An Annotated Bibliography on Using Parallel Processing Systems (With Emphasis on Topics Related to Air Quality Modeling)

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Introduction

This work is broken down into the following sections:

Annotated Bibliography

[Aba93] B. Abali, F. Özgünar, and A. Bataineh, "Balanced Parallel Sort on Hypercube Multiprocessors," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 5, May, 1993, pp. 572-581.

This paper presents a parallel sorting algorithm which achieves a perfect load balance on a hypercube multiprocessor. Experimental results are obtained on an Intel iPSC/2 with 16 nodes.

Relevance: 3

[Ala93] G. Alaghband, M. S. Benten, R. Jakob, H. F. Jordan, and A. V. Ramanan, "Language Portability Across Shared Memory Multiprocessors," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 9, September, 1993, pp. 1064-1072.

Force is a Fortran-like programming language that has been implemented on a wide variety of shared memory multiprocessors: HEP, Flex/32, Encore Multimax, Sequent Balance and Symmetry, Alliant FX, Convex, IBM 3090, and Cray. For each implementation, Force uses a two-level macro processor: the upper-level machine-independent macros make use of a small number of lower-level machine-dependent macros, which are the only units which must be implemented for each machine.

See also [Jor89].

Relevance: 2

[Alv93] G. A. Alverson and D. Notkin, "Program Structuring for Effective Parallel Portability," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 9, Sept., 1993, pp. 1041-1059.

This paper introduces Chameleon, a model and system used for structuring programs for effective portability across shared-memory platforms. Programs under Chameleon are defined in terms of data structure and partitioning-scheduling abstraction in a C++-like manner to avoid program rewriting during a port. The system has been tested on the Sequent Symmetry 81 with 20 processors and a BBN Butterfly Model GP1000 with 32 processors.

Relevance: 3

[Ami92] D. Amitai, A. Averbuch, S. Itzikowitz, and M. Israeli, "Parallel Adaptive and Time-Stabilizing Schemes for Constant-Coefficient Parabolic PDEs," *Computers and Mathematics with Applications*, Vol. 24, No. 10, Nov., 1992, pp. 33-53.

This paper presents new asynchronous and time-stabilizing finite-difference methods for constant-coefficient parabolic PDEs. These schemes allow adaptive and non-constant time increments and are suitable for multiprocessors with non-identical processors or unbalanced workload. Results on a Sequent Balance using 2-16 PEs show good efficiency but less accuracy as compared to other methods.

Relevance: 2

[Ami93] D. Amitai, A. Averbuch, M. Israeli, S. Itzikowitz, and E. Turkel, "A Survey of Asynchronous Finite-Difference Methods for Parabolic PDEs on Multiprocessors," *Applied Numerical Mathematics*, Vol. 12, Nos. 1-3, May., 1993, pp. 27-45.

This paper surveys parallel asynchronous finite-difference methods based on domain decomposition for parabolic PDEs, specifically, the multidimensional heat equation. Among those surveyed are the asynchronous, corrected asynchronous, time-stabilizing, parametric, and hybrid. The hybrid scheme, which can also be applied to nonlinear problems, showed high-order approximation and high efficiency on a parallel machine with 2-16 PEs.

Relevance: 2

[Amr92] B. S. Amruter, R. Joshi, and N. K. Karmarker, "A Projective Geometry Architecture for Scientific Computation," *Proceedings of the International Conference on Application Specific Array Processors*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 64-80.

This paper describes the architecture and implementation issues of a parallel computer architecture designed specifically for sparse matrix computations based on finite projective geometries. The resulting interconnection structure of the machine aids in load balancing, data-routing, and memory access conflicts.

Relevance: 2

[Ang93] M. Angelaccio and M. Colajanni, "Unifying and Optimizing Parallel Linear Algebra Algorithms," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 12, Dec., 1993, pp. 1382-1397.

This paper introduces Subcube Matrix Decomposition (SMD) to define a decomposition-independent programming environment which can be used for LU factorization and other linear algebra functions. Pseudocode for the meta-algorithms are included, which are appropriate for hypercube and mesh topologies. Experimental results are obtained on an Intel iPSC/2 with 128 nodes.

Relevance: 3

[Bab92] I. Babuska, H. C. Elman, and K. Markley, "Parallel Implementation of the hp-Version of the Finite Element Method on a Shared-Memory Architecture," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 6, Nov., 1992, pp. 1433-1459.

This paper analyzes the cost of the hp-version of the finite element method for solving two-dimensional PDEs on a shared-memory parallel computer. Some numerical results are presented for execution on an Alliant FX/8 with 4-16 PEs. The authors conclude that when using these methods, local computation dominates global; however, memory conflicts place limitations on the size and number of local problems than can be handled in parallel.

Relevance: 2

[Bas91] P. Bastian and G. Horton, "Parallelization of Robust Multigrid Methods: ILU Factorization and Frequency Decomposition Method," *SIAM Journal on Scientific and Statistical Computing*, Vol. 12, No. 6, Nov., 1991, pp. 1457-1470.

This paper presents the parallelization of two multigrid methods used to solve linear systems of equations arising from elliptical PDEs: multigrid with ILU smoothing and multigrid with frequency decomposition. Speedup and performance are based on two MIMD platforms: transputers with shared memory connected by a ring and transputers connected by a hypercube. The ILU method is shown to be superior in many cases over the other, and over the standard red-black smoother as well.

Relevance: 2

[Bec92] J. C. Becker and L. Dagum, "Particle Simulation on Heterogeneous Distributed Supercomputers," *Proceedings of the First International Symposium on High-Performance Distributed Computing*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 133-140.

This paper describes the implementation and performance of a three-dimensional particle simulation distributed between a Thinking Machines CM-2 with 32k processors and a Cray Y-MP, connected by both a High Performance Parallel Interface (HIPPI) and an optical network (UltraNet). Results are favorable but reveal that although the data transmission times between the two machines is not inhibiting, the data conversion time is costly.

Relevance: 2

[Beg91] A. Beguelin, J. J. Dongarra, G. A. Geist, R. Manchek, and V. S. Sunderam, “Graphical Development Tools for Network-Based Concurrent Supercomputing,” *Proceedings of Supercomputing '91*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1991, pp. 435-444.

This paper describes an X-window based software environment called HeNCE (Heterogeneous Network Computing Environment), which provides a paradigm and graphical support tools for programming a network of computers as a single resource. HeNCE is built on top of PVM, a software package that supports process management and communication between a network of heterogeneous computers.

HeNCE and PVM are available by sending
  send index from pvm
  send shmap from hence
to netlib@ornl.gov

Relevance: 3

[Bel90] A. Bellen, R. Vermiglio, and M. Zennaro, “Parallel ODE Solvers with Stepsize Control,” *Journal of Computation and Applied Mathematics*, Vol. 31, No. 2, Aug. 31, 1990, pp. 277-294.

This paper proposes a parallel implementation of one-step methods with stepsize control for the numerical solution of initial value problems for stiff and nonstiff ordinary differential equations. Detailed pseudocode is provided for the mesh-based method, as well as results from speedup estimation and numerical experiments simulated on a CDC CYBER-860-A. The researchers conclude that although speedup increases with the number of processors for their algorithm, efficiency decreases.

Relevance: 1

[Bel92] A. Bellen and F. Tagliaferro, “A Combined WR-Parallel Steps Method for ODEs,” in P. Messina and A. Murli (Eds.), *Parallel Computing: Problems, Methods, and Applications*, Elsevier, Amsterdam, 1992, pp. 77-86.

This paper proposes a method of combining wave relaxation (Jacobi, Gauss-Seidel, SOR, etc.) with a parallel steps method to solve ordinary differential equations. Concurrency is performed across the time in each equation rather than across the system. Numerical results are included to show how the implementation affects the number of iterations required for acceptable inaccuracies.

Relevance: 1

[Bel93] A. Bellen and M. Zennaro, “The Use of Runge-Kutta Formulae in Waveform Relaxation Methods,” *Applied Numerical Mathematics*, Vol. 11, Nos. 1-3, Jan., 1993, pp. 95-114.

This paper describes waveform relaxation methods based on Runge-Kutta processing for solving initial value problems for large systems of ODEs. Specifically, some guidelines for parallelizing WR-Gauss-Jacobi, WR-Gauss-Seidel, and WR-successive-overrelaxation methods are presented.

Relevance: 1

[Bla92] K. Black, "Polynomial Collocation Using a Domain Decomposition Solution to Parabolic PDEs via the Penalty Method and Explicit/Implicit Time Marching," *Journal of Scientific Computing*, Vol. 7, No. 4, Dec., 1992, pp. 313-338.

This paper describes a domain decomposition method for solving time-dependent parabolic PDEs. An advantage of this method is that interprocessor communication is minimized. Results compare performance on a single processor (IBM RISC 6000) with a multiprocessor (Intel iPSC/i860 with 32 nodes).

Relevance: 2

[Ble94] G. E. Blelloch, J. C. Hardwick, J. Sipelstein, M. Zagha, and S. Chatterjee, "Implementation of a Portable Nested Data-Parallel Language," *Journal of Parallel and Distributed Computing*, Vol. 21, No. 1, 1994, pp. 4-14.

This paper provides an overview of NESL, a portable nested data-parallel language, which is used for applications employing divide-and-conquer strategies or operating on irregular data structures. Currently, the language is portable across several platforms, including the CM-2, CM-5, Cray Y-MPC90, and serial workstations. Some performance benchmarks are included with comparisons against other languages.

NESL is available from nesl-request@cs.cmu.edu.

Mosaic URL: http://www.cs.cmu.edu:8001/Web/Groups/scandal/
www/papers.html

Relevance: 2

[Bod93] F. Bodin, P. Beckman, D. Gannon, S. Yang, S. Kesavan, A. Malony, and B. Mohr, "Implementing a Parallel C++ Runtime System for Scalable Parallel Systems," *Proceedings of Supercomputing '93*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1993, pp. 588-597.

This paper introduces pC++, a language that allows the user to write portable and efficient code which will run on a wide range of scalable parallel computer systems, including the CM-5, the Intel Paragon, the BBN TC2000, the KSR-1, and the Sequent Symmetry. One of the benchmark programs used is a fast Poisson solver for PDE problems. Comments on the performance behavior are included, as well as speedup figures.

Relevance: 3

[Bro89] P. N. Brown and G. D. Byrne, "VODE: A Variable-Coefficient ODE Solver," *SIAM Journal on Scientific and Statistical Computing*, Vol. 10, No. 5, Sept., 1989, pp. 1038-1051.

This paper introduces VODE, a variable-coefficient ODE solver for both stiff and nonstiff systems. VODE borrows implementation and user interface ideas from EPISODE [Hin76]. Two examples of a diurnal kinetics-diffusion PDE system are given along with runtime results.

Relevance: 2 (EPA-recommended)

[Bro93] T. Brown and R. Xiong, "A Parallel Quicksort Algorithm," *Journal of Parallel and Distributed Computing*, Vol. 19, No. 2, 1993, pp. 83-84.

This paper provides pseudocode and mathematical analysis for an optimal parallel quicksort algorithm developed for shared-memory MIMD machines.

Relevance: 2

[Bur93] K. Burrage, "Parallel Methods for Initial Value Problems," *Applied Numerical Mathematics*, Vol. 11, Nos. 1-3, Jan., 1993, pp. 5-25.

This paper presents a review of recently developed techniques that address initial value problems with parallel numerical methods. Parallelism across time and parallelism across space for certain classes of problems are the primary focus. Some basic information on solving stiff ordinary differential equations, with respect to modeling long-range transportation of air pollutants in the atmosphere, is given in the introduction.

Relevance: 1*

[Byr75] G. D. Byrne and A. C. Hindmarsh, "A Polyalgorithm for the Numerical Solution of Ordinary Differential Equations," *ACM Transactions on Mathematical Software*, Vol. 1, No. 1, March, 1975, pp. 71-96.

This paper presents a combination of two methods for the numerical solution of the initial value problem for ordinary differential equations. The mathematical analysis required to arrive at the serial algorithm is provided along with a block diagram of the algorithm, which when combined with a driver and auxiliary subroutines, form a complete EPISODE (Experimental Package for Integration of Systems of Ordinary Differential Equations) package. This code implements a polyalgorithm, which "contains many algorithms for the same problem, from which the user can easily select the one most appropriate."

Relevance: 2 (EPA-recommended)

[Byr87] G. D. Byrne and A. C. Hindmarsh, "Stiff ODE Solvers: A Review of Current and Coming Attractions," *Journal of Computational Physics*, Vol. 70, No. 1, May, 1987, pp. 1-62.

This paper provides a backdrop for current research in computing solutions to stiff ODEs. The authors begin with an explanation of the general problem, which is followed by a survey of solution methods and examples. A history of applicable software packages written for serial machines is included, along with some comments of their appropriate use.

Relevance: 2 (EPA-recommended)

[Car94] G. Carey, J. Schmidt, V. Singh, and D. Yelton, "A Prototype Scalable, Object-Oriented Finite Element Solver on Multicomputers," *Journal of Parallel and Distributed Computing*, Vol. 20, No. 3, March, 1994, pp. 357-379.

This paper presents research experience with object-oriented development on a parallel computer. Code and execution analysis are provided for implementation of a finite element solver on a Motorola multicomputer with 1-16 processors, and MCC ES-kit multicomputer with 1-4 processors and a group of 1-16 Sun workstations connected by Ethernet.

Relevance: 2

[Chak93] A. Chakraborty, D. C. S. Ribbens, and L. T. Watson, "The Parallel Complexity of Embedding Algorithms for the Solution of Systems of Nonlinear Equations," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 4, April, 1993, pp. 458-465.

This paper describes static and dynamic mapping strategies for solving systems of nonlinear equations on a hypercube. Experiments performed on a 32-node Intel iPSC/1 hypercube with varying problem parameters led the researchers of several conclusions describing when to use static vs. dynamic mapping, and how problem characteristics may affect solutions on a hypercube.

Relevance: 2

[Cha90] T. F. Chan and D. Goovaerts, "A Note on the Efficiency of Domain Decomposed Incomplete Factorizations," *SIAM Journal on Scientific and Statistical Computing*, Vol. 11, No. 4, July, 1990, pp. 794-803.

This paper shows that domain decomposition is better than parallelizing standard sequential methods in the case of iterative solutions of elliptic PDEs by preconditioned conjugate gradient iteration. Included are ways to construct effective incomplete factorization preconditioners based on decomposition principles, which result in good convergence rates.

Relevance: 2

[Cha92] C. M. Chase, A. L Cheung, A. P. Reeves, and M. R. Smith, "Paragon: A Parallel Programming Environment for Scientific Applications Using Communication Structures," *Journal of Parallel and Distributed Computing*, Vol. 16, No. 2, Oct., 1992, pp. 79-91.

This paper describes Paragon, a programming environment designed for the development of large-scale scientific applications on parallel machines. Current implementations of Paragon run on serial workstations, the Intel iPSC/2 and iPSC/860 machines, and the Encore Multimax; however, the objective of the designers is to provide a common programming environment capable of efficient execution on any parallel architecture. A PDE solver using the Chebyshev Successive Over Relaxation (CSOR) method is presented as an example application, which highlights some of Paragon's programming features.

Relevance: 3

[Chau93] V. Chaudhary and J. K. Aggarwal, "A Generalized Scheme for Mapping Parallel Algorithms," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 3, March, 1993, pp. 328-346.

This paper presents a scheme for mapping parallel algorithms to parallel architectures when the structure of the algorithm differs from the interconnection network of the machine or when the number of processes generated by the algorithm exceeds the number of processors available. The mapping involves developing a brief series of graphs which take into account the interdependence between the algorithm and the architecture. To verify the validity of the method, simulation on 4-node and 8-node hypercubes, as well as actual implementation in a distributed environment, were performed.

Relevance: 2

[Che92] D. Y. Cheng and D. M. Pase, "An Evaluation of Automatic and Interactive Parallel Programming Tools," *Proceedings of Supercomputing '92*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1992, pp. 412-423.

This paper provides and evaluation of two automatic tools and one interactive tool: the Cray Autotasking facility, fpp; the Kuck and Associates KAP/Cray; and the Pacific Sierra Research Forge program, respectively. Through the use of 25 NAS applications on the Cray Y-MP, the researchers found the automatic tools produced insufficient performance, while the interactive tool was able to enhance performance through assisting the user in finding and eliminating false dependencies. Since even these benefits are often cancelled out by naive code transformation, the tools need to be tailored for optimization on specific machines.

