Electronic Circuits

Prof. Nizamettin AYDIN
naydin@yildiz.edu.tr
http://www.yildiz.edu.tr/~naydin

Dr. Gökhan Bilgin
gokhanb@ce.yildiz.edu.tr

Electronic systems

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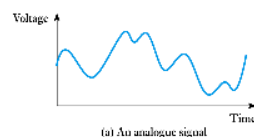

Introduction

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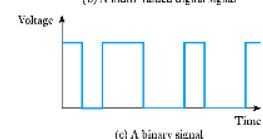- Continuous signals are often described as **analogue.**

(a) An analogue signal

Introduction (contd.)

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

(b) A multi-valued digital signal
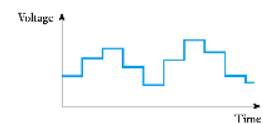
- Many digital signals take only two values and are referred to as **binary signals.**


(c) A binary signal

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
    – an ecosystem.
- Inputs and outputs will reflect the nature of the system.

Electronic systems (contd.)

- Electronic systems can take many forms, for example.
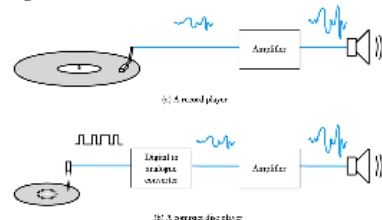

Electronic systems (contd.)

- 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.**
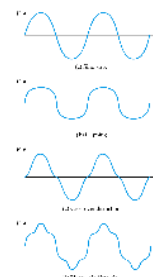
Distortion and noise (contd.)

- 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.
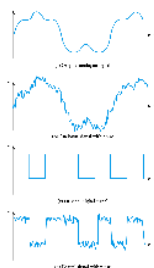
System design

- 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.
  - Simulation **demonstration files** are available to support the material in the course text.

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.