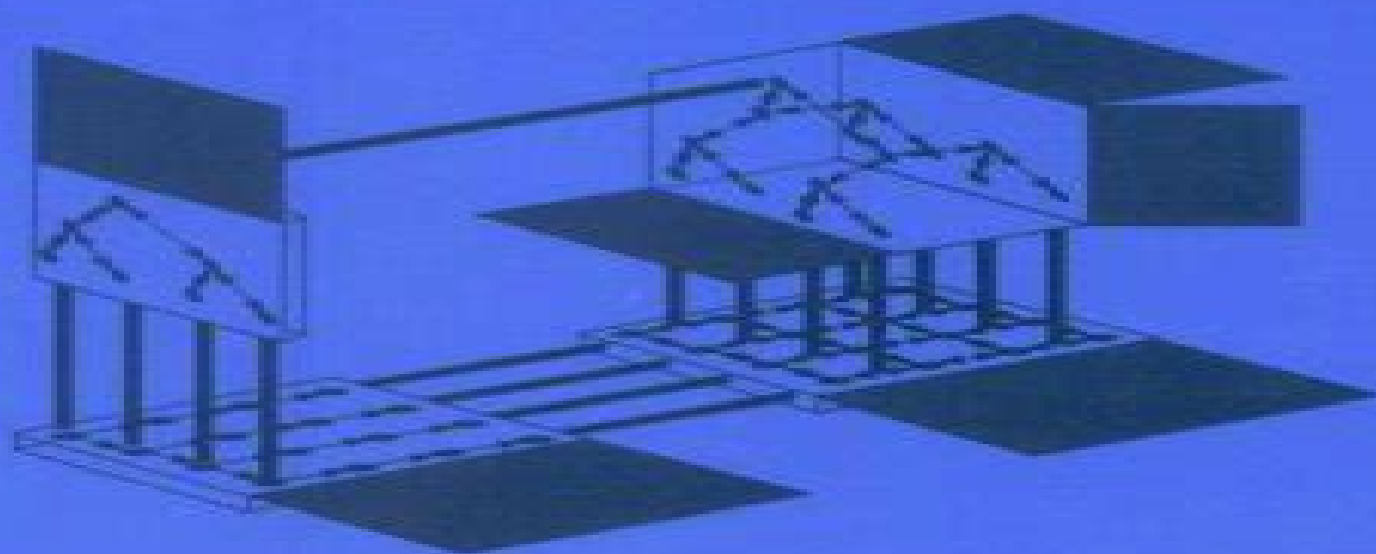


# CONCURRENT AGGREGATES

SUPPORTING MODULARITY IN  
MASSIVELY PARALLEL PROGRAMS



ANDREW A. CHIEN

# Concurrent Aggregates

**Roman Wyrzykowski**



## **Concurrent Aggregates:**

Concurrent Aggregates Andrew Andai Chien, 1993 Concurrent Aggregates addresses a key problem in programming languages for massively parallel machines how to write programs that are both modular and highly concurrent It describes a novel approach for managing program complexity based on multi access data abstractions and combining ideas from object oriented and data parallel approaches that allows programmers to build modular programs without sacrificing concurrency The concepts are developed and using application kernels evaluated for effectiveness and implementability The programming language called Concurrent Aggregates incorporates innovative data abstraction tools that allow unlimited concurrency Concurrent Aggregates surpasses existing data parallel languages in its support for arbitrary concurrent abstractions not simply arrays or sets as well as its support for heterogeneous concurrency By adapting a proven complexity management and code reuse technique data abstraction to massively parallel systems Chien produces a language suited for high degrees of concurrency and modular programs The data abstraction tools aggregates permit exploitation of both homogeneous data and heterogeneous concurrency operations against a parallel abstraction in uniform and efficient style Aggregates can encapsulate arbitrary amounts of data and concurrency thus limiting the complexity of Concurrent Aggregates programs Concurrent Aggregates even supports efficient composition of concurrent data abstractions Concurrent Aggregates is designed for machines of the future Chien presents a vision of how to organize computations on massively parallel MIMD machines and program them in modular fashion while facilitating efficient execution by allowing tuning within each abstraction His unique perspective as a designer of the processor network and operating systems for the J Machine prototype results in a language design that reflects the costs of computation in future systems Andrew Andai Chien is Assistant Professor in the Department of Computer Science at the University of Illinois at Champaign Urbana

