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

Mathematics for Signals & Controls

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University of Applied Sciences

STIFTUNG MERCATOR

Mathematics for Signals & Controls (MOD1-01)

Code Number	Workload	Credits	Semester	Frequency	Duration
10110/11	180 h	6	Sem. 1	annually	1 Semester

1	Course Title	Contact hours	Self-Study	Planned Group Size
	Mathematics for Signals & Controls	4 SWS / 60 h	120 h	25 students

2 Course Description

This course introduces the necessary mathematical concepts for signal processing and control engineering. It starts with a tailored review of real and complex analysis. A major focus is on different kinds of integral transforms that are of essential use in subsequent courses. A huge amount of physical phenomena can be described by sets of linear differential equations and thus the latter are dealt with in this course. Linear algebra plays a prominent role in case of systems with several states and/or multiple inputs and outputs. Usually, sensor signals are corrupted by noise or other sources of uncertainty. To be able to deal with those, probability theory is introduced. Matlab and Octave are used as examples for state of the art tools for numerical mathematics and as a preparation for following courses.

3 Course Structure

1. Real and complex analysis
2. Fourier, Laplace and Z transform
3. Differential equations
4. Linear algebra
5. Probability theory
6. Introduction into Matlab/Octave
7. Numerical mathematics

4 Parameters

- Course characteristics: compulsory
- Course frequency: every year - winter semester
- Capacity: 25 students
- Course admittance prerequisites: none
- Skills trained in this course: theoretical, practical and methodological skills
- Assessment of the course: Written Exam (90 min) at the end of the course (100%)
- Teaching staff: Prof. Dr. Andreas Becker, (Prof. Dr. Thomas Felderhoff)

5 Learning outcomes

5.1 Knowledge

- Knows basic theorems of complex analysis and linear algebra
- Knows relevant theoretical foundations of signal processing and control engineering
- Knows the most important concepts of probability theory

5.2 Skills

- Can make use of analysis and linear algebra to describe physical phenomena

	• Can make use of different domains for the description of signals • Can apply probabilistic concepts • Can make use of tools for numerical mathematics 5.3 Competence – attitude • Can discuss mathematical prerequisites of mechatronic systems with experts • Understands experts for mathematics and translates between different domains
6	**Teaching and training methods** • Lectures & Exercises • Labs with Matlab/Octave • E -learning modules on higher mathematics, tool tutorials
7	**Course mapping** Input for: • MOD2-04 – Signals & Control Systems 1 • MOD-E04 – Signals and Systems for Automated Driving • MOD-E06 – Computer Vision • MOD-E07 – Signals & Control Systems 2
8	**References** James, Modern Engineering Mathematics, Pearson Education, 2015 Stroud, Engineering Mathematics, Macmillan Education, 2013 Oppenheim, Willsky, Nawab, Signals and Systems, Pearson Education, 2013