Relevance: 3

[Chr91-1] A. T. Chronopoulos, "Towards Efficient Parallel Implementation of the CG Method Applied to a Class of Block Tridiagonal Linear Systems," *Proceedings of Supercomputing '91*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1991, pp. 578-587.

This paper presents a theoretical implementation of the s-step conjugate gradient method to solve an elliptic partial differential equation. This technique works on both a vector parallel system with a memory hierarchy and a message passing distributed memory hierarchy. Through various comparisons, the author concludes that the s-step methods provide substantial performance enhancement over the standard methods.

Relevance: 2

[Chr91-2] N. P. Chrisochoides, C. E. Houstis, E. N. Houstis, P. N. Papachiou, S. K Kortesis, and J. R. Rice, "DOMAIN DECOMPOSER: A Software Tool for Mapping Partial Differential Computations to Parallel Architectures," in R. Glowinski, Y. A. Kuznetsov, G. Meurant, J. Périaux, and O. B. Widlund (Eds.), *Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations*, SIAM, 1991, pp. 341-357.

This paper discusses the DOMAIN DECOMPOSER tool (DecTool) used for quickly determining the otherwise NP-hard problem of determining the optimal mapping of PDE data suitable for domain decomposition methods on MIMD machines. This system runs under X-windows and contains visualization and manipulation capabilities for the processor mappings.

Relevance: 2

[Chr94] N. Chrisochoides, E. Houstis, and J. Rice, “Mapping Algorithms and Software Environment for Data Parallel PDE Iterative Solvers,” *Journal of Parallel and Distributed Computing*, Vol. 21, No. 1, April, 1994, pp. 75-95.

This paper presents two non-NP-complete algorithms for mapping PDE computations into load-balanced parallel tasks. The performance of these algorithms is evaluated against other data mapping algorithms on the NCUBE II. Additionally, a graphical software environment, DecTool, for solving the partitioning problem of data parallel iterative solvers is included to show how the user can control domain decomposition interactively on a workstation connected to the NCUBE through a local area network.

Relevance: 1

[Col90] T. F. Coleman and G. Li, “Solving Systems of Nonlinear Equations on a Message-Passing Multiprocessor,” *SIAM Journal on Scientific and Statistical Computing*, Vol. 11, No. 6, Nov., 1990, pp. 1116-1135.

This paper presents the following parallel algorithms for the solution of dense systems of nonlinear equations: a distributed finite-difference Newton method, a multiple secant method, and a rank-1 secant method. Experimental results on an Intel Hypercube with 1 and 16 nodes show that these methods give good speedups on message-passing multiprocessors.

Relevance: 2

[Cor92] P. F. Corbett and I. D. Scherson, “Sorting in Mesh Connected Multiprocessors,” *IEEE Transactions on Parallel and Distributed Systems*, Vol. 3, No. 5, Sept., 1992, pp. 626-632.

This short note presents two efficient sorting algorithms, MeshSort and FastMeshSort, of which Bitonic Sort and Shear Sort are special cases. Both operate only on complete vectors of the mesh and can be extended to irregularly shaped meshes, and all other orthogonally connected multiprocessors.

Relevance: 3

[Cow92] L. C. Cowsar, E. J. Dean, r. Glowinski, P. Le Tallec, C. H. Li, J. Periaux, and M. F. Wheeler, “Decomposition Principles and their Applications in Scientific Computing,” in J. Dongarra (Ed.), *Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computing*, SIAM, Philadelphia, 1992, pp. 213-237.

This paper discusses three classes of computational methods based on decomposition principles: domain decomposition methods for PDEs, time discretization by operator splitting methods, and decomposition of variational problems by Lagrange multiplier methods. Numerical experiments and sample applications are provided for each method on an Intel i860 hypercube with 128 PEs.

Relevance: 2

[Cox91] C. L. Cox and J. A. Knisely, “A Tridiagonal System Solver for Distributed Memory Parallel

Processors with Vector Nodes," *Journal of Parallel and Distributed Computing*, Vol. 13, No. 3, Nov., 1991, pp. 325-.

This paper presents the odd-even cyclic reduction algorithm for solving tridiagonal linear systems and ultimately differential equations, in which the number of equations is much larger than the number of processors. Tests are run on the Intel iPSC/2-VX, which is a distributed memory parallel computer with nodes that are themselves vector processors, that balance computations among the nodes evenly, but with some overlap in computation. Results for the Fortran implementation, which are evaluated under Gustafson's concept of scaled speedup, show efficiency around 90%.

Relevance: 2

[Cri94] M. R. Crisci, "Parallel Frontal Methods for Ordinary Differential Equations," *BIT*, Vol. 34, No. 2, 1994, pp. 215-227.

This paper presents parallel frontal predictor-corrector methods for solving systems of nonstiff ODEs. These methods do not achieve massive parallelism across time and are of the same order as serial methods. Numerical results are included for the Encore Multimax with 4 PEs.

Relevance: 2

[Cro94] L. A. Crowl, M. E. Crovella, T. J. LeBlanc, and M. L. Scott, "The Advantages of Multiple Parallelizations in Combinatorial Search," *Journal of Parallel and Distributed Computing*, Vol. 21, No. 1, April, 1994, pp. 116-123.

This paper analyzes the use of various forms of parallelism and the combination of these methods to achieve higher performance. Combinational search was chosen as an example application for testing with implementation and execution results reported on the following machines: the Sequent Balance (19 processors), the Silicon Graphics Iris (8 processors), the BBN Butterfly One (39 processors), the BBN Butterfly TC2000 (21 processors), the IBM 8CE (7 processors), and the KSR1 (32 processors). From their experiences, the researchers conclude that there is no one best parallelization that suffices over a range of machines, inputs, and precise problem specifications.

Relevance: 2

[Cve90] Z. Cvetanovic, E. G. Freedman, and C. Nofsinger, "Efficient Decomposition and Performance of Parallel PDE, FFT, Monte Carlo Simulations, Simplex, and Sparse Solvers," *Proceedings of Supercomputing '90*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1990, pp. 465-474.

This paper presents the decomposition and performance results, among others, of the following two PDE solvers on a VAX 6300 series with up to 8 processors and an M31 with up to 22 processors: Successive Over-Relaxation (SOR) and Alternating Discrete Implicit (ADI). Although ADI's speedup is worse than SOR's, ADI's overall elapsed time is much less than that of SOR; therefore, using speedup only as a performance measurement is misleading. The researchers also provide some insight into a number of techniques for achieving efficient algorithm decomposition, including reducing the number of synchronization points, eliminating (even small) sequential sections of code, developing asyn-

chronous pipelined algorithms to reduce synchronization overhead, increasing data locality to take advantage of cache block size, and reducing data dependence through preliminary analysis.

Relevance: 2

[De K92] J. De Keyser and D. Roose, "Multigrid with Solution-Adaptive Irregular Grids on Distributed Memory Computers," in D. J. Evans, G. R. Joubert, and H. Liddell (Eds.), *Parallel Computing '91 - Proceedings of the International Conference on Parallel Computing*, North-Holland, Amsterdam, 1992, pp. 375-382.

This paper describes a multigrid method based on a solution-adaptive hierarchy of irregular grids. Tradeoffs in performance exist between calculation load balancing and minimization of the communication overhead. Performance and efficiency results are reported for an iPSC/2 hypercube with 2-9 PEs.

Relevance: 2

[Don90] J. Dongarra, O. Brewer, J. A. Kohl, and S. Fineberg, "A Tool to Aid in the Design, Implementation, and Understanding of Matrix Algorithms for Parallel Processors," *Journal of Parallel and Distributed Computing*, Vol. 9, No. 2, June, 1990, pp. 185-202.

This paper describes the Shared-Memory Access Pattern (SHMAP) program, a tool for studying memory access patterns, different cache strategies, and the effects of multiprocessors on matrix algorithms in a Fortran setting. SHMAP runs under X-windows and graphically models shared-memory parallel machines with up to 16 separate PEs. Using such tools can potentially provide insight into algorithm behavior and possible bottlenecks before actual execution on a high-performance computer.

SHMAP is available by sending
send index from tools
send shmap from tools
to netlib@ornl.gov

Relevance: 2

[Don93] J. Dongarra, "Linear Algebra Libraries of High-Performance Computers," *IEEE Parallel and Distributed Technology*, Vol. 1, No. 1, Feb., 1993, pp. 17-24.

This highly readable article describes the Linpack and Lapack software for solving linear algebra problems on high-performance computers. Benchmark figures for Lapack are provided for a wide range of computers.

Relevance: 3

[Dow93] E. M. Dowling, Z. Fu, and R. S. Drafz, "HARP: An Open Architecture for Parallel Matrix and Signal Processing," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 10, Oct., 1993, pp. 1081-1091.

This paper describes the Hybrid Array Ring Processor (HARP) Architecture, which uses a

host processor, shared memory, Texas Instruments TMS34082 processors, and a bidirectional systolic ring to form application-specific hardware useful for matrix multiplication, FFT, QRD (for solving linear systems), and SVD (for matrix transformations). The machine may be programmed in Concurrent C as a shared-memory machine, a message-passing distributed memory machine, or a systolic array. Algorithms with regular data flows can achieve and sustain computation rates of 10 MFLOPS per processor (including program overhead and data I/O time).

Relevance: 3

[Duf91] I. S. Duff, "Exploitation of Parallelism in Direct and Semi-direct Solution of Large Sparse Systems," in A. E. Fincham and B. Ford, (Eds.), *Parallel Computation Conference Proceedings*, Clarendon Press, Oxford, 1991, pp. 159-174.

This paper describes ways to take advantage of parallelism when solving large linear systems used in Gaussian elimination. A general partitioning and block iterative approach aids in parallelizing the problem. The performance of the algorithm discussed is included for the Cray-2, the IBM 3090/VF, the Alliant FX/80, and the BN TC-2000.

Relevance: 2

[Elm93] H. C. Elman and X. -Z. Guo, "Performance Enhancements and Parallel Algorithms for Two Multilevel Preconditioners," *SIAM Journal on Scientific Computing*, Vol. 14, No. 4, July, 1993, pp. 890-913.

This paper presents a parallel algorithm that works in conjunction with the hierarchical basis Bramble, Pasciak and Xu (PBX) and multilevel preconditioners for elliptic PDEs. Descriptions and pseudocode are included for the algorithm, as well as numerical results on a CM1 with 8192 PEs and a CM2 with 16,384 PEs.

Relevance: 2

[Eva90-1] D. J. Evans and C. Li, "Successive Underrelaxation (SUR) and Generalised Conjugate Gradient (GCG) Methods for Hyperbolic Difference Equations on a Parallel Computer," *Parallel Computing*, Vol. 16, Nos. 2-3, Dec., 1990, pp. 207-220.

This paper compares the serial and parallel successive underrelaxation (SUR) and generalised conjugate gradient (GCG) methods used in the solution of hyperbolic initial value problems. Numerical results on a Sequent Balance 8000 with 1-9 PEs show that in the general case, the SUR is twice as fast as the GCGT scheme.

