DSP First

Second Edition

Modified by TL Harman Spring 2021
For CENG 3315

Chapter 1

Introduction

Pearson

Introduction to Signal Processing
Van Veen Video 12:58

https://www.youtube.com/watch?v=YmSvQe2FDKs&feature=youtu.be

Signal Processing Ch1

Analog Signals – s(t); t is time

- Analogous to the actual physical signal
- Typically continuous – temperature, etc. Values are real numbers

Discrete-time signals s[n]=s(nTs); n= 1,2,…

- Ts is the sampling period in seconds
- Amplitude of s(nTs) is a real number
- Signal is Quantized in Time!

Digital Signal

S(nTs) is similar to discrete-time signal

BUT

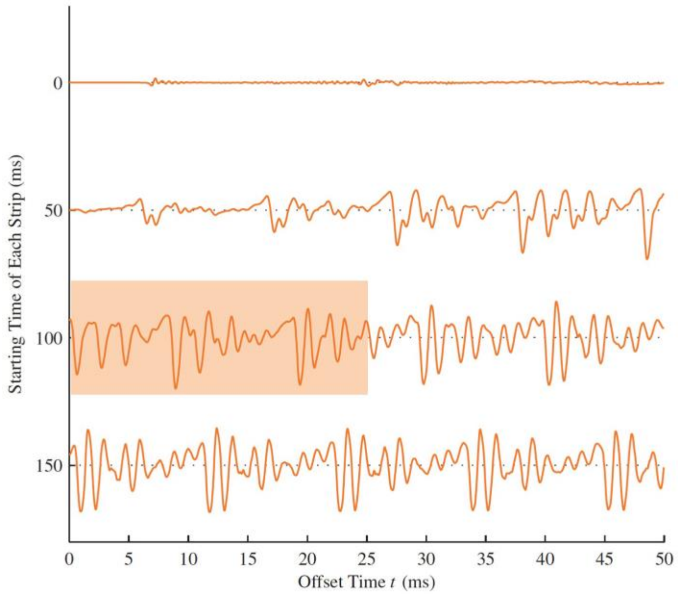
Signal is quantized in Time and Amplitude

Example: 8 – bit data for Amplitude

Values are 1,2,3,…, 255 only

Mathematical Representation of Signals (1 of 2)

Figure 1-1: Strip plot of a speech signal where each row is a continuation of the row above. This signal $s(t)$ can be represented as a function of a single (time) variable. The shaded region is shown in more detail in Figure 1-2.



Mathematical Representation of Signals

Figure 1-2: Discrete-time signal represented as a one-dimensional sequence which is a function of a discrete variable *n*. Signal samples are taken from the shaded region of Figure 1-1. The continuous-time speech signal $s(t)$ is shown in gray.

