
Unit 1. Introduction

Digital Electronic Circuits
(Circuitos Electrónicos Digitales)
E.T.S.I. Informática
Universidad de Sevilla

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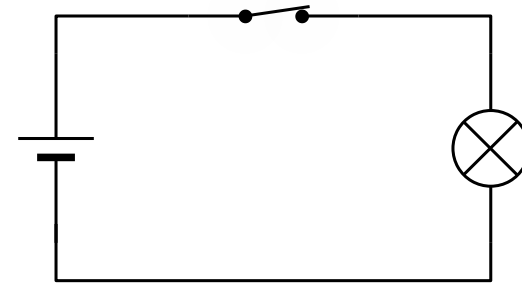
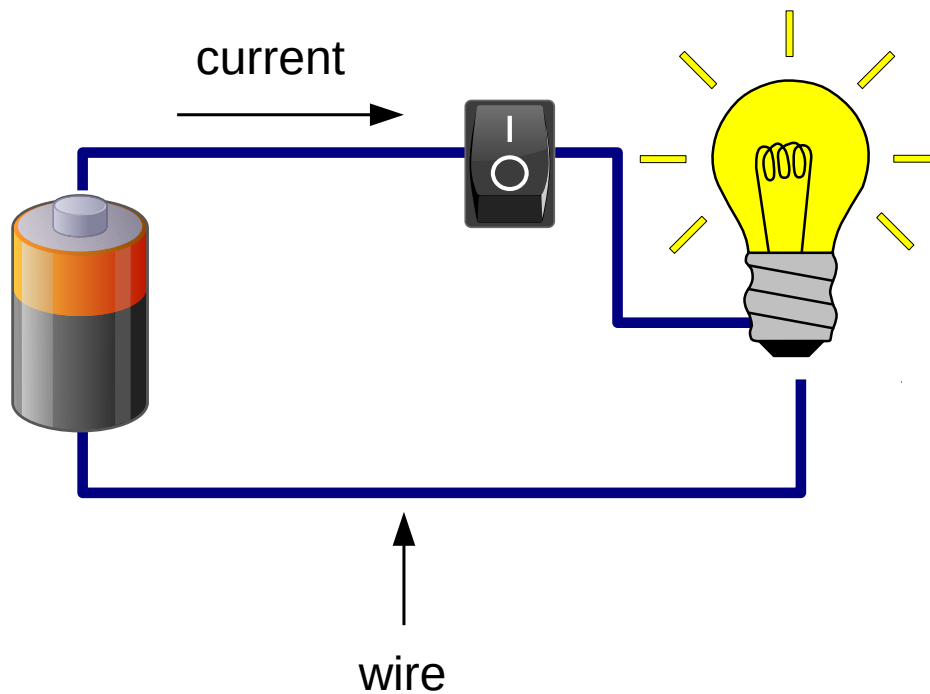
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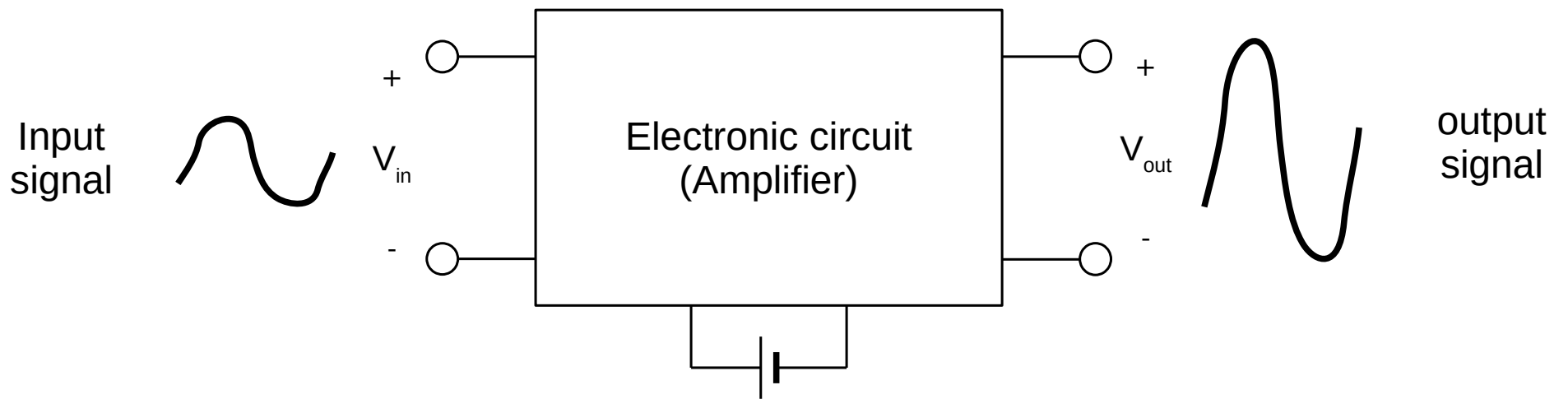
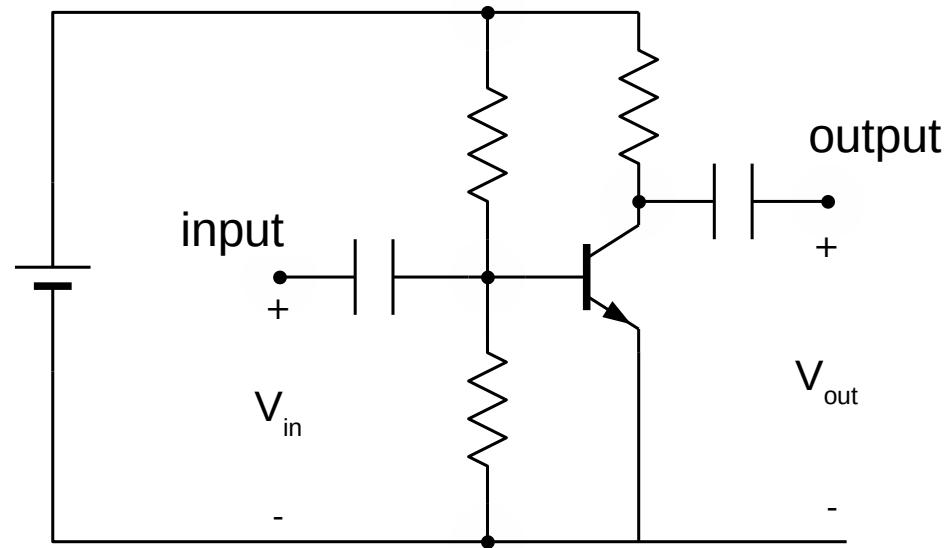
Contents

- Digital Electronic Circuits (DEC)
- Analog vs Digital
- DEC and computer curricula
- Practical Course's information

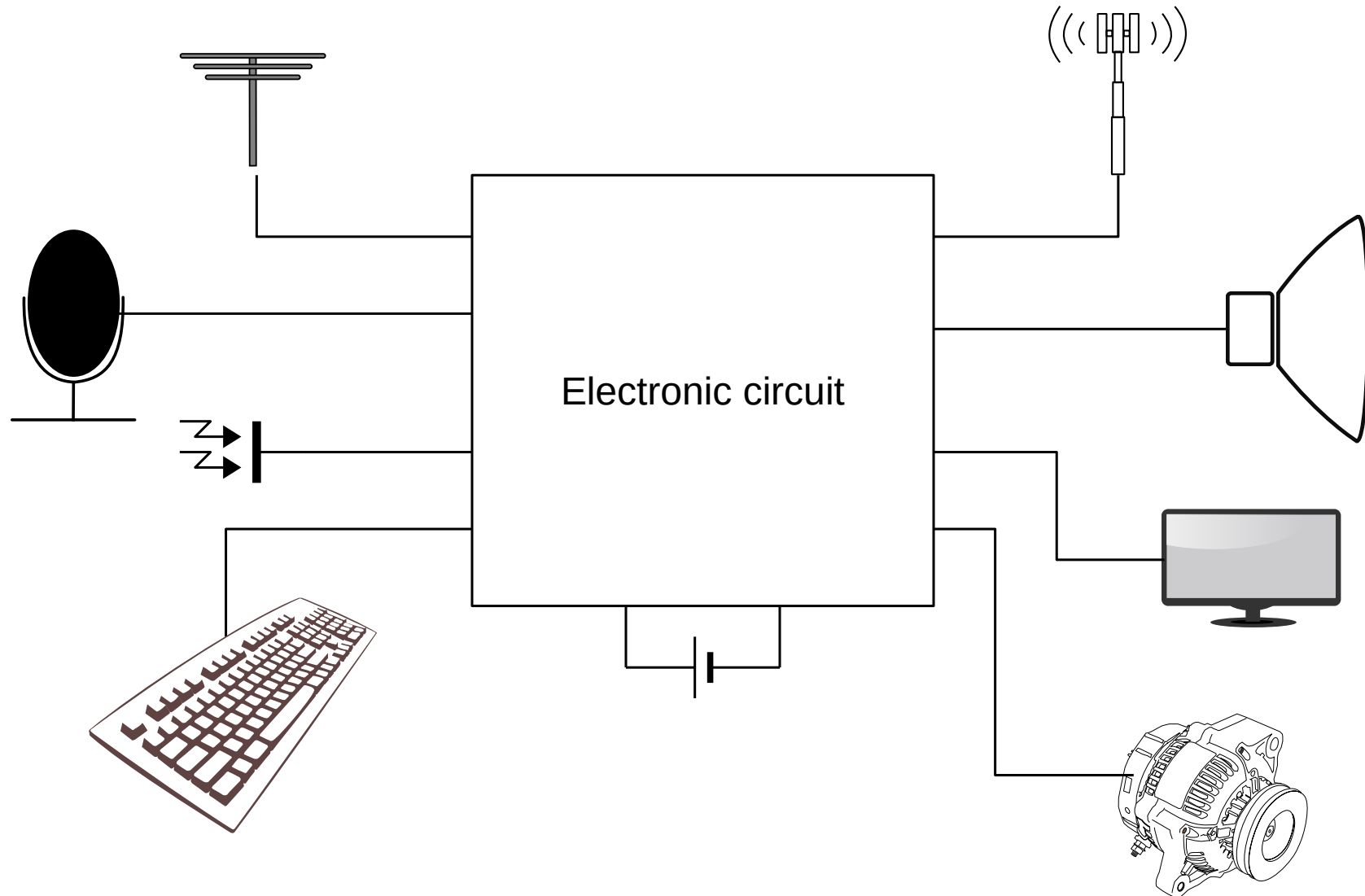
