inf960 - Fundamental Competences in Computing Science I: Signals and Dynamical Systems

Module label: Fundamental Competences in Computing Science I: Signals and Dynamical Systems
Module code: inf960
Credit points: 6.0 KP
Workload: 180 h
Used in course of study: Master's Programme Engineering of Socio-Technical Systems > Fundamentals/Foundations
Contact person:

Module responsibility:

- Martin Georg Fränzle
- Andreas Hein

Authorized examiners:

- Die im Modul Lehrenden

Entry requirements:

This course provides an introduction into digital signal processing. It covers the mathematical foundations necessary for understanding the impact digitization has on a continuous signal as well as the goal-directed synthesis of digital filters. As such, it lays the theoretical foundations preparing for understanding and designing applications of digital signal processing in a variety of fields relevant to the MSc EngSTS, like neurophysiological measurements, brain-computing interfaces, or embedded control. In contrast to subsequent modules of the study programme, the module itself does not aim at covering such applications, but at providing a solid grasp of the underlying principles and the fundamental constraints to digital signal processing. It is targeted at psychologists, but also at computer scientists who have not previously been exposed to a systematic mathematical treatment of the fundamentals of digital signal processing.

Professional competences:
The students:

- Name the concepts of signal and image processing in technical systems
- Name the methods/algorithms of preprocessing, filtering, classification, interpretation and visualisation of signals and pictures
- Select algorithms appropriately
- Evaluate the effectiveness of algorithms
- Design algorithms and processing chains and evaluate their quality

Methodological competences:
The students:

- Get used to specific subjects of signal and image processing

Social competences:
The students:

- Present solutions for specific questions in signal and image processing

Self-competences:
The students:

- Reflect their solutions by using methods learned in this course

Module contents:

- Basic Concepts
- Signal Processing
- Signal Spaces and Signal Processing Systems
- Discrete and Constant Signals
- Labelling of Signal Transmitters with Test Signals
- Representations Areas and Transformations
- Time-Discrete Systems and Scanning
- Estimation and Filtering
- Construction with MATLAB
- Image Processing
- Introduction / Range of Applications
- Functional Transformation
- Image Enhancement/Filtering
- Segmentation
- 3D Reconstruction an Visualization

**Reader’s advisory**

essential: Slides

recommended:
- Meyer, M.; Signalverarbeitung: Analoge und digitale Signale, Systeme und Filter
- Grünningen, D. C. v.; Digitale Signalverarbeitung: mit einer Einführung in die kontinuierlichen Signale und Systeme
- Tönnies, K.; Grundlagen der Bildverarbeitung; Pearson Studium 2005
- Lehmann, Th.; Oberschelp, W.; Pelinak, E.; Pepges, R.; Bildverarbeitung in der Medizin; Springer Verlag 1997
- Handels, H.; Medizinische Bildverarbeitung; Teubner Verlag, Stuttgart - Leipzig 2000

**Links**

**Language of instruction** English

**Duration (semesters)** 1 Semester

**Module frequency** Once a year

**Module capacity** unlimited

**Reference text**

This course is part of the base curriculum of the MSc program "Engineering of Socio-Technical Systems". It provides students featuring a background in psychology with fundamental competences in computer science and related subjects. This course is also intended for students with a background in computer science lacking prior knowledge in digital signal processing

**Modullevel** BC (Basiscurriculum / Base curriculum)

**Modulart** Pflicht o. Wahlpflicht / compulsory or optional

**Lern-/Lehrform / Type of program** V+Ü

**Vorkenntnisse / Previous knowledge**

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<th>Examination</th>
<th>Time of examination</th>
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<th>Hands-on exercises and written or oral exam</th>
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<td>Final exam of module</td>
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<tr>
<td>Exercises</td>
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<td>WiSe</td>
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**Total time of attendance for the module** 56 h