

**Analogical Systems**

# Course description

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## Analogical Systems

*Number of credits: 4 ( 3 theory + 1 practical)*

*Semester: 2*

*Type: optional*

### Objectives

The overall objective of the course is that the student acquires a broad view of analog design aspects that allow both design analog circuits and systems, and understand electronic equipment used in communications and instrumentation. Especially, the student will be able to design with Operational Amplifiers and other analog integrated circuits as analog multipliers, linear voltage regulators and switched, VCOs, PLLs, etc.. Additional emphasis will be placed on the ability to assess the noise in the analog signal processing knowledge of the main limitations and consistent care when analog design.

### Program

The exact content of the program is adapted to the student profile. To do this, at the beginning of course there is an analysis of the average profile and interests of reinforcement and intensification, indicated by attendees in the first class. In any case, the subject is divided into two parts, but by modulating the intensity of each subject based on the profile of students:

#### **Part One: Concepts horizontal applications (~ 20 h)**

- Sensors and Electronic signals in the interaction with the real world. Equivalent circuit real signal sources. Signal / noise ratio and management (conditioning) appropriate electronic signals as appropriate. Amplifiers required type and its limitations.

- Operational Amplifiers (AO) integrated. Basic structure and concrete according to the types and use of AO's current. Features, benefits and limitations of the AO's current. Basic Employment negative feedback (RN) in the AO's design. Easements circuital and practical design aspects.

- Use feedback advanced in design with AO's. Positive feedback and design possibilities offered. Frequency dependent feedback signal: RN instability or loss and compensation. Simultaneous feedback (positive and negative) and their use in analog design. New design aspects of Global Negative Feedback (RGN) and Balanced (GERD).

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### **Second part: Getting more specific application (~ 20 h)**

- Systems for handling weak signals. Types of electrical noise. AO's design for low noise performance in the system.

- Practical aspects of printed circuit (Seebeck effect, leak guard techniques, etc.). Noise reduction techniques in systems.

- Systems for analog signal processing. Integrated multiplier circuits. Features and employment according to the design requirements. Application Communications and Instrumentation: practical examples of current use circuits.

- Systems for signal acquisition and actuation. A / D Conversion High resolution: Oversampling and generators using "dither". Related noise reduction.

Data Acquisition Systems for PC. Integrated Circuits and Systems Drive (Smart Power IC's).

- Power amplifiers: design and thermal constraints.

- ...

### **Bibliography**

#### **Main**

- N.R. Malik. «Electronic Circuits: Analysis, Simulation and Design», Prentice Hall, 1997. Disponible en castellano, Prentice Hall, 1996

- J.I. Izpura, "Diseño con Amplificadores Operacionales: Control básico de las realimentaciones". Fundetel, ETSIT-UPM (2004)

- A.S. Sedra y K.C. Smith. , «Microelectronic Circuits», Oxford University Press, 1998. Disponible en castellano, Oxford University Press, 1999

#### **Additional**

- S. Franco. «Design with Operational Amplifiers and Analog Integrated Circuits», McGraw-Hill, 1988

- J.M. Fiore, “Amplificadores Operacionales y Circuitos Integrados Lineales”. Thomson International (2002).
- P.R. Gray y R.G. Meyer, “Análisis y diseño de circuitos integrados analógicos”. Prentice Hall Hispanoamericana (1995).
- Catálogos de Circuitos Integrados Analógicos y notas de aplicación (National Semiconductor, Texas Instruments, etc.)

## Teachers

Coordinator: Javier Ferreiros López.

Teachers: Javier Ferreiros López y Álvaro de Guzmán Fernández González

## Teaching Methodology

It is based on various activities:

- Classes theoretical presentation of topics by the teachers
- Practical problems and case studies related to the theme design by teachers
- Personal work of students with memory performance results
- Classes exhibition of work by students in front of everyone
- Class of comment and clarification of job failures and presentations by teachers
- Written exam final course

## Evaluation

2 components:

### Personal work on a set of proposals for teachers

- Defined at mid-course
- Presentation type memory scientific article results
- 4 pages in two columns
- With title, abstract, memory, conclusions and bibliography
- With oral presentation in class

### Examination

A set 2-3 with affordable problems developed in the classroom

### **Qualification**

Personal work 30% + 70% Exam (mandatory pass both parts).

### **Contact**

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### **Moodle**

<http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=4710>

