inf330 - Embedded Systems

Module label: Embedded Systems
Module code: inf330
Credit points: 6.0 KP
Workload: 180 h
Used in course of study: Master's Programme Engineering of Socio-Technical Systems > Human-Computer Interaction

Contact person
Module responsibility
- Wolfgang Nebel
- Martin Georg Fränzle

Authorized examiners
- Die im Modul Lehrenden
- Wolfgang Nebel
- Martin Georg Fränzle

Entry requirements
Skills to be acquired in this module

Professional competences:
The students:
- Name functional and non-functional requirements to specify embedded systems
- Discuss design space and associated embedded systems design methods
- Name control and feedback control systems’ core concepts
- Characterise the fundamental digital signal processing algorithms

Methodological competences:
The students:
- Design and develop embedded feedback control systems with modelling tools
- Implement an embedded hardware-/software system according to a given specification
- Analyze various specification languages according to different properties

Social competences:
The students:
- Implement solutions to given problems in teams
- Present results of computer science problems to groups
- Organize themselves as a team to solve a larger problem using project management methods

Self-competences:
The students:
- Acknowledge the limits of their ability to cope with pressure during the implementation process of systems
- Solve exercises self-responsibly

Module contents
Embedded systems support complex feedback problems, control problems and data processing tasks. They have an important value creation potential for telecommunications, production management, transport and electronics. The functionality of embedded systems is realised by the integration of processors, special hardware and software. The embedded systems design is influenced by the heterogeneity of system architectures, the complexity of systems and technical and economic requirements.

This module gives an overview of embedded systems and their design. The process of digital signals is especially important for telecommunications and multimedia. For this purpose, the module introduces digital signal processing algorithms. The principles of feedback control are introduced by exemplary transport applications. Subsequently, the module provides the specifications and language characteristics of the embedded system design. For this purpose, graphical data-flow
modelling languages (for instance Simulink) and control-flow specifications (for instance State
Charts) are presented. The module closes with the concepts of possible architectures and
communication models.

Hands-on exercises with the tools Matlab/Simulink/StateFlow support the module contents.

Reader's advisory

Programming, 8, North-Holland, 1987, page(231-274)
Engineering Methods, Oct 1996
- Josef Hoffmann: Matlab und Simulink: Beispielorientierte Einführung in die Simulation

Secondary literature:

- T. Painter, A. Spanias. Perceptual Coding of Digital Audio. Proceedings of the IEEE, vol 88,
no 4, April 2000.
- B. Friedrichs. Kanalcodierung: Grundlagen und Anwendungen in modernen
- G.C. Clark. Error-correction coding for digital communications. 3rd printing, Plenum Press,
- Artikelserie zum MPEG-2-Standard 3/94 - 10/94 und das Tutorial "Digitale Bildcodierung"
1/92 - 1/93, beides in "Fernseh- und Kinotechnik" (BIS: Zelt ZA 1536)

Links

- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: unlimited
- Module capacity: unlimited
- Reference text: This module is compulsory for students who are specialising in "Eingebettete Systeme und Mikrorobotik".

Module level

Modulart

Modulart

Lern-/Lehrform / Type of program

V+Ü

Vorkenntnisse / Previous knowledge

- Grundlagen der technischen Informatik
- Technische Informatik

Associated with the module(s):

In the module "Eingebettete Systeme II" additional relevant topics such as design processes, HW/SW-
Partitioning, High-Level-Synthesis and Hardware discription languages are discussed. The modules
Eingebettete Systeme I und II offer cross-references to the module "Rechnerarchitektur", "Realzeitbetriebssysteme" and semantic orientated modules of theoretical computer science. It is
possible to enhance the knowledge of embedded systems design by attending the modules "System
Level Design" and "Low energy System Design".

Examination

Final exam of module

Time of examination

At the end of the semester period

Type of examination

Written or oral exam

Course type

Lecture

Comment

SWS

2.00

Frequency

WiSe

Workload attendance

28 h
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<th>Comment</th>
<th>SWS</th>
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<td>Exercises</td>
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<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
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**Total time of attendance for the module**

56 h