UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

CIRCUITS AND SYSTEMS FOR HIGH-SPEED COMMUNICATIONS

Anno immatricolazione	2017/2018
Anno offerta	2018/2019
Normativa	DM270
SSD	ING-INF/01 (ELETTRONICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	ELECTRONIC ENGINEERING
Curriculum	Space Communication and Sensing
Anno di corso	2°
Periodo didattico	Primo Semestre (01/10/2018 - 18/01/2019)
Crediti	6
Ore	48 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	MAZZANTI ANDREA (titolare) - 6 CFU
Prerequisiti	The course mixes interdisciplinary aspects of electronic engineering. Although a review of background concepts is scheduled in the lectures, basic knowledge of analog circuits design, communication systems, signal processing and fundamentals of electromagnetic fields and propagation are recommended prerequisites for successfully attending the course.
Obiettivi formativi	The course is planned for students interested in deepening the knowledge of advanced IC design for high speed communications. In particular, the course addresses the main aspects that concern the realization in CMOS technology of the electronic interfaces for very high speed base-band digital transmission and reception. Applications span from computer interfaces (processor-to-memory, processor-to-peripherals.) to wired and optical communications at speed beyond 10Gbit/sec. The student will be able to design the transceivers

	architectures and building blocks. Starting from a behavioral description of the functionality of the systems, the course will go up to the schematics and circuit design of the components. More specifically, the students will learn the key aspects of signal integrity, wide band amplification techniques, high speed equalizers and systems for clock generation and recovery (PLL, DLL, CDR). Practical activities (laboratory) are planned. The students will gain the competences required for system planning and to design the main building blocks for high speed communications over cable and optical channels.
Programma e contenuti	Binary signals and transmission channels Properties of the random binary signals. Effects of noise, jitter and bandwidth limitations. Characteristics and limitations of wired channels (attenuation, reflections, dispersion, noise and cross-talk) and optical channels (lasers, photodiodes, single- and multi-mode fibers) Amplifiers and drivers Drivers for wireline and semiconductor lasers. Trans-impedance amplifiers, programmable-gain amplifiers, limiters, high-speed comparators. Broad-band circuit techniques: inductive-peaking, Cherry-Hopper amplifier, distributed amplification. Channel equalization General concepts and system analysis. Fully analog and mixed-signal equalizers (Transmitter pre-emphasis, Feed-forward Equalizers, Decision-Feedback equalizers). Circuit topologies for very high speed. Adaptation algorithms e techniques. Generation and recovery of the clock signals General concepts and system analysis. Phase Locked Loops, Delay Locked Loops. Phase detectors for random binary signals, phase interpolators. Architectures of Clock and Data Recovery. Circuit design for highly integrated solutions. Laboratory Programming language for the behavioral description of analog circuits: Verilog-A. Behavioral simulation of a complete transceiver for Gbit/sec communications. Circuit design of the key building blocks with CMOS technology.
Metodi didattici	Lectures with a problem-solving approach and practical activities focused on realist test cases.
Testi di riferimento	Slides and lecture notes will be distributed. W. J. Dally , J. W. Poulton. Digital Systems Engineering. Cambridge University Press. B. Razavi. Design of Integrated Circuits for Optical Communications. McGraw-Hill. S.H. Hall and H. L. Heck. Advanced Signal Integrity For High-Speed Digital Designs. John Wiley & Sons.

Modalità verifica apprendimento	An individual project will be assigned to each student. The discussion of the achieved results will be the basis of the oral examination. The examination will continue with a discussion around all the topics of the course
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile