CS-471

# Advanced multiprocessor architecture

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| Cursus | Sem. | Type |
|---|---|---|
| Computational science and Engineering | MA1, MA3 | Opt. |
| Computer and Communication Sciences | | Opt. |
| Computer engineering minor | H | Opt. |
| Computer science | MA1, MA3 | Opt. |
| Electrical and Electronical Engineering | MA1, MA3 | Opt. |
| SC master EPFL | MA1, MA3 | Opt. |

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| Language of teaching | English |
| Credits | 6 |
| Session | Winter |
| Semester | Fall |
| Exam | During the semester |
| Workload | 180h |
| Weeks | 14 |
| **Hours** | **4 weekly** |
| Lecture | 4 weekly |
| **Number of positions** | |

## Remark

Cours biennal donné une année sur deux les années impaires (donné en 2017-18)

## Summary

Multiprocessors are now the defacto building blocks for all computer systems. This course will build upon the basic concepts offered in Computer Architecture I to cover the architecture and organization of modern multiprocessors from mobile and embedded platforms to servers, data centers and cloud computing platforms.

## Content

Introduction to multiprocessor systems, parallel programming models including Pthreads, MPI, hardware and software transactional memory, synchronization primitives, memory consistency mdels, cache coherence, on-chip shared cache architectures, on-chip interconnects, multi-chip interconnects, multi-chip bus-based and general-purpose interconnect-based shared-memory systems, clusters.
The course will include weekly readings, discussions, and student reviews and reports on publications (besides the text book) of seminal and recent contributions to the field of computer architecture. Student reviews, class discussions, and an independent research project will account for a significant fraction of the grade. Feedback on performance will be given only upon request by a student. There will be no recitation classes.
The course will also include an independent and original research project, in which students study, improve, and evaluate multiprocessor innovations using a software simulation infrastructure. There will be a list of project ideas given out, but students can suggest and work on their own ideas with potentials for advancing the state of the art.

## Learning Prerequisites

### Recommended courses

Computer Architecture I, basic C/C++ systems programming.

## Learning Outcomes

By the end of the course, the student must be able to:

- Design and evaluate parallel computer organizations
- Develop parallel programs and benchmarks for parallel systems
- Design the basic components of modern parallel systems including multiple processors, cache hierarchies and networks
- Quantify performance metrics for parallel systems
- Interpret and critique research papers

- Plan , propose and conduct a research project empirically
- Present research contributions

## Teaching methods

Lectures, homeworks, and a research project

## Assessment methods

Continuous control :
Homework : 30 %, Project 15 %, Midterm test : 20 %,
End term test : 35 %

## Resources

### Websites

- http://parsa.epfl.ch/courses/cs471/.