

M.Sc. Program High-Integrity Systems

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Introduction Topics

High-Integrity Systems

Safety Critical Systems (SCS)

Mission and Business Critical Systems (MCS)

Examples

Application Areas

HIS Curriculum

General Structure

Examinations and Credits

Collaboration

High-Integrity Systems

Safety Critical Systems

- Safety Critical Systems (SCS) are able to endanger
 - **human life**,
 - **health** and
 - the **environment** in case of malfunction or failure!

High-Integrity Systems

Mission and Business Critical Systems (MCS)

- Mission or Business Critical Systems are able to endanger the **existence of organisations** in case of malfunction or failure!

High-Integrity Systems

Computer Science Problem

- Main component of High-Integrity Systems:
SOFTWARE
- Designing and building of High-Integrity Systems is largely
a **Computer Science Problem!**

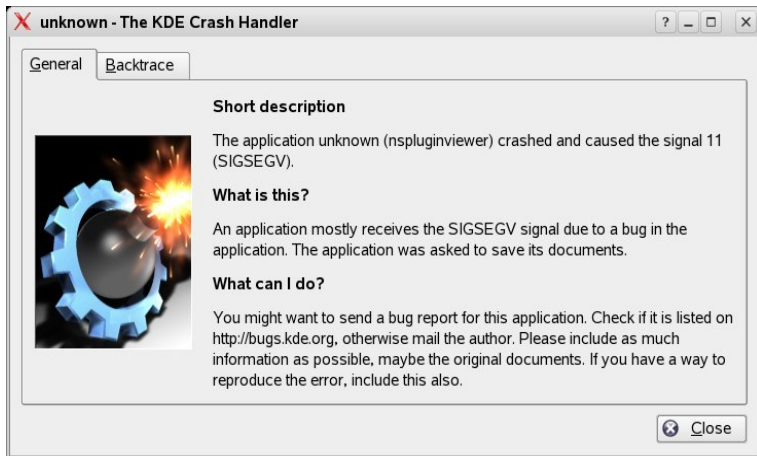
High-Integrity Systems

Areas of Application

- High-Integrity Systems grow in importance!
- Many fields of application for SCS:
 - Aeronautics and space systems
 - Automotive industry
 - Production technology
 - Railroad industry
 - Power generation
 - Medical technology
 - Chemical industry
 - ...
- and Mission Critical Systems (MCS)
 - Enterprise Resource Planning
 - Customer Relationship Management
 - Financial Transaction Systems
 - Airline Booking Systems
 - ...

Familiar Screen

Program Crash



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Example

Danger?



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Example

PFD Crash



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Example

PFD Malfunction



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Example

Frankfurt Mainstation



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Example

Hamburg Harbor



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Example

Financial System



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HIS Curriculum

General Structure

- 2 year Master's program in applied computer science
- 3 semesters lectures, exercises, projects and seminars
- 1 semester Master's thesis in applied research
- All courses in English, including exams and thesis

HIS Curriculum

Foundation and Advanced Methods: 1st Term

1. Safety Critical Computer Systems (SCS) (Lectures/Exercises)
2. Advanced Formal Modeling (Lectures/Exercises)
3. Introductory Data Analysis (Lectures/Exercises)
4. Compulsory Elective Subjects I
 - Advanced Real-Time Systems (Project)
 - Machine Learning (Lectures/Exercises)
5. Implementation of DBMS (Lectures/Exercises)
6. Compulsory Elective Subjects II
 - Pattern Oriented Software Architecture (Lectures/Exercises)
 - Quantum Information Science (Lectures/Exercises)

HIS Curriculum

Foundation and Advanced Methods: 2nd Term

1. Mathematics Update (Lectures/Exercises)
2. Compulsory Elective Subjects III:
 - Advanced Distributed Systems (Lectures/Exercises)
 - Advanced Testing Methods (Lectures/Exercises)
3. Advanced IT-Security (Lectures/Exercises)
4. Compulsory Elective Subjects IV:
 - Human Machine Interaction (Project)
 - Smart Sensor Network Systems (Project)
5. Data Mining Methods (Lectures/Exercises)
6. Compulsory Elective Subjects V:
 - System Theory and Modeling (Lectures/Exercises)
 - Transaction Management (Lectures/Exercises)
 - Learning from Data (Project)

HIS Curriculum

Applications: 3rd Term

1. Compulsory Elective Subjects VI:
 - Multivariate Data Analysis (Lectures/Exercises)
 - Simulation Methods (Lectures/Exercises)
 - Artificial Intelligence (Lectures/Exercises)
2. Compulsory Elective Subjects VII:
 - Standards and Certification (Seminar)
 - Current Topics in High-Integrity Systems (Seminar)
 - Internet of Things (Seminar)
3. Formal Specification and Verification (Lectures/Exercises)
4. Compulsory Elective Subjects VIII:
 - Selective Subjects in Current Web Engineering (Lectures/Exercises)
 - Mobile Systems and Applications (Lectures/Exercises)
 - Cloud Computing (Lectures/Exercises)
5. **HIS Project (Project)**

HIS Curriculum

Master's Thesis: 4th Term

1. Research in applied computer science
 - Frankfurt University of Applied Sciences
 - Industrial partners
 - International research institutes
 - Collaborating universities
 - ...

High Integrity Systems

Collaboration

- Universidad de Cádiz, Spain
- University of Plymouth
- Universidad Complutense de Madrid
- Lufthansa Systems
- Scuola Superiore Sant'Anna (SSSUP)
Pisa Institute of Advanced Studies
Pisa, Italy
- Medical University of Graz
- Chalmers University, Gothenburg, Sweden
- Deutsche Bahn
- . . .

Summary

Future Perspectives

- A M.Sc. degree in High-Integrity Systems enables for a rewarding career in all high-tech fields in and relating to computer science!
- High-integrity systems gain importance in all areas of application.
- A M.Sc. is a prerequisite for entering a Ph.D. program!