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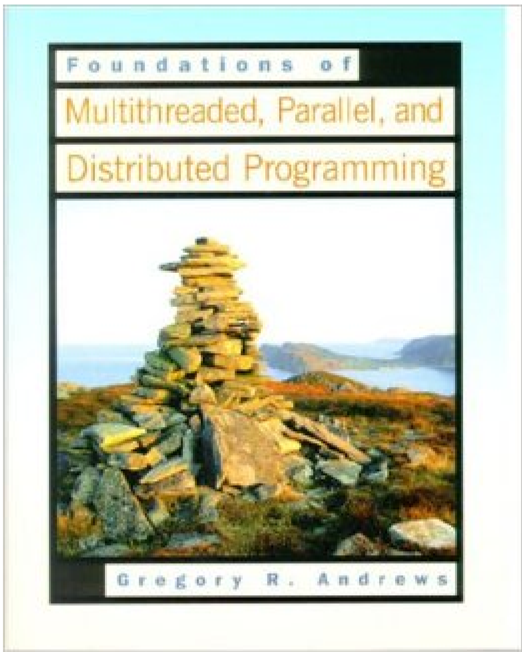
Foundations Of Multithreaded, Parallel, And Distributed Programming



Synopsis

Greg Andrews teaches the fundamental concepts of multithreaded, parallel and distributed computing and relates them to the implementation and performance processes. He presents the appropriate breadth of topics and supports these discussions with an emphasis on performance. Features *Emphasizes how to solve problems, with correctness the primary concern and performance an important, but secondary, concern *Includes a number of case studies which cover such topics as pthreads, MPI, and OpenMP libraries, as well as programming languages like Java, Ada, high performance Fortran, Linda, Occam, and SR *Provides examples using Java syntax and discusses how Java deals with monitors, sockets, and remote method invocation *Covers current programming techniques such as semaphores, locks, barriers, monitors, message passing, and remote invocation *Concrete examples are executed with complete programs, both shared and distributed *Sample applications include scientific computing and distributed systems

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Customer Reviews

The book provides all material needed for a beginner to easily acquire knowledge required for development and beginner’s research in the field of parallel computation. It’s written though not for a beginner in programming, solid basics and initial knowledge of OS internals are prerequisites. I found it’s easy to read and understand with a mass of useful examples and with coverage of MPI and Java. This was especially important to since it bridges the theory in the earlier sections with practical implementations using production environment tools. In overall I strongly recommend it for those who are new to the field. For a more deep discussion on parallel algorithms one may want to look at F.T. Leighton's "Intro to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes" - that one is much more technical though.

The author of this text, Dr. Andrews, has dealt with the theory and implementation of parallel/multithreaded/distributed in computer systems since the 70s. I was fortunate to take his class at the University of Arizona in which this book was used as the primary text.Unlike many textbooks of its ilk, Dr. Andrews does use coded examples, but they are not complex code excerpts that span several pages. He does an excellent job of covering the topic in both C with Posix, Java, as well as the language he worked on MPD. Since this topic has been his primary focus he really knows the subject matter yet can explain it in a way such that anyone with moderate programming skills can grasp.Just like his lectures, the fundamentals and theory presented in each chapter is always structured, explained, and numerous examples are given to reinforce the topics that are being taught. I would recommend this book to anyone who requires an introductory to medium exposure to the critical topic of multithreaded, parallel and distributed programming.

This book is clear, easy to read and nicely organized.The contents are summarized below:Chapter 1 begins with an introduction to concurrent computing;PART I: SHARED MEMORY Chapter 2 explains processes and synchronization, including a very easy introduction to axiomatic semantics; Chapter 3 explains locks and barriers (both use and implementation); Chapter 4 is dedicated to semaphores and their use (examples of use include mutual exclusion, barriers, producer/consumer, reader/writers); Chapter 5 is about monitors, and this is where condition variables are introduced (they're not treated separately as in POSIX, but the author does mention POSIX mutexes+cond.vars approach). Examples include bounded buffer, readers/writer, interval timer, sleeping barber, and a disck scheduling system. There is a section on Java and another one on pthreads; Chapter 6 goes into details of implementation of semaphores and monitors;PART II: DISTRIBUTED PROGRAMMING Chapter 7 is about message passing -- first asynchronous then synchronous. Case studies include CSP, Linda, MPI and Java; Chapter 8 goes into RPC and rendezvous, and case studies are Ada, SR and Java. The examples here include a remote database andsorting network; Chapter 9 deals with ways in which processes may interact. Here the author uses as examples sparse matrix multiplication, cellular automata, and other problems; Chapter 10 is about implementation details of message-passing mechanisms, RPC and distributed shared memory;PART III: PARALLEL PROGRAMMING Chapter 11 is about scientific computing (number-crunching stuff). Grid computing, particle computations, matrix computations; Chapter 12 discusses MPI, parallelzing compilers, programming languages and tools and their support for concurrent programming.Each chapter has a section with historical notes, references and LOTS of exercises.

I used this book for Dr. Andrews' parallel computing class many years ago and LOVED this book. This book covers a wide ranging topics of parallel computing and is a good enough reference for 99% people out there.The book is extremely useful in that it provides actual working example codes for nearly all the topics covered, in C or Java or both. The codes are also very small, in most cases less than a page. This is very important because a lot cases such as multiple readers single writers are not easy to code from scratch and could easily have synchronization problems unless one has strong overall grasp of the concept. This book does very good analysis of potential pitfalls of them. Even if you already knew the concepts, this book provides a valuable reference and code templates.Some part of the book may seem to be pseudo code to some people since Dr. Andrews uses the MPD language (which is on top of C) for a far easier time dealing with many of the computing issues. Although I have never used to MPD language, I find the syntax useful in understanding many concepts Dr. Andrews is trying to explain, such as how to partition work into small tasks.

I've used this as a course text several times for a senior undergraduate / graduate course. What I like the most about it is that it uses a form of programming logic to give a logical justification for the correctness of the algorithms. This is a direction, however, in which it could have gone further. Having introduced some programming logic, the book could have made more use of it -- for example in the discussion of semaphore-based algorithms. The book is strongest on shared memory parallelism and not so strong on distributed computation; I wouldn't call this a fault, but rather a matter of emphasis. It is not a perfect text, but it is the best I know of. I would recommend it not only as a textbook, but also for the serious practitioner.

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