12.24196

Introduction to Embedded Systems

Prof. Dr.-Ing. Stefan Kowalewski | Julius Kahle, M. Sc.

Summer Semester 2025

Organization

Audience

► The lecture is part of more than 22 programs

- Allgemeiner Maschinenbau (M.Sc.)
- Automatisierungstechnik (M.Sc.)
- Computational Engineering Science (B.Sc. / M.Sc.)
- Elektrotechnik, Informationstechnik u. Technische Informatik (M.Sc.)
- Informatik (B.Sc. / M.Sc.)
- Media Informatics (M.Sc.)
- Simulation Science (M.Sc.)
- Software Systems Engineering (M.Sc.)
- Technik-Kommunikation (M.A.)
- Verfahrenstechnik (M.Sc.)
- …

► Amount: V3/Ü1 or 6 ECTS credits, resp.

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Dates and Rooms

▶ **Lectures/Exercises:**

- In person at H07 (1385|104)
- German language (Videos in English will be available in the Moodle-Room)
- Live-Broadcast via Zoom (Link in the Moodle-Room)

▶ **Schedule:**

- Monday, 16:30-18:00
- Wednesday, 10:30-12:00

▶ **Examination:**

- Written exam: July 31st, 2025
- Retake exam: September 16th, 2025
- The exam will be held in the ZuseLab (and/or Couven hall, Sparkassenforum) using Dynexite

> ## English Lecture
> - **Monday, 14:30 – 16:00**
>   **AH III (2350|314.1)**
> - **Tuesday, 18:30 – 20:00**
>   **H06 (1385|004)**

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Register via RWTHonline

► You need to register to **both**, Lecture and Exam

► Lecture (To get access to the Moodle-Room):
  ▪ De-/register from now until 30th May

► Written exam:
  ▪ Register from 15th May until 1st July
  ▪ Deregister until 28th July

► Retake exam:
  ▪ Register from 15th May until 9th September
  ▪ Deregister until 12th September

► If RWTHonline doesn't work
  ▪ Contact the central examination office (ZPA, SuperC) and register personally

► If you want to skip the first exam date
  ▪ Pick directly the second date in RWTHonline

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# Context: Other Lectures by i11 – Embedded Software

▶ **This semester:**

- Advanced Microcontroller Programming and Debugging
- Functional Safety and System Dependability

▶ **Next semester:**

- Formal Methods for Logic Control Software
- Control and Perception in Networked and Autonomous Vehicles

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Videos

► All lectures will be recorded and the videos will be made available via RWTHmoodle (German)

► Additionally, we provide recordings from previous semester for preparation of the lectures (English)

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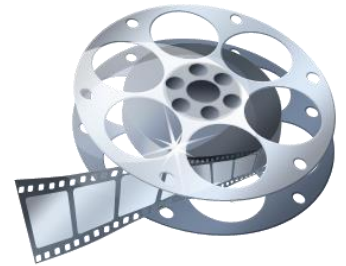
Exercises

▶ It will be announced in advance when there will be an exercise hour instead of a lecture (RWTH-Moodle calendar)

▶ An exercise sheet will be provided, and the solution will be presented in the exercise hour

▶ The written exam will consist of exercises very similar to those on the exercise sheets

▶ There may be additional content in the exercises that will be part of the written exam

▶ You should be able to solve the exercises quickly to pass the exam

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Websites

► Embedded Software Laboratory: www.embedded.rwth-aachen.de
- → Academics
- → Courses
- → Introduction to Embedded Systems

► RWTHmoodle: https://moodle.rwth-aachen.de/
- ▪ Requires registration with RWTHonline
- ▪ Information: News and announcements
- ▪ Materials: videos, slides, and exercises
- ▪ Shared: Forum

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Lecturer: Prof. Dr.-Ing. Stefan Kowalewski

- ▶ 1990   Diplom degree in electrical engineering from the University of Karlsruhe

- ▶ 1995   PhD, Department of Chemical Engineering, University of Dortmund

- ▶ 2000 – 2003   Head of research group (automotive software technology) at Corporate Research and Advanced Engineering at Robert Bosch GmbH, Frankfurt am Main

- ▶ 2003   Habilitation in Control and Safety Engineering, University of Dortmund

- ▶ Since 11/2003   Professor for Embedded Software, RWTH Aachen Univ.

- ▶ 2012 – 2014   Dean of Faculty 1 of RWTH Aachen University

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Tutor

Julius Kahle

▶ Contact:
- emsy@embedded.rwth-aachen.de
- RWTHmoodle Forum

▶ Office hours: make an appointment (email)

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Student Assistant

Alexander Steinbrecher

▶ Contact:

- emsy@embedded.rwth-aachen.de
- RWTHmoodle Forum

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Literature (in the CS library)

- ► H. Kopetz: Real-Time Systems. Kluwer, 2002.

- ► P. Marwedel: Embedded System Design. Springer Cham, 2021.

- ► M. Barr: Programming Embedded Systems in C and C++. O'Reilly, 1999.

- ► R. W. Lewis: Programming Industrial Control Systems using IEC 61131-3. IEEE, 1998.

- ► K. H. John, M. Tiegelkamp: SPS-Programmierung mit IEC 61131-3, 2009

- ► J. Schäuffele u. T. Zurawka: Automotive SW Engineering. Vieweg, 2003.

- ► Günther Gridling, Bettina Weiss: Introduction to Microcontrollers. TU Wien, 2007. http://ti.tuwien.ac.at/ecs/teaching/courses/mclu/theory-material/Microcontroller.pdf/at_download/file

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Topics

▶ Organization and Introduction

▶ Microcontrollers

▶ Data buses

▶ Programmable logic controllers

▶ Real time

▶ Embedded software design

▶ Software Development with Simulink

▶ Repetition & teaser

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