Electric circuits



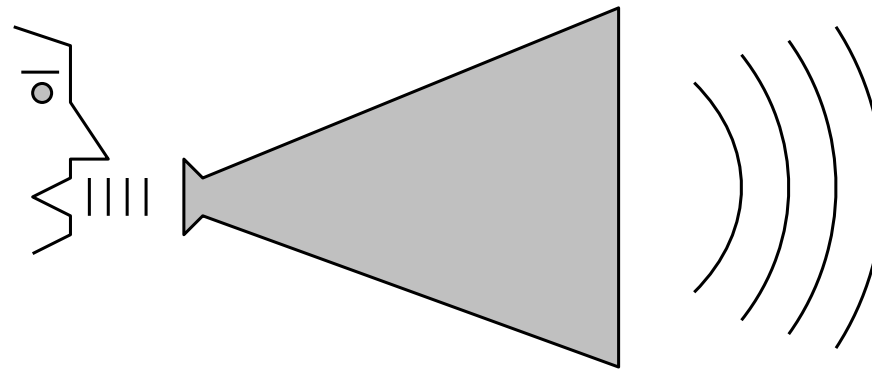
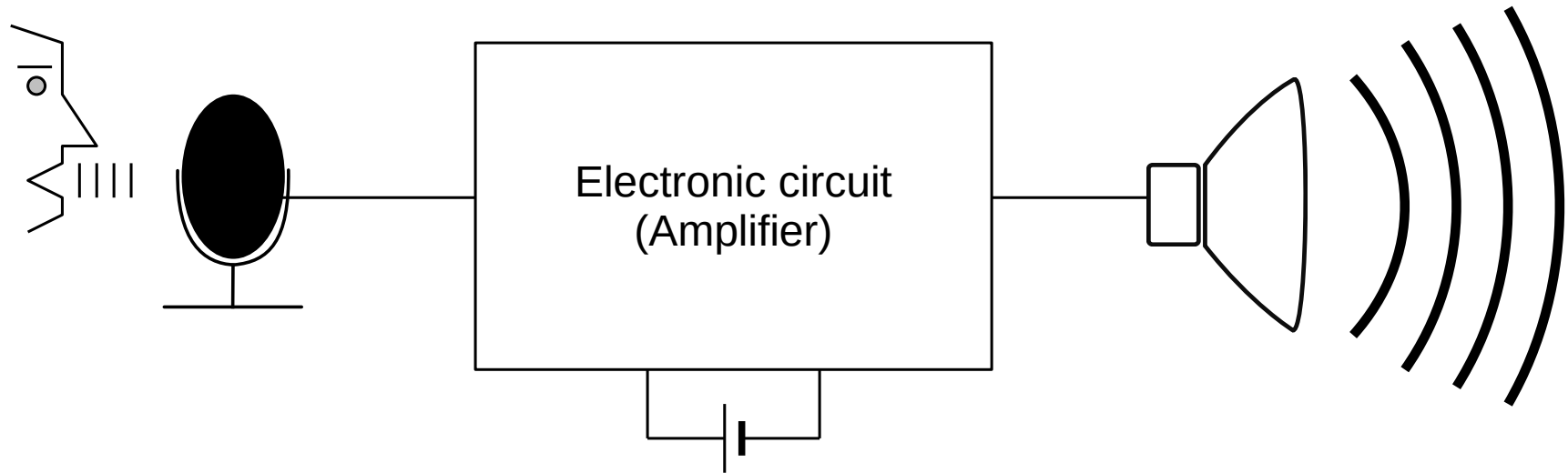
Electronic circuits



