Electronic Circuits
Elektronik Devreler

Doç. Dr. Gökhan Bilgin (Gr.1)

gbilgin@yildiz.edu.tr

Dr. Öğr. Üyesi Hamza Osman İLHAN (Gr.2)

hoilhan@yildiz.edu.tr

Electronic systems

- Introduction
- Electronic systems
- Distortion and noise
- System design.

Introduction

- The world in which we live is constantly changing.
- To survive, we need to respond to changes in our environment.
  - To respond we sense a changing quantity (the **input**).
  - And modify some other quantity (the **output**).
- We often use machines to respond on our behalf.
  - The nature of these machines is that they **sense** some input quantity, **process** the information, and then **control** some output quantity.

Introduction (contd.)

- The world about us is characterised by a number of **physical properties** or **quantities.**
  - e.g. temperature, pressure, humidity, etc.
- Physical quantities may be *continuous* or *discrete*.
- **Continuous quantities** change smoothly and can take an infinite number of values.
- **Discrete quantities** change abruptly from one value to another.
  - Most real-world quantities are continuous.
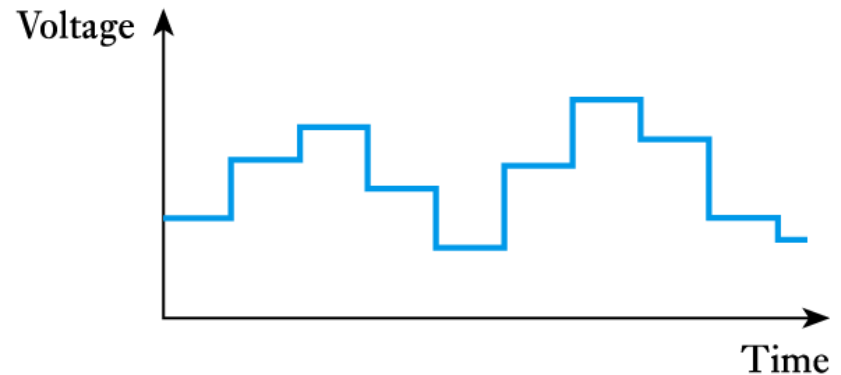 - Many man-made quantities are discrete.

Introduction (contd.)

- It is often convenient to represent physical quantities by electrical signals. These can also be continuous or discrete.

- Continuous signals are often described as **analogue.**
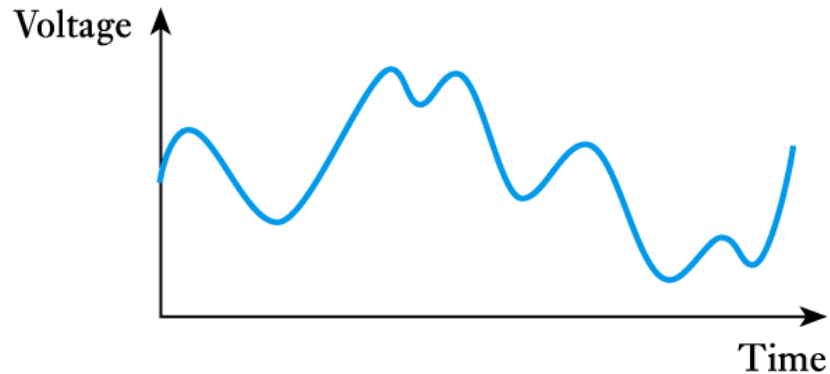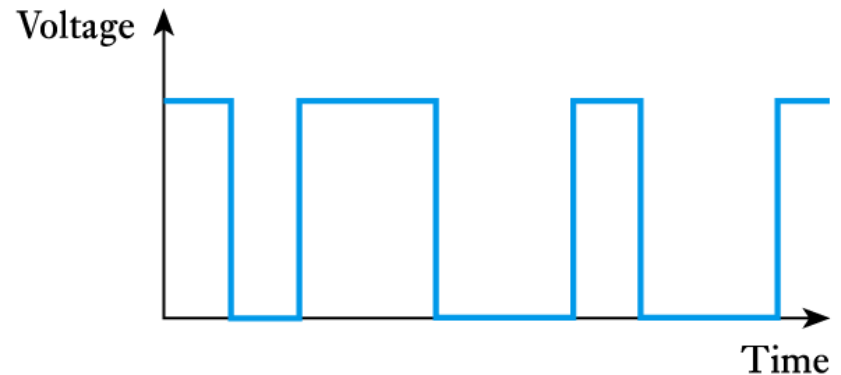

(a) An analogue signal

Introduction (contd.)

