CS-471

Advanced multiprocessor architecture

Cursus	Sem.	Type
Computational science and Engineering	MA1, MA3	Opt.
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
Electrical and Electronical Engineering	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

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 (pas donné en 2020-21

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

- https://parsa.epfl.ch/course-info/cs471/