



LUNDS UNIVERSITET  
Lunds Tekniska Högskola

*Course syllabus*

## Integrerade A/D och D/A omvandlare Integrated A/D and D/A Converters

**ETIN55, 7,5 credits, A (Second Cycle)**

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED E

Date of Decision: 2023-04-11

### General Information

Main field: Electronic Design.

Compulsory for: MSOC1

Elective for: E4-is

Language of instruction: The course will be given in English

### Aim

This course gives the student a basic knowledge about two kinds of fundamental mixed-signal circuits, i.e. A/D and D/A converters, which are becoming increasingly important in modern electronic systems. While the largest amount of signal processing is undoubtedly performed in the digital domain, very often the input and/or the output of the system is analog: as examples, we can mention the power amplifiers in digital audio, screens and monitors in digital video, and the antenna in radio communications, all applications that typically require high performance A/D and D/A converters. In fact, very diverse fields such as radio communications, wireline communications, hearing aids, and, in general, all kinds of embedded systems, are experiencing a very strong push to move the converters closer and closer to the user interface, in an effort to enter the robust and design-friendly digital domain as soon as possible. As a consequence, the performance of the A/D and D/A converters, in terms of conversion speed, signal range, power consumption, and area, is a key parameter in the overall quality of many commercial ICs.

### Learning outcomes

*Knowledge and understanding*

For a passing grade the student must

- be able to describe the theoretical basis of A/D and D/A converters, and particularly

- sampling and quantization;
- be able to describe the most important specifications for A/D and D/A converters,
- be able to describe different architectures and their advantages and disadvantages;
- be able to describe key components and circuits, and how they are implemented;
- be able to describe the main factors limiting a converter performance, and discuss alternative solutions to improve it.

#### *Competences and skills*

For a passing grade the student must

- be able to design an A/D or D/A converter for a practical application, simulating it thoroughly at the component level with advanced CAD tools.

#### *Judgement and approach*

For a passing grade the student must

- be able to orally communicate the results obtained from the laboratory experiments;
- be able to contribute sufficient fundamental information, so that a competent person in this area can document ideas, problems, and solutions.
- be able to sift through an extensive amount of material, as e.g. presented in books and manuals, and extract the most important data.

## **Contents**

Theoretical background of A/D and D/A conversion; specifications for A/D and D/A converters; most common architectures for A/D and D/A converters; Nyquist-rate and oversampled A/D and D/A converters; circuits for A/D and D/A converters; state-of-the-art of A/D and D/A converters

## **Examination details**

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)

**Assessment:** Approved labs and approved written lab reports are required to pass the course with grade 3. For a higher grade (4 or 5), a successful written examination is required.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

## **Admission**

**Assumed prior knowledge:** ESSF01 Analogue Circuits or ETIN70 Modern electronics.

**The number of participants is limited to:** No

**The course overlaps following course/s:** ETI220

## **Reading list**

- Maloberti F: Data Converters. ISBN-10: 0387324852, ISBN-13: 978-0387324852.

## **Contact and other information**

**Course coordinator:** Universitetslektor Pietro Andreani, Pietro.Andreani@eit.lth.se

**Course homepage:** <http://www.eit.lth.se/course/etin55>