

CS-471

Advanced multiprocessor architecture

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| Cursus | Sem. | Type |
|---|----------|------|
| Computational science and Engineering | MA1, MA3 | Opt. |
| Computational science and engineering minor | H | Opt. |
| Computer and Communication Sciences | | Opt. |
| Computer science | MA1, MA3 | Opt. |
| Cybersecurity | 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 | 8 |
| Session | Winter |
| Semester | Fall |
| Exam | During the semester |
| Workload | 240h |
| Weeks | 14 |
| Hours | 12 weekly |
| Lecture | 4 weekly |
| Project | 8 weekly |
| Number of positions | |

Summary

Multiprocessors are basic building blocks for all computer systems. This course covers the architecture and organization of modern multiprocessors, prevalent accelerators (e.g., GPU, TPU), and datacenters. It includes a research project on multiprocessors and post-Moore era datacenters.

Content

- Introduction
- Metrics and methodologies
- Parallel programming models
- Communication models
- Applications and Workloads
- Cache hierarchies & memory models
- Memory & storage hierarchies
- Interconnects
- GPUs
- AI/ML/Analytic accelerators
- Near-memory computing
- Datacenters & cloud Computing
- Cloud-native CPU
- Cloud-native memory hierarchies
- Sustainable architecture

Learning Prerequisites**Recommended courses**

- Advanced computer architecture
- Systems for data management and data science

Learning Outcomes

- Explore the development trend of computation systems and datacenters
- Establish the basic model to analyze the performance and characteristics of foundational workloads operating in cloud environments.
- Classify and describe the components of modern parallel systems, including multiple processors, cache hierarchies, memory systems, interconnects, and accelerators, and their roles in handling emerging workloads
- Define and clarify research questions and opportunities
- Interpret and critique research papers and extract insights for research questions
- Plan and conduct a research project
- Present research contributions

Teaching methods

Lecture, research paper retrieval, and a research project

Assessment methods

- Homework: 10%
- Research project (in group): 40%
- Midterm exam: 20%
- Final exam: 30%

Resources

Websites

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