- Discrete signals are often described as **digital signals.**

Voltage

(b) A multi-valued digital signal

Time

- Many digital signals take only two values and are referred to as **binary signals.**

Voltage

(c) A binary signal

Time

Electronic systems

- A system can be defined as

  Any closed volume for which all the inputs and output are known.

- Examples include:
  - an engine management system
  - an automotive system
  - a transportation system

- Inputs and outputs will reflect the nature of the system.

Electronic systems (contd.)

- Electronic systems can take many forms, for example.
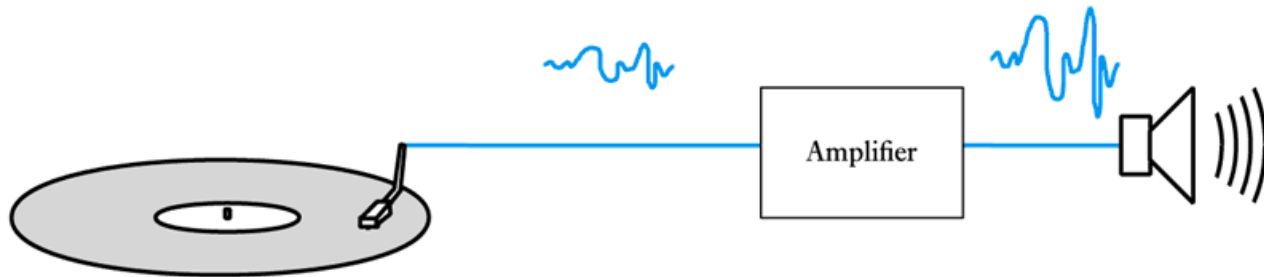

(a) A record player
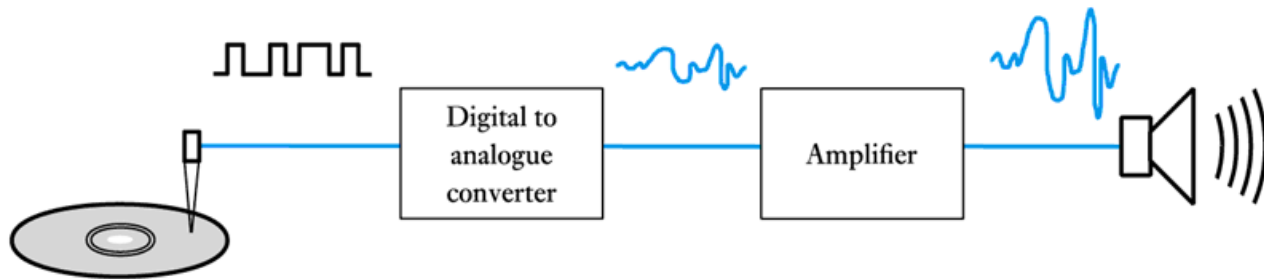
(b) A compact disc player

Electronic systems (contd.)

