ĐẠI HỌC QUỐC GIA HÀ NỘI
TRƯỜNG QUỐC TẾ
VNU-INTERNATIONAL SCHOOL

CHAPTER 1:
INTRODUCTION TO ADVANCED DIGITAL SIGNAL PROCESSING

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Course Objectives

- To understand advanced DSP concepts: spectral analysis, digital filter design, and multi-rate signal processing.
- To understand advanced DSP applications.

Assessment methods

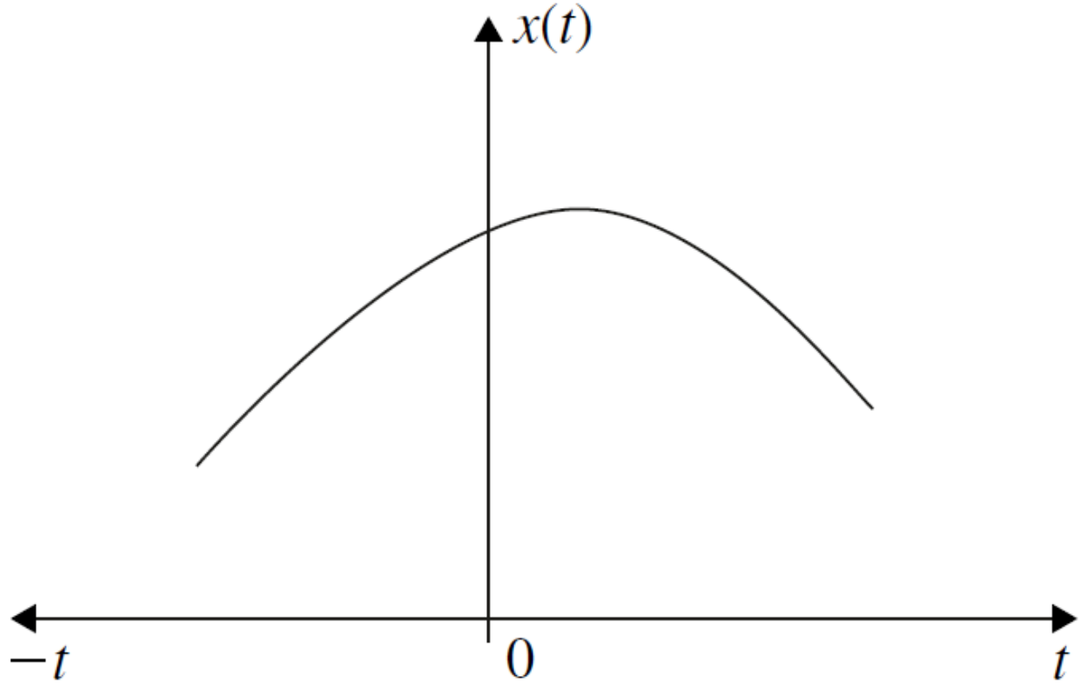
No.	Description	Weight	Remark
1	Class attendance	10%	
2	Mid-term exam	30%	Written Exam
3	End-term exam	60%	Project + Presentation

Textbooks

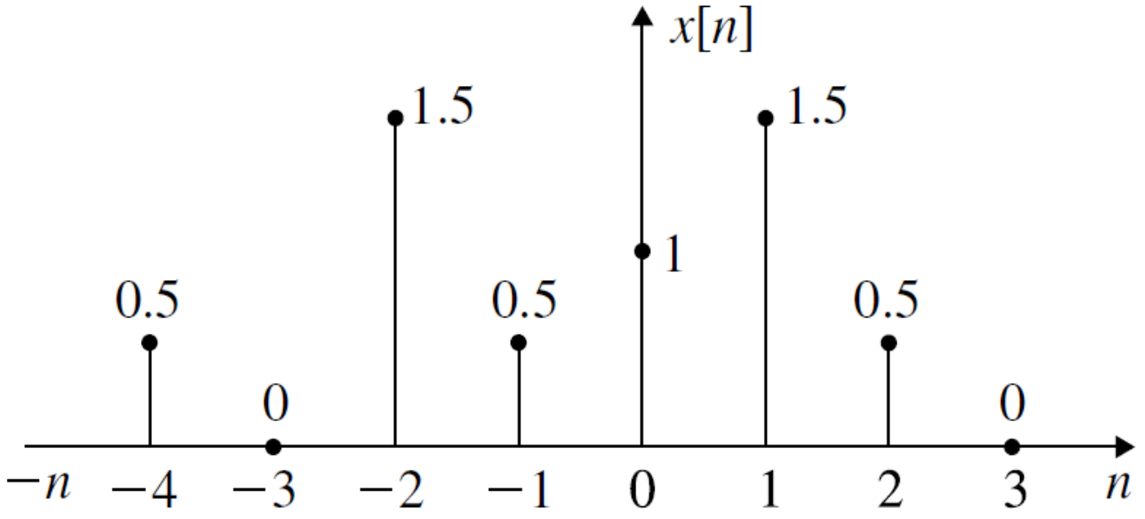
[1] Lizhe Tan, Jean Jiang (2019), Digital Signal Processing Fundamentals and Applications, 3rd edition.
[2] John G Proakis and Vinay K. Ingle (2016), Digital Signal Processing Using MATLAB, 3rd edition.
[3] E. S. Gopi (2019), Multi-Disciplinary Digital Signal Processing, A Functional Approach Using Matlab.
[4] S. Parris, A. Sehgal, N. Kehtarnavaz (2020), Smartphone-Based Real-Time Digital Signal Processing, 3rd edition.
[5] Kayvan Najarian, Robert Splinter, Biomedical Signal and Image Processing, CRC Press, 2012, 2nd edition.