**Specification of Parallel Algorithms** Guy E. Blelloch, K. Mani Chandy, Suresh Jagannathan, 1994 This volume contains papers presented at the DIMACS workshop on Specification of Parallel Algorithms held in May 1994 at Princeton University The goal of the workshop was to bring together some of the best researchers in parallel languages algorithms and systems to present and discuss recent developments in their areas of expertise Among the topics discussed were new specification techniques for concurrent and distributed systems behavioral and operational specification techniques new parallel language and system abstractions novel concurrent architectures and systems large scale parallel systems specification tools and environments and proof techniques for concurrent systems

**Object-Technologies for Advanced Software** Kokichi Futatsugi, Satoshi Matsuoka, 1996-02-28 This book constitutes the refereed proceedings of the Second International Symposium on Object Technologies for Advanced Software ISOTAS 96 held in Ishikawa Japan in March 1996 ISOTAS 96 was sponsored by renowned Japanese and international professional organisations The 14 papers included in final full versions together with the abstracts of four invited papers were carefully reviewed and selected from a total of 56 submissions they address most

current topics in object software technology object oriented programming object oriented databases etc The volume is organized in sections on design and evolution parallelism and distribution meta and reflection and evolution of reuse

**Languages and Compilers for Parallel Computing** Utpal Banerjee,1993-12-08 The articles in this volume are revised versions of the best papers presented at the Fifth Workshop on Languages and Compilers for Parallel Computing held at Yale University August 1992 The previous workshops in this series were held in Santa Clara 1991 Irvine 1990 Urbana 1989 and Ithaca 1988 As in previous years a reasonable cross section of some of the best work in the field is presented The volume contains 35 papers mostly by authors working in the U S or Canada but also by authors from Austria Denmark Israel Italy Japan and the U K

**The Semantics and Implementation of Aggregates Or how to Express Concurrency Without Destroying Determinism** Thomas Clarke,1990

**Object-Based Parallel and Distributed Computation** Jean-Pierre Briot,1996-07-24 This book contains a refereed collection of revised papers selected from the presentations at the France Japan Workshop on Object Based Parallel and Distributed Computation OBPDC 95 held in Tokyo in June 1995 The 18 full papers included in the book constitute a representative well balanced set of timely research contributions to the growing field of object based concurrent computing The volume is organized in sections on massively parallel programming languages distributed programming languages formalisms distributed operating systems dependable distributed computing and software management

**Parallel Symbolic Computing: Languages, Systems, and Applications** Robert H.

Halstead,Takayasu Ito,1993-11-03 Parallel and distributed computing are becoming increasingly important as cost effective ways to achieve high computational performance Symbolic computations are notable for their use of irregular data structures and hence parallel symbolic computing has its own distinctive set of technical challenges The papers in this book are based on presentations made at a workshop at MIT in October 1992 They present results in a wide range of areas including speculative computation scheduling techniques program development tools and environments programming languages and systems models of concurrency and distribution parallel computer architecture and symbolic applications

**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

### **Annual Review Of Scalable Computing, Vol 2**

Chung Kwong Yuen,2000-11-14 Continuing the Series on Scalable Computing launched in 1999 this volume presents five articles reviewing significant current developments in the field The topics include the collaborative activities support system parallel languages Internet Java the multithreaded dataflow machine and task allocation algorithms

### **Annual Review of Scalable Computing**

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### **Concurrent Aggregates (CA): an Object-oriented Language for Fine-grained Message-passing Machines**