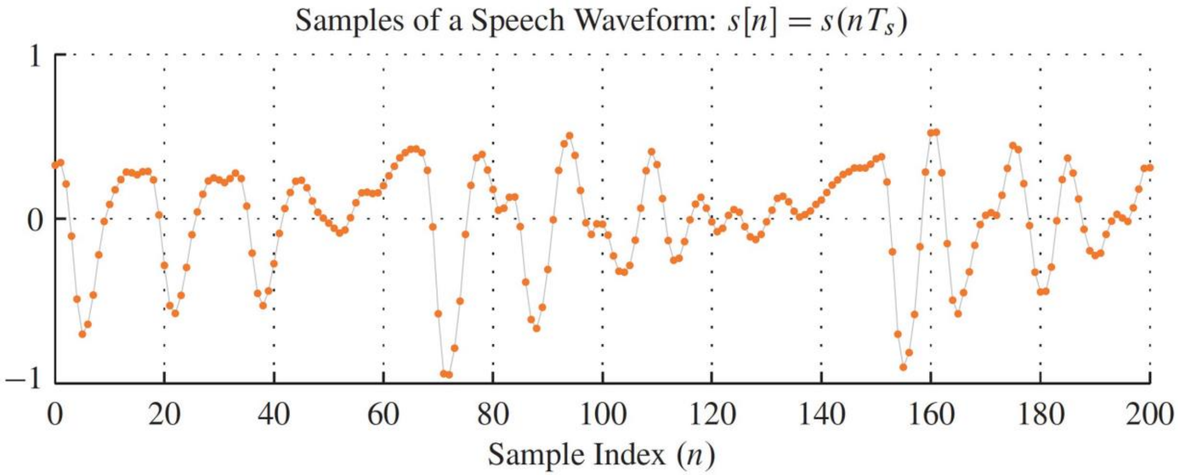
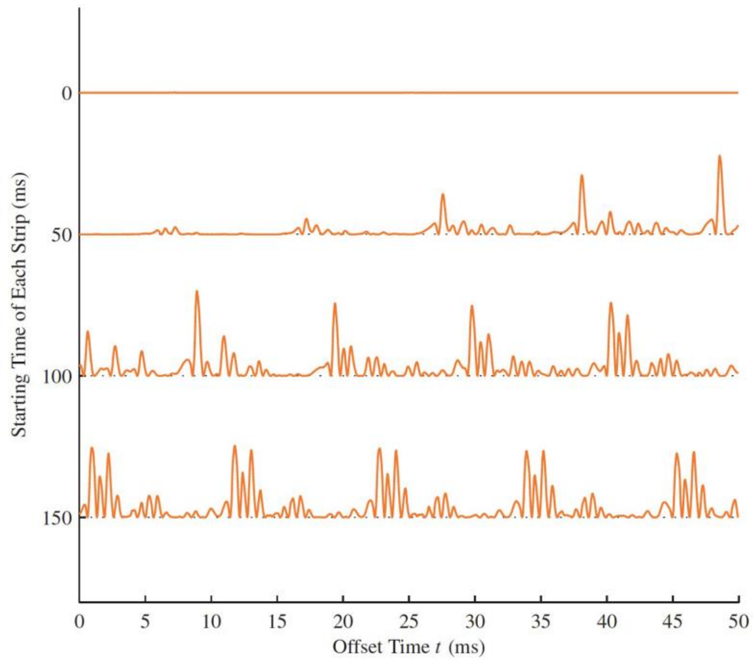


Figure 1-3: Example of a Signal that can be Represented by a Function of Two Spatial Variables

F(x,y) for Example

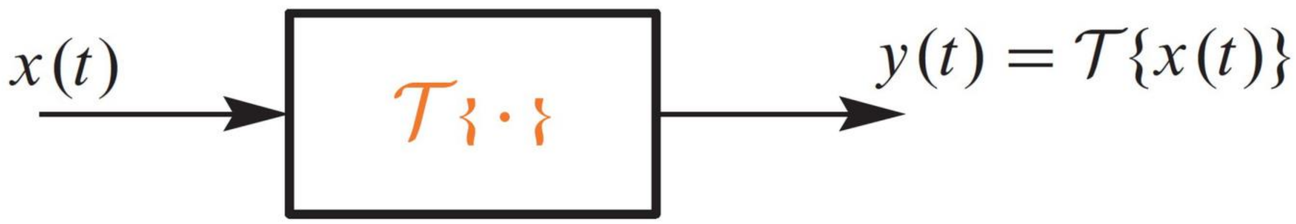
Mathematical Representation of Systems (1 of 3)

Figure 1-4: Output of a squarer system for the speech signal input of Figure 1-1. The squarer system is defined by the equation $y(t) = [x(t)]^2$



Mathematical Representation of Systems (2 of 3)

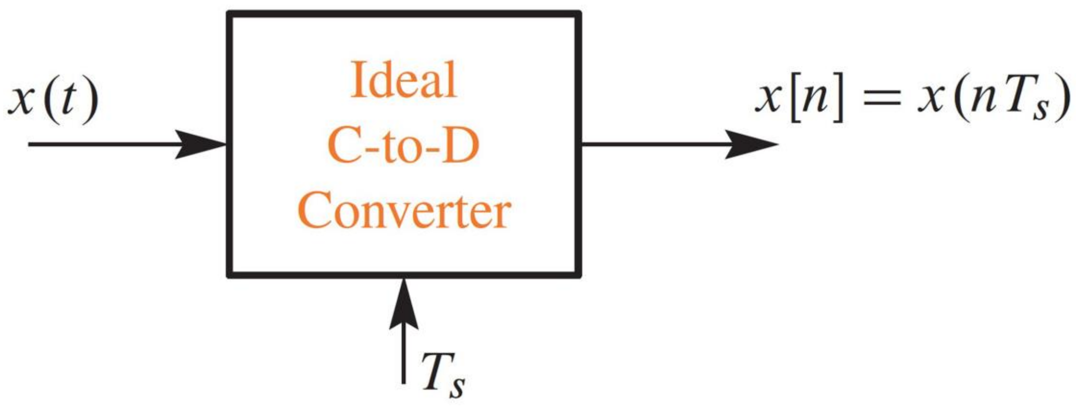
Figure 1-5: Block Diagram Representation of a Continuous-time System



If System is LINEAR, y(a $x1(t)$ $+b$ $x2(t)) = a$ $y(x1(t)) + b$ $y(x2(t))$

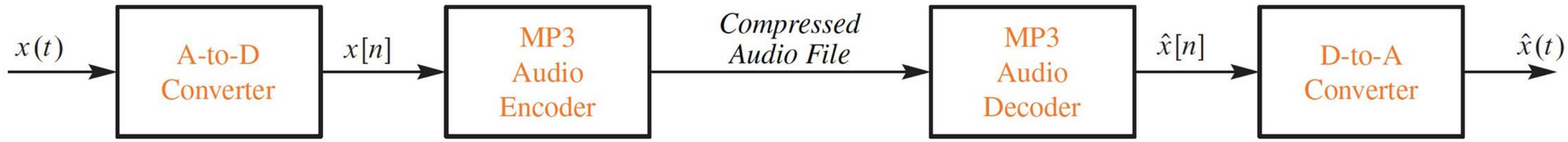
Mathematical Representation of Systems (3 of 3)

Figure 1-6: Block Diagram Representation of a Sampler.



Ideal means NO Numerical or Electronic Errors

Figure 1-7: Simplified Block Diagram for MP3 Audio Compression and Playback System



CD vs Record

Characteristic	CD	Vinyl Record*
Low frequency	20 Hz	10 Hz
High frequency	22.05 kHz	50kHz
Frequency response ripple	+- 0.5 dB	+- 3 dB
Dynamic Range	90 dB	70 dB
Signal to Noise Ratio	90 dB	60 dB
Harmonic Distortion	0.01 %	1-2 %
Stereo separation	90 dB	30 dB
Lossy	Yes	No
Damage – Scratch, dust, etc.	Relatively unaffected	Definitely

Technically – CD "sounds better on paper" But for Sound to your ears??
*** Depends heavily on Record Player.**

The Beautiful Secrets Behind Vinyl

https://www.hypebot.com/hypebot/2017/08/the-beautiful-secrets-behind-vinyl.html

What people find special about vinyl records is this magical factor. Because of how it was made and the fact that there is nothing digital about it, vinyl sound offers the experience, which is very close to listening live music. It’s mid-range-y and mahogany warm. That’s the sound that flatters every musical instrument.

Why Tubes Sound Better

https://www.kenrockwell.com/audio/why-tubes-sound-better.htm

McIntosh MC240 Review. McIntosh MC240 (rated 40 watts per channel, **56 pounds**/25.4 kg, measured 145 watts idle power draw, about **$2,400 used**)

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