Continuous and Discrete-Time Signals

The signal that is specified for every value of time t is called **continuous-time (analog) signal** and is denoted by x(t).

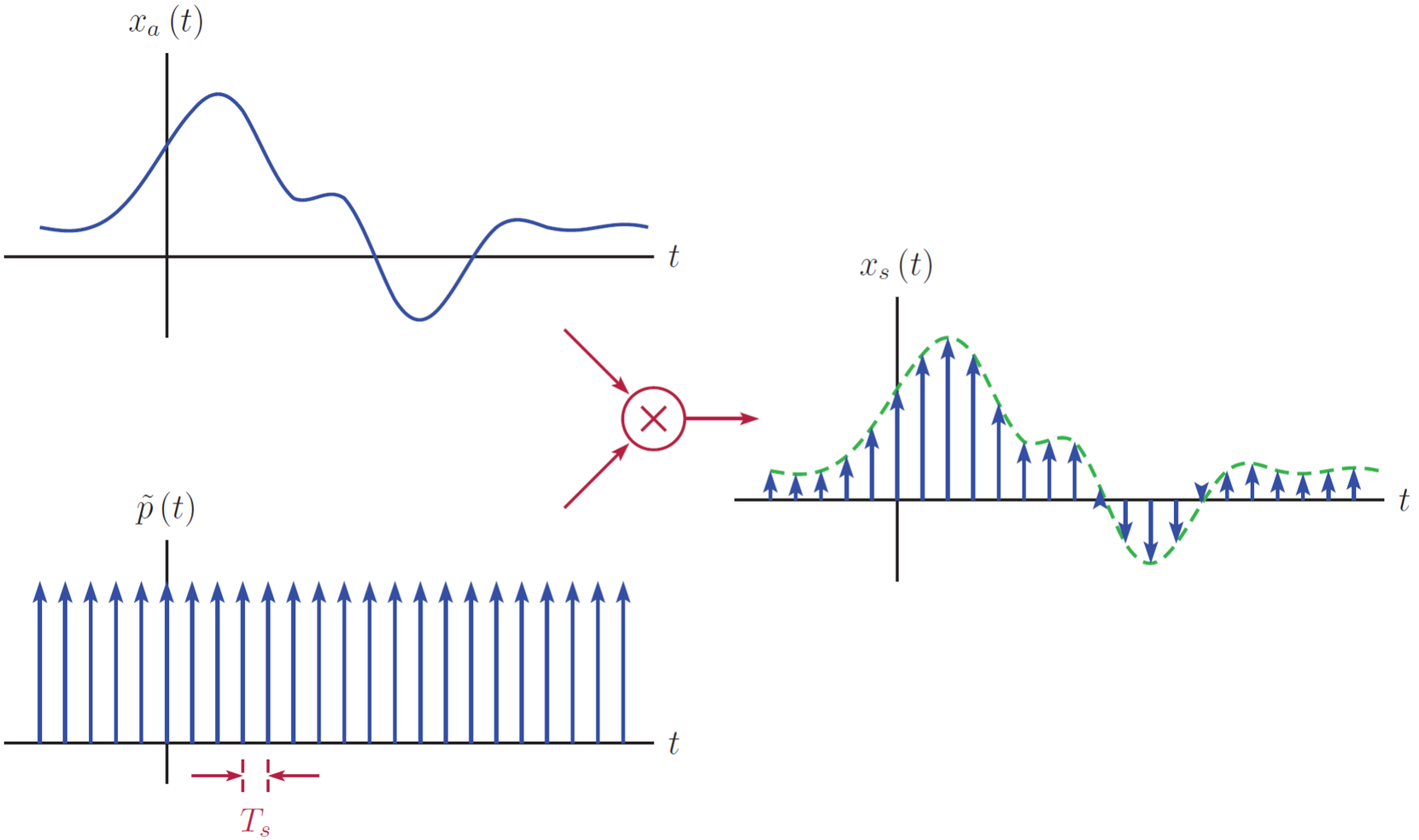


The signal that is specified at the discrete value of time is called discrete time