

PARALLEL COMPUTING

Summer Semester 2021



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Topics

Application of concurrency to speed-up computations.

- Multi-core processors, multi-processor systems, computer clusters, computational grids.
- Shared memory (multi-threaded) and distributed memory (message passing) programming.
- Task parallel and data parallel algorithms.
- Strategies for parallel program design.
- Performance measures and complexity models.
- Performance analysis and debugging.

Various interrelated aspects (many of which we will discuss).

Preliminary Schedule

- March 9 (Schreiner): Parallel Architectures and Performance.
- March 16 (Biere): Parallel Algorithms and Complexity.
- March 23 (Schreiner): Concurrency in Java and OpenMP.
- April 13 (Biere): Shared Mem. Prog., Lockless Data Struct.
- April 20 (Biere): Shared Mem. Prog., Cilk, Lace, Work Stealing
- April 27 (Schreiner): Presentations of Solutions 1.
- May 11 (Schreiner): Message Passing Programming with MPI.
- May 18 (Biere): Shared Memory Programming with PThreads.
- June 1 (Biere): Presentations of Solutions 2.
- June 8 (Schreiner): Designing Parallel Programs.
- June 15 (Schreiner): Presentation of Solutions 3.
- June 29 (Biere): Presentations of Solutions 4.

Individual meetings for discussing the assignments.

Organization and Grades

■ Moodle Course

- Materials and links.
- Forums for announcements and Q&A.
- Submission of assignments.

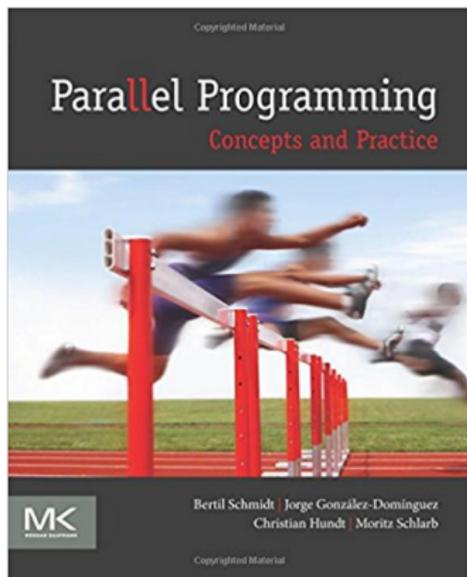
■ Assignments

- 4 programming assignments will be handed out.
- At least 3 have to be turned in and graded positively.
- Elaboration *individually*.
- Selected submissions will be invited for presentation.

No exam, grade will be entirely based on assignments/presentations.

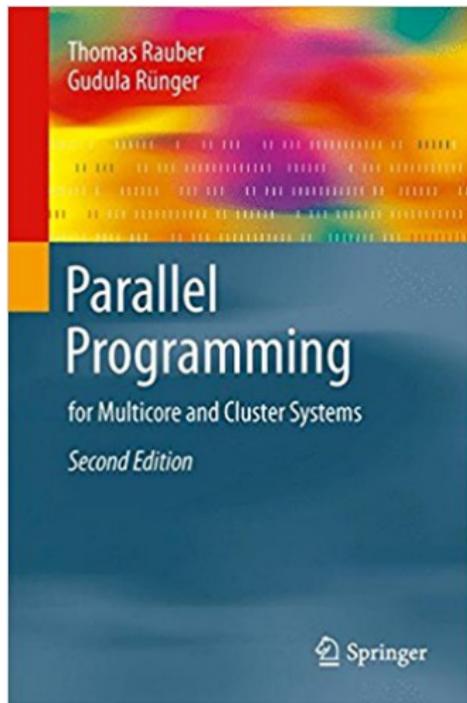
Literature

Bertil Schmidt et al. *Parallel Programming: Concepts and Practice*, Morgan Kaufmann, 2017.