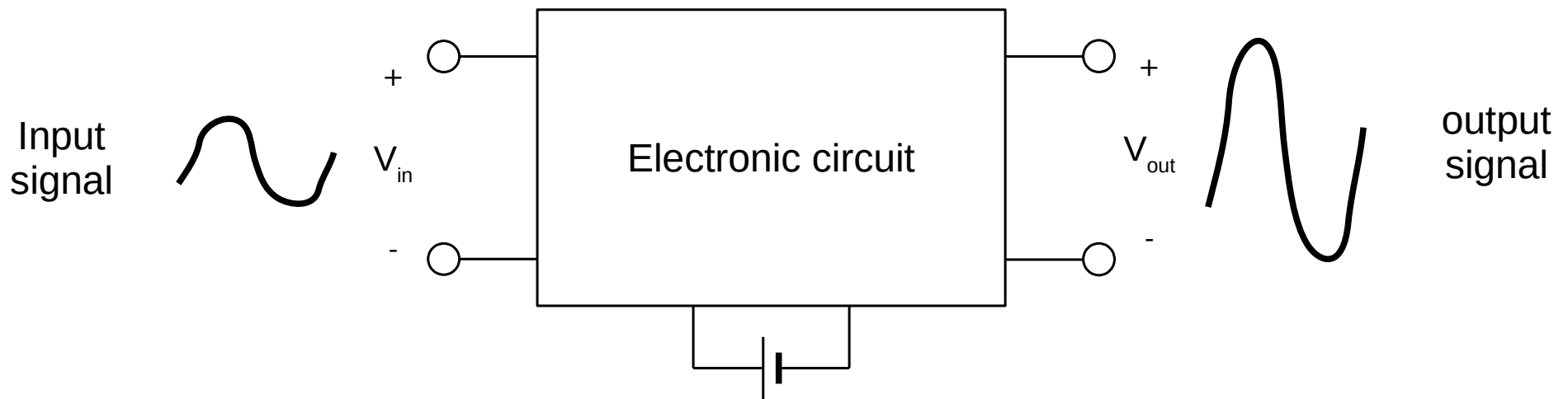
Electronic circuits. Transducers



Electronic circuits. Example

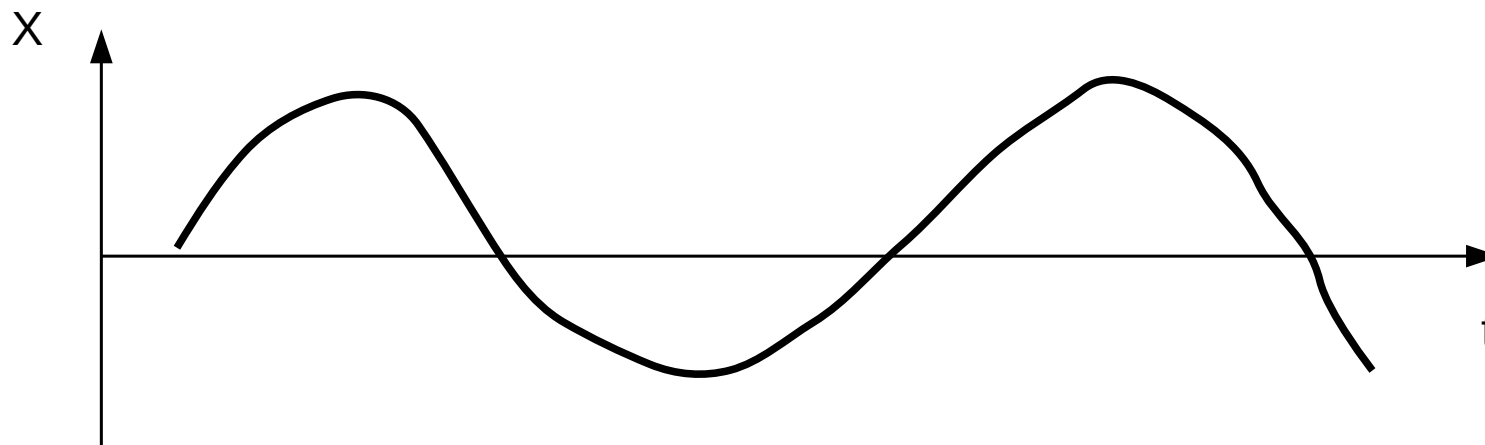


Analog vs Digital



Analog

- Analog signals
 - Continuous in time
 - Can take any value in a given range

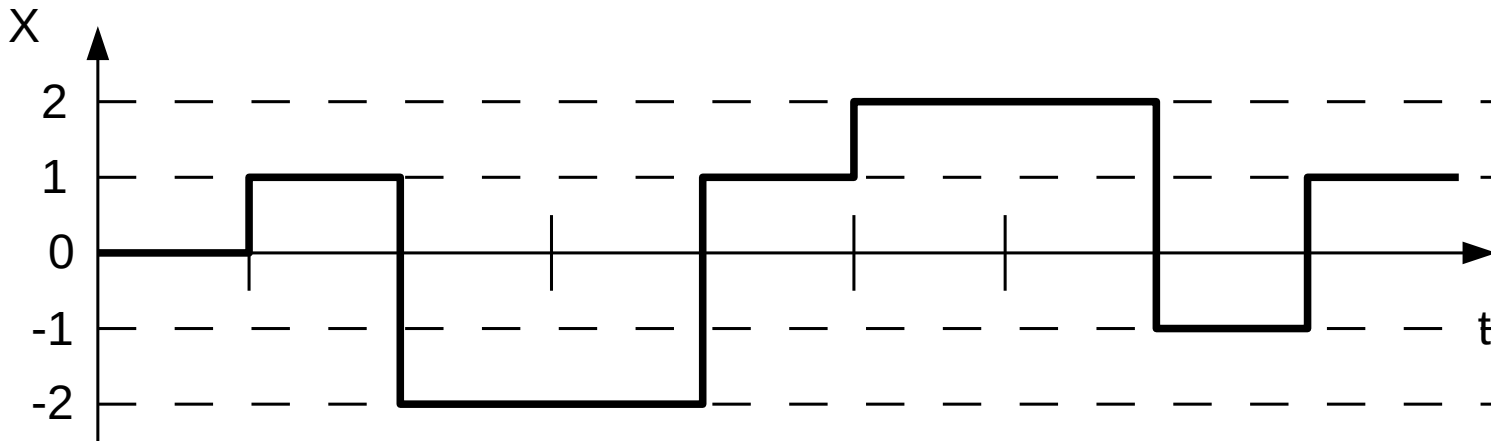


Analog

- Analog signals
 - Come from the nature: light, sound, temperature, ...
 - Transducer circuits convert natural magnitudes in electrical signals: microphones, speakers, photodiodes, antennas, ...
- Analog electronic circuits
 - Process analog signals: amplifiers, filters, ...

Digital

- Digital signals
 - Change at definite times (discrete in time)
 - Only take a definite number of values (discrete values)

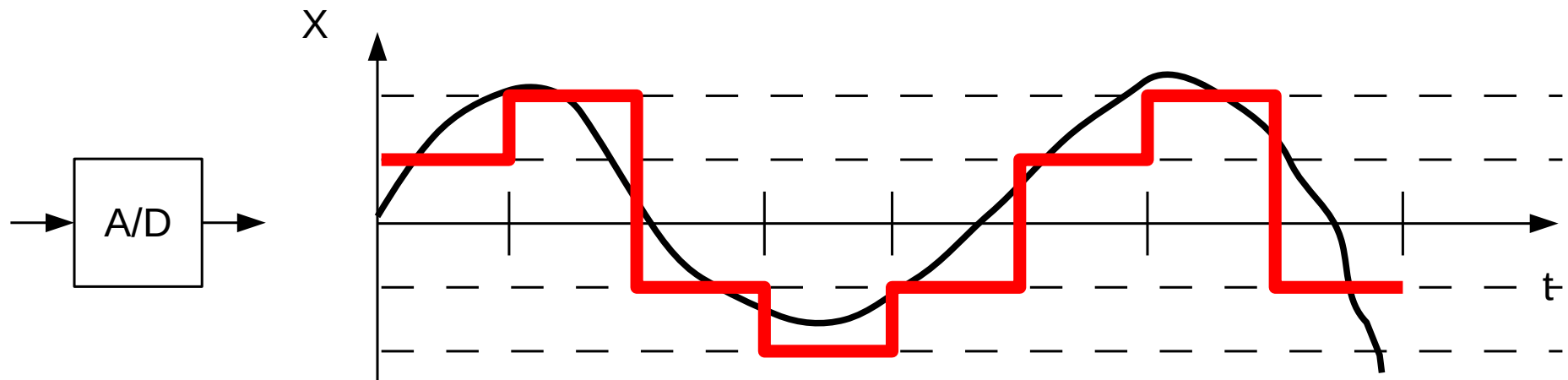


Sequence: 0, 1, -2, -2, 1, 2, 2, -1, 1

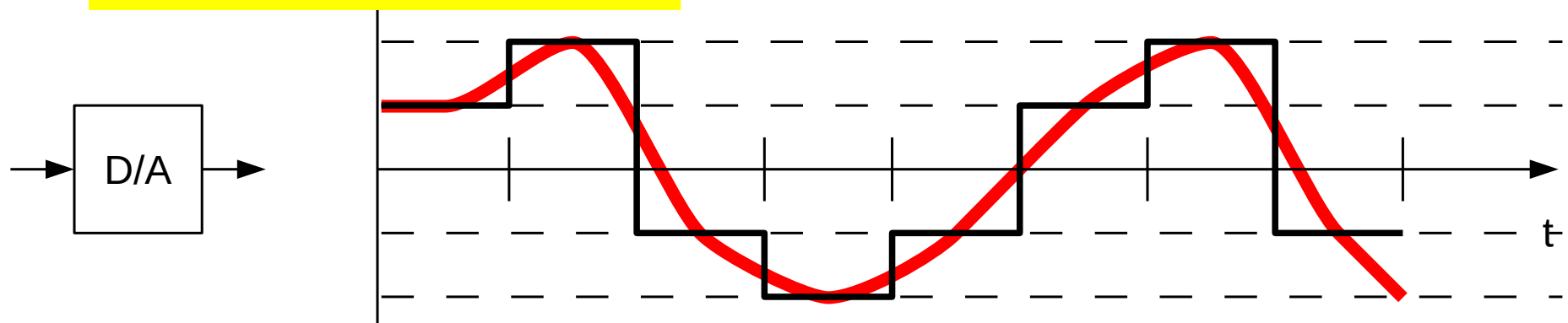
Digital

- Digital signals
 - Obtained from conversion from analog signals through analog-to-digital converters (A/D)
 - Allow a numeric treatment of information
- Digital electronic circuits
 - Process digital signals by operating with numerical data
 - Addition, product, storing, ...

A/D and D/A conversion



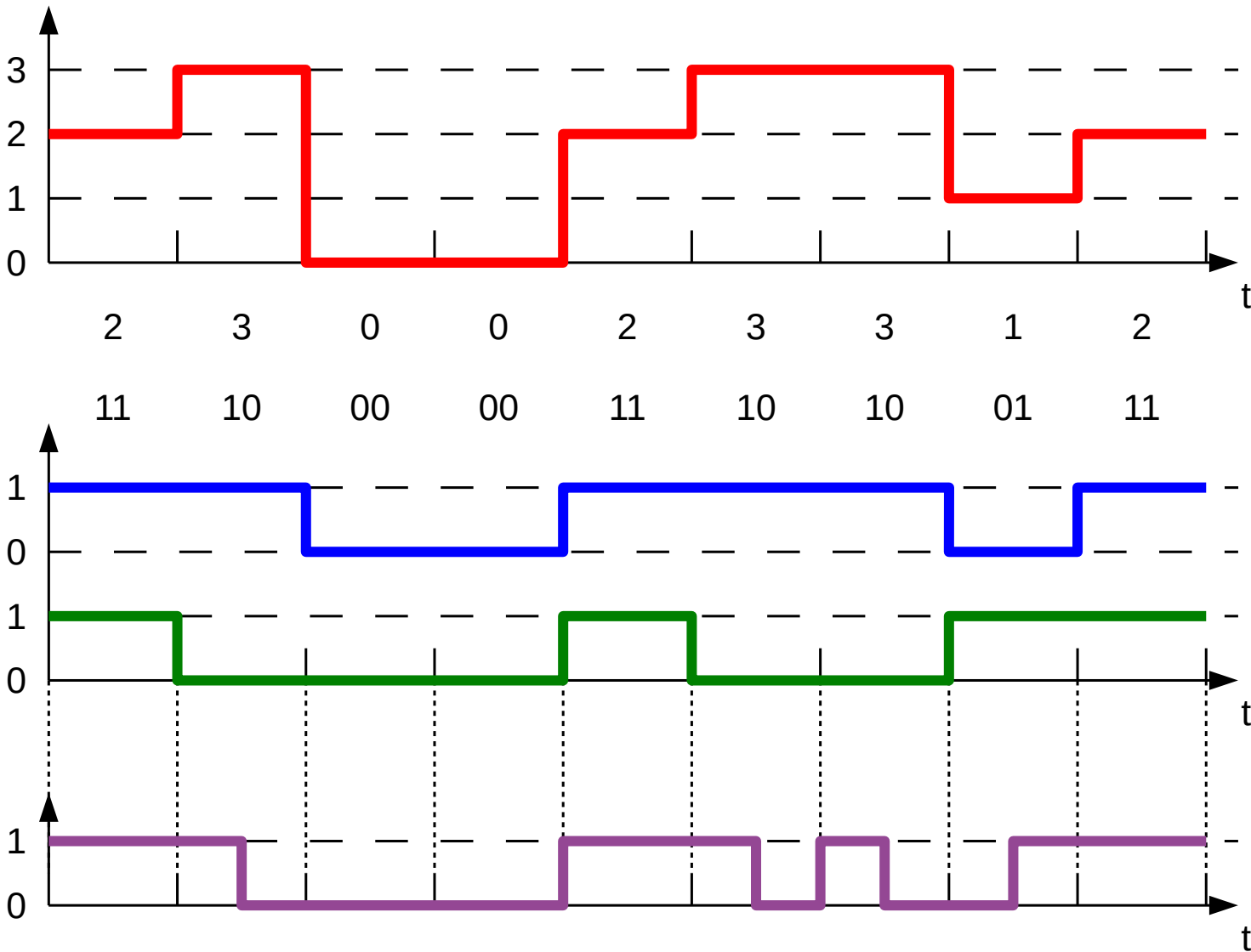
Quantization error



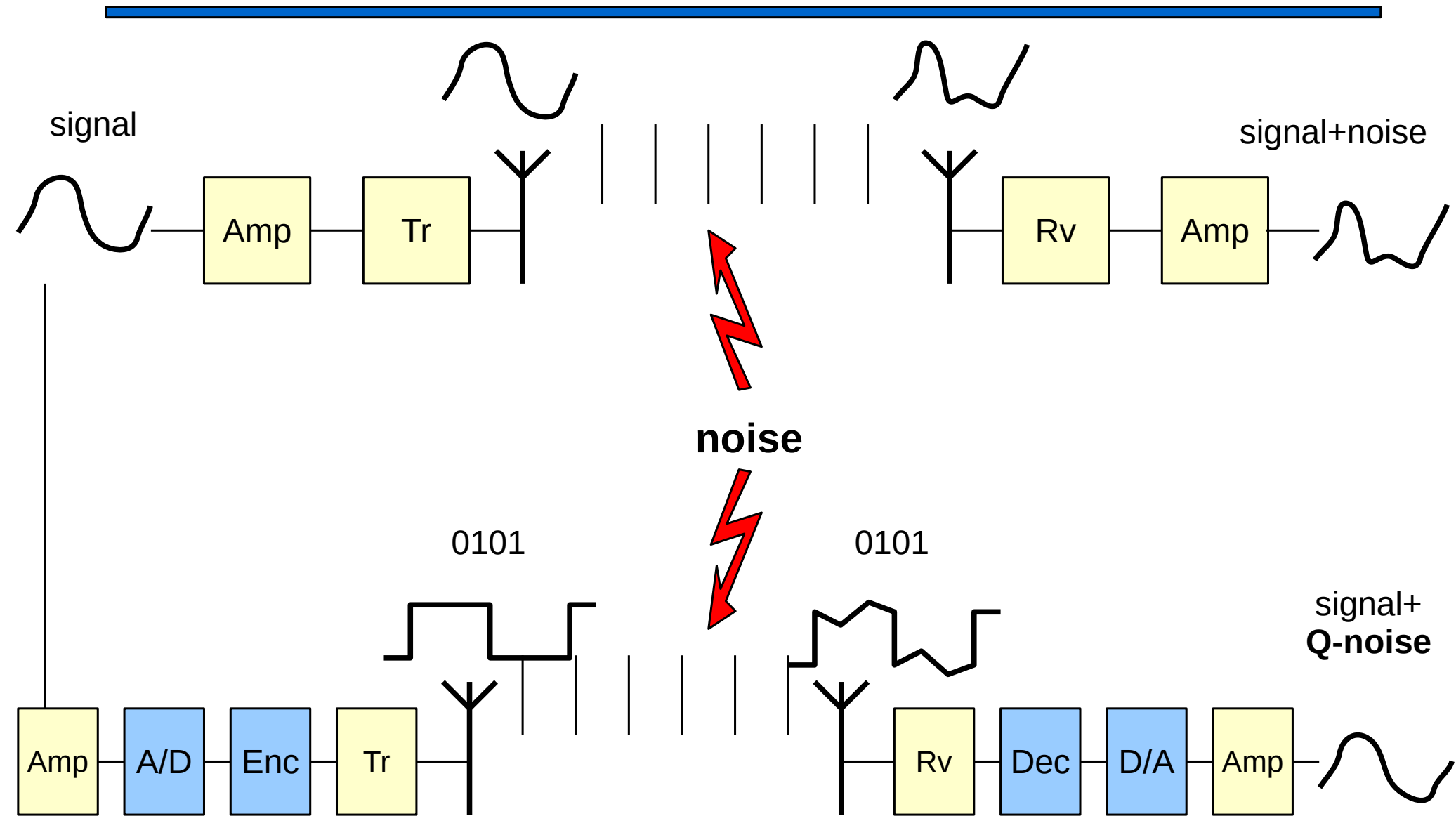
Binary digital signal

- Binary digital signal only take two values {0, 1}
 - (this is where all the 0's and 1's fuzz comes from)
