inf454 - Communicating and Mobile Systems

Module label: Communicating and Mobile Systems
Module code: inf454
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master's Programme Computing Science > Theoretische Informatik
- Master's Programme Embedded Systems and Microrobotics > Akzentsetzungsmodule
- Master's Programme Engineering of Socio-Technical Systems > Systems Engineering

Contact person:
Module responsibility:
- Ernst-Rüdiger Olderog
- Die im Modul Lehrenden

Authorized examiners:
- Die im Modul Lehrenden
- Ernst-Rüdiger Olderog

Entry requirements:
Skills to be acquired in this module:
- Introduction to Milner's Calculus of Communicating Systems (CCS) and the \( \mu \)-Calculus.

Professional competence:
The students:
- Know the theory of the operational semantics of CCS and the \( \mu \)-calculus
- Perform equivalence proofs using simulations and bisimulations
- Specify communicating and mobile systems with CCS and the \( \mu \)-calculus

Methodological competence:
The students:
- Learn about different views on mobility
- Recognize equivalences as formal means for system correctness

Social competence:
The students:
- Work together in small groups to solve problems
- Present their solutions to groups of other students

Self-competence:
The students:
- Learn persistence in pursuing difficult tasks
- Learn precision in specifying problems

Module contents:
Communication is one of the basic concepts of computer science. It occurs between computers in a network as well as between components of a computer. The focus of the course is on Robin Milner's \( \mu \)-calculus. It enables a new modelling of communication, taking the location of the communication into account.

The \( \mu \)-calculus can describe the change of data in a computer as well as the sending of messages or even programs along networks like the internet. It is also possible to describe reconfigurable networks. This will be shown using the examples of mobile phones, schedulers, automatic vending machines, data structures, communication protocols, and objects in object-oriented programming. All these applications are backed by the theory of the \( \mu \)-calculus, which is based on operational semantics and a concept of behavioural equivalence.

The theory will be explained in a step-by-step manner.

Topics:
- different views on mobility
transition systems with simulations and bisimulations
Milner's Calculus of Communicating Systems (CCS) and Milner's \( \pi \)-calculus for mobile systems, both with operational semantics, structural congruence, strong equivalence and observational equivalence, relationship between reactions and transitions, solvability of recursive equations
formal specification of examples of communicating and mobile systems using CCS and the \( \pi \)-calculus
proof of strong equivalence and observational equivalence of given processes
 specification of dynamic data structures in the \( \pi \)-calculus

Reader's advisory


Links
Languages of instruction German, English
Duration (semesters) 1 Semester
Module frequency irregular
Module capacity unlimited
Module level AS (Akzentsetzung / Accentuation)
Module type Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program V+Ü
Vorkenntnisse / Previous knowledge Theoretical Computer Science II

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<td>Final exam of module</td>
<td>At the end of the lecture period</td>
<td>written exam or oral exam</td>
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Total time of attendance for the module 56 h