

EE 7393

Special Topics -- High Speed Communication Circuits

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Office location: 337 Junkins Building, SMU campus

Office hours: Tuesday and Thursday 2:00pm-3:00pm and/or by arrangement (contact me)

Lecture time/place: 12:30pm-1:50pm Tuesday and Thursday, Junkins Rm. 215

Course Description

This is a special topic course on high speed communication circuits. It covers circuit and system design techniques of high-speed serial links. High-speed serial links are widely used in data communication, telecommunication and consumer electronics. Topics include high-speed electrical and optical channel properties, modeling and communication techniques; design specifications and implementation details of high-speed serial link circuits, including high-speed/broadband amplifiers, serializers and deserializers, transmitter drivers, receivers, equalization circuits (pre-emphasis, DFE, and analog equalizers), phase-locked loop (PLL), clock and data recovery (CDR), high-speed current-mode logic (CML) circuits, voltage controlled oscillators, trans-impedance amplifier, laser and modulator drivers, limiting amplifier and automatic gain control amplifiers.

Prerequisites

1. EE3322 Electronic Circuits II (Grade of C- or better).
2. EE3311 Solid-State Devices (Grade of C- or better).
3. EE5/7321 Semiconductor Integrated Circuits (Grade of C- or better, or with instructor's permission).

Grading

1. 50% Projects
2. 20% Homeworks
3. 30% Final Exam

Textbook and Other Related Materials

Textbook

There is no required textbook. Lecture notes and reference materials will be provided.

References

1. Digital Systems Engineering, W. Dally and J. Poulton, Cambridge University Press, 1998
2. The Design of CMOS Radio-Frequency Integrated Circuits, Thomas H. Lee, Cambridge University Press, 2007

3. Design of Integrated Circuit for Optical Communications, Behzad Razavi, McGraw-Hill, 2003
4. Broadband Circuits for Optical Fiber Communication, Eduard Sackinger, Wiley InterScience

Topics Covered (hrs):

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| 1. CMOS Device Physics | 2 |
| 2. High-Speed Analog Circuits | 6 |
| 3. High-Speed Digital Circuits | 6 |
| 4. Channel Components and Modeling | 6 |
| 5. Digital Communication Techniques | 4 |
| 6. Transmitter and Receiver Fundamentals | 6 |
| 7. Equalization Circuits | 4 |
| 8. Clocking and Synchronization Circuits and Systems | 8 |
| Total | 42 |

Laboratory / Projects

Students are required to design using Matlab and Cadence design tools 1) a limiting amplifier with bandwidth-efficient techniques meeting various design specifications (gain, bandwidth, input/output swing, noise, and power dissipation); 2) a pre-emphasis equalization filter to compensate FR4 backplane channel impairments and its CMOS circuit implementation (transmitter serializer and output driver) at a 10Gb/s data-rate; and 3) a PLL/CDR circuit in CMOS technology meeting jitter tolerance, jitter transfer, and jitter generation requirements.

Disability Accommodations: If you need academic accommodations for a disability, you must first contact Ms. Rebecca Marin, Coordinator, Services for Students with Disabilities (214-768-4563) to verify the disability and to establish eligibility for accommodations. Then you should schedule an appointment with the professor to make appropriate arrangements. (See University Policy No. 2.4.)

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)