- Multi-valued digital signals can be equivalently represented by binary digital signals easily
- In most cases, we use binary digital signals for convenience (more on this in next unit)

Binary digital signal



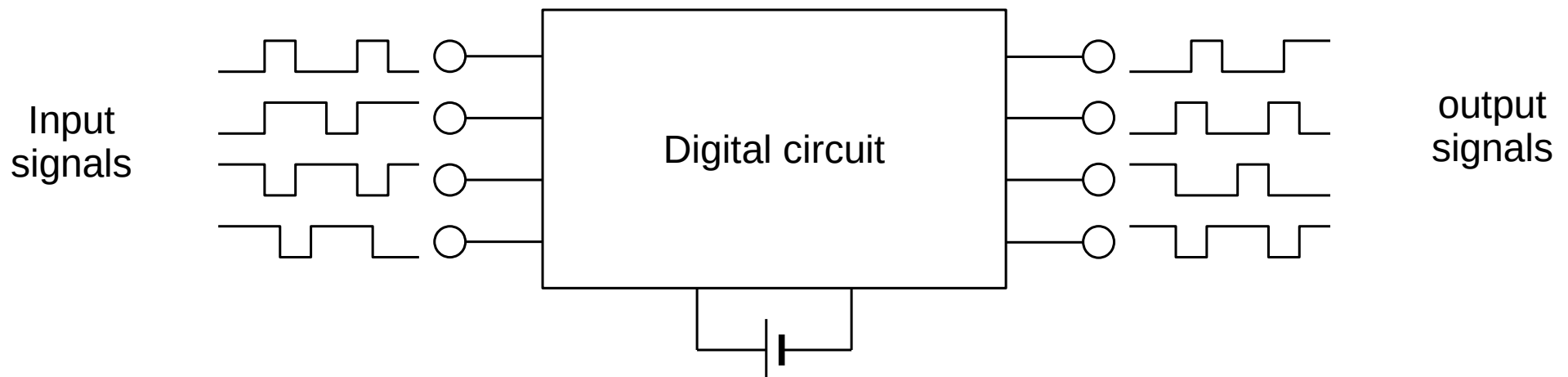
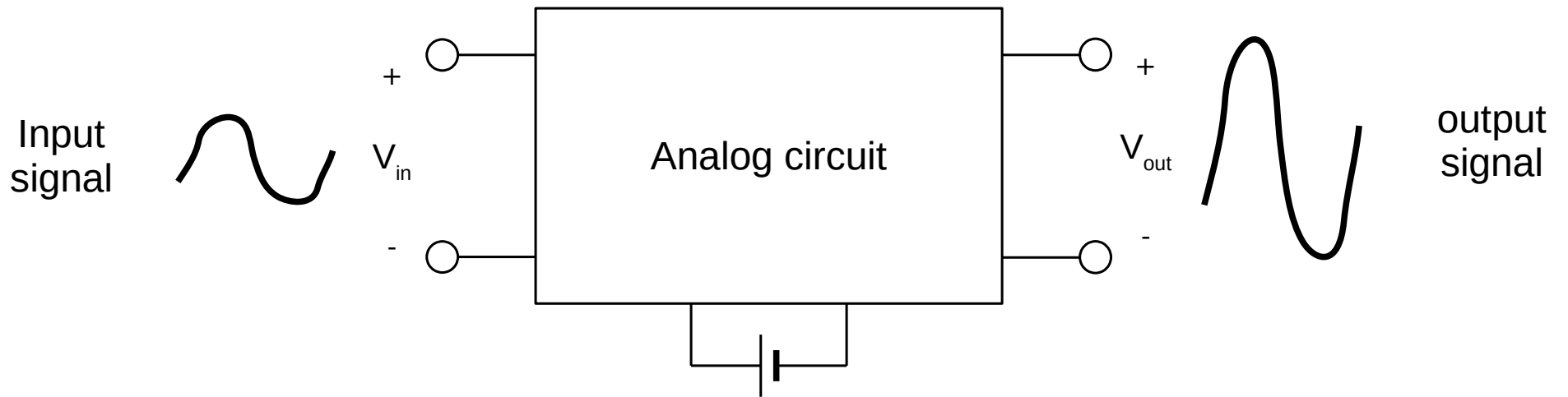
E.g.: analog vs digital transmission



