UCLouvain

lelec2650

2020

Synthesis of analog integrated circuits

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Flandre Denis ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	LELEC2532 or equivalent *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	This course addresses the synthesis of analog integrated circuits, that is the design and sizing at transistor level of the main analog electronics components integrated on Si, in view of applications in instrumentation, telecommunication, signal processing ... This course aims at presenting the state-of-the art (architectural solutions, performances and limitations) and at further providing an advanced design methodology.
Aims	With respect to the AA referring system defined for the Master in Electrical Engineering, the course contributes to the development, mastery and assessment of the following skills : • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.3, AA2.4, AA2.5 • AA3.1, AA3.2, AA3.3 • AA5.3, AA5.4, AA5.5 • AA6.1, AA6.3 1 **At the end of this course, the student will be able to :** • Derive the mathematical relationships between the performances of the main integrated analog functions and the sizing of the transistors of the circuits. • Apply these concepts to the optimal synthesis of such circuits in CMOS technology. • Use to this aim, the appropriate professional methodologies and software CAD tools. • Analyze and develop a critical view on standard and advanced implementations proposed in the technical and scientific literature. • Understand, compare, and discuss different solutions proposed for actual applications - - - - *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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The exam features two parts : • The realization of an original work in groups of 2 or 3 students during the 2nd semi-quadrimester on the analysis of a case study, on the basis of technical articles and the practice on this case, of the methods and techniques of synthesis of the course. A written report must be delivered for the start of the January exam session and is orally discussed during the written exam. • The written exam is individual and open-book. Main questions are on the analysis of a technical article (explanations of concepts, equations and performances ; proposition of a sizing algorithm). In addition, a few short questions are on important concepts discussed in the course.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course is organized in successive theoretical and practical sessions, in presence as long as sanitary rules allow. Exercices are mainly hands-onand consist in training and use of computer-aided design softwares on workstations (MATLAB, SPICE / ELDO, CADENCE...) in view of practicing taught optimization and simulation methods and techniques in practical application case studies.
Content	• Analog modelling of the MOS transistor • Operational and transconductance amplifiers • Switched-capacitor filters • Continuous-time filters (MOSFET-C, gm-C)

	• Switched-current circuits • D-A, A-D converters (incl. Sigma-Delta) • Voltage- or current- controlled oscillators The details of the internal achitecture and of the operation of analog CMOS basic blocks and circuits are studied in the cases of actual integrated systems. Design and optimisation strategies are derived in order to achieve the performance specifications of target applications. Advanced computer-aided analysis and synthesis techniques are introduced. Practical case studies are presented or implemented in the frame of exercice sessions.
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=7469
Bibliography	Supports de cours sur Moodle • Copies des transparents • Chapitres de thèse • Références de livres et articles disponibles en bibliothèque ou en ligne
Other infos	This course assumes that basic notions of fundamental electronics devices and circuits have been acquired at Bac Level, such as in LELEC1330 and LELEC1530. The course is primarily aimed at students in 2nd year of Master ELEC or ELME preferably after following the course LELEC2532.
Faculty or entity in charge	ELEC

Force majeure

Evaluation methods	**No modification except that the professor might organize an oral exam for students for whom they have doubts about the grade obtained for the written exam.**

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electrical Engineering	ELEC2M	5	LELEC2532	
Master [120] in Electro-mechanical Engineering	ELME2M	5		