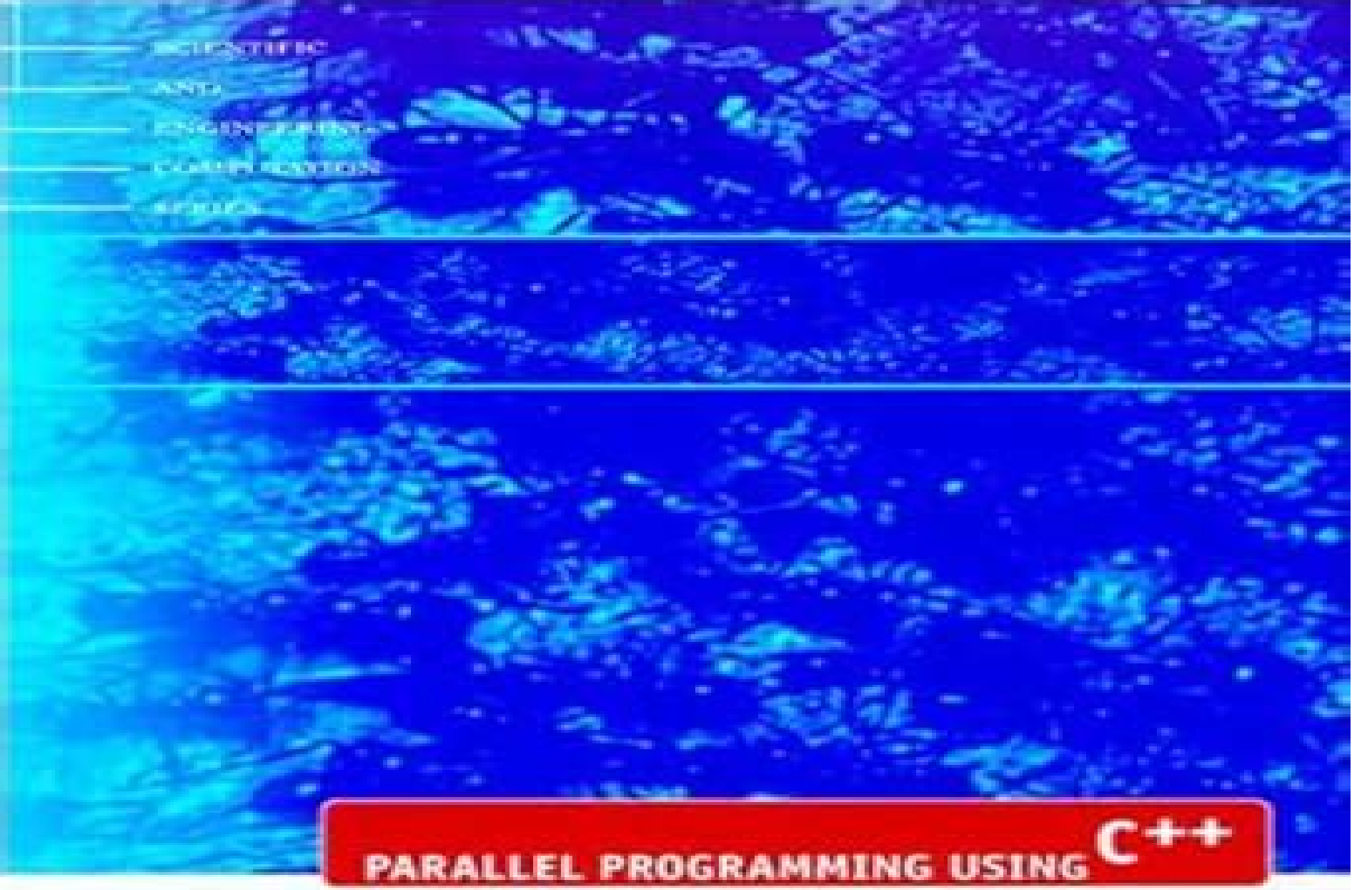

PARALLEL PROGRAMMING USING C++

EDITED BY GREGORY V. WILSON AND PAUL LU

FOREWORD BY BJARNE STROUSTRUP

Parallel Programming Using C Scientific And Engineering Computation

Albert A Gayle

Parallel Programming Using C Scientific And Engineering Computation:

