

EE-423

**Low power electronics: analog mixed signal design**

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Cursus	Sem.	Type
Data and Internet of Things minor	H	Opt.
Electrical and Electronical Engineering	MA1, MA3	Obl.
MNIS	MA3	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	3 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

This course deals with the analyze, design and optimization of CMOS analog circuits, emphasizing low-power solutions required in a broad range of applications (e.g. IoT, wearables, Biosensors ...). Some examples of mixed-signal design are also addressed.

**Content**

- Introduction: Low-Power AMS design and applications (IoT, Wearable, Sensors, Healthcare, ...)
- MOS Transistor: Modelling, Operation and trade-offs
- Voltage references and regulators
  - Supply and temperature independent biasing
  - Low-Voltage solutions
- Operational-Amplifiers:
  - Applications (Amplification, Filtering and Regulation)
  - Frequency analysis and Stability
  - Noise, Offset and Mismatch
  - Filly Differential and common mode feedback
  - Low-voltage solutions: Rail to Rail Amp.
- Introduction to Mixed-Signal Design:
  - ADC, DAC and PLL
  - Digital calibration of analog circuits
  - Comparators
  - Practical aspects in MS-SOC

**Keywords**

MOS transistor, Modelling, Analog Design, Current Mirrors, Voltage references, Regulators, Amplifiers, Stability, low-power, Low-noise, Low Voltage, digital calibration, mixed-signal

**Learning Prerequisites****Required courses**

## Electronics I, II, IC Design I

### Resources

#### Bibliography

- Reference books (electronic version available at [epfl.library.ch](http://epfl.library.ch)):
  - Analog Design Essentials by W. Sansen
  - CMOS Circuit Design, Layout, and Simulation by J. Baker
- Reference books (paper version available at epfl's library):
  - Design of Analog CMOS Integrated Circuits By B. Razavi

#### Ressources en bibliothèque

- [Analog Design Essentials / Sansen](#)
- [Design of Analog CMOS Integrated Circuits / Razavi](#)
- [CMOS Circuit Design, Layout, and Simulation / Baker](#)