Module Description

Design of Embedded Hardware and Firmware

General Information

Number of ECTS Credits

3

Abbreviation

TSM_EmbHardw

Version

20.12.2016

Module Responsibility

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Language

	Lausanne	Bern	Zürich
Instruction	☐ E ☑ F	☐ D ☐ E ☐ F	☐ D ☑ E
Documentation	☑ E ☐ F	☐ D ☐ E ☐ F	☐ D ☑ E
Examination	☐ E ☑ F	☐ D ☐ E ☐ F	☐ D ☑ E

Module category

☐ Fundamental theoretical principles
☑ Technical/ scientific specialization module
☐ Context module

Lessons

☑ 2 lecture periods and 1 tutorial period per week

Brief course description of module objectives and content

This module introduces the student to advanced concepts in modern embedded engineering. The module is divided into two sections. The first section is practical/theoretical and is designed to get the student familiar to implementing System on Chip designs. The second part discusses formal Hardware/Software Co-Design including design and implementation of advanced embedded architectures and verification of the resulting system.

Aims, content, methods

Learning objectives and acquired competencies

The student will know some of the forces driving the direction of modern embedded architectures.
The student will understand and be able to apply structured HW/SW Co-Design methodologies as well as strategies for test and verification of embedded systems (HW/SW Co-Verification).
The student will be able to design and commission complete SoC designs in an FPGA.
The student will be able to design SoC's using the following technologies - (multiple) soft-core processors, co-processors (custom instructions, closely coupled co-processors, signal processors) and hardware acceleration
The student will apply and understand advanced software optimisation techniques
The student will be required to complete relevant exercises on a suitable development board.

Contents of module with emphasis on teaching content

- Introduction
  - FPGA technology
  - SoC design, soft-core processors, self-designed modules
  - Bus systems, DMA, memory hierarchy (caches, SPM)
- Automaton Architectures
  - Soft-Core processors, custom instructions, co-processors, processor architectures
  - Embedded firm/software and optimization techniques
  - Peripheral interfacing, hardware acceleration
- Test and Verification
  - Hardware-Software Co-Verification and test strategies
- Review
  - Exercises and laboratories using an FPGA board

Teaching and learning methods

Lectures
Accompanied exercises
Self-study

Prerequisites, previous knowledge, entrance competencies

The students have a working knowledge of programming embedded systems in C.
The students have a working knowledge of basic hardware design including VHDL coding

Literature

No mandatory literature

Assessment

Certification requirements for final examinations (conditions for attestation)

Voluntary Test Part 1: SoC Implementation (20%)
Voluntary Test Part 2: Formal Processes and Methods (20%)

Written module examination

Duration of exam :	120 minutes
Permissible aids:	Lecture notes and VHDL reference