SIGNALS AND SYSTEMS

Baseband Sampling of Continuous-Time Signals

Basic Concepts and Applications

Sampling

Conversion of Continuous-Time (CT) signals to Discrete-Time (DT) signals

Purpose of Sampling

➢ Digital systems to process analog signals

Applications in Digital Signal Processing

➢ Communication, audio, and video systems.

Nyquist-Shannon Sampling Theorem

Baseband Signals

➢ Baseband Signals - Low-frequency signals

➢ Characteristics of Baseband Signals - Low frequencies, centered around zero frequency

Nyquist Theorem

➢ Avoiding aliasing

➢ Nyquist Rate - Minimum sampling rate as twice the highest frequency of the signal

$$f_s \geq 2f \, max$$

Baseband Sampling Process

➢ Step-by-step process of sampling a CT baseband signal

➢ Illustration of Sampling Point

Aliasing and Sampling Rate

➢ Aliasing - occurs when a CT signal is sampled below the Nyquist rate.

➢ Aliased Signals- Common examples

➢ Avoid Aliasing - Increasing the sampling rate or using anti-aliasing filters

Sampling in Frequency Domain

➢ Fourier Transform of Sampled Signal

➢ Relationship between CT and DT Frequencies

➢ Graphical Representation

Applications

➢ Communication Systems

➢ Audio and Video Processing

➢ Medical Imaging