

Notes for ECE 30100 - Signals and Systems

Zeke Ulrich

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Course Description

Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Introduction

As this course studies signals and systems, it behooves us to understand what signals and systems are. A signal is a quantity that varies over time. Examples include voltage waveform on a circuit, height as a function of age, or pulses of light through fiber optic.

We distinguish between continuous time (CT) and discrete time (DT) signals. CT signals have a continuous independent variable, such as time. DT signals have a discrete independent variable, such as the date. The indices are a set of integers.

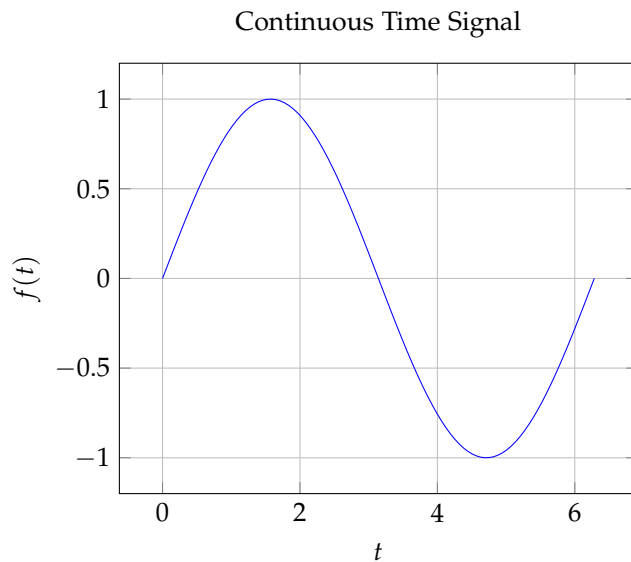


Figure 1: Continuous Time Signal

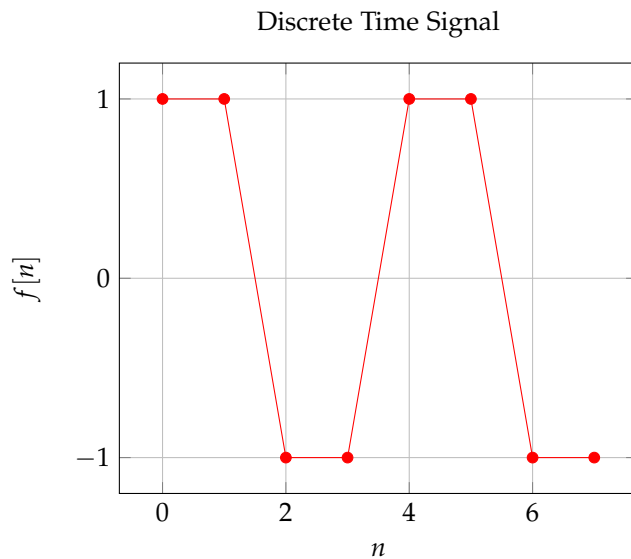


Figure 2: Discrete Time Signal

In the most general terms, a systems transform inputs to outputs. They're interconnections of subsystems. Examples of systems include, topically, circuits.

Similarly to signals, there are continuous time systems and discrete time systems. In a CT system, the input and output are continuous. Conversely, DT systems have discrete inputs and outputs.

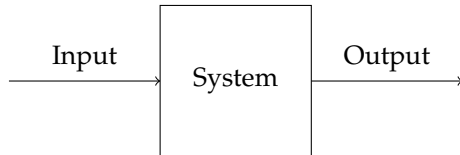


Figure 3: System Diagram

The astute reader will notice systems operate much like functions. We use function notation to describe systems. For a CT system, we write $y(t) = S(x(t))$ with parentheses to show it's CT. For DT, we use brackets like $y[t] = S(x[t])$.

It's easy to imagine a system with continuous input and discrete output, or vice versa. These are called samplers and reconstructors respectively. We'll mostly be looking at linear time-invariant discrete systems, since they have the greatest analogy to ECE.

Reference

- $E = mc^2$