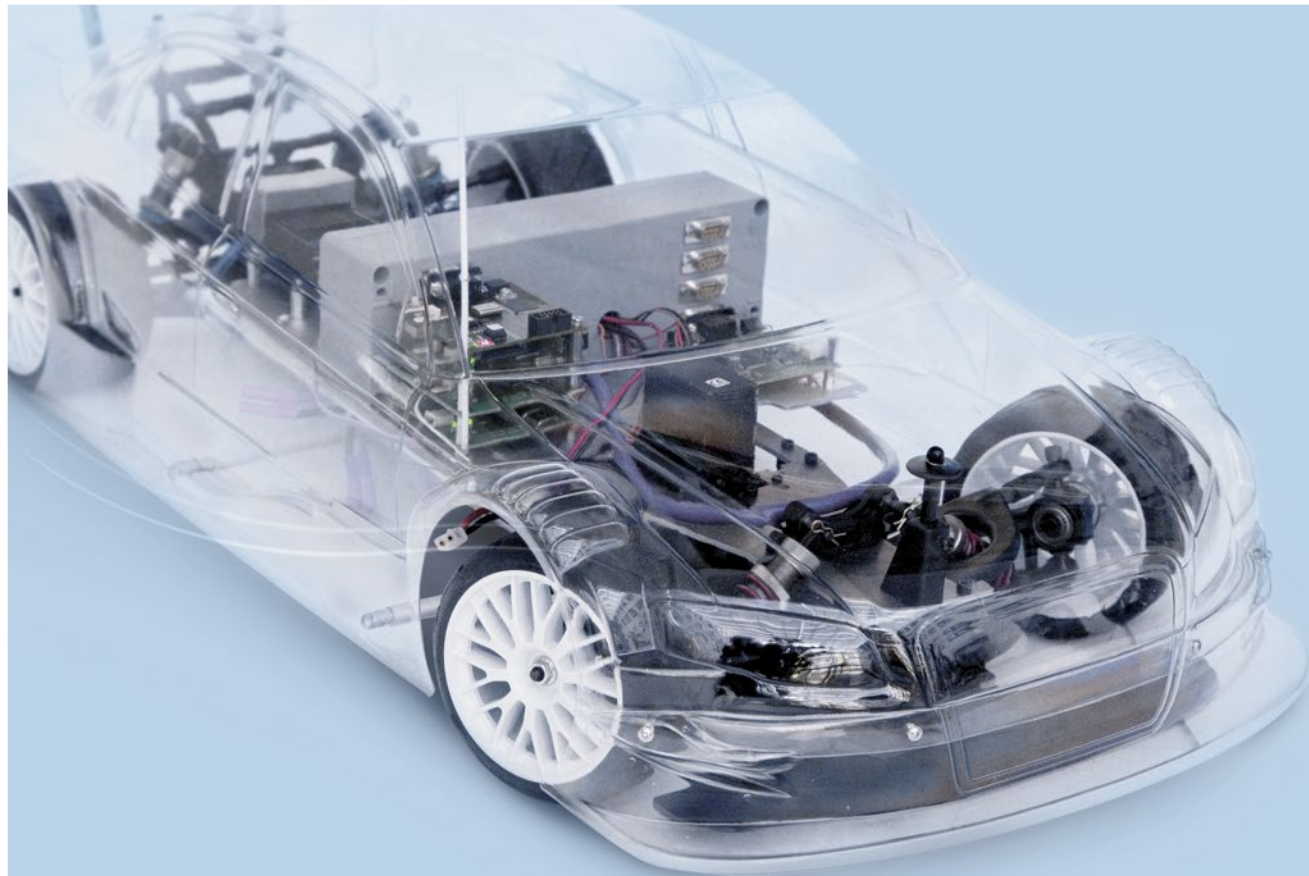




DISTANCE STUDY
PROGRAM

MASTER OF
ENGINEERING

POSTGRADUATE STUDIES
SCIENCE & ENGINEERING



PROGRAM INFORMATION

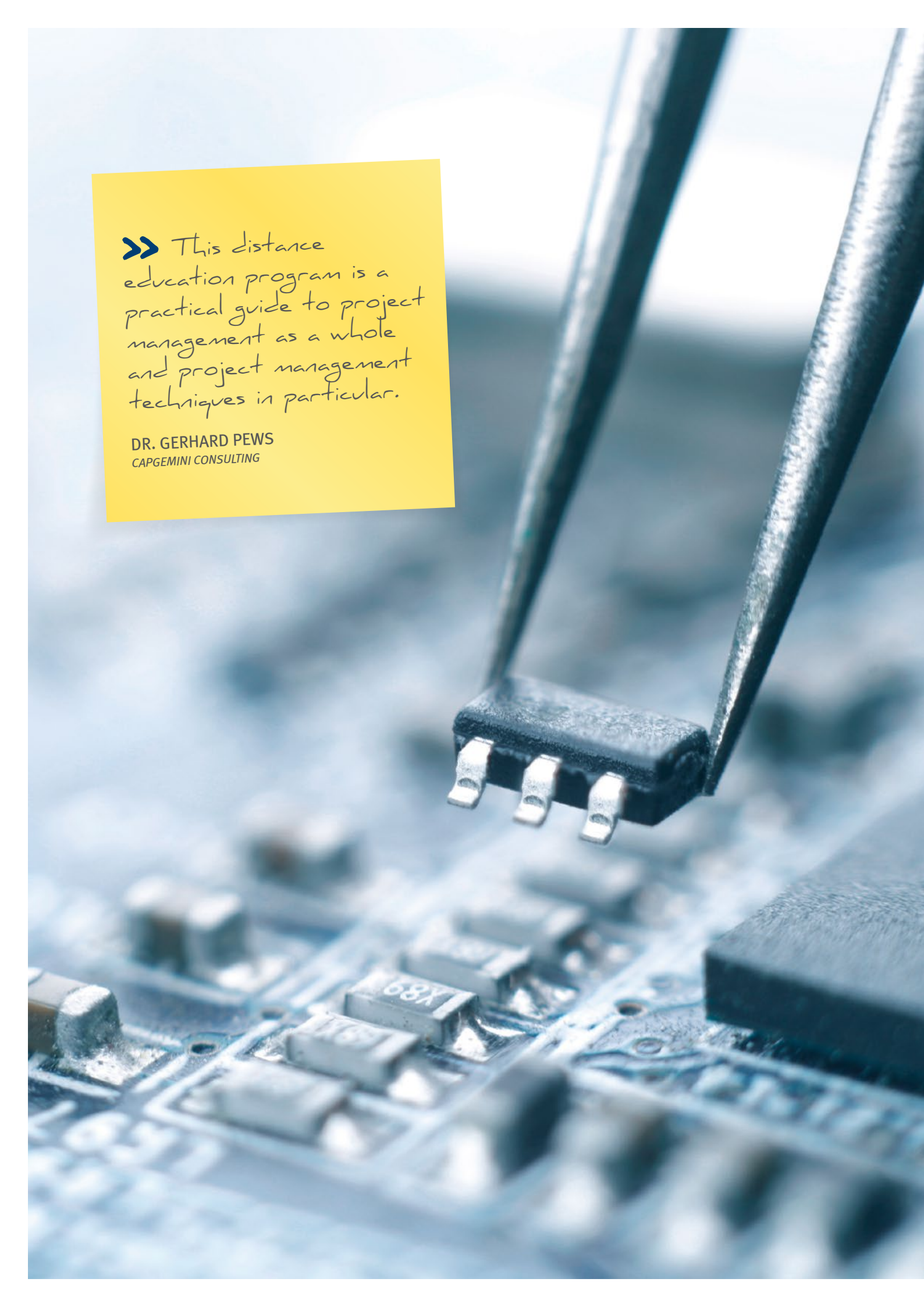
SOFTWARE ENGINEERING FOR EMBEDDED SYSTEMS