Parallel Programming Using C++ Gregory V. Wilson,Paul Lu,1996-07-08 Foreword by Bjarne Stroustrup Software is generally acknowledged to be the single greatest obstacle preventing mainstream adoption of massively parallel computing While sequential applications are routinely ported to platforms ranging from PCs to mainframes most parallel programs only ever run on one type of machine One reason for this is that most parallel programming systems have failed to insulate their users from the architectures of the machines on which they have run Those that have been platform independent have usually also had poor performance Many researchers now believe that object oriented languages may offer a solution By hiding the architecture specific constructs required for high performance inside platform independent abstractions parallel object oriented programming systems may be able to combine the speed of massively parallel computing with the comfort of sequential programming Parallel Programming Using C describes fifteen parallel programming systems based on C the most popular object oriented language of today These systems cover the whole spectrum of parallel programming paradigms from data parallelism through dataflow and distributed shared memory to message passing control parallelism For the parallel programming community a common parallel application is discussed in each chapter as part of the description of the system itself By comparing the implementations of the polygon overlay problem in each system the reader can get a better sense of their expressiveness and functionality for a common problem For the systems community the chapters contain a discussion of the implementation of the various compilers and runtime systems In addition to discussing the performance of polygon overlay several of the contributors also discuss the performance of other more substantial applications For the research community the contributors discuss the motivations for and philosophy of their systems As well many of the chapters include critiques that complete the research arc by pointing out possible future research directions Finally for the object oriented community there are many examples of how encapsulation inheritance and polymorphism can be used to control the complexity of developing debugging and tuning parallel software *Object Oriented Methods for Interoperable Scientific and Engineering Computing* Michael E. Henderson,Christopher Radcliff Anderson,Stephen L. Lyons,1999-01-01 Contains papers presented at the October 1998 SIAM Workshop on Object Oriented Methods for Interoperable Scientific and Engineering Computing that covered a variety of topics and issues related to designing and implementing computational tools for science and engineering Using Advanced MPI William Gropp,Torsten Hoefler,Rajeev Thakur,Ewing Lusk,2014-11-07 A guide to advanced features of MPI reflecting the latest version of the MPI standard that takes an example driven tutorial approach This book offers a practical guide to the advanced features of the MPI Message Passing Interface standard library for writing programs for parallel computers It covers new features added in MPI 3 the latest version of the MPI standard and updates from MPI 2 Like its companion volume Using MPI the book takes an informal example driven tutorial approach The material in each chapter is organized according to the complexity of the programs used as examples

starting with the simplest example and moving to more complex ones Using Advanced MPI covers major changes in MPI 3 including changes to remote memory access and one sided communication that simplify semantics and enable better performance on modern hardware new features such as nonblocking and neighborhood collectives for greater scalability on large systems and minor updates to parallel I O and dynamic processes It also covers support for hybrid shared memory message passing programming MPI_Message which aids in certain types of multithreaded programming features that handle very large data an interface that allows the programmer and the developer to access performance data and a new binding of MPI to Fortran Domain-Specific Program Generation Christian Lengauer,2004-05-24 Program generation holds the promise of helping to bridge the gap between application level problem solutions and efficient implementations at the level of today s source programs as written in C or Java Thus program generation can substantially contribute to reducing production cost and time to market in future software production while improving the quality and stability of the product This book is about domain specific program generation it is the outcome of a Dagstuhl seminar on the topic held in March 2003 After an introductory preface by the volume editors the 18 carefully reviewed revised full papers presented are organized into topical sections on surveys of domain specific programming technologies domain specific programming languages tool support for program generation domain specific techniques for program optimization **The Architecture of Scientific Software** Ronald F. Boisvert,Ping Tak Peter Tang,2001-04-30 Scientific applications involve very large computations that strain the resources of whatever computers are available Such computations implement sophisticated mathematics require deep scientific knowledge depend on subtle interplay of different approximations and may be subject to instabilities and sensitivity to external input Software able to succeed in this domain invariably embeds significant domain knowledge that should be tapped for future use Unfortunately most existing scientific software is designed in an ad hoc way resulting in monolithic codes understood by only a few developers Software architecture refers to the way software is structured to promote objectives such as reusability maintainability extensibility and feasibility of independent implementation Such issues have become increasingly important in the scientific domain as software gets larger and more complex constructed by teams of people and evolved over decades In the context of scientific computation the challenge facing mathematical software practitioners is to design develop and supply computational components which deliver these objectives when embedded in end user application codes The Architecture of Scientific Software addresses emerging methodologies and tools for the rational design of scientific software including component integration frameworks network based computing formal methods of abstraction application programmer interface design and the role of object oriented languages This book comprises the proceedings of the International Federation for Information Processing IFIP Conference on the Architecture of Scientific Software which was held in Ottawa Canada in October 2000 It will prove invaluable reading for developers of scientific software as well as for researchers in computational sciences and engineering **Languages and Compilers for Parallel**