Relevance: 2

[Eva90-2] D. J. Evans and W. S. Yousif, "The Implementation of the Explicit Block Iterative Methods on the Balance 8000 Parallel Computer," *Parallel Computing*, Vol. 16, No. 1, Nov., 1990, pp. 81-97.

This paper describes variants of the implementation of explicit block iterative methods for solving elliptic PDEs. Advantages and limitations of the methods are cited, along with some strategies and recommendations for achieving better performance. Test results are given for a Sequent Balance 8000 with 1-9 PEs.

Relevance: 2

[Evr93] P. Evripidon and J. -L. Gaudiot, "Block Scheduling of Iterative Algorithms and Graph-Level Priority Scheduling in a Simulated Data-Flow Multiprocessor," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 4, April, 1993, pp. 398-413.

This paper focuses on exploiting parallelism of iterative algorithms in data-flow multiprocessors. Although the methods presented are general in nature, the researchers specifically study iterative solvers for linear systems, which are used extensively in PDE solvers. The method basically involves scheduling the iterative portion of the algorithm in blocks and looking ahead across iterations to eliminate the sequential characteristics of the algorithm.

Relevance: 3

[Far93] C. Farhat and M. Lesoinne, "Mesh Partitioning Algorithms for the Parallel Solution of Partial Differential Equations," *Applied Numerical Mathematics*, Vol. 12, No. 5, July, 1993, pp. 443-457.

This paper elaborates on the idea of using mesh partitioning methods to solve partial differential equations instead of the more common divide-and-conquer schemes. Such solutions are useful for methods which require grids of points or patches of elements. A family of cost-effective algorithms for automatically partitioning arbitrary two- and three-dimensional finite element and finite difference meshes are given and analyzed. The target machine for the algorithms is a MIMD hypercube, with example problems demonstrated on the iPSC/2 and iPSC/860.

Relevance: 2

[Fij93] A. Fijany, "Time Parallel Algorithms for Solution of Linear Parabolic Partial Differential Equations," in S. Hariri and P. B. Berra, (Eds.), *Proceedings of the 1993 International Conference on Parallel Processing - Vol. III, Algorithms and Applications*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 51-55.

This paper proposes a parallel time-stepping method for the solution of parabolic PDEs. The described method decouples the usual serial nature of the time-stepping technique and allows all time steps to be computed simultaneously. Although no specific implementation is described, near linear speedup is expected on MIMD machines.

Relevance: 2

[Fra94] R. S. Francis, I. D. Mathieson, P. G. Whiting, M. R. Dix, H. L. Davies, and L. D. Rotstayn, "A Data Parallel Scientific Modeling Language," *Journal of Parallel and Distributed Computing*, Vol. 21, No. 1, April, 1994, pp. 45-60.

This paper describes the data parallel meta language (DPML) and its associated Fortran source code rewriter (DP77), which support high-performance models (e.g., climate and weather prediction) independent of computer architecture. Some example code is included as well as a short climate modeling application, which is analyzed through execution comparison on vector, SIMD, and MIMD machines, i.e., SUN SPARCstation-2 (1 processor), SGI (8 processors), CRAY Y-MP (1 processor) and MasPar MP-1 (4096 processors).

Relevance: 2

[Gal92] E. Gallopoulos and Y. Saad, "Efficient Solution of Parabolic Equations by Krylov Approximation Methods," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 5, Sept., 1992, pp. 1236-1264.

This paper presents numerical techniques for solving parabolic equations by the method of lines and high-dimension Krylov subspaces. Because of the larger time steps involved in the Krylov subspaces and hence, the reduction in the number of steps overall, performance of the algorithm is improved. Comparisons to other implicit and explicit algorithms and remarks on extending the methods to general ODEs and non-linear PDEs are provided, as well as explanations for implementation on a Cray Y-MP and a Cray-2.

Relevance: 1

[Gar94] V. K. Garg and B. Waldecker, "Detection of Weak Unstable Predicates in Distributed Programs," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 3, March, 1994, pp. 299-307.

A fundamental problem of distributed computing is the detection of global predicates (i.e., a condition that depends on the state of multiple processes), which could produce undesirable execution sequences. This paper includes a formal algorithm for detecting weak unstable predicates and a brief section on how the algorithm is incorporated into the UTDDB (University of Texas Distributed Debugger).

Relevance: 3

[Gär92] U. Gärtel and K. Ressel, "Parallel Multigrid: Grid Partitioning versus Domain Decomposition," in R. Glowinski (Ed.), *Proceedings of the 10th International Conference on Computing Methods in Applied Sciences and Engineering*, Nova Science Publishers, Inc., New York, 1991, pp. 559-568.

This paper compares two strategies, grid partitioning and domain decomposition, for designing parallel multigrid methods used in solving elliptic differential equations. Results on an Intel hypercube with 4-16 nodes show that the domain decomposition methods are highly parallelizable, while the grid partitioning show higher numerical efficiency. Further, the former method achieves high multiprocessor efficiency, but at the expense of increased computation and communication due to the required global communication; the latter produces lower efficiency but also lower communication cost due to exclusive use of nearest neighbor communication.

Relevance: 2

[Gea93-1] C. W. Gear, "Massive Parallelism Across Space in ODEs," *Applied Numerical Mathematics*, Vol. 11, Nos. 1-3, Jan., 1993, pp. 27-43.

This paper and its companion, [Gea93-2], deal with parallelism across time and space for the solution of initial value ODEs by both direct and waveform relaxation methods. No specific performance results are given; however, some general guidelines are presented for implementation on various parallel architectures, such as shared memory and hypercube.

