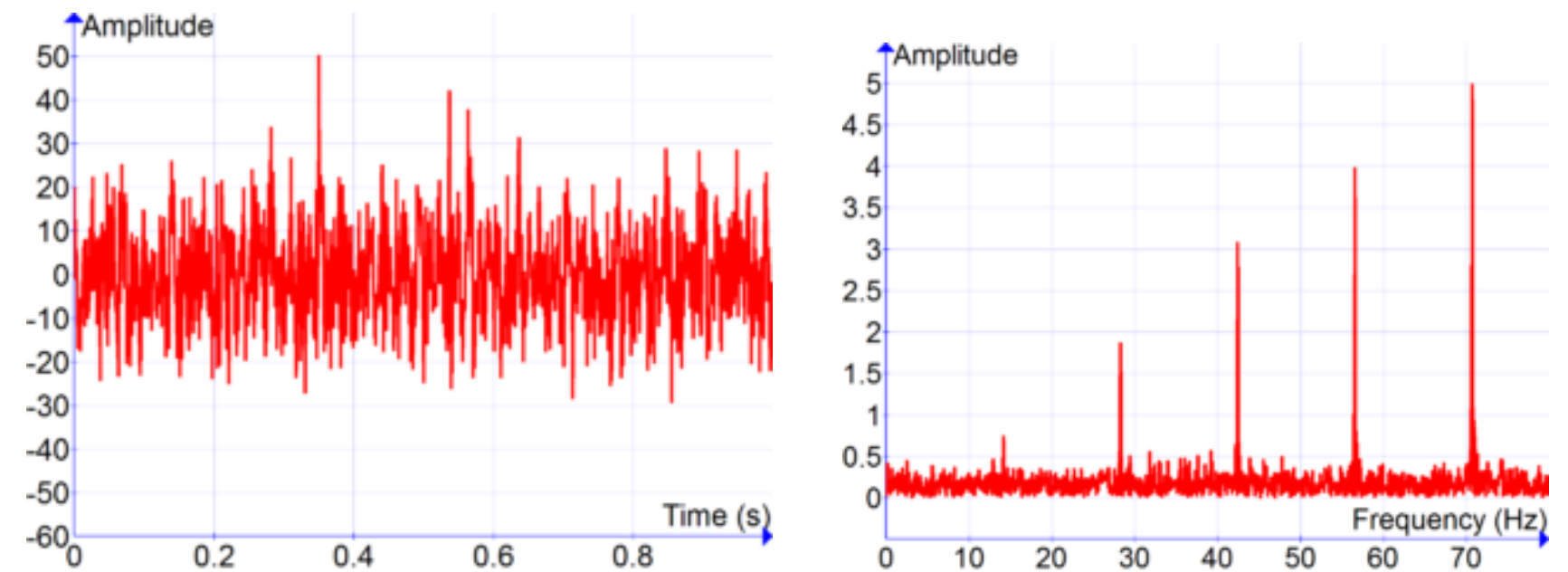
Examples of Signals

- **Motion:** The motion of an object can be considered to be a signal and can be monitored by various sensors to provide **electrical signals**.
 - **Sound:** Since a sound is a vibration of a medium (such as air), a sound signal associates a pressure value to every value of time. A sound signal is converted to an **electrical signal** by a microphone, generating a voltage signal as an analog of the sound signal.
 - **Images:** A picture or image consists of a brightness or colour signal, a function of a two-dimensional location. The object's appearance is presented as emitted or reflected light, an **electromagnetic signal**.
 - The output of a **thermocouple**, which conveys temperature information.
 - The output of a **pH meter** which conveys acidity information
- etc.



Signal Processing

- Signal processing involves converting or transforming data in a way that allows us to see things in it that are not possible via direct observation.
- Signal processing allows engineers and scientists to analyze, optimize, and correct signals, including scientific data, audio streams, images, and video.
- It enhances our ability to communicate and share information.
- Today, digital signal processing is done primarily in software. Signal processing software can run on the processor or graphics card of a desktop computer, or on a smart device.



The signal on the left looks like noise, but the **signal processing technique** known as **spectral density estimation** shows (right) that it contains five well-defined frequency components.





Thank
you!