


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	<p>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.</p> <p>This course concludes the ELEC formation in electronic circuits and systems.</p>
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p>a. <u>Contribution of the activity to the learning outcomes of the program</u>                      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&amp;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).</p> <p>b. <u>Learning outcomes</u></p> <p><b>After this course, the electrical engineers in circuit and systems should be able to:</b></p> <p>1</p> <ul style="list-style-type: none"> <li>• critically compare analog and digital circuit solutions within a given applicative system context with respect to signal quality, power consumption, cost and flexibility,</li> <li>• analyze the sources and propagation of analog non-idealities into a mixed-signal chain,</li> <li>• generate appropriate abstractions for analog building blocks and model their behavior at high level in Verilog-AMS language,</li> <li>• setup an appropriate methodology for designing, simulating and verifying a mixed-signal system from specification phase to block partitioning to physical implementation,</li> <li>• 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,</li> <li>• analyze industrial-level datasheets of an electronic system in the context of a design project ,</li> <li>• analyze scientific-level papers in the field of electronic circuit and systems.</li> </ul>
Evaluation methods	See the French version.
Teaching methods	<p>The course is composed of the following activities:</p> <ul style="list-style-type: none"> <li>• lectures on the key AMS concepts,</li> <li>• assignment in groups for active learning with in-class kick-off and debriefing sessions.</li> </ul> <p>This course addresses questions linked to sustainability and the socio-ecological transition through a 2-hour seminar on the societal consequences of the digitalization.</p>
Content	<ul style="list-style-type: none"> <li>• Analog/mixed-signal (AMS) system design methodologies.</li> <li>• Behavioral analog modeling.</li> <li>• Analog non idealities and auto-compensation.</li> <li>• Digital assistance of analog circuits.</li> <li>• Modeling and implementation of phase-locked loops.</li> <li>• Modeling and implementation of systems based on sigma-delta modulation (if time allows).</li> </ul>

Inline resources	<a href="https://moodle.uclouvain.be/course/view.php?id=659">https://moodle.uclouvain.be/course/view.php?id=659</a>
Bibliography	Chapitres de certains livres de référence.
Faculty or entity in charge	ELEC

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		