

Electronic Circuits

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Electronic systems

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

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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.

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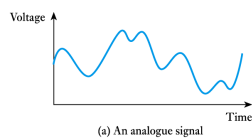
...Introduction...

- 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.

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...Introduction...

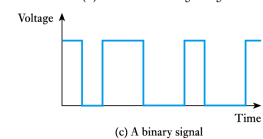
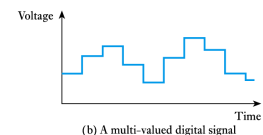
- It is often convenient to represent physical quantities by electrical signals. These can also be continuous or discrete.
- Continuous signals are often described as **analog(ue)**.



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...Introduction

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



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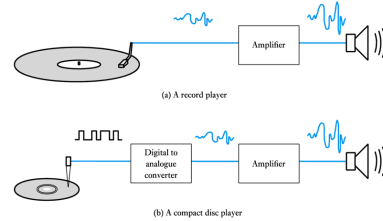
Electronic systems...

- 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.

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...Electronic systems

- Electronic systems can take many forms, for example.



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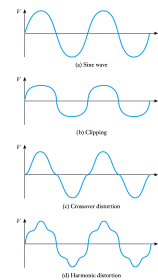
...Electronic systems

- 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.

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Distortion and noise...

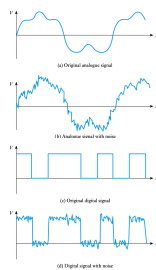
- All systems distort electrical signal to some extent
 - examples include clipping, crossover distortion and harmonic distortion.
- Distortion is systematic and is repeatable.



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...Distortion and noise

- 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.



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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.

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...System design

- 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,
 - Multisim
 - LTspice.

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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.

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