Computing Zhiyuan Li,1998-04-29 This book constitutes the refereed proceedings of the 12th Biennial Conference of the Canadian Society for Computational Studies of Intelligence AI 98 held in Vancouver BC Canada in June 1998 The 28 revised full papers presented together with 10 extended abstracts were carefully reviewed and selected from a total of more than twice as many submissions The book is divided in topical sections on planning constraints search and databases applications genetic algorithms learning and natural language reasoning uncertainty and learning Languages and Compilers for Parallel Computing ,1996 **Programming Models for Parallel Computing** Pavan Balaji,2015-11-20 An overview of the most prominent contemporary parallel processing programming models written in a unique tutorial style With the coming of the parallel computing era computer scientists have turned their attention to designing programming models that are suited for high performance parallel computing and supercomputing systems Programming parallel systems is complicated by the fact that multiple processing units are simultaneously computing and moving data This book offers an overview of some of the most prominent parallel programming models used in high performance computing and supercomputing systems today The chapters describe the programming models in a unique tutorial style rather than using the formal approach taken in the research literature The aim is to cover a wide range of parallel programming models enabling the reader to understand what each has to offer The book begins with a description of the Message Passing Interface MPI the most common parallel programming model for distributed memory computing It goes on to cover one sided communication models ranging from low level runtime libraries GASNet OpenSHMEM to high level programming models UPC GA Chapel task oriented programming models Charm ADLB Scioto Swift CnC that allow users to describe their computation and data units as tasks so that the runtime system can manage computation and data movement as necessary and parallel programming models intended for on node parallelism in the context of multicore architecture or attached accelerators OpenMP Cilk Plus TBB CUDA OpenCL The book will be a valuable resource for graduate students researchers and any scientist who works with data sets and large computations Contributors Timothy Armstrong Michael G Burke Ralph Butler Bradford L Chamberlain Sunita Chandrasekaran Barbara Chapman Jeff Daily James Dinan Deepak Eachempati Ian T Foster William D Gropp Paul Hargrove Wen mei Hwu Nikhil Jain Laxmikant Kale David Kirk Kath Knobe Ariram Krishnamoorthy Jeffery A Kuehn Alexey Kukanov Charles E Leiserson Jonathan Lifflander Ewing Lusk Tim Mattson Bruce Palmer Steven C Pieper Stephen W Poole Arch D Robison Frank Schlimbach Rajeev Thakur Abhinav Vishnu Justin M Wozniak Michael Wilde Kathy Yelick Yili Zheng **An Implementation of the LPAR Parallel Programming Model for Scientific Computations** Scott R. Kohn,1993

