

Parallel Computing (PCA-730E)

Introduction

Motivation
Scope of parallel computing

Basics of Parallelization

Mutual exclusion
Concurrent objects
Principles of parallel algorithm design
Scheduling and Work Distribution
Foundations of Shared Memory
Primitive Synchronization Operations

Tools and Platforms

C++11 threads
Intel Threading Building Blocks
OpenCL
CUDA
LAM/MIPCH

Issues of Multicore Programming

Basic Communication Operations
Analytical Modelling of Parallel Programs
Universality of Consensus
Spin Locks and Contention
Monitors and Blocking Synchronization

Parallel Algorithms & Data Structures

Decomposition Techniques
Characteristics of Tasks and Interactions
Mapping Techniques for Load Balancing
Methods for Containing Interaction Overheads
Parallel Algorithm Models
Linked Lists: The Role of Locking
Concurrent Queues and the ABA Problem
Concurrent Stacks
Sorting and Distributed Coordination
Concurrent Hashing and Natural Parallelism
Priority Queues
Sets
Graphs
Skiplists and Balanced Search

Books and references

1. The Art of Multiprocessor Programming by *Maurice Herlihy and Nir Shavit*, Morgan Kaufmann Publishers
2. The Art of Concurrency by *Clay Breshears*, O Reilly
3. Introduction to Parallel Computing (2 Ed) by *Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar*, Addison Wesley
4. Professional C++ by *M Gregoire, NA Solter, SJ Kleper* (2Ed)