- ❑ COMPONENT-BASED SOFTWARE DEVELOPMENT
- ❑ DEPENDABILITY ENGINEERING
- ❑ MODEL-BASED COMPONENT ENGINEERING
- ❑ PROJECT MANAGEMENT
- ❑ REAL-TIME SYSTEMS
- ❑ REQUIREMENTS ENGINEERING
- ❑ SOFTWARE ARCHITECTURES
- ❑ SOFTWARE DEVELOPMENT FOR EMBEDDED SYSTEMS
- ❑ SOFTWARE ENGINEERING INTRODUCTION
- ❑ SOFTWARE PRODUCT LINE ENGINEERING
- ❑ SOFTWARE QUALITY ASSURANCE

 **TECHNISCHE UNIVERSITÄT
KAISERSLAUTERN**

**DISTANCE AND INDEPENDENT
STUDIES CENTER**





»» This distance education program is a practical guide to project management as a whole and project management techniques in particular.

DR. GERHARD PEWS
CAPGEMINI CONSULTING



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» Engineers for embedded systems need to master mechanics, electronics, and, increasingly, – software. In this course, experienced engineers will learn state-of-the-art software engineering for embedded systems.

DR. DR. H.C. DIETER ROMBACH
FRAUNHOFER IESE



PREFACE

WELCOME

The Distance and Independent Studies Center (DISC) is one of the leading establishments in Germany for distance-learning postgraduate courses. The establishment has more than 20 years of experience in developing and designing academic courses for guided self-study.

The aim of this study guide is to answer the key questions you may have about our Distance Learning Program “Software Engineering for Embedded Systems” and to provide an outline of the structure of the course.

The first part of the guide comprises an overview of the administrative formalities associated with the course. In the subsequent sections, the course learning objectives, the course structure, and course contents are presented, together with more detailed information on the team of authors and the participating institutions.

The final part of this guide provides a brief introduction to the University of Kaiserslautern. We hope that reading this short guide will provide you with the information you need to confirm that our postgraduate study program is the best choice for you.

Prof. Dr. Dr. h.c. Dieter Rombach

*Software Engineering Processes
and Measurement Research Group
University of Kaiserslautern*

WHAT CONSTITUTES ADVANCED SCIENTIFIC STUDY?

ADVANCED SCIENTIFIC STUDY

- ▣ requires the ability to pursue a course of study,
- ▣ presupposes experience in conducting scientific work,
- ▣ requires the student to confront and be confronted by different points of view,
- ▣ utilizes scientific language, which is not always easy for “outsiders” to understand,
- ▣ requires a willingness to reflect on and become attuned to new forms of language and ways of thinking.

ADVANCED SCIENTIFIC STUDY DOES NOT PROVIDE

- ▣ instant solutions which can be applied in the world of business,
- ▣ easily consumable knowledge.

The world of continuing education is teeming with courses. One way to categorize these offerings is to look at the target audience for each course. Some courses do not stipulate any prior educational requirements. Anyone interested in tackling the program’s contents may sign up.

Other more specialized programs are only relevant for a limited target group. These classes are often restricted because they build upon the knowledge gained from a previous academic degree. Advanced scientific study falls in this latter category.

Although, in principle, no one should be excluded from insights into the worlds of science and research, it is simply not possible to avoid having some specific, basic entrance requirements. A willingness to engage in the language of science is one crucial prerequisite. Another prerequisite is elementary scientific knowledge of the advanced subject areas being taught.

»» Even if you have many commitments both at work and home, a distance learning degree at DSC enables you to make your postgraduate learning goals a reality.

DISTANCE STUDIES

The essence of „distance“ study is that the student does not go to the university but the university virtually comes to the student. This means that in a distance study program the lectures, exercises and seminars, which normally provide the knowledge about the subject matter, have been adapted to written learning material. This material is provided to the student online. The student can work on the material independently from home as the necessary instructions are provided together with the material. Self-study, which takes place at home with learning

material, is being complemented by mandatory participation at events taking place at the university, so-called „on-campus events“. This compulsory attendance comprises of one weekend in the first semester and one week at the end of the second and at the end of the third semester. The reasons for the mandatory on-campus events are the in-depth analysis of the study material and written examinations. An additional goal is to get to know other students / participants of the program and discuss different experiences.

OBJECTIVES OF THE PROGRAMS

BACKGROUND AND DEMAND FOR THE PROGRAM

Software Engineering is concerned with the development of large and complex software-intensive systems in an economic and timely manner by following engineering principles and applying best practice methods, techniques, and tools. Software Engineering focuses on the specification of system structure and behavior, and on the implementation of these specifications; the activities required for assuring that the specifications have been met; and the development of such systems over space (distributed development, subcontracting) and time (evolution, maintenance). In most embedded systems domains (e.g., automotive), software is taking on a dominating role. Today, software and electronics already account for more than 40% of the overall costs. Applications are no longer limited to classical embedded control systems, such as airbag control software, but cover a broad range from mission critical embedded systems in the X-by-wire field to infotainment and autonomous driving, complex medical control systems, and personalization in the Human Machine Interface area.

Today, traditional hardware-dominated product domains are turning more and more into software dominated ones. Many of the companies and organizations in these transitional domains still employ

mostly traditional engineers with limited basic education and training in software and software engineering. These companies face the challenge to qualify experienced engineers for the software engineering domain. This transfer is anything but easy. The increasing software complexity, the rising demand for secure and high-quality software in embedded systems, and the constant change and stream of new software engineering methods, techniques, and tools demand that engineers from embedded system domains (e.g., automotive and military) receive professional education. As long as the situation continues unremedied, the enormous and continuously growing challenges provided by software will not be mastered adequately. The necessary education and training cannot be accomplished by company-internal programs, nor can companies afford to give lengthy leaves of absence to their experienced engineers.



This is the purpose behind the development of the four-semester distance education program “Software Engineering for Embedded Systems”, under the scientific direction of Prof. Dr. Dr. h.c. Dieter Rombach. The program will provide a sound theoretical background as well as practical methods, techniques, and tools that consider both management and software development issues:

- ❖ The program reflects the latest state-of-the-art in software engineering for embedded systems.
- ❖ International top experts of the software engineering domain share their knowledge and practical experience with the students by developing high-quality textbooks. The experts are either high-ranking researchers who are recognized in industry or professional leading engineers with profound knowledge in system engineering.
- ❖ Students will enhance their competitiveness in system engineering and will earn recognized degrees and certificates by enrolling in the course.
- ❖ The distance learning mode lets the students balance their job and their education and lets them decide when, where, how, and with whom they want to study.