Digital vs Analog

- Drawbacks
 - Slow processing compared to analog
 - Bigger circuits
 - Higher power consumption
 - A/D and D/A required
 - Quantization error
- Advantages
 - Much easier design and implementation
 - Transmission without loss of quality
 - Much more powerful processing
 - Compression, error detection/correction, storage, etc.
 - Homogeneous treatment of information:
 - sound, image, text, etc.

Digital vs Analog



DEC and computer curricula

Software
Computer networks
Computers
Digital systems
Digital circuits
Analog circuits
Circuit theory
Electronic Physics

Computer Structure
(EdC)

Digital Electronic Circuits
(CED)

Summary

- Electronic circuits (electronic technology) is a convenient way to solve many practical problems:
 - Detect objects and events
 - Process control
 - Signal broadcasting and processing
 - ...
- Digital electronics simplifies and allow further applications:
 - Complex data processing
 - Complex control algorithms
 - Easy and reliable data storage
 - ...
- Digital electronic technology builds the hardware where software is executed

Practical information

- Teaching staff
- Digital electronics
- Program
- Activities
- Methodology
- Calendar
- Assessment (evaluation)
- Resources

Teaching Staff

- Jorge Juan-Chico (me)
 - Theory and practical session
- David Guerrero Martos
 - Laboratories

Program

- Part 1: Electronic circuits and logic families
 - 1. Introduction
 - 1.5. Electronic circuits and logic families
 - 2. Digital encoding
- Part 2: Combinational applications
 - 3. Combinational circuits
 - 3.5. Hardware description languages
 - 4. Combinational subsystems
 - 5. Arithmetic and logic units
- Part 3: Sequential applications
 - 6. Synchronous sequential circuits
 - 7. Sequential subsystems

Activities

- On-site/on-line (~60 hours, 4 h/week)
 - Theory sessions: concepts, examples, short tests.
 - Practical sessions: problem solving.
 - Laboratory sessions: actual implementations
 - Quizzes, tests
- Off-site (~90 hours, 6 h/week)
 - Study
 - Problem solving
 - Laboratory preparation
- Tutorship
 - On-site/on-line: see professor's web page

Methodology

- Theory sessions
 - Prof. explains theory concepts and problem solving methods using practical examples
 - Proposes an assignment (key exercises).
 - Proposes additional exercises from the course's collection.
- Personal (including group) work
 - Learn the theory and methods. Try to solve the assignment NOT watching other year's solutions. Ask the prof. for assistance.
- Practical sessions
 - Students ask questions about assignments or other problems.
 - Prof. gives guidance so that students finish their assignment.
- Labs
 - Students read the lab exercise and do the pre-lab work.
 - Sample circuits are implemented in lab sessions.

Assessment

- In-course (continuous) assessment
 - Theory and problems (80%)
 - Two blocks: combinational, sequential
 - Short quizzes with every unit (20%)
 - Two partial tests (80%) one block each
 - Labs (20%)
 - Mandatory (may skip just one)
 - Must pass both
- Final exams
 - Theory and problem exam (80%)
 - May take only the failed block during in-course assignment
 - Lab exam (20%)
 - Must pass both
 - Marks from in-course assignment are preserved until 3rd official call

Resources

- US Virtual Teaching platform (EV) (ev.us.es)
 - Everything should be there
- Department's web page (www.dte.us.es)
 - Professors web pages (office hours, e-mails, etc.)
 - Courses backup page (in case EV go nuts)
 - Basic emergency information
- ETSII web page (www.informatica.us.es)
 - Class place and dates, exam dates, covid-19 info, etc.
- Communication
 - Official: E-mail through EV.
 - Others: check EV and web page.

You must read the Syllabus (in EV)