Analog and Discrete-Time Integrated Circuits

Programme course

6 credits

Analoga och tidsdiskreta integrerade kretsar

TSTE08

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Electrical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Electronics Engineering, Master's programme
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Signals and Systems, Analog construction, Analog CMOS Integrated Circuits

Intended learning outcomes

The purpose of the course is that the attendee should get:

- fundamental knowledge wrt. analysis and design of analog and discrete-time systems integrated ni CMOS technology for system-on-chips (SOCs)
- an understanding for the purpose and need of advanced computer-aided deisgn tools (CAD), i.e., different analysis and synthesis methodologies using computers.
- an ability to use simulation tools for circuit design

After the course is completeted, the students should be able to:

- describe the relationships between different parameters and performance measures for different types of integrated circuits and components.
- understand the influence due to limitations in performance of subcomponents on integrated filters, A/D and D/A converters
- specify OPs and OTAs to be used in larger systems
- perform charge analyses on SC circuits and understand the influence of non-ideal components on the transfer characteristics
- design integrated continuous-time filters given building blocks such as OPs, OTAs, switches, and more
- design integrated switched-capacitor filters
- describe the architecture and functionality of the most common types of A/D and D/A converters suitable for CMOS
- perform noise and distortion analysis on CMOS circuits and understand the impact on for example data converters

Course content

- Integrated circuit components, such as PMOS and NMOS transistors, capacitors, switches, current sources
- Analysis with respect to feedback and stability.
- Integrated active filters.
- Integrated switched-capacitor filters: charge-redistribution, error sources, switches, transfer functions.
- Performance measures: Noise. Spectral density. Distortion.
- Integrated data converters: Integrated analog-to-digital and digital-to-analog converters.

Teaching and working methods

The course is organized in lectures, lessons, and computer-aided group exercises.

Examination

PRA1	Computer simulations	2 credits	U, G
TENA	Written examination	4 credits	U, 3, 4, 5

Computer simulations, PRA1 The student will together with other students in smaller groups hand in a compilation of their own work concerning circuit simulation exercsies. Note that the group exercises constists of a combined suite of laboratories. The report is the concluding, examination document. The schedule laboratories are resource hours and the students have to plan their own time.
Written exam (TENA) During the lectures five quizzes will be handed out. The answers will be returned during the same lecture. Out of five quizzes one can maximally obtain three points. These points can be accounted for in the written exam. The written exams contains of five exercises totalling 25 points. With correct quizzes, the student can obtain a total of 28 points. The grading is: 10p: 3, 15p: 4, 20p: 5.

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

Supplementary courses: Mixed-signal processing systems

Department

Institutionen för systemteknik

Director of Studies or equivalent

Tomas Svensson

Examiner

Jacob Wikner

Course website and other links

http://www.isy.liu.se/edu/kurs/TSTE08

Education components

Preliminary scheduled hours: 52 h
Recommended self-study hours: 108 h

Course literature

Huvudsakligen: Johns and Martin: Analog Integrated Circuit Design, John Wiley & Sons, 2013 Gray, Hurst, Lewis, and Meyer: Analysis and Design of Analog Integrated Circuits Allen and Holberg: CMOS Analog Circuit Design Razavi: Design of Analog CMOS Integrated Circuits
samt utdelat material.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.