signal. **The discrete-time signal** is represented as a sequence of numbers and is denoted by x[n] where n is an integer.



Sampling

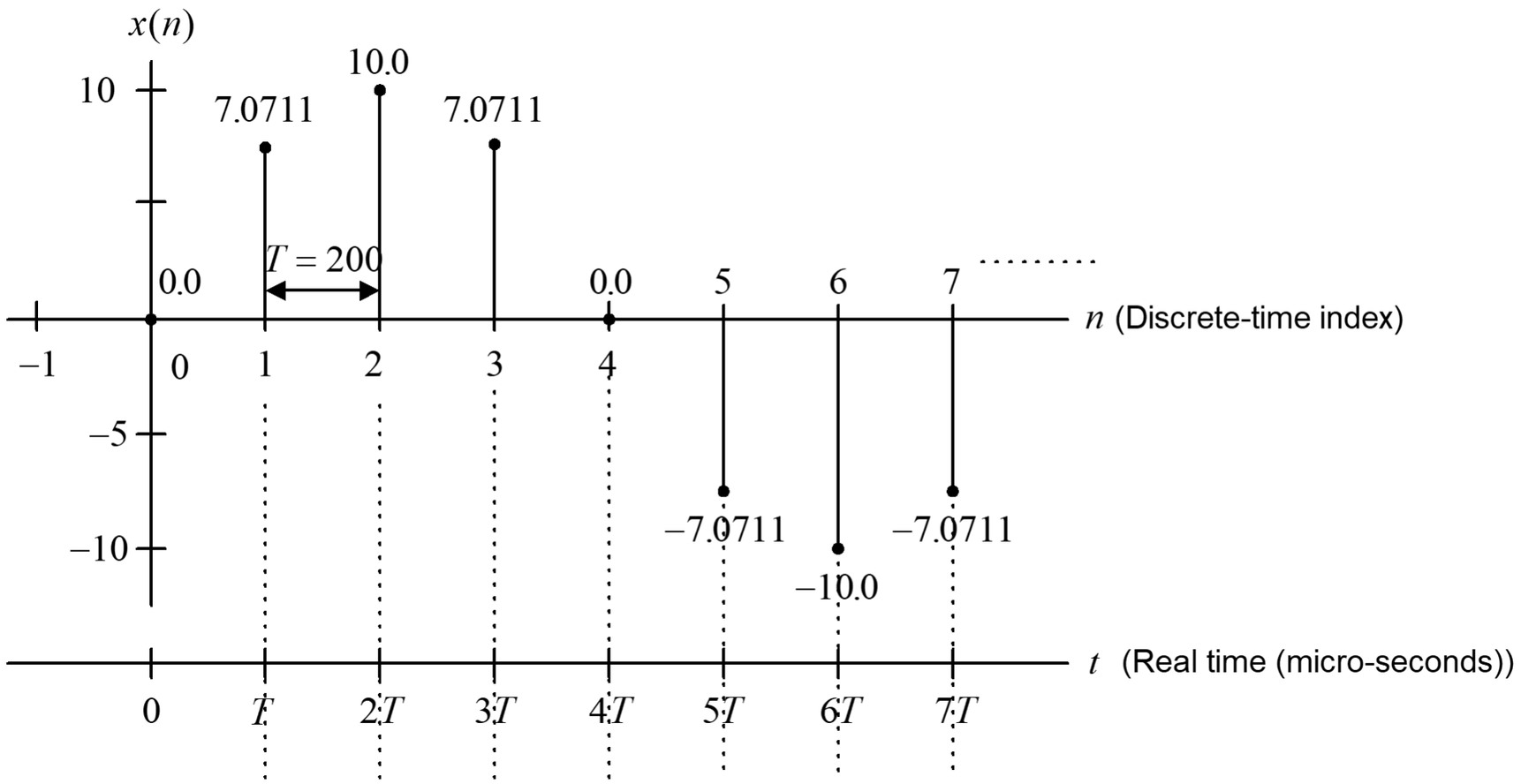
- A continuous-time signal is converted into a discrete-time signal by taking samples at specific intervals.



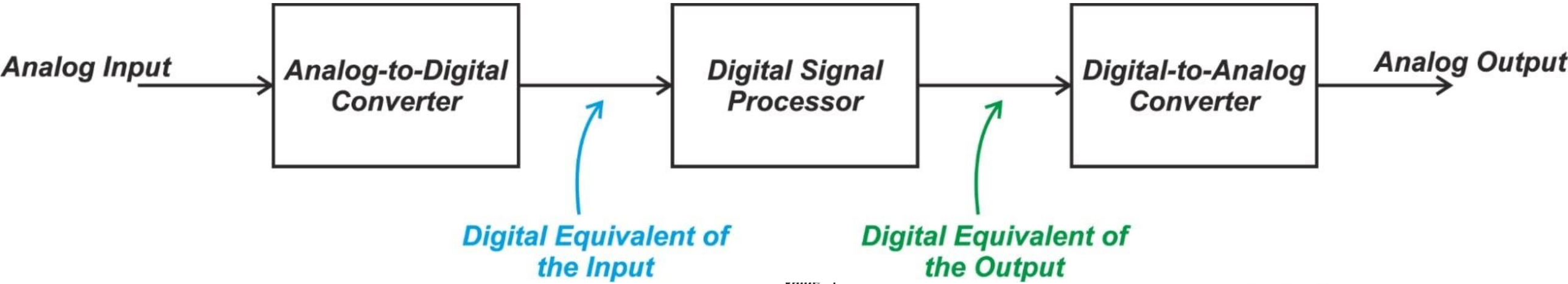
Sampling

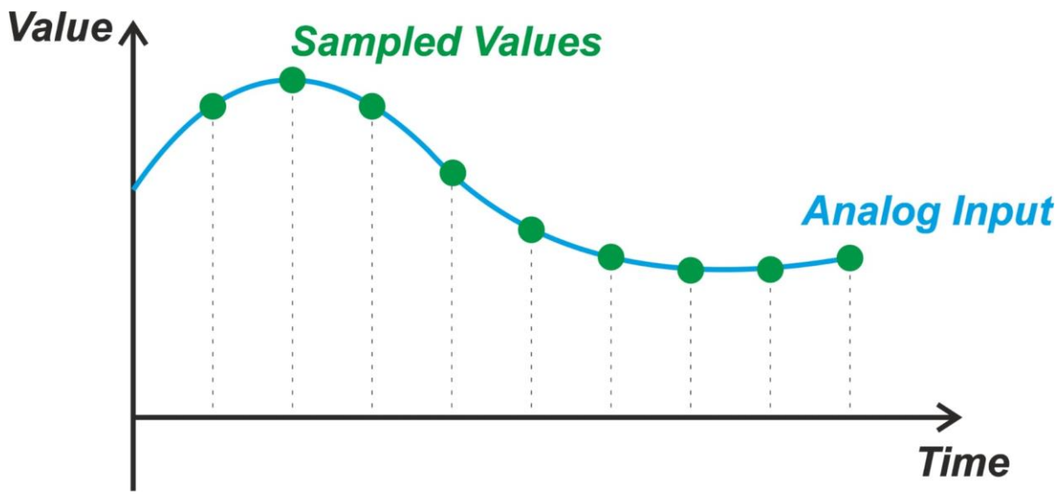
Sampling period: T=200μs

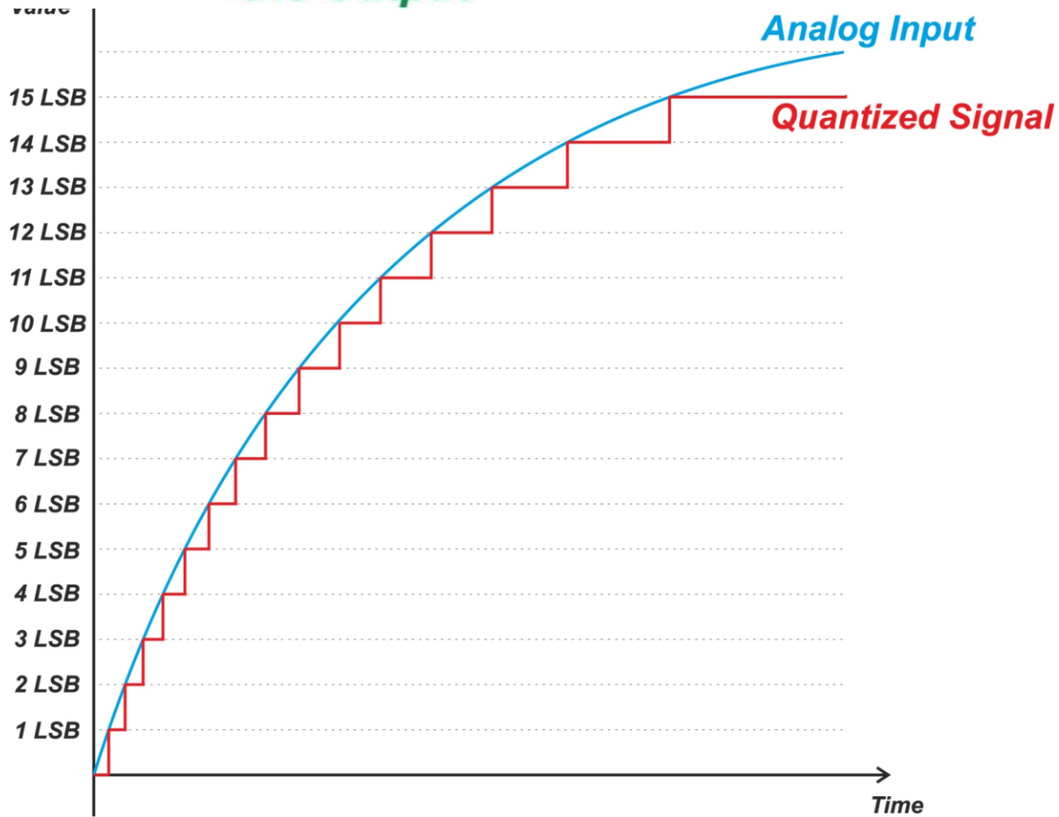
Sampling rate: $f_s=1/T$



Analog vs Digital Signal Processing







Analog vs Digital Signal Processing

❖ Analog Signal Processing

✓ Variation in the value of the electrical components

✓ Analog circuits are not flexible.

✓ Not suitable for implementing mathematical functions

❖ Digital Signal Processing

