Analysis of Distributed Systems

Description

The goal of the subject is to give an overview for the student about how can we explain the parallel behaviour by algebraic methods and Petri-nets, and how work applications based on that models in practice.
The basic concepts of the course are processes, computational processes, parallelism, operations of processes, compositions of processes and properties of processes (liveness, deadlock-free, etc.). The theory of Petri-nets is explored more partially with many modelling example. The behavioural and structural properties, methods of analysis, famed subclasses and relationships between these subclasses are investigated. We define theorems about liveness, safetyness and reachability and present transformation, which preserve these properties. The course introduces the Petri-boxes, a special class of Petri-nets, which help us to model the program structures (sequences, branches and loops). Some tools for simulation and analysis of Petri-nets are also investigated. The second part of the course introduces the theory of algebraic models through a given example. The properties of the models, the methods of descriptions of processes and the possible compositions are examined. The denotational, operational and axiomatic semantics of the model is given and the relationships of these different descriptions are investigated. Teaching methods: There will be lectures introducing the formal specification and properties of Petri nets and algebraic models and exercises where the students will create concrete examples. There will be also programming exercises where the students can use the learned methods.

Literature

- Murata, T.: Petri Nets, Properties, Analysis and Applications (Proc. of the IEEE. Vol. 77., no. 4, ASpr 1989, 541-580)
- Best, E., Devillers, R., Koutny, M.: Petri Net Algebra (Springer 2001)
- Hennessy M.: Algebraic Theory of Processes (MIT, 1989)
- Hoare, C.A.R.: Communicating Sequential Processes (Prentice-Hall, 1985)