- Components that interact with the outside world are termed **sensors** and **actuators.**
  - In the previous examples the pickup or laser scanner represents a sensor.
  - In the previous examples the loudspeaker represents an actuator.
- We will look at sensors and actuators in more detail in later lectures.
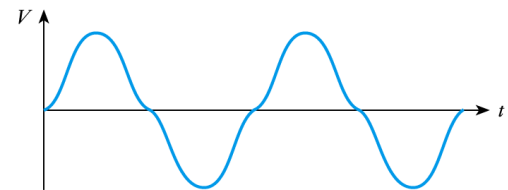
Distortion and noise

- All systems distort electrical signal to some extent
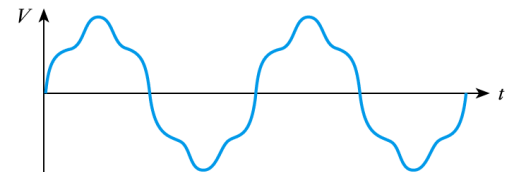 - examples include clipping, crossover distortion and harmonic distortion.
- Distortion is **systematic** and is **repeatable.**
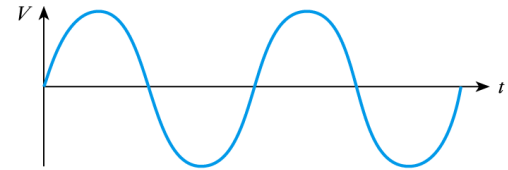
(a) Sine wave
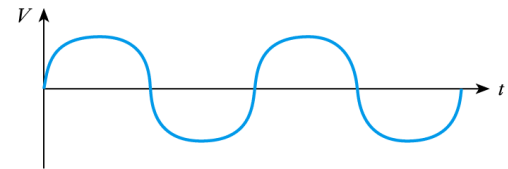
(b) Clipping

(c) Crossover distortion

(d) Harmonic distortion

Distortion and noise (contd.)

- All systems also add noise to the signals that pass through them.

- Unlike distortion, noise is **random** and not repeatable.

- Noise can often be removed from digital signals but this is often impossible with analogue signals.

(a) Original analogue signal

(b) Analogue signal with noise

(c) Original digital signal

(d) Digital signal with noise
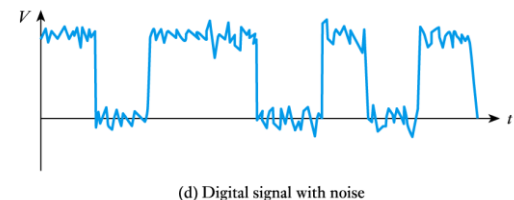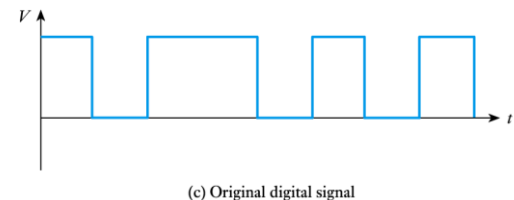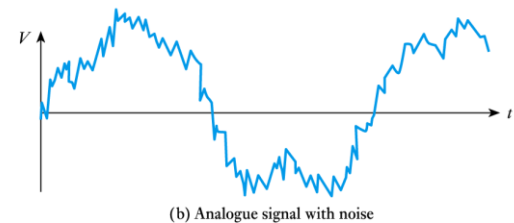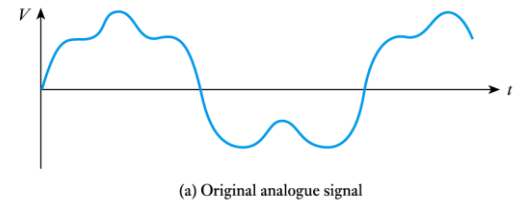
System design

- The task of designing an electronic system can be simplified by adopting a methodical approach.

- Generally this involves a **top-down approach.**
  - Customer requirements
  - Top-level specification
  - Choice of technology
  - Top-level design
  - Detailed design
  - Module construction and testing
  - System testing.

System design (contd.)

- **Electronic design aids**
  - schematic capture
  - circuit simulation
  - PCB or VLSI layout packages.
- Circuit simulation greatly assists our understanding of the operation of a circuit.
  - Common examples include PSpice and Multisim.

Key points

- Systems interact with the world using sensors and actuators.
- Physical quantities can be either continuous or discrete.
- Physical quantities are often represented by signals.
- Useful electronic systems take input signals, process this information and produce appropriate outputs.
- Distortion and noise are always present.
- System design normally follows a top-down approach.
- Electronic design tools, such as simulators, are invaluable.