Ruhr Master School
of Applied Sciences

Dieses Wahlpflichtmodul ist ein Angebot der:

Fachhochschule Dortmund
University of Applied Sciences and Arts

Master Embedded Systems for Mechatronics

Distributed and Parallel Systems

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STIFTUNG MERCATOR

Distributed and Parallel Systems (MOD1-02)

Code Number	Workload	Credits	Semester	Frequency	Duration
10120/21	180 h	6	Sem. 1	annually	1 Semester

1	Course Title	Contact hours	Self-Study	Planned Group Size
	Distributed and Parallel Systems	4 SWS / 60 h	120 h	25 students

2 Course Description

Distributed systems are groups of networked computers and/or embedded systems, which have a common goal for their work. The terms distributed computing and parallel computing have a lot of overlap and frequently the term concurrent computing is used in this field. There is no clear distinction between them. This course is a prerequisite for the deeper understanding of multicore and manycore systems. It builds the theoretical core knowledge about cyber physical systems (CPS) and about the current state of research in the field of embedded distributed systems.

3 Course Structure

1. Architectures for distributes systems (in principle)
2. Communication
   a. Synchronous, Asynchronous
   b. Peer-to-Peer, Broadcast, Multicast
   c. Protocols
3. Time and States
   a. States and Timestamps
   b. Clocks
4. Coordination and Agreement
   a. Transactions and Concurrency Control
   b. Deadlocks
   c. Replication and Fault Tolerance
5. Scheduling/Partitioning/Distribution (Multicore/Manycore)
6. Cyber physical systems (CPS)
7. Dependable Systems
8. Programming Paradigms and Methods

4 Parameters

- Course characteristics: compulsory
- Course frequency: every year - winter semester
- Capacity: 25 students
- Course admittance prerequisites: computer science & programming
- Skills trained in this course: theoretical and methodological skills
- Assessment of the course: Written Exam (60 min) at the end of the course (50%) and individual homework (50%): paper/report about a recent topic from CPS research
- Teaching staff: Prof. Dr. Burkhard Igel, (Prof. Dr. Erik Kamsties)

5 Learning outcomes

5.1 Knowledge

- Knows theory of distributed and parallel systems
- Knows critical issues concerning reliable distributed systems
- Knows recent research about partitioning and scheduling for cyber physical systems

	5.2 Skills • Can assess the feasibility of distributed CPS • Can implement algorithms for distributed embedded systems • Can model the behavior of distributed CPS • Can apply state of the art tools and can develop new tools for distribution 5.3 Competence - attitude • Can setup tooling and design flows • Can discuss distribution issues with computer scientists • Understands the potential of concurrency in CPS
6	**Teaching and training methods** • Lectures & Exercises, AMALTHEA and TA tool labs • e-learning modules on theoretical informatics, tool tutorials • Presentation and discussion of an industry case by a partner company (e.g. Bosch, BHTC, TA)
7	**Course mapping** Input for: • MOD2-01- Mechatronic Systems Engineering • MOD2-02 – Microelectronics & HW/SW Codesign • MOD-E03 – SW Architectures for Embedded and Mechatronic Systems
8	**References** G. Coulouris, J. Dollimore, T. Kindberg, G.Blair: Distributed Systems: Concepts and Design (5th ed.), Addison Wesley, May 2011 Hermann Kopetz, Real-Time Systems: Design Principles for Distributed Embedded Applications (Real-Time Systems Series), Springer, April 2011 P. Linington, Z. Milosevic, A. Tanaka, A. Vallecillo. Building Enterprise Systems with ODP: An Introduction to Open Distributed Processing, Chapman & Hall/CRC, September 2011 P. Koopmann. Better Embedded System Software, Drumnadrochit Education, 2010 Research Papers: Lamport, Chandy & Lamport Other recent research papers