Relevance: 2

[Gea93-2] C. W. Gear and X. Xuhai, “Massive Parallelism Across Time in ODEs,” *Applied Numerical Mathematics*, Vol. 11, Nos. 1-3, Jan., 1993, pp. 45-67.

See [Gea93-1].

Relevance: 2

[Geh93] N. H. Gehani, “Capsules: A Shared Memory Access Mechanism for Concurrent C/C++,” *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 7, July, 1993, pp. 795-811.

This paper explains the notion of capsules in Concurrent C/C++, as well as gives examples of their use. Capsules blend syntactically and semantically with the C++ class facility and are similar to monitors in their data access-control features.

Relevance: 3

[Gir92] L. Giraud and P. Spiteri, “Implementations of Parallel Solutions for Nonlinear Boundary Value Problems,” in D. J. Evans, G. R. Joubert, and H. Liddell (Eds.), *Parallel Computing ‘91 - Proceedings of the International Conference on Parallel Computing*, North-Holland, Amsterdam, 1992, pp. 203-211.

This paper presents parallel implementations of synchronous and asynchronous relaxation subdomain algorithms for the solution of discretized PDEs. The performance of the synchronous and asynchronous algorithms are compared for a nonlinear boundary value problem on shared-memory architectures (the IBM 3090-400 and the Alliant FX/80) and on a network of T800 transputers.

Relevance: 2

[Göt91] J. Götze and U. Schwiegelshohn, “VLSI-Suited Orthogonal Solutions of Systems of Linear Equations,” *Journal of Parallel and Distributed Computing*, Vol. 11, No. 4, April, 1991, pp. 198-211.

This paper presents orthogonal solutions of systems of linear equations for one- and two-dimensional processor arrays. Each PE performs a Givens rotation, which requires only multiplication and addition with 1 single division at the end of the computation.

Relevance: 3

[Gra92] A. Y. Grama and V. Kumar, “Scalability Analysis of Partitioning Strategies for Finite Element Graphs: A Summary of Results," *Proceedings of Supercomputing '92*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1992, pp. 83-92.

This paper provides scalability analysis of three partitioning strategies for finite element meshes which are used in solving differential equations: striped partitioning, scattered decomposition, and binary decomposition. Results are based on the isoefficiency model and are included for hypercube and mesh-connected architectures.

Relevance: 2

[Grie91] M. Griebel, W. Huber, T. Störtkuhl, and C. Zenger, "On the Parallel Solution of 3D PDEs on a Network of Workstations and Vector Computers," in A. Bode and M. D. Cin (Eds.), *Parallel Computer Architectures - Theory, Hardware, Software, Applications*, Springer-Verlag, Amsterdam, 1991, pp. 276-291.

This paper explains the parallel solution of three-dimensional elliptic PDEs using the sparse grid continuation technique. Load balancing is addressed along with a parallel strategy to minimize data exchange. Experiments are run on a network of 110 HP720 workstations and on a Cray Y-MP4/464 with 1-4 PEs.

Relevance: 2

[Grim93-1] A. S. Grimshaw, W. T. Strayer, and P. Narayan, "Dynamic, Object-Oriented Parallel Processing," *IEEE Parallel and Distributed Technology*, Vol. 1, No. 2, May, 1993, pp. 33-47.

This article presents Mentat, a dynamic, object-oriented parallel processing system which provides tools for constructing medium-grain parallel software. Mentat's three design objectives are "high performance via parallel execution, easy parallelism, and software portability across a wide range of platforms." Some pseudocode and speedup figures are included for an iPSC/2 with 8-16 processors.

See also [Gri93-2].

Relevance: 3

[Grim93-2] A. S. Grimshaw, "Easy-to-Use Object-Oriented Parallel Processing with Mentat," *IEEE Computer*, Vol. 26, No. 5, May, 1993, pp. 39-51.

See [Gri93-1].

Relevance: 3

[Gro90] L. Gross, P. Sternecker, and W. Schönauer, "Optimal Data Structures for an Efficient Vectorized Finite Element Code," in H. Burkhart (Ed.), *CONPAR 90-VAPP IV - Joint International Conference on Vector and Parallel Proceedings*, Springer-Verlag, Berlin, 1990, pp. 435-446.

This paper presents a specialized data structure for efficiently computing large finite element (FEM) problems, which can be used to approximate certain types of initial value problems. The algorithm using these structures is executed in three steps: computing the

element matrices (grouping), converting these matrices to the data structure of the solver, and solving the linear set of equations. The current implementation uses Fortran 77 for the Siemens/Fujitsu VP400-EX with 7000 nodes, from which figures for the speedup are derived.

Relevance: 2

[Gro91] W. D. Gropp and D. E. Keyes, "Parallel Domain Decomposition and the Solution of Nonlinear Systems of Equations," in R. Glowinski, Y. A. Kuznetsov, G. Meurant, J. Périaux, and O. B. Widlund (Eds.), *Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations*, SIAM, 1991, pp. 373-381.

This paper considers the use of domain decomposition Krylov methods for the solution of linear problems arising from the larger problem of nonlinear equations resulting from a simple fixed-point or Newton's method iteration. Results for an Intel iPSC/2-SX with 4-64 PEs show that the domain decomposition is an effective preconditioner for the parallel solution of some nonlinear equations in which less than 100 PEs are used.

Relevance: 2

[Gro92] W. D. Gropp and D. E. Keyes, "Parallel Performance of Domain-Decomposed Preconditioned Krylov Methods for PDEs with Locally Uniform Refinement," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 1, Jan., 1992, pp. 128-145.

