Technology
Arts Sciences
TH Köln

Course
DSS - Discrete Signals and Systems

Version: 2 | Last Change: 11.09.2019 11:39 | Draft: 0 | Status: vom verantwortlichen Dozent freigegeben

General information

Long name	Discrete Signals and Systems
Approving CModule	DSS_BaET
Responsible	Prof. Dr. Harald Elders-Boll Professor Fakultät IME
Level	Bachelor
Semester in the year	summer semester
Duration	Semester
Hours in self-study	60
ECTS	5
Professors	Prof. Dr. Harald Elders-Boll Professor Fakultät IME
Requirements	Knowledge of the following mathematical subjects: Trigonometric functions, exponential function, logarithm, complex calculus, integral and differential calculus, series expansion, geometric series, partial fraction expansion. Knowledge of the following physical subjects: Work, power and energy.
Language	German
Separate final exam	Yes

Final exam

Details

During the exam students shall demonstrate by solving problems dealing with the methods and algorithms for the analysis and the processing of discrete-time signals and systems, such as discret convolution, DTFT, z-transform and DFT, that they are able to apply the fundamental terms, concepts

and techniques of discrete signals and systems to determine and describe the propoerties of signals and sytems in the time and frequency domain, to digitize and analyse analog signals and process them with basic discrete-time systems.

Minimum standard

At least 24 of the 50 points that can be gained in total in the final exam and the two midterm tests during the semester.
In the final exam 40 points can be gained in total, in the two midterm test 5 points can be gained each yielding 10 points in total for the two tests.

Exam Type

During the exam students shall demonstrate by solving problems dealing with the methods and algorithms for the analysis and the processing of discrete-time signals and systems, such as discret convolution, DTFT, z-transform and DFT, that they are able to apply the fundamental terms, concepts and techniques of discrete signals and systems to determine and describe the propoerties of signals and sytems in the time and frequency domain, to digitize and analyse analog signals and process them with basic discrete-time systems.

Lecture / Exercises

Learning goals

Knowledge

Basic Concepts: Classification of signals and systems, stability, causality
LSI Systems: discrete-time convolution, impulse response, stability, causality
Sampling: sampled vs. discrete time signals, sampling theorem, aliasing
DTFT: derivation, properties, calculation of the DTFT, frequency response
z-Transform: derivation, properties, calculation of the inverse z-transform, system function, stability, block diagrams
DFT: derivation, properties, leakage effect
Basics of filter design: principles of FIR and IIR filter design, properties and comparison of FIR and IIR filters

Skills

Assessment of the stability of LSI systems
Calculation of the DTFT and the z-transform and the corresponding inverse transforms
Implementation of FIR systems by programming of the discrete-time convolution
Implementation of basic IIR Systems
Assessment of the characteristics of LSI filters

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	2
Exercises (shared course)	0

Tutorial (voluntary)	0

Separate exam

Exam Type

solving exercises within limited functional / methodical scope under examination conditions

Details

Two midterm tests with excercises dealing with the subjects from the lecture/tutorial that were covered up to that point, suich the by passing the midterm tests students demonstrate that they have the required skills to sucessfully participate in the corresponding labs.

Minimum standard

Two out of five points that can be scored in total per test.

Practical training

Learning goals

Skills

Two iPython-based labs on digital soignal processing of acoustical signals to apply the methods from the lecture tutorial to practical problems:
1. Discrete-time signals and systems in the time domain:
Programming of the discrete-time convolution to implement FIR filters
Programming of basic recursive (IIR) filters
Assessment of the filter characteristics by hearing acoustical signals
2. Discrete-time signals and systems in the frequency domain:
Analysis of basic FIR and IIR filters in the frequency domain using the DTFTR and the z-transform from Scipy
Comparison of the auditory impression and the frequency response

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	1
Tutorial (voluntary)	0

Separate exam

Exam Type

working on practical scenarion (e.g. in a lab)

Details

Sucessful solution of the lab problems in small groups consisting of two students, in general. The corresponding midterm test from the lecture/tutorial needs to be passed as a prerequisite for participation in the lab.

Minimum standard

Successful participation of all labs. Per lab the substantial parts have to accomplished individually from each group. To pass the corresponding midterm test 2 out of 5 points have to be gained.