Technology Arts Sciences
TH Köln

Course Manual SMP

Signalprocessing using Matlab/Python and Microprocessors

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— General information

Long name	Signalprocessing using Matlab/Python and Microprocessors
Approving CModule	SMP_BaET, SMP_BaTIN
Responsible	Prof. Dr. Harald Elders-Boll Professor Fakultät IME
Valid from	winter semester 2022/23
Level	Bachelor
Semester in the year	winter semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Harald Elders-Boll Professor Fakultät IME Prof. Dr. Uwe Dettmar Professor Fakultät IME Prof. Dr.-Ing. Christoph Pörschmann Professor Fakultät IME
Requirements	Basic procedural programming skills Basic knowledge of digital signal processing: Sampling Theorem, Digital Filter, Fourier Transform
Language	German and English
Separate final exam	Yes

Literature

Welch, Wright, Morrow: Real-Time Digital Signal Processing (CRC Press)

Final exam

Details	In their projects students implement given methods for digital signal processing in small teams and thereby show their ability to develop signal processing applications for various purposes. For the final grade the poject work, the project results, the final project presentation and the written project report are evaluated and scored according to different criteria and the final grade is derived form the total score.
Minimum standard	50% of the maximum achievable total score.
Exam Type	EN mündlicher Ergebnisbericht (Vortrag / Präsentation)

− Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	Principles of Digital Signal Processing:
	Sampling and Reconstruction
	Digital Filters
	DFT and FFT
	Fast FFT-based Convolution
	Sectral Analysis
	Signal Generation
	Real-time Signal Processing:
	Interrupt and Polling
	Block-based Signal Processing
Skills	Apply fundamentals of digital signal processing:
	Understanding of and ablilty to explain the fundamental principles of digital signal processing
	Ability to compare and evaluate different digital filter types and different implementations
	Implementation of real-time DSP:
	Ability to explain the general problem of real-time DSP
	Abilty to name aspects influencing the processing speed
	Understanding of and ablilty to explain the fundamental methods of real-time digital signal processing

Expenditure classroom teaching

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

Special requirements

Accompanying material	Lecture slides Example code snippets
Separate exam	No

─ Practical training

Learning goals

Goal type	Description
Skills	Implementation of fundamental methods and procedures for signal processing in Python/Matlab and on microprozessors.

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	2
Tutorial (voluntary)	0

Special requirements

Accompanying material	Lab instructions with code skeletons
Separate exam	No

− <u>Lecture / Exercises</u>

Learning goals

Goal type	Description
Skills	Implementation Python/Matlab: Program, debug and optimize algorithm in Python Matlab.
	Implementierung on microporocessor: Port algorithm to target micorprocessor platform Familiarity with development environment Optimize algorithm for target platform
	Solve complex tasks in team work: Plan simple projects Keep agreements and deadlines Schedule and carry out reviews
	Implementation of DSP algorithm on microporcessor platform: Understand given methods for digital signal processing Obtain required references for given methods Translate mathematical methods to program code Test, verify, and optimize program code
	Presentation of results: Presentation of project results

Special requirements

Accompanying material	Installed software on lab computers Microprozessor boards with code skeletons for free develpoment environment
Separate exam	No

Expenditure classroom teaching

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