

**Module Description, available in: EN**

## Software Assurance

### General Information

**Number of ECTS Credits**

3

**Module code**

TSM\_SoftwAs

**Valid for academic year**

2024-25

**Last modification**

2023-07-03

**Coordinator of the module**

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**Explanations regarding the language definitions for each location:**

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
<b>Instruction</b>					X E 100%		
<b>Documentation</b>					X E 100%		
<b>Examination</b>					X E 100%		

**Module Category**

TSM Technical scientific module

**Lessons**

2 lecture periods and 1 tutorial period per week

### Entry level competences

**Prerequisites, previous knowledge**

Students will need knowledge in software engineering, specifically testing.

Students will need to be reasonably fluent in a variety of languages including but not limited to C and Python. Knowledge of some assembly (e.g., x86, x86-64, or ARM) will be advantageous.

Students will need to be familiar with the idea that there are standards for software development and testing.

## Brief course description of module objectives and content

Students shall gain an overview over current methods for software assurance. This includes

- automatic test case minimisation;
- negative test case generation ("fuzzing");
- side channels and their avoidance ("constant-time computing");
- security implications when designing safety systems
  
- exposure to standards-compliant software development;
- software verification and validation;
- safe testing according to the standards; and
- fault tolerance.

## Aims, content, methods

### Learning objectives and competencies to be acquired

- Students can apply test case minimisation techniques to their own test cases.
- Students know how fuzzing works, to what class of faults it applies, how to interpret its output, and how to use it in their own projects.
- Students know that side channels exist and how they are exploited, that they are a serious danger to software assurance and security, and how to avoid certain types of side channel, especially those that have to do with variable-time computation based on secret inputs.
- Students know about the safety life cycle according to IEC 61508 and its adaptation to automotive security in ISO 26262, and can apply it in their own projects.
- Students can apply probabilistic methods used to estimate the impact of device failures on overall safety.
- Students know what options there are to certify, validate, and verify software components, and what that means.

### Module content with weighting of different components

- Safety life cycle according to IEC 61508 (2 lectures)
- Application of IEC 61508 to automotive software (ISO 26262) (1 lecture)
  
- Probabilistic methods to estimate impact of failure (2 lectures)
  
- Certification, validation, and verification of software (2 lectures)
- Test cases and their minimisation (2 lectures)
  
- Negative test case generation ("fuzzing") (2 lectures)
  
- Side channels (3 lectures)

### Teaching and learning methods

Lectures will be part ex-cathedra, part in-class exercises. These exercises are designed to be done either individually or in groups and can therefore be done remotely.

### Literature

Andreas Zeller, *Why Programs Fail*. Morgan Kaufman. Second Edition, 1770. (Yes, that's the date that Amazon has for the book. In reality, the second edition is from 2008.)

Ari Takanen, *Fuzzing for Software Security Testing and Quality Assurance*. Artech House Publishers. Second Edition, 2018.

Seokhie Hong (Ed.), *Side Channel Attacks*. MDPI. 2019.

David J. Smith and Kenneth G. L. Simpson, *The Safety Critical Systems Handbook: A Straightforward Guide to Functional Safety: IEC 61508* (2010 Edition), *IEC 61511* (2015 Edition) and *Related Guidance*. Butterworth-Heisman. Fifth edition, 2020.

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

**As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.**

### Standard final exam for a module and written resit exam

#### Kind of exam

Written exam

#### Duration of exam

120 minutes

#### Permissible aids

*Aids permitted as specified below:*

#### Permissible electronic aids

- Open book
- Open Internet

#### Other permissible aids

None

### Special case: Resit exam as oral exam

#### Kind of exam

Oral exam

#### Duration of exam

30 minutes

#### Permissible aids

*Aids permitted as specified below:*

#### Permissible electronic aids

- Open Book
- Open Internet

#### Other permissible aids

None