Massachusetts Institute of Technology. Artificial Intelligence Laboratory,Andrew Andai Chien,1990 Fine grained parallel machines exhibit great potential for high speed computation Several machines such as the J machine and the Mosaic C are projected to provide peak performance of 100 s of billions of instructions per second in an air cooled computer that fits in a cubic meter While the hardware technology to build fine grained machines is available significant challenges remain in developing software systems to harness their computational power To program massively concurrent MIMD machines programmers need tools for managing complexity One important tool used in the sequential programming world is hierarchies of abstractions Unfortunately most concurrent object oriented languages construct hierarchical abstractions from objects that serialize serializing the abstractions In machines with tens of thousands of processors this unnecessary serialization can cause significant loss of concurrency Tools for managing concurrency should not restrict or reduce program concurrency Concurrent Aggregated CA provides multiple access data abstraction tools Aggregates for managing program

complexity These tools can be used to implement abstractions with virtually unlimited potential for concurrency Such tools allow programmers to modularize programs without reducing concurrency These aggregates can be composed hierarchies of abstractions allowing the structuring of a program to be highly concurrent at all levels kr Parallel Computing on Distributed Memory Multiprocessors Füsün Özgüner, Fikret Ercal, 2012-12-06 Advances in microelectronic technology have made massively parallel computing a reality and triggered an outburst of research activity in parallel processing architectures and algorithms Distributed memory multiprocessors parallel computers that consist of microprocessors connected in a regular topology are increasingly being used to solve large problems in many application areas In order to use these computers for a specific application existing algorithms need to be restructured for the architecture and new algorithms developed The performance of a computation on a distributed memory multiprocessor is affected by the node and communication architecture the interconnection network topology the I/O subsystem and the parallel algorithm and communication protocols Each of these parameters is a complex problem and solutions require an understanding of the interactions among them This book is based on the papers presented at the NATO Advanced Study Institute held at Bilkent University Turkey in July 1991 The book is organized in five parts Parallel computing structures and communication Parallel numerical algorithms Parallel programming Fault tolerance and Applications and algorithms Proceedings 20th International Conference Parallel Processing 1991 Tse-yun Feng, 1991-08-06 **Collected Papers** Thomas Chrowder Chamberlin, 1893 *Abstract Machine Models for Parallel and Distributed Computing* M. Kara, J. R. Davy, D. Goodeve, 1996 Abstract Machine Models have played a profound though frequently unacknowledged role in the development of modern computing systems They provide a precise definition of vital concepts allow system complexity to be managed by providing appropriate views of the activity under consideration enable reasoning about the correctness and quantitative performance of proposed problem solutions and encourage communication through a common medium of expression Abstract Models in Parallel and Distributed computing have a particularly important role in the development of contemporary systems encapsulating and controlling an inherently high degree of complexity The Parallel and Distributed computing communities have traditionally considered themselves to be separate However there is a significant contemporary interest in both of these communities in a common hardware model a set of workstation class machines connected by a high performance network The traditional Parallel Distributed distinction therefore appears under threat **Parallel Processing and Applied Mathematics** Roman Wyrzykowski, 2008-05-26 This book constitutes the thoroughly refereed post conference proceedings of the 7th International Conference on Parallel Processing and Applied Mathematics PPAM 2007 held in Gdansk Poland in September 2007 The 63 revised full papers of the main conference presented together with 85 revised workshop papers were carefully reviewed and selected from over 250 initial submissions The papers are organized in topical sections on parallel distributed architectures and mobile computing numerical algorithms and parallel numerics parallel and distributed non

numerical algorithms environments and tools for as well as applications of parallel distributed grid computing evolutionary computing meta heuristics and neural networks The volume proceeds with the outcome of 11 workshops and minisymposia dealing with novel data formats and algorithms for dense linear algebra computations combinatorial tools for parallel sparse matrix computations grid applications and middleware large scale computations on grids models algorithms and methodologies for grid enabled computing environments scheduling for parallel computing language based parallel programming models performance evaluation of parallel applications on large scale systems parallel computational biology high performance computing for engineering applications and the minisymposium on interval analysis      *Scientific and*

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