PROGRAM OBJECTIVES

The overall goal of this four-semester distance education program “Software Engineering for Embedded Systems” is to provide the professional with a sound theoretical software engineering background as well as with practical methods, techniques, and tools that consider software development issues. The program prepares the student for a career as a professional software engineer in industry. Students will acquire competencies in the following domains:

- ❖ Fundamentals – understand and apply fundamental principles and basic software engineering concepts across all software development phases for embedded systems.
- ❖ Software and systems engineering – understand the difference between software and systems engineering; become aware of the challenges and risks of developing software for embedded systems; understand the co-existence of software and hardware development; understand the issues in software-hardware co-design.

- ❖ Develop large-scale software – understand the challenges for and differences between software development in the small and software development in the large; learn how to systematically develop complex software by applying selected methods, techniques, and tools; be able to use specific tools, algorithms, architectures, components, and frameworks in order to develop a software solution; understand the importance of dependability and hence explicitly consider correctness, reliability, availability, performance, security, and safety as critical aspects of embedded software.
- ❖ Evaluate design and system – understand the importance of verification and validation; apply the most common V&V methods and techniques.
- ❖ Team work and collaboration – work efficiently in teams in order to achieve common goals.
- ❖ Critical thinking and decision making – analyze, evaluate, and synthesize information, make the right decision, and develop appropriate solutions to solve problems.
- ❖ Communication – present and share information about software and systems, processes, and related knowledge in a variety of forms with selected description techniques in an effective way.
- ❖ Self-organized learning – be able to independently learn new methods, techniques, and tools as they evolve; serve as an agent of change for introducing new technologies; be able to assume responsibility for one’s own continued professional development.

The aim of this distance education program is to convey a well-founded, wide-ranging basis of knowledge for developing, implementing, and evaluating software for embedded systems. In this way, the program graduates should find themselves in a position where they are able to assess the manifold interrelationships and effects of these new technologies. On this basis, they will have the ability to elaborate useful applications for their own institutions.

TARGET GROUPS

The distance education program is designed for professionals working in the field of software development who need to acquire advanced knowledge of emerging technologies and who wish to broaden their software engineering skills by pursuing graduate level education in software engineering.

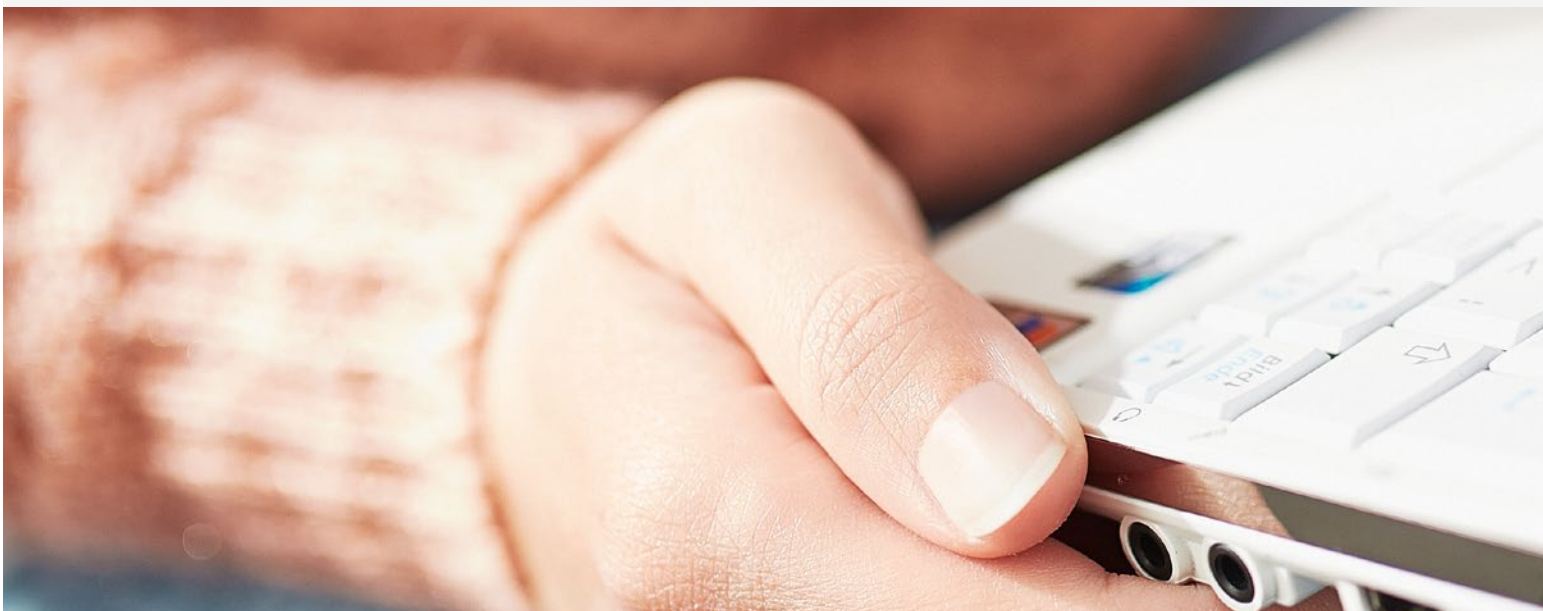
The program targets three kinds of graduates with a special emphasis on the first one: graduates of engineering disciplines such as electrical, mechanical and industrial engineering, graduates of IT disciplines such as computer science and business informatics, and graduates of non-engineering disciplines: mathematics and physics.

STUDY INTERRUPTION

It is possible to take a semester off (Urlaubssemester) but it is highly recommended that this is only done after consulting with the DISC staff in advance. Such a break is possible only at the end of each semester, as is dropping out of the program entirely (Exmatrikulation).

COURSE LENGTH

The standard course length for the “Software Engineering for Embedded Systems” Program is four semesters (60 credit points). The program starts every year in October.





ADMISSION REQUIREMENTS

ADMISSION WITH UNDERGRADUATE DEGREE

The requirement for being admitted to the program “Software Engineering for Embedded Systems” is a graduate degree either in an engineering discipline (electrical or mechanical engineering), computer science or business information technology, physics or mathematics. A minimum of two year’s relevant work experience in software development after the first degree is also required.

ADMISSION WITH WORK EXPERIENCE

Applicants may also be accepted who have relevant work experience but have not graduated from a university. They must hold a diploma qualifying for university admission, be able to prove several years of relevant work experience and pass an aptitude test. The aptitude test is intended to determine whether the vocational and professional qualifications of the applicant are comparable to those of a completed undergraduate degree. Persons with work experience can submit their application documents for the aptitude test from 1 November to 31 January every year. If the aptitude test is passed successfully, these candidates can participate in the regular application process between mid-May and mid-July of every year. More information about the admission requirements and the aptitude test can be found on the website of the DISC.

