UCLouvain

lelec2620

2025

Modeling and implementation of analog and mixed analog/digital circuits and systems on chip

The version you're consulting is not final. This course description may change. The final version will be published on 1st June.

5.00 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Bol David ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	LELEC 1530, LELEC2531 and LELEC2532. LELEC2650 strongly recommended
Main themes	Over the last decades, integrated circuits have evolved from chips with a single function to complex systems on a single silicon chip. Such modern systems-on-chip (SoCs) features digital signal processors, microcontrollers, analog and RF circuits to provide the necessary interfaces to the physical world made of sensor signals, audio/video interfaces, electronic signals or wireless communications. These analog/mixed-signal (AMS) systems require the co-integration, co-design and co-verification of analog and digital circuits on the same CMOS technology platform. In this course, we will study the implementation of mixed analog/digital circuits with the help of behavioral modeling, as an essential tool within the design flow of AMS systems. This course concludes the ELEC formation in electronic circuits and systems.
Learning outcomes	**At the end of this learning unit, the student is able to :** a. Contribution of the activity to the learning outcomes of the program AA1 Knowledge base : electronic concepts (AA1.1), simulation and CAD tools (AA1.2) AA2 Engineering skills : analysis and modeling of an electronic system, AA3 R&D skills : find appropriate references on the existing solutions in the field of the course's project (AA3.1) AA4 Project management AA5 Communication skills : analysis and writing of a technical datasheet (AA5.3-5.5). b. Learning outcomes **After this course, the electrical engineers in circuit and systems should be able to:** 1 • critically compare analog and digital circuit solutions within a given applicative system context with respect to signal quality, power consumption, cost and flexibility, • analyze the sources and propagation of analog non-idealities into a mixed-signal chain, • generate appropriate abstractions for analog building blocks and model their behavior at high level in Verilog-AMS language, • setup an appropriate methodology for designing, simulating and verifying a mixed-signal system from specification phase to block partitioning to physical implementation, • co-simulate and co-verify analog blocks with a digital circuit in Verilog to mitigate the limitations of analog blocks and to extract specifications for the mixed-signal circuit implementation, • analyze industrial-level datasheets of an electronic system in the context of a design project , • analyze scientific-level papers in the field of electronic circuit and systems.
Evaluation methods	See the French version.
Teaching methods	The course is composed of the following activities: • lectures on the key AMS concepts, • assignment in groups for active learning with in-class kick-off and debriefing sessions. This course adresses questions linked to sustainability and the socio-ecological transition through a 2-hour seminar on the societal consequences of the digitalization.
Content	• Analog/mixed-signal (AMS) system design methodologies. • Behavorial analog modeling. • Analog non idealities and auto-compensation.

	• Digital assistance of analog circuits. • Modeling and implementation of phase-locked loops. • Modeling and implementation of systems based on sigma-delta modulation (if time allows).
Inline resources	https://moodle.uclouvain.be/course/view.php?id=659
Bibliography	Chapitres de certains livres de référence.
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		