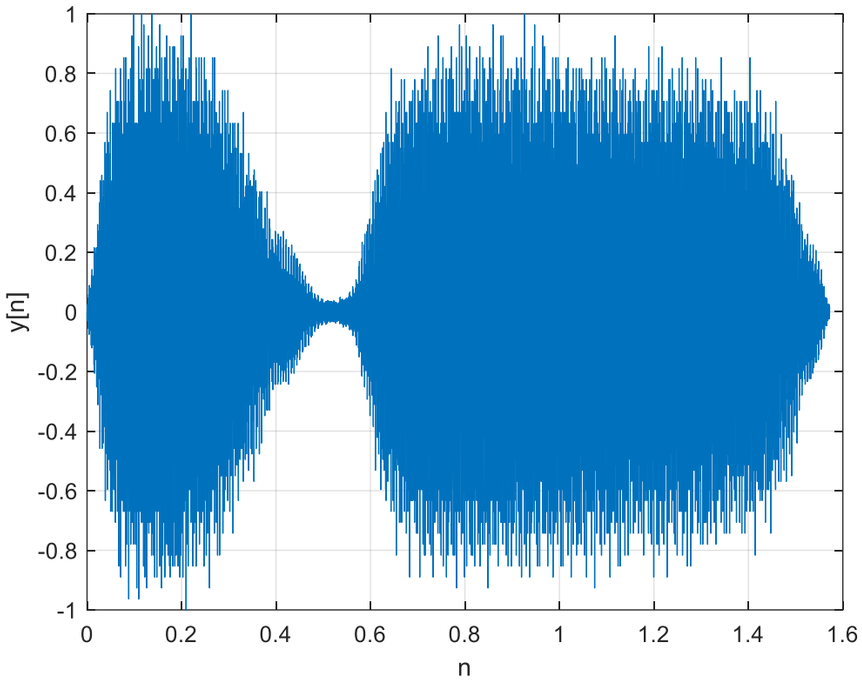
✓ Digital circuits are less susceptible to component variations.

✓ Digital circuits are also more flexible

✓ Suitable for implementing mathematical functions.

Fundamental DSP concepts

```
load train
sound(y,Fs)
t=0:1/Fs:(length(y)-
1)/Fs;
plot(t,y');
grid
ylabel('y[n]');
xlabel('n')
```



Fundamental DSP concepts

```
[x, Fs] =
audioread('ringtone.mp3');
sound(x, Fs)
t=0:1/Fs:(length(x)-1)/Fs;
plot(t,x,'b');
grid
```