

Progettazione Mixed Signal (Design of Mixed Signal Circuits and Systems)

A.A. 2022-2023

Paolo Bruschi

The Sensor Systems Engineering program (15 CFU)

Curriculum: **Sensor System Engineering**

- ❑ Sistemi sensoriali per l'automazione, l'ambiente e la salute (6 cfu)
- ❑ Progettazione *mixed signal* (9 cfu)



- ❑ **Design of integrated cells for:**
 - Sensor interfacing
 - Analog control systems
 - Analog signal processing
- ❑ **Data conversion (ADCs & DACs)**
- ❑ **Digital and Analog circuit integration**

Main Topics (not in chronological order)

1) High level description of a collection of fundamental Analog and Mixed Signal (AMS) systems:

- DAS (Data Acquisition Systems) and elementary sensor interfaces
- Methods for offset and flicker noise cancellation
- Fully-differential architectures
- Analog Integrated Filters
- Data converters (ADC-DAC)

2) Complement of Mixed Signal Analysis & Design Methods

- Design friendly MOSFET and BJT noise models
- Useful network theorems (feedback system design, parameter variation effects, ...)
- Mixed Signal design flow

3) Transistor level Analysis & Design of main analog cells

- Elementary blocks: Switches and Current Mirrors
- Operational amplifiers (S/E and Fully-Differential)
- Integrated Comparators

Experimental Lectures

- 1) Design and Simulation of a few important analog blocks (LTSpice)
- 2) Experiments performed by the teacher with dedicated analog circuits and computer-controlled oscilloscopes / signal generators

Final Exam

- 1) Only oral: typically, two questions (transistor-level topic + system level topic)

Suggested Prerequisites

- 1) Progettazione di Sistemi Microelettronici (PSM)
- 2) Elettronica Analogica

Didactic material

From teacher's web page:

http://www2.ing.unipi.it/~a008309/mat_stud/lista_dida.html

The image shows a file manager interface with two panes. The left pane displays the directory structure under the path `/home/a008309/public_html/`. The folders listed are `..`, `2022`, `2021`, `2020`, and `archive`. The folder `2022` is highlighted with a dashed box. A red arrow points from this folder to the right pane. The right pane shows a list of sub-directories with their creation dates and permissions:

Directory Name	Creation Date	Permissions
Parent Directory	-	-
Exercises/	2021-09-09 13:24	-
Lecture_notes/	2021-09-09 13:24	-
Optional_Material/	2021-09-09 13:24	-
SW/	2021-09-09 13:24	-
Slides/	2021-09-09 13:24	-