With the advent of multiprocessors, it becomes crucial to master the underlying algorithmics of concurrency. The objective of this course is to study the foundations of concurrent algorithms and in particular the techniques that enable the construction of robust such algorithms.

Content

Model of a parallel system
A Multicore architect
Processes and objects
Safety and liveness

Parallel programming
Automatic parallelism
Mutual exclusion and locks
Non-blocking data structures

Register Implementations
Safe, regular and atomic registers
General and limited transactions
Atomic snapshots

Hierarchy of objects
The FLP impossibility
The consensus number
Universal constructions

Transactional memories
Transactional algorithms
Opacity and obstruction-freedom

Keywords
Concurrency, parallelism, algorithms, data structures

Learning Prerequisites
Required courses
ICC, operating systems

Recommended courses
Important concepts to start the course
Processes, threads, data structures

Learning Outcomes
By the end of the course, the student must be able to:
  • Reason in a precise manner about concurrency
  • Design a concurrent algorithm
  • Implement a concurrent system
  • Prove a concurrent algorithm

Teaching methods
Lectures, exercises and practical work

Expected student activities
Midterm and final exam
Project

Assessment methods
With continuous control, midterm final exams and project

Supervision
Office hours  Yes
Assistants    Yes
Forum        No

Resources
Notes/Handbook
Concurrent Algorithms, R. Guerraoui and P. Kouznetsov

Websites
• http://lpd.epfl.ch/site/education