UCL Université catholique de Louvain

LELEC2620

2013-2014

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

5.0 credits	30.0 h + 30.0 h	2q

Teacher(s) :	Bol David ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	Moodle > http://moodleucl.uclouvain.be/enrol/index.php?id=2373
Prerequisites :	The whole basicformation in electronic circuits is compulsory: ELEC1530, LELEC2531 and LELEC2532. It is highly recommended to have followed an advanced course in implementation of digital circuits (LELEC2570 Design of digital integrated circuits) and/or analog integrated circuit design (LELEC2650 Design of analog integrated circuits).
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 and analog/mixed-signal circuits to provide the necessary interfaces to the physical world made of sensor signals, audio/video interfaces, electronic signals or wireless communications. These SoCs 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 complete SoCs. This course concludes the ELEC formation in electronic circuits and systems.
Aims :	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& mp;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), efficient oral communication (AA5.6). b. Learning outcomes After this course, the electrical engineers in circuit and systems should be able to: -- choose and setup an appropriate methodology for designing and verifying a mixed-signal system from specification phase to block partitioning to physical implementation (transistor- and gate-levels but no layout), -- critically compare analog and digital implementations of circuit blocks within a given applicative system context, -- generate appropriate abstractions for analog building blocks and model their behavior at high level in Verilog-AMS language, -- 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 and produce 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, -- clearly and efficiently communicate technical results they obtained with an oral presentation. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	An individual evaluation is done with 2 problem-based learning activities and an evaluation by groups of 2 is based on the writing of a datasheet for the system designed within the project as well as on an oral presentation during the session. An intermediate formative evaluation allows the student to situate themselves at the mid-point.

Teaching methods :	The course is organized as follows. -- 14 lectures and/or specific seminars given by experts from the industrial worldregarding the design, modeling and implementation. They will be broadly illustrated by recent mixed-signal SoC examples from both the industrial and research worlds. -- 2 problem-based learning activities by groups focus on the development of soft skills linked to the course topic (use of industrial datasheets, rapid exploration of an unknown system, reading of scientific literature and efficient oral communication of technical results). -- a central project, by groups of 2, about the implementation of a mixed analog/digital system for wireless communication, biomedical signal processing or integrated sensors (temperature, image, radiations,...). This self-learning project will be based on CAD tools with short assignments regularly during the semester, to ensure a smooth progression of the project. The interaction between the students, the teachers and assistants will be encouraged by the use of a discussion forum on Moodle platform.
Content :	-- Mixed-signal SoC design methodologies -- Behavorial analog modeling -- Digital assistance of analog circuit -- A/D and D/A conversion - system-level -- Mixed-signal SoC verification -- Mixed-signal SoC physical implementation -- Analog blocks to support digital systems
Bibliography :	Supports -- Slides of the lectures on moodle -- Reference text book -- Forum on moodle -- Technical documentation on moodle -- Official access to the on-line support of CAD tool vendor
Cycle and year of study :	> Master [120] in Electro-mechanical Engineering > Master [120] in Electrical Engineering > Master [120] in Computer Science and Engineering > Master [120] in Mathematical Engineering
Faculty or entity in charge:	ELEC