This paper analyzes the tradeoffs of Krylov preconditioners with local mesh refinement for PDEs on distributed and shared-memory computers. Although the mesh refinement is straightforward to implement, it introduces load balancing considerations which should be addressed. A convection-diffusion problem is considered and numerical results presented for the Encore Multimax with 1-16 PEs and the Intel iPSC/860 with 1-64 PEs.

Relevance: 2

[Gu94] Q. Ping Gu and J. Gu, "Algorithms and Average Time Bounds of Sorting on a Mesh-Connected Computer," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 3, March, 1994, pp. 308-315.

This paper provides three parallel sorting algorithms, with improved average time bound over other work, which run on a parallel machine with a torus interconnection network.

Relevance: 2

[Gup92] S. N. Gupta, M. Zubair, and C. E. Grosch, "A Multigrid Algorithm for Parallel Computers: CPMG," *Journal of Scientific Computing*, Vol. 7, No. 3, Sept., 1992, pp. 263-279.

This paper describes the chopped parallel multigrid (CPMG) algorithm, which is useful in the solution of PDEs. The algorithm shows good convergence rates and hardware utilization, communication costs, and execution time. Some metrics are presented in conjunction with numerical results for the SIMD DAP-510 with 1024 PEs.

Relevance: 2

[Gup93-1] A. K. Gupta and S. E. Hambrusch, "Multiple Network Embedding into Hypercubes," *Journal of Parallel and Distributed Computing*, Vol. 19, No. 2, May, 1993, pp. 73-82.

This paper presents methods for embedding multiple networks (complete binary tree, leap tree, linear array, and mesh) into a hypercube.

Relevance: 3

[Gup93-2] A. Gupta and V. Kumar, "The Scalability of FFT on Parallel Computers," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 8, Aug., 1993, pp. 922-932.

This paper describes the scalability of an FFT algorithm on hypercubes and meshes based on the isoefficiency metric. Results for the hypercube are produced on an NCUBE1 with 1-1024 processors, while the results for the 2-D mesh are projected. The authors conclude that the problem scales better on a hypercube machine (such as the NCUBE1, NCUBE2, iPSC/2, or iPSC/RX) than on a 2-D or 3-D mesh, due to the latter's exponential isoefficiency function, which can be alleviated only by enlarging the problem size at an unreasonable rate.

Relevance: 3

[Hin76] A. C. Hindmarsh and G. D. Byrne, "Applications of EPISODE: An Experimental Package for the Integration of Ordinary Differential Equations," in L. Lapidus and W. E. Schiesser (Eds.), *Numerical Methods for Differential Systems - Recent Developments in Algorithms, Software, and Applications*, Academic Press, New York, 1976, pp. 147-166.

This paper describes EPISODE, a package of serial Fortran subroutines used in solving initial value problems for first-order systems of ordinary differential equations. EPISODE uses the generalized backward differentiation formulas (BDF) for stiff problems. Some example applications and associated code are included.

Relevance: 2 (EPA-recommended)

[Hin83] A. C. Hindmarsh, "ODEPACK, A Systematized Collection of ODE Solvers," in R. S. Stepleman, et. al. (Eds.), *Scientific Computing, Vol. 1, IMACS Transactions on Scientific Computation*, North-Holland, Amsterdam, 1983, pp. 55-64.

This paper describes ODEPACK, a collection of serial ODE solvers which meet high standards of quality and uniformity. The solvers are briefly described and an example of their use in a 2-D atmospheric kinetics-transport model is provided.

Relevance: 2 (EPA-recommended)

[Hor92] G. Horton and R. Knirsch, "Time-Parallel Multigrid in an Extrapolation Method for Time-Dependent Partial Differential Equations," in H. P. Zima (Ed.), *Parallel Computation - Proceedings of the First International ACPC Conference*, Springer-Verlag, Berlin, 1992.

This paper presents a method for solving parabolic PDEs utilizing two kinds of parallel-

ism: algorithmic parallelism inherent in the extrapolation method in which the time interval may be simultaneously integrated with different time steps, and time parallelism contained in the parabolic multigrid method where problems with smaller steps are solved with a larger number of processors spread across the time divisions. The unsteady heat equation is studied as an example implemented on a transputer system with 1-31 processors.

Relevance: 2

[Hua94] S.-H. S. Huang, H. Liu, and V. Viswanathan, "Parallel Dynamic Programming," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 3, March, 1994, pp. 326-328.

This short note gives an algorithm that can be used in solving various recurrence formulation problems (e.g., optimal order of matrix multiplication and optimal binary search tree) with parallel dynamic programming using fewer processors than previously published algorithms.

Relevance: 2

[Hwa91] K. Hwang, P. -S. Tseng, and D. Kim, "An Orthogonal Multiprocessor for Parallel Scientific Computations," in D. J. Lilja (Ed.), *Architectural Alternatives for Exploiting Parallelism*, IEEE Computer Society Press, Los Alamitos, CA, 1991, pp. 278-292.

This paper introduces the orthogonal multiprocessor (OMP) architecture, which has a simplified busing structure and partially shared memory. Higher performance is achieved through increased memory bandwidth, fully exploited parallelism, reduced communication overhead, and lower hardware control complexities. Although mixed-mode accesses are not supported and the number of memory modules increases nonlinearly with number of processors, the OMP is quite efficient and particularly well-suited for computations such as solving ODEs.

Relevance: 2

[Iba94] O. H. Ibarra and M. H. Kim, "Fast Parallel Algorithms for Solving Triangular Systems of Linear Equations on the Hypercube," *Journal of Parallel and Distributed Computing*, Vol. 20, No. 3, March, 1994, pp. 303-316.

This paper presents algorithms for solving triangular systems of linear equations