Parallel Processing for Scientific Computing Michael A. Heroux,Padma Raghavan,Horst D. Simon,2006-01-01 Scientific computing has often been called the third approach to scientific discovery emerging as a peer to experimentation and theory Historically the synergy between experimentation and theory has been well understood experiments give insight into possible theories theories inspire experiments experiments reinforce or invalidate theories and so on As scientific

computing has evolved to produce results that meet or exceed the quality of experimental and theoretical results it has become indispensable Parallel processing has been an enabling technology in scientific computing for more than 20 years This book is the first in depth discussion of parallel computing in 10 years it reflects the mix of topics that mathematicians computer scientists and computational scientists focus on to make parallel processing effective for scientific problems Presently the impact of parallel processing on scientific computing varies greatly across disciplines but it plays a vital role in most problem domains and is absolutely essential in many of them Parallel Processing for Scientific Computing is divided into four parts The first concerns performance modeling analysis and optimization the second focuses on parallel algorithms and software for an array of problems common to many modeling and simulation applications the third emphasizes tools and environments that can ease and enhance the process of application development and the fourth provides a sampling of applications that require parallel computing for scaling to solve larger and realistic models that can advance science and engineering This edited volume serves as an up to date reference for researchers and application developers on the state of the art in scientific computing It also serves as an excellent overview and introduction especially for graduate and senior level undergraduate students interested in computational modeling and simulation and related computer science and applied mathematics aspects Contents List of Figures List of Tables Preface Chapter 1 Frontiers of Scientific Computing An Overview Part I Performance Modeling Analysis and Optimization Chapter 2 Performance Analysis From Art to Science Chapter 3 Approaches to Architecture Aware Parallel Scientific Computation Chapter 4 Achieving High Performance on the BlueGene L Supercomputer Chapter 5 Performance Evaluation and Modeling of Ultra Scale Systems Part II Parallel Algorithms and Enabling Technologies Chapter 6 Partitioning and Load Balancing Chapter 7 Combinatorial Parallel and Scientific Computing Chapter 8 Parallel Adaptive Mesh Refinement Chapter 9 Parallel Sparse Solvers Preconditioners and Their Applications Chapter 10 A Survey of Parallelization Techniques for Multigrid Solvers Chapter 11 Fault Tolerance in Large Scale Scientific Computing Part III Tools and Frameworks for Parallel Applications Chapter 12 Parallel Tools and Environments A Survey Chapter 13 Parallel Linear Algebra Software Chapter 14 High Performance Component Software Systems Chapter 15 Integrating Component Based Scientific Computing Software Part IV Applications of Parallel Computing Chapter 16 Parallel Algorithms for PDE Constrained Optimization Chapter 17 Massively Parallel Mixed Integer Programming Chapter 18 Parallel Methods and Software for Multicomponent Simulations Chapter 19 Parallel Computational Biology Chapter 20 Opportunities and Challenges for Parallel Computing in Science and Engineering Index *Introduction to Parallel Computing* Vipin Kumar,1994 Mathematics of Computing Parallelism Parallel Computing Technologies ,1999 *Scientific Computing in Object-oriented Parallel Environments* ,1997 *Modular Programming Languages* ,2000 **Conference Record of HPCS ...** ,1997 **Introduction to High Performance Computing for Scientists and Engineers** Georg Hager,Gerhard Wellein,2010-07-02 Written by high performance computing HPC experts Introduction to High Performance Computing for

Scientists and Engineers provides a solid introduction to current mainstream computer architecture dominant parallel programming models and useful optimization strategies for scientific HPC From working in a scientific computing center the author Practical Parallel Computing Paul Messina,Almerico Murli,1991 This is a special issue of the journal Concurrency Practice and Experience It synthesizes contributions from researchers at the forefront of this leading edge technology and reports the latest results from internationally renowned research centers Describes actual experiences in solving a wide range of scientific and computationally intensive problems Discusses such state of the art systems as massively parallel computers parallel and distributed object oriented systems and various types of connection machines Includes applications from disciplines ranging from neural networking to image analysis fluid flows and seismic modeling **Proceedings of the ... ACM SIGPLAN Symposium on Principles & Practice of Parallel Programming** ,2006 **USENIX C++ Technical Conference** ,1992 **SIAM Journal on Computing** Society for Industrial and Applied Mathematics,2000

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