INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Electronic systems for communication

Introducing

Description

The objective of this course is to introduce the fundamentals of analog and digital electronic systems used by engineers designing electronic communications systems. Organized into thirteen sections, the course aims to cover the analog and digital functions typical of a telecommunications system, such as that of a cell phone. The signal conditioning aspect is addressed by presenting various analog filter structures, with the canonical expressions demonstrated. Operational amplifiers (Op Amps) are studied in linear mode in Laplace space, followed by their study in saturated mode.

The second part of the course covers the concepts of digital electronics: combinational and sequential logic, gates, flip-flops, registers, multiplexers, converters, and memories. The connection to digital signal processing is introduced through CAN and DAC architectures. The issue of communication and interfacing between different logic families is analyzed, associating communication protocols with transmission modes (synchronous, asynchronous, duplex, etc.).

Objectives

At the end of this module, the student should have understood and be able to explain the following main concepts:
- Basic concepts of signal processing (amplification, filtering, Fourier transform)
- Operation of an ideal amplifier and limitations of a real operational amplifier
- Basic Op Amp-based analog electronics setups
- Linear and saturated operating conditions of an Op Amp-based circuit
- The difference between analog and digital electronics
- Basic principles of analog-to-digital conversion (sampling, quantization, Shannon's theorem)
- Physical characteristics of digital circuits
- Gate and flip-flop architectures of simple digital circuits (counter, register, multiplexer)
- Basic principles of digital signal transmission
- Basic principles of analog and digital modulation

The student should be able to:
- Calculate the Laplace transform of the transfer function of an analog circuit
- Design a first-order filter
- Design a simple Op Amp-based analog function (amplifier, integrator, summing circuit)
- Set up an analog-to-digital conversion chain
- Wire analog and digital circuits

Necessary prerequisites

General laws of electricity.
Signal processing basics (Fourier transform, frequency domain representation).
Logic systems.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit,

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évaluation par les pairs...

Practical info

Location(s)

Toulouse