Module Description, available in: EN

Parallel and distributed computing

General Information

Number of ECTS Credits

3

Module code

TSM_ProgAlg

Valid for academic year

2021-22

Last modification

2021-02-12

Coordinator of the module

Christoph Stamm (FHNW, christoph.stamm@fhnw.ch)

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		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**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

- Procedural and object oriented programming
- Software engineering (UML or other)
- Basic notions of algorithms and complexity
- Basic notions of concurrent programming (Threads)

Brief course description of module objectives and content

The objective of this module is to present an overview of parallel and distributed computing and related algorithms. The first part of the course will be dedicated to the architectures of parallel and distributed infrastructures, the different theoretical models for these architectures and the different programming models and tools for programming such architectures. The second part will be dedicated to the study of a number of classical parallel and distributed algorithms. This course includes practical work to train the student in the use of parallel and distributed computing.

Aims, content, methods

Learning objectives and acquired competencies

At the end of the course the student knows:

- The most common parallel and distributed hardware infrastructures
- The different ways to model and efficiently program these architectures
- How to choose the proper parallel or distributed algorithm to write an application for solving a specific problem on a specific architecture
- How to efficiently program this application
- How to assess the performance of this application

Contents of module with emphasis on teaching content

Introduction

- Different architectures of parallel and distributed infrastructures
- Communications models and communication costs
- Performance metrics for parallel and distributed systems
- Scalability of parallel and distributed systems

Heterogeneous shared memory systems

- Architecture of widely used multi-core systems
- Parallel programming models (OpenMP)

Distributed memory systems

- Communication operations and their costs
- Message passing paradigm (MPI)
- Distributed object paradigm

Parallel and distributed algorithms

- Asymptotic analysis of parallel programs
- Decomposition techniques
- Mapping techniques for load balancing
- Matrix-vector and matrix-matrix multiplication
- Parallel and distributed sorting algorithms
- Parallel and distributed Graph algorithms

Teaching and learning methods

This course involves theoretical presentations and practical exercises or laboratories. Some of the exercises or laboratories are programming exercises that can be done at home by accessing a parallel and distributed infrastructure made available through the internet.

Literature

A. Introduction to Parallel Computing, Zbigniew J. Czech, Cambridge University Press, 2017
B. An Introduction to Parallel Programming, 1st edition, Peter Pacheco , Morgan Kaufmann Publishers Inc, 2011

Assessment

Certification requirements

Module uses certification requirements

Certification requirements for final examinations (conditions for attestation)

Some exercises or laboratories could be mandatory.

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

No electronic aids permitted

Other permissible aids

A handwritten summary of a fixed number of pages given by the lecturer.

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted