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

Mechatronic Systems Engineering

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University of Applied Sciences

STIFTUNG MERCATOR

Mechatronic Systems Engineering (MOD2-01)

Code Number	Workload	Credits	Semester	Frequency	Duration
10210/11	180 h	6	Sem. 2	annually	1 Semester

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

2 Course Description

Mechatronics Systems Engineering is both a challenge and a chance. A holistic and well elaborated engineering process for complex mechatronic system/cyber physical systems is a mandatory requirement for developing future intelligent products. Teaching this new school of engineering is the major goal of the whole master programme and an attractive offer for a university of applied sciences. This module introduces the holistic engineering methodology and offers the big picture for the other modules. The focus is on the early phase of mechatronic systems design since this phase offers the biggest leverage for better technical systems. Topics like cross domain engineering and systems integration are addressed, too. The content of the course is largely inspired from finding of the BMBF Spitzencluster “it’s OWL” and the new Fraunhofer Institute “Entwurfstechnik Mechatronik”. A continuous transfer of new findings into this course is intended.

3 Course Structure

1. Motivation:
   a. Examples for Mechatronic Systems
   b. Characteristics of Mechatronic Systems
   c. Challenges
2. Discipline-spanning development process
3. Systems Engineering (according to INCOSE SE handbook)
4. Conceptual Design of Mechatronic Systems
   a. CONSENS
5. The Software Engineering Domain
   a. MechatronicUML
   b. Behavior synthesis
6. Self-Optimization: Operator Controller Module (OCM)
7. Application to Use Case (Printing Industry, Rail Cab)

5 Parameters

- Course characteristics: compulsory
- Course frequency: every year - summer semester
- Maximal capacity: 25 students
- Course admittance prerequisites: mechanics/physics, basics of embedded systems
- Skills trained in this course: theoretical, practical and methodological skills
- Assessment of the course: Written Exam (90 min) at the end of the course (50%) and individual homework (50%): MechatronicUML model of an example
- Teaching staff: Prof. Dr. Stefan Henkler, (Prof. Dr. Martin Hirsch)

5 Learning outcomes

5.1 Knowledge

- Knows CONSENS, INCOSE SE handbook, MechatronicUML
- Knows mechatronic systems engineering processes
- Knows Enterprise Architect and other relevant tools

	5.2 Skills • Can model mechatronic systems • Can apply methodology and state of the art tools on real use cases (e.g. printing machine) • Can select tools and define tool chains and design flows 5.3 Competence - attitude • Can structure the early phase of mechatronic systems design • Can lead cross domain design of mechatronic systems • Understands issues from different domains and can integrate solutions into a holistic design
6	**Teaching and training methods** • Lectures, Labs (with Enterprise Architect and other tools), homework • Access to tools and tool tutorials • Access to recent research papers
7	**Course mapping** Input for: • MOD-E03 – SW Architectures for Embedded and Mechatronic Systems • MOD-E08 – Formal Methods Requires: • MOD1-03 - Embedded Software Engineering Connects to: • MOD1-04 – Requirements Engineering • MOD2-03 – R&D Project Management
8	**References** Jürgen Gausemeier, Franz Rammig, Wilhelm Schäfer (Editors): Self-optimizing Mechatronic Systems: Design the Future. HNI-Verlagsschriftenreihe, Band 223, 2008 P.L. Tarr, A.L. Wolf (eds.): Engineering of Software. Springer-Verlag Berlin Heidelberg 2011 K. Pohl, H. Hönninger, R. Achatz, M. Broy (Eds.): Model-Based Engineering of Embedded Systems: The SPES 2020 Methodology, Springer, 2012 INCOSE: Guide to the Systems Engineering Body of Knowledge - G2SEBoK: http://g2sebok.incose.org/app/mss/menu/index.cfm