Program Specification: Master of Electrical and Microsystems Engineering

V7E: Analog-to-Digital and Digital-to-Analog Converter (ADA)

Learning Objectives:

A. Knowledge of the 4 most important D/A and A/D converter architectures, their most important parameters and simplest mathematical models, knowing the figure of merit, knowing and modeling of the different noise sources.

B. Skills: Computing required settings for A/D and D/A converters, for example for the track & hold circuit, computation of analog anti-aliasing filter and adjustment of combined analog and digital anti-aliasing filters, capability to compute noises sources individualy and their cumulative effect.

C: Competence: The student learns to decide for appropriate A/D and D/A conversion architectures based on their advantages and disadvantages for particular demands. He knows the different noise sources, how they add and how they comply with demanded quality specifications. He can subdivide a complex specification into subtasks.

Entrance Requirements:

Contents of the fundamental first semesters

Content:

- Examples to illustrate demands to A/D and D/A converter
- Simple simulation models for A/D and D/A converter
- Quantization: A/D- and D/A converter types, architectures and important parameters
- Time discretization: sampling & aliasing, tuning analog-digital anti-aliasing filter
- Signal-to-noise ratio, noise sources at A/D and D/A conversion
- Oversampling A/D and D/A converters with emphasis on delta-sigma modulators
- Labs: Modeling and simulation using Matlab, construction of a delta-sigma A/D/A conversion system programming field programmable gate arrays with VHDL, using the 10-bit SAR-ADCs within the micro controller MSP430 of Texas Instruments.

Literature:

- The Data Conversion Handbook, Analog Devices, 2004
Teaching session:

Lectures and hands-on training

Duration:

4 lessons of 45min per week

Credit Points:

5 ECTS points

Evidence of Academic Achievement:

120h
14 weeks x 4 x ¾ hours = 42 h;
14 weeks x 1,5 h work at home = 21 h
Learning for exam 55.5 h, Exam 1.5 h

Written exam of 90min duration, successful participation in hands-on training

Lecturer:

Prof. Dr.-Ing. Martin J. W. Schubert

Frequency:

Summer and winter semester