PROOF OF ENGLISH PROFICIENCY

For the enrollment to the English-language Master distance education program „Software Engineering for Embedded Systems“ a sufficient proof of English proficiency is necessary. This can be evidenced by an English-language first degree Common European Framework of Reference for Languages (Common European Framework of Reference for Languages): C1, a Cambridge Certificate of Proficiency (CPE): Grade C, IELTS: 6.0, TOEFL Computer: 213, TOEFL Paper: 550 or TOEFL Internet 79. If you have acquired English language skills otherwise, e.g. from your education or occupation, please fill in this declaration and send it with your application documents:

http://www.zfuw.uni-kl.de/fileadmin/downloads/pdf/Zulassungsvoraussetzungen/Declaration_of_proficiency_in_English.pdf

>> 95 %

of all students
would recommend
DISC to friends
and acquaintances.

TECHNICAL REQUIREMENTS

To successfully participate in the distance learning program, you are expected to have sufficient computer and Internet skills, as well as access to the necessary technical resources. This means you must be capable of configuring your browser, conducting Internet searches, saving pages and graphics, creating and sending emails, adding attachments to emails, installing programs, downloading files,

etc. Moreover, you should be able to solve minor computer problems yourself. You should also have a smoothly functioning method already in place for accessing the Internet, including the ability to adjust any existing firewalls to allow your Internet access to function properly. In addition to the technical requirements, you should also be willing to take part in online discussions.

APPLICATION AND ENROLLMENT

The application period for the “Software Engineering for Embedded Systems” Master Program runs from mid-May to mid-July each year. Current application deadlines can be found at:

www.zfuw.uni-kl.de/en/registration/application-deadlines.

Matriculation is possible only in the winter semester (October). Please send the application form, certificates about your first university degree, about your work experience and about your English language skills to:

Department of academic affairs, P.O. Box 3049 , 67653 Kaiserslautern, Germany

ACCREDITATION

The distance learning program has been accredited for awarding the academic degree Master of Engineering. Responsible agency for the accreditation process is ASIIN (www.asiin.de).

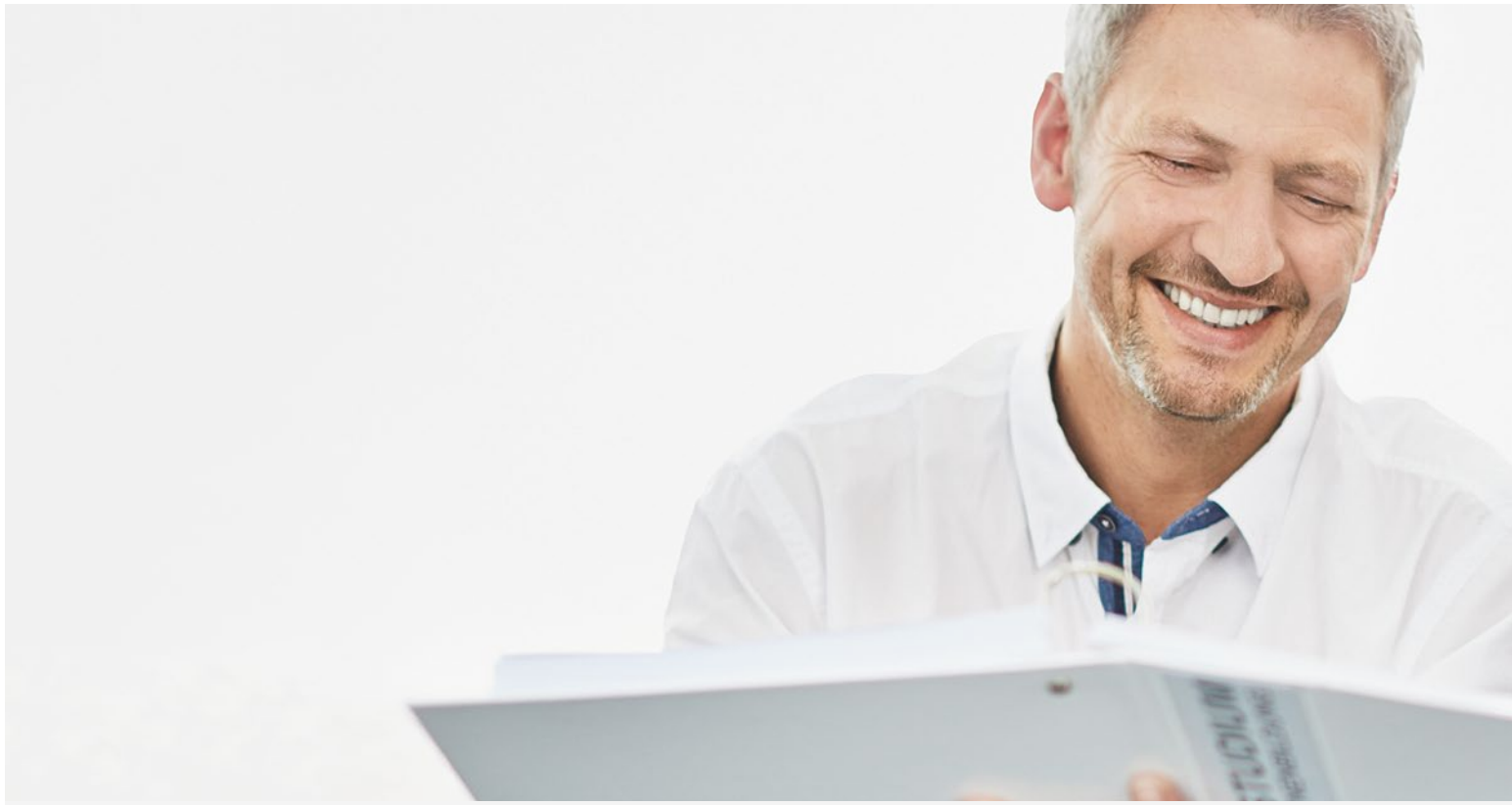


COSTS

Cost for the entire course is € 7,800. This covers all course-related costs (program materials, participation in online phases, on-campus events, etc.). This fee covers neither the costs of travel and accommodation, nor the university registration fee of € 90 per semester. In addition, participants have to pay a one-time Master examination fee of € 500 to cover

the cost of the thesis. Payment is made at the start of each semester, i.e. in four installments of € 1950 each. The Master examination fee has to be paid along with the registration of the Master thesis. These fees are not subject to German VAT and are tax-deductible.





▣ OBJECTIVES, STRUCTURE AND ORGANIZATION

FINANCIAL AID

Participants whose primary place of residence is in Germany can obtain financial aid. The government supports continuing education, for instance through individual tax relief. Dependent on the personal income and the job situation, the costs of the distance studies program can be claimed as income-related expenses or as special expenses and can thus be reimbursed in whole or in part. Expert advice can be obtained from a tax advisor or from the local tax office.

The federal and state governments may support your professional continuing education with so-called education and qualification vouchers. Information

about this can be found on the Internet, for example under www.bildungspraemie.info.

Frequently, employers share the costs of qualification programs pursued by their employees. Another possibility are education loans with favorable interest rates, which are offered by the federal and state governments, as well as by banks, such as the KfW. Unfortunately, financial aid pursuant to the German Social Insurance Code (SGB III) or the German Federal Education and Trainings Assistance Act (BAföG) is not possible.

FINAL CERTIFICATE

Once you have completed all the requirements for the “Software Engineering for Embedded Systems” Program, you will be awarded a “Master of Engineering” (M.Eng.) diploma. You will also receive a transcript of your grades and a Diploma Supplement, which is given by most universities

within the European Union to provide an overview of the university and grading structure within each country along with explanatory information about each specific university’s course requirements and grading methods.



STUDY TIME

It is estimated that the study program requires approximately 14 hours of study time per week. This amount of time will be particularly crucial at the start of the course since, as a rule, it will take more time to find your personal working and learning style, and to accustom yourself to the course contents and online learning environment.

The actual study time required depends on a number of factors: your individual study habits, your personal and professional situation, and your prior knowledge. It will also be necessary to participate on three on-campus events.

Obviously, it is highly unlikely you will be able to continue your previous activities and hobbies in the same manner if you intend to properly complete the required course work. We strongly advise you realistically assess your working capacity, your interests and existing time commitments before applying for this program.

» Excellence in software engineering and technical skills are essential prerequisites for developing embedded systems.

PROF. DR. PETER LIGGESMEYER
UNIVERSITY OF KAISERSLAUTERN





LEARNING ENVIRONMENT AND STUDY MATERIALS

The course consists primarily of independent study modules which are supplemented by three on-campus events. The independent coursework is supplemented by online tutorials in a specially developed learning environment. In the tutorials, a scientist answers your questions about the course contents or about the assignments. Our learning environment utilizes multiple teaching methods. We start with basic didactic course materials (textbooks). The contents of each module are available in PDF format and are supplemented by overviews, images and links to more examples or further materials.

The communication area is the core of our learning environment. This is where you will find discussion

forums for each study unit, a calendar, etc. Students can meet in chat rooms for social exchanges and discussions. You can also create your own personal profile within the learning environment, making it possible to put faces to your online discussion partners. These will be the same people you will meet at on-campus events.

We expect all students to actively participate in the course on a regular basis. This means you should visit the learning environment at least 2-3 times a week, as well as check your emails several times a week.

ON-CAMPUS PHASES

The on-campus phase takes place at the end of each semester for all participants except in the last semester. All on-campus phases are scheduled in a compact format: one weekend in the first semester and two studio modules of one week length each in the second and third semester.

An additional voluntary information day takes place on campus, typically in November at the start of the program. The goal is to become acquainted with the university, the tutors and fellow students. A few months before any on-campus event, you will receive the schedule and registration forms.

On-campus events give you an opportunity to do more in-depth study and take your written exams. Besides you get practical insights in the Fraunhofer IESE lab. It's also an important opportunity to meet your fellow students, share experiences and

form study groups. It's also possible to get with IESE tutors (to plan the master thesis for example). A studio module requires that you join a team of about five other students to develop software by applying the methods, techniques, and tools you have learned.

The DISC takes no responsibility for accommodations during on-campus weekends, but we do offer assistance in searching for it.

PROGRAM AT A GLANCE

The program “Software Engineering for Embedded Systems” is divided into three segments: the basic course (first semester), advanced studies (second and third semester) and the Master thesis (fourth semester). The entire program consists of 7 modules plus the Master thesis. The following table lists the subjects for each module, study requirements and exams.

As with any course of study, a student’s progress must be verified. Written exams are required for all modules. These last 90–240 minutes. The examination modalities are determined by the examiner and communicated to you in time to prepare. Examinations are always held during on-campus events so that a separate journey to Kaiserslautern for exams is not necessary.

The on-campus events are compulsory for all participants and conclude with oral examinations which will be not graded. Besides all students need to submit mail-in exercises (offline questions) in advance.

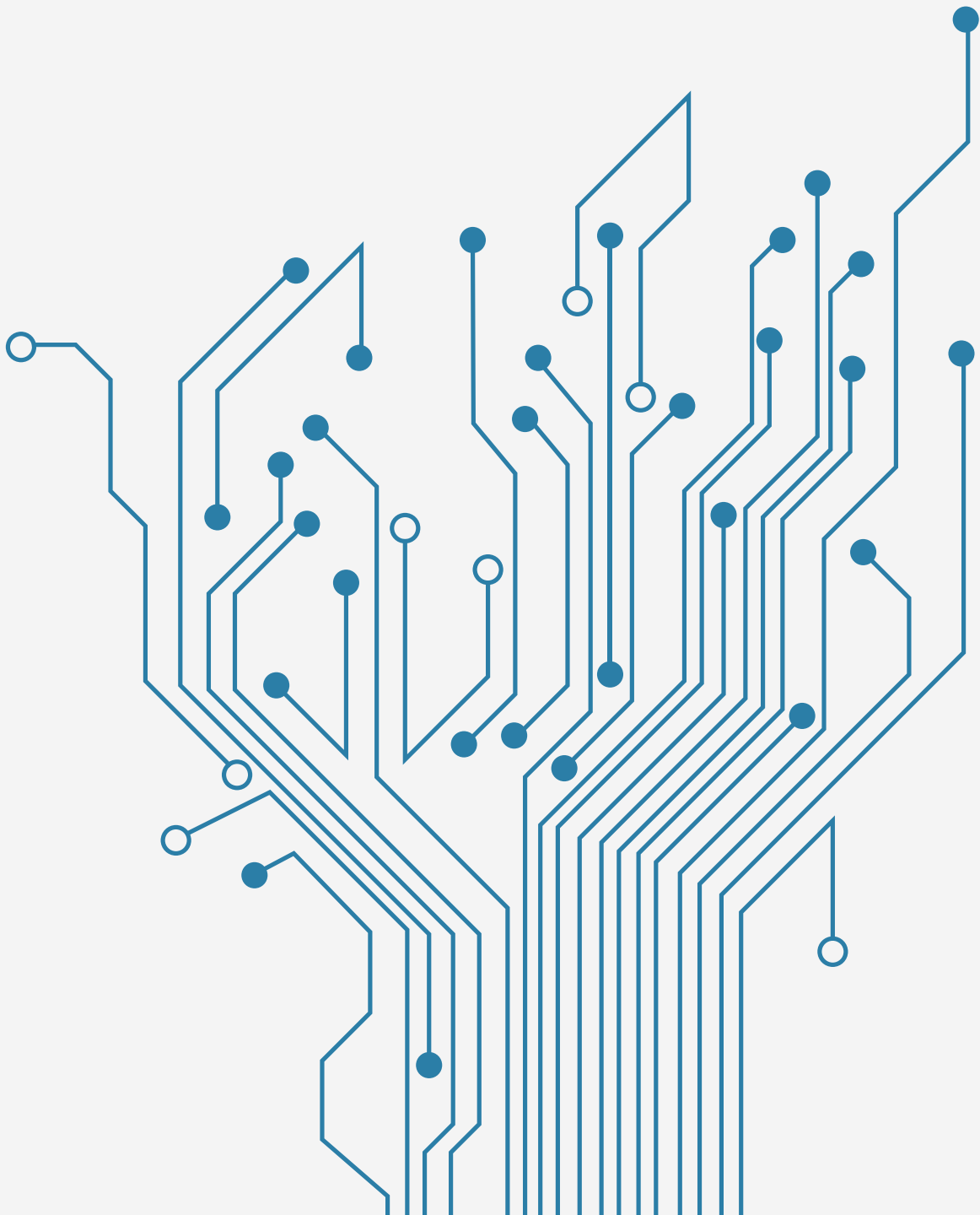
The master thesis is usually written during the fourth semester with a six-month window for completion. If you have not yet passed all the necessary examinations when registering for the thesis phase, the following documents have to be submitted: evidence you have successfully completed the first semester; evidence you have successfully passed two of the necessary exams from the second and the third semester, and evidence of participation in the two on-campus events from the second and third semester.





▣ ACADEMIC ACHIEVEMENTS AND EXAMINATIONS

SOFTWARE ENGINEERING FOR EMBEDDED SYSTEMS





MASTER'S PROGRAM AT A GLANCE

SEM.	MODULE (CREDITS)	SUBJECT	ASSESSMENT
1	Software Engineering Basics (7)	❖ Software Engineering Introduction & Software Development for Embedded Systems	Written exam
1	Project Management (4)	❖ Project Management	Written exam
1	On campus weekend	❖ Classroom Session 1	On-campus weekend
2	Software Quality Engineering (7)	❖ Software Quality Assurance & Software Product Line Engineering	Written exam
2	Software Concept Engineering (7)	❖ Requirements Engineering & Software Architectures for Embedded Software Systems	Written exam
2	Software Development Studio, part 1 (3)	❖ Quality and Concept Engineering	On-campus week
3	Software Component Engineering (7)	❖ Component-based Software Development & Model-based Component Engineering	Written exam
3	Embedded Software Engineering (7)	❖ Real-time Systems & Dependability Engineering	Written exam
3	Software Development Studio, part 2 (3)	❖ Component and Embedded Software Engineering	On-campus week
4	Master Thesis (15)		



»» At present, high software quality at reasonable costs is clearly a necessary precondition for business success. Thus, software quality assurance is an important topic within this masters program.

PROF. DR. PETER LIGGESMEYER
UNIVERSITY OF KAISERSLAUTERN

CONTENT OF THE STUDY PROGRAM

■ SOFTWARE ENGINEERING BASICS

„Software Engineering Introduction“ lays the foundations with respect to software engineering in general. The module presents the differences between software and hardware, and their engineering. It provides you with the body of knowledge and the principles of software development. At the end of the module, you will know the key techniques, methods, and tools for developing software and how to apply them.

The part „Software Development for Embedded Systems“ focuses on the methodology as well as on the dependability issues of software engineering for embedded systems. An exemplary seamless engineering approach is introduced in the textbook, ranging from requirements to implementation and testing. Moreover, a detailed case study is presented in the appendix to illustrate the application of the engineering approach.“

■ PROJECT MANAGEMENT

The module „Project Management“ gives an overview of the basics of project management. It explains what a software development project is, and it describes the interdependencies between scope of work, time, budget, and quality. Approaches to initialize, plan, control, and manage the project, while ensuring a basic project quality, are presented.

■ EMBEDDED SOFTWARE ENGINEERING

The subject covers „Real-Time Systems“ which are systems that provide a predictable timing. Therefore, besides providing correct values, for this class of systems it is important to provide them at the right time as well. Not providing results in time is a failure; the severity of this failure depends on the type of system and may range from a decreased service quality, in the case of multimedia systems, to catastrophic failures in the case of a system controlling an airplane. This subject introduces the concepts and principles of real-time operation, discusses selected bus systems for real-time communication and covers proven analysis methods for real-time systems.

Software is a crucial element of virtually all modern engineered systems. Ensuring that engineering systems are adequately dependable is a significant challenge and requires a variety of analysis and development techniques. The course “Dependability Engineering” presents the principles of dependability from the software engineer’s point of view showing:

- How software engineering affects and is affected by the engineering of dependable systems.
- The key techniques that need to be applied in software engineering to address the demands imposed on software by the system in which the software operates. The areas to be covered include basic terminology of dependability, dependability requirements, types of faults, dependability analysis, computing platform hardware architectures, software fault avoidance in specification and implementation, software fault elimination in implementation, software fault tolerance, and software assurance arguments.

SOFTWARE QUALITY ENGINEERING

„Software Quality Assurance“ provides an overview of the existing testing methodologies and shows how they are used to test software. It introduces and evaluates various dynamic and static testing techniques. By means of exercises, it teaches you to apply the knowledge gained to decide which testing technique best suits the software at hand to be tested. After the „Software Product Line Engineering“ subject, the participant should be able to:

- Understand the importance of a product line scope within the product line lifecycle,
- Understand the term “product line architecture” and its role in the overall product line lifecycle,
- Understand the central VM capabilities, the need to separate concerns and how to model variabilities and their interdependencies,
- Have an overview of a good selection of variability mechanisms at code level,
- And apply different techniques for realizing variability at code level

SOFTWARE CONCEPT ENGINEERING

„Requirements Engineering“ gives an overview on the different activities of requirements engineering for embedded software system's. Within a systems lifecycle, requirements engineering is the phase in which an (embedded) systems purpose is captured, relevant stakeholders are identified and their needs are documented, modelled and analyzed. This module provides a description of the underlying methods and techniques for requirements elicitation, notations for documenting and modelling goals, scenarios, and solution-oriented requirements, as well as techniques for requirements validation and verification. It further explains the basic activities of requirements management.

This subject introduces „Software Architectures“ with the focus on embedded software. It provides an overview on relevant methods and technologies for creating and maintaining embedded software architectures. Furthermore, this module covers techniques for documenting relevant architecture decisions, as well as requirements for software architectures, and relevant non-functional properties as for example maintainability and traceability. Self-control exercises with realistic examples enable students to control their progress towards the learning objectives of this module.

SOFTWARE COMPONENT ENGINEERING

„Component-Based Software Development“ (CBSD) introduces motivations, notions, and concepts of component-based software development. It particularly highlights the role and benefits of CBSD in relation to other software engineering disciplines as well as in relation to other programming paradigms and techniques. By applying state of the practice component frameworks such as Java EE (EJB), CORBA, and OSGi in the context of a running example of a sensor/actuator control system, the module elaborates on goals, features, and services of component frameworks in general and provides methodological advice on how to build larger software systems from components. Finally, the module presents new trends and anticipated future developments in the field of CBSD.

„Model-Based Component Engineering“ gives an overview which role components play in the development context of embedded software systems: these usually deal with discrete and continuous behavior descriptions, and have to integrate object-oriented and data-flow-oriented development approaches. It is described how components are specified as part of an architecture, and where the difference between a component and other structural elements like classes or subsystems is. Central aspects for the realization of components like the modelling of decomposition and behavior models with block-diagrams and state-charts are introduced.

AUTHORS

Leading international experts from industry sources and research institutes have taken on responsibility for the quality of the program contents. These include:

PROF. DR. DR. H.C. DIETER ROMBACH

University of Kaiserslautern, Faculty of Computer Science, Software Engineering Processes and Measurement Research Group

PROF. DR.-ING. NORBERT WEHN

University of Kaiserslautern, Faculty of Electrical and Computer Engineering, Microelectronic Systems Design Research Group

DR. GERHARD PEWS

Capgemini Consulting

PROF. DR.-ING. PETER LIGGESMEYER

University of Kaiserslautern, Faculty of Computer Science, Software Engineering Research Group

DR. DIRK MUTHIG

Lufthansa Systems AG

PROF. DR. HANS HANSSON

Mälardalen University Sweden, School of Innovation, Design and Engineering

PROF. DR. ARND POETZSCH-HEFFTER

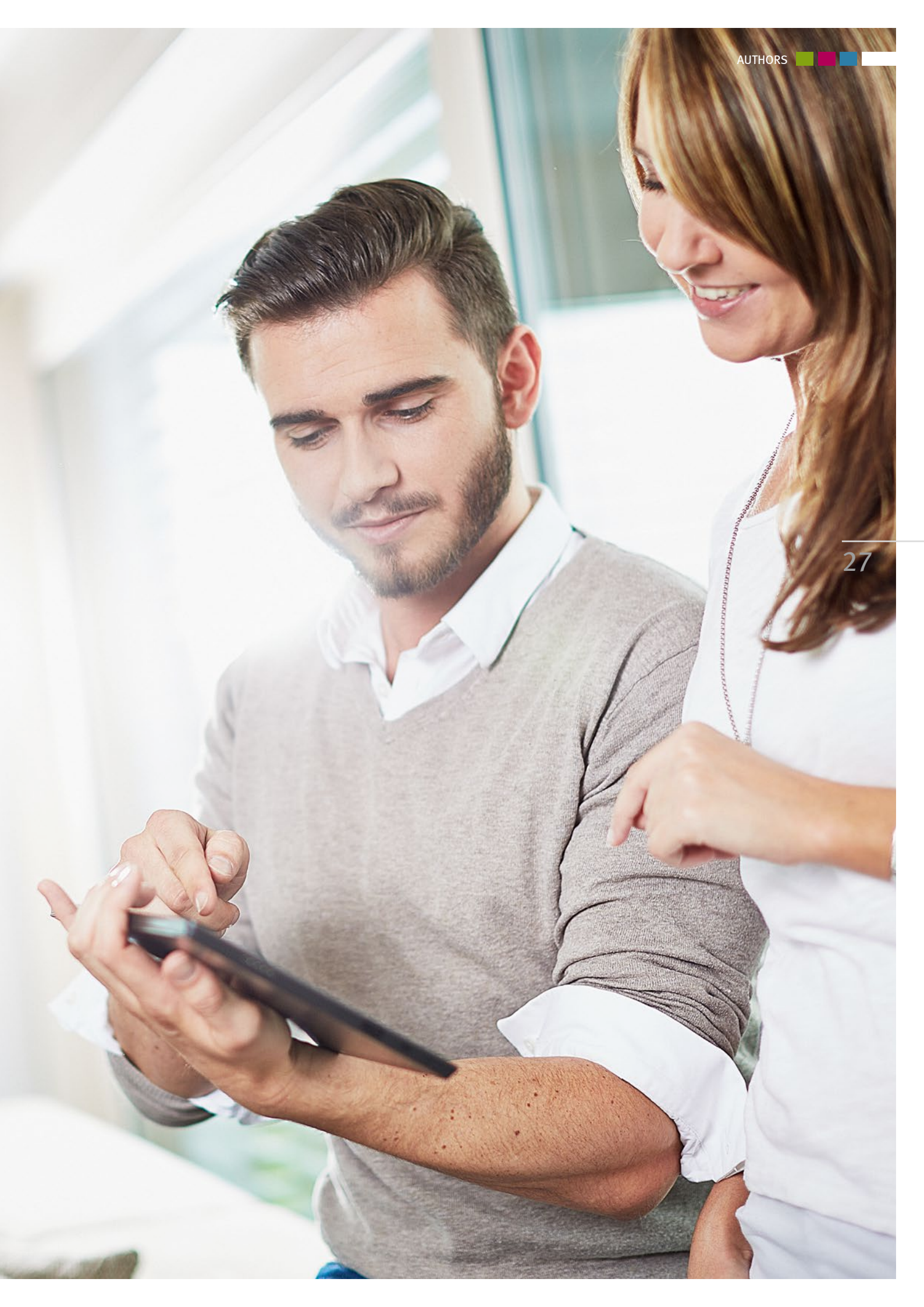
University of Kaiserslautern, Faculty of Computer Science, Software Technology Research Group

DR. MARIO TRAPP

Fraunhofer IESE, Model-based Component Engineering, Fraunhofer IESE, Division Software Development

PROF. DR. JOHN KNIGHT

University of Virginia, Department of Computer Science



PARTICIPATING INSTITUTIONS

The program is a cooperative venture between the Distance and Independent Studies Center (DISC) and the Department of Computer Science at the University of Kaiserslautern and the Fraunhofer Institute for Experimental Software Engineering (IESE). The program is organized and run by the DISC. The following sections provide more detailed information on all departments.

DEPARTMENT OF COMPUTER SCIENCE AT THE UNIVERSITY OF KAISERSLAUTERN

The university is home to about 12,500 students. Its focus on technical and science education is underlined by a strong cluster of affiliated research institutes in an adjacent science park. The university reflects a special profile and orientation towards applied research, which is emphasized by a number of highly prestigious centers of excellence and well established cooperation with international and German industries. Its highly qualified and motivated faculty attracts talented students from all over the world, which creates an international and multicultural teaching and research environment. The university has an inviting modern campus located

in the Palatine Forest (UNESCO Biosphere Reserve). Kaiserslautern is famous for its soccer team “Red Devils” and was selected as one of the official venues for the 2006 FIFA World Cup. The city’s unique mixture of high tech and unspoiled nature, history and modernity makes for an international but still typical traditional German city. The Computer Science Department is very active in research and education. There are currently 23 groups covering the entire spectrum of research topics, focusing particularly on:

- ▣ Information and Communication Systems
- ▣ System and Software Engineering
- ▣ Knowledge-based and Multimedia Systems.



FRAUNHOFER INSTITUTE FOR EXPERIMENTAL SOFTWARE ENGINEERING (IESE)

Fraunhofer IESE develops innovative methods and solutions for the development of high-quality, complex information systems and embedded systems. In order to offer an immediate added value, it applies its methods directly during its customers' product development and/or transfers its methods and solutions to them. In research, it performs contract research for its customers and conducts research in public projects. It has focused and tailored its competencies to its customers' challenges in the information systems and embedded systems domain. Fraunhofer IESE addresses new upcoming systems of systems that combine information systems and embedded systems through its research focus on Smart Ecosystems. As basic competencies for all system classes, support is provided in the field of process management.

Fraunhofer IESE in Kaiserslautern is one of the worldwide leading research institutes in the area of software and systems engineering methods. A major portion of the products offered by its customers is defined by software. These products range from automotive and transportation systems via automation and plant engineering, information systems, and health care to software systems for the public sector. The institute's software and systems

engineering approaches are scalable, which makes Fraunhofer IESE a competent technology partner for organizations of any size from small companies to major corporations. Fraunhofer IESE currently has about 200 employees.

Fraunhofer IESE, which was founded in 1996, is directed by Prof. Peter Liggesmeyer and Prof. Dieter Rombach. It is one of 67 institutes and research units of the Fraunhofer-Gesellschaft, the largest applied research organization in Europe, which has a major impact on shaping applied research in Europe and contributes to Germany's competitiveness in international markets. Since the founding of the institute, a close relationship has existed between Fraunhofer IESE and the University of Kaiserslautern in both academia and research. As assistant lecturers, employees of the institute contribute to the high level of practice-oriented education in the Department of Computer Science. The area of Software Engineering is represented by the Software Engineering Research Group: Processes and Measurement of Prof. Dr. Dieter Rombach and the Software Engineering Chair: Dependability led by Prof. Dr. Peter Liggesmeyer. In joint projects with third-party funds, the basic research of the Department of Computer Science and the applied research of Fraunhofer IESE complement each other ideally.

FRAUNHOFER ACADEMY

In 2005 the Fraunhofer Academy was established as a central unit to support Fraunhofer institutes in offering advanced training programs. With our range of training and development courses, we seek to contribute to the creation of a new innovation culture in Germany and Europe. Especially in-service online Master programs like IESE's "Software Engineering

for Embedded Systems" are perfectly suited to create new opportunities for software professionals. In cooperation with our partner DISC, we will try to provide a program that provides best-in-class theoretical and practical aspects of software engineering. Further information can be found at www.academy.fraunhofer.de.



DISTANCE AND INDEPENDENT STUDIES CENTER

The Distance and Independent Studies Center (DISC) was founded in 1992 as the „Center for Distance Learning and University Education“ (ZFUW). We are a central scientific institution of the University of Kaiserslautern. Our task comprises of launching and developing new course offerings for further education for university graduates.

The variety of measures, which are provided in cooperation with the departments of the University of Kaiserslautern, include postgraduate distance study programs with different durations and degrees. All distance study programs can be studied part-time. Currently, around 4.000 students from all over Germany, neighbouring countries and overseas are enrolled in the following study programs:

DEPARTMENT „HUMAN RESOURCES“

- ❖ Adult Education (Master of Arts)
- ❖ Human Resources Development (Master of Arts)
- ❖ School Management (Master of Arts)
- ❖ Systemic Management (Certificate)
- ❖ Systemic Consulting (Master of Arts)
- ❖ Organizational Development (Master of Arts)
- ❖ Social Sciences: Organisation and Communication (Master of Arts)

DEPARTMENT „MANAGEMENT & LAW“

- ❖ Management of Health and Social Institutions (Master of Arts)
- ❖ Economy and Management (Master of Arts)
- ❖ Commercial Law for Business Practice (Master of Laws)
- ❖ Management of Cultural and Non-Profit Organisations (Master of Arts)
- ❖ Sustainable Development Cooperation (Master of Arts)

DEPARTMENT „SCIENCE & ENGINEERING“

- ❖ Medical Physics (Master of Science)
- ❖ Medical Physics and Engineering (Certificate)
- ❖ Child Psychology: Learning and Learning Disabilities (Master of Science)
- ❖ Software Engineering for Embedded Systems (Master of Engineering)
- ❖ Structural Fire Protection and Safety Engineering (Master of Engineering)
- ❖ Nanobiotechnology (Certificate)
- ❖ Nanotechnology (Master of Science)

The program is a cooperative venture between the Distance and Independent Studies Center (DISC) and the Department of Physics at the University of Kaiserslautern. The program is organized and run by the DISC. The following sections provide more detailed information on both departments.

THE UNIVERSITY OF KAISERSLAUTERN

HISTORY

The University of Kaiserslautern was founded on July 13 July, 1970. It started as part of the twin University of Trier and Kaiserslautern. In the winter semester of 1970/1971, 191 new students enrolled in the new Department of Mathematics, Physics, and Technology. In 1972, the creation of the Departments of Chemistry and Biology reinforces the new institute's specialized scientific focus. At the same time, the Department of Technology was split into the departments of Mechanical Engineering and Electrical Engineering, Architecture/Regional and Environmental Planning/Educational Sciences. In 1975, the University of Kaiserslautern became independent when it separated from the University of Trier. The following departments, which were established successively, continued to strengthen the university's scientific character: Electrical Engineering, established in 1975 became Electrical and Computer Engineering (1999), Computer Science (1975), Engineering (1975) became Mechanical and Process Engineering in 1995, Architecture/Regional and Environmental Planning/Civil Engineering (1978-1979), and Social and Economic Studies (1985) which separated in 2003 into two independent departments. The official name of the university is Technische Universität Kaiserslautern according to according to the Higher Education Act (Hochschulgesetz) of the state Rhineland-Palatinate.

STUDIES AND OUTLOOK

Future oriented programs, education with practical orientation, and a modern infrastructure: these are the conditions for students at the University of Kaiserslautern. Since it was established in 1970, Rhineland-Palatinate's only technology- and natural science-oriented university has gained a considerable reputation which is comparable to the well-established technical universities. This is evident in the latest German university rankings, which were carried out by Stern, der Spiegel, Centrum für Hochschulentwicklung (Center for University Development) – and the Humboldt-Stiftung (Humboldt Foundation); the University of Kaiserslautern achieved top rankings

in multiple categories in these surveys. Prospective engineers and natural scientists will be well prepared for their careers while studying at the University of Kaiserslautern. Internships in business and science, as well as living/studying abroad, are part of an academic education that is closely related to professional practice. Students can benefit from numerous well-known research institutes on and near the campus that cooperate closely with the university. This so-called Science Mile includes: Deutsches Forschungszentrum für Künstliche Intelligenz (German Research Center for Artificial Intelligence), the Institut für Verbundwerkstoffe (Institute for Composite Materials), the Fraunhofer-Institut für Experimentelles Software Engineering (Fraunhofer Institute for Experimental Software Engineering), and the Fraunhofer-Institut für Techno- und Wirtschaftsmathematik (Fraunhofer Institute for Technical and Industrial Mathematics). There are currently some 14.200 students enrolled at the university. This is the perfect size for providing excellent academic support and fostering close relationships between professors and students. The university also offers very modern equipment and an excellent infrastructure, including libraries, laboratories and its own computing center. Accommodation for 2,000 students is located near the campus, all of which offer free Internet access. The university campus offers more than just an excellent education, though. The university is idyllically located on the edge of the Palatinate Forest and also offers a wide range of sports, as well as an excellent cultural atmosphere created by on-campus concerts, theater productions, films and exhibitions. Additionally, various clubs allow you to enjoy your hobbies while studying. All these leisure time activities are complemented by the Summer Festival, the Welcome Party for new students, and the famous Old Town Festival (Altstadtfest) in Kaiserslautern's city center, which was also one of the venues for the 2006 Soccer World Cup.

Dipl.-Volkswirt Thomas Jung

PR + Marketing for the University of Kaiserslautern

DISTANCE STUDY

» Embedded software systems impinge on human wellbeing through implantable medical devices, pharmaceutical production, train controls, automotive components and more; failures can injure humans and cause financial loss.

PROF. DR. JESSE H. POORE

ERICSSON-HARLAN D. MILLS CHAIR IN SOFTWARE
ENGINEERING DEPARTMENT OF ELECTRICAL ENGINEERING
AND COMPUTER SCIENCE THE UNIVERSITY OF TENNESSEE



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HOW TO CONTACT US

THE STAFF OF DISC AND FRAUNHOFER IESE WILL BE PLEASED TO HELP YOU WITH ANY QUESTIONS RELATING TO

- ✦ the structure of the programs
- ✦ the costs involved
- ✦ on-campus phases, etc.
- ✦ the application process
- ✦ dates and schedules

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