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

SW Architectures for Embedded and Mechatronic Systems

masteresm@fh-dortmund.de
+49 (0)231 9112-7991

Prof. Dr. Stefan Henkler
stefan.henkler@fh-dortmund.de

Hochschule Bochum
Bochum University
of Applied Sciences

Fachhochschule Dortmund
University of Applied Sciences and Arts

Westfälische Hochschule
Gelsenkirchen Bocholt Recklinghausen
University of Applied Sciences

STIFTUNG MERCATOR

SW Architectures for Embedded and Mechatronic Systems (MOD-E03)

Code Number	Workload	Credits	Semester	Frequency	Duration
10403	180 h	6		annually	1 Semester

1	Course Title	Contact hours	Self-Study	Planned Group Size
	SW Architectures for Embedded and Mechatronic Systems	4 SWS / 60 h	120 h	25 students

2 Course Description

The ongoing complexity increase in mechatronic solutions consequently leads to more complex embedded systems and embedded software. Therefore, advanced SW engineering methodology from large software development projects is consecutively applied in the embedded world, too. Software architectures help to structure, to manage and to maintain large embedded SW systems. They allow re-use, design patterns and component based development. In addition, specific topics like safety, SW quality, integration and testing are addressed by SW architectures and respective standards (e.g. AUTOSAR). In this module, students learn about the concepts and structure of SW architectures for embedded systems.

3 Course Structure

1. Characteristics of Embedded (and real-time) Systems
2. Motivation for Architectures for Embedded and Mechatronic Systems
3. Software Design Architecture for Embedded and Mechatronic Systems
4. Patterns for Embedded and Mechatronic Systems
5. Real-Time Building Blocks: Events and Triggers
6. Dependable Systems
7. Hardware's Interface to Embedded and Mechatronic Systems
8. Layered Hierarchy for Embedded and Mechatronic Systems Development
9. Software Performance Engineering for Embedded and Mechatronic Systems
10. Optimizing Embedded and Mechatronic Systems for Memory and for Power
11. Software Quality, Integration and Testing Techniques for Embedded and Mechatronic Systems
12. Software Development Tools for Embedded and Mechatronic Systems
13. Multicore Software Development for Embedded and Mechatronic Systems
14. Safety-Critical Software Development for Embedded and Mechatronic Systems

4 Parameters

- Course characteristics: elective
- Course frequency: every year - summer semester
- Capacity: 25 students
- Course admittance prerequisites: programming, basics of embedded systems
- Skills trained in this course: theoretical, practical and methodological skills
- Assessment of the course: Oral Exam (30 min) at the end of the course (50%) and individual homework (50%): paper/essay on a recent research topic, presentation
- Teaching staff: Prof. Dr. Stefan Henkler, (Prof. Dr. Martin Hirsch)

5 Learning outcomes

5.1 Knowledge

- Knows concepts and structure of SW architectures for embedded systems
- Knows standards and frameworks
- Knows specific challenges (e.g. real time, functional safety)

	5.2 Skills • Can define requirements and features for a specific problem • Can develop a SW architecture for a specific problem • Can model SW architectures with state of the art tools • Can apply SW architecture standards to structure a project 5.3 Competence - attitude • Ensures quality and safety for embedded SW • Can discuss and assess the advantages and disadvantages of different SW architectures • Understands the main issues within research about SW architectures for embedded systems
6	**Teaching and training methods** • Lectures, Labs (with AMALTHEA and Artop tools), homework • Access to tools and tool tutorials • Access to recent research papers • Presentation of an industry case by partner BHTC GmbH
7	**Course mapping** Requires: • MOD1-02 – Distributed and Parallel Systems • MOD1-03 - Embedded Software Engineering • MOD2-01 – Mechatronic Systems Engineering Connects to: • MOD-E01 – Applied Embedded Systems • MOD-E10 – Automotive Systems
8	**References** Robert Oshana and Mark Kraeling, Software Engineering for Embedded Systems: Methods, Practical Techniques, and Applications, Expert Guide, 2013 Bruce Powel Douglass. Doing Hard Time: Developing Real-Time Systems with UML, Objects, Frameworks and Patterns. Addison-Wesley, May 1999 Bruce P. Douglass, Real-Time Design Patterns: Robust Scalable Architecture For Real-Time Systems, Addison-Wesley, 2009 F. Buschmann, R. Meunier, H. Rohnert, P. Sommerlad, and M. Stal. Pattern Oriented Software Architecture. John Wiley & Sons, Inc., 1996