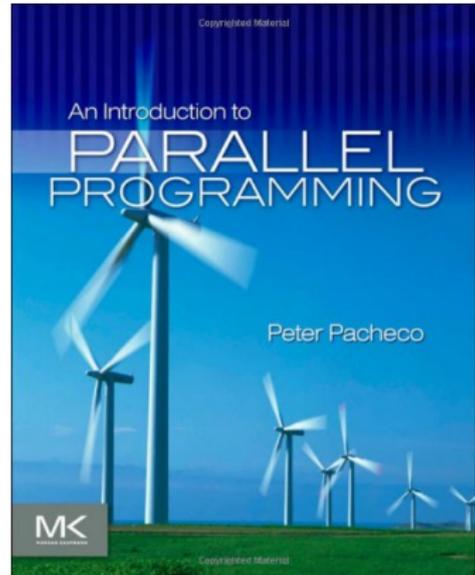
Literature

Thomas Rauber and Gudula Runger, *Parallel Programming: for Multicore and Cluster Systems*, Second Edition, Springer, 2013.



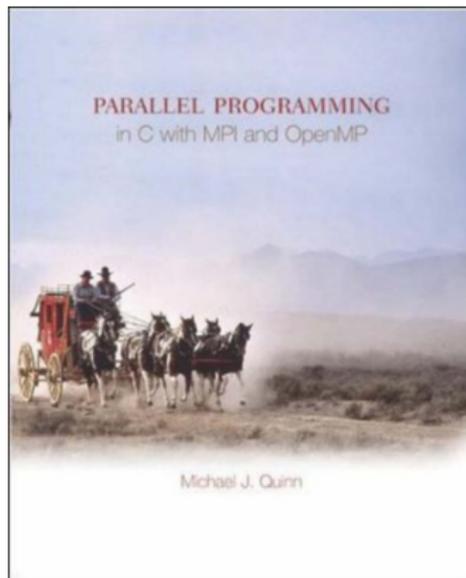
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Peter Pacheco, *An Introduction to Parallel Programming*, Morgan Kaufmann, 2011.



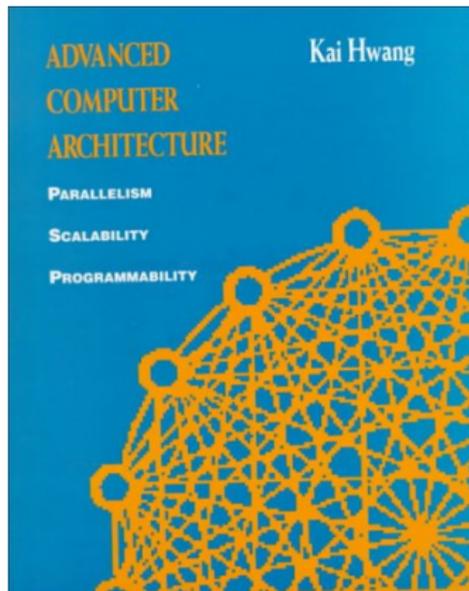
Literature

Michael J. Quinn, *Parallel Programming in C with MPI and OpenMP*, McGraw-Hill, 2003.



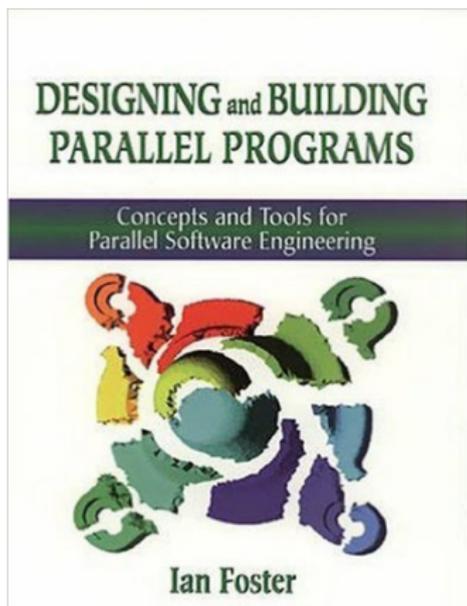
Literature

Kai Hwang, *Advanced Computer Architecture — Parallelism, Scalability, Programmability*, McGraw-Hill, 1993.



Literature

Ian Foster, *Designing and Building Parallel Programs*, Addison-Wesley, 1995.



Free online version at <http://www.mcs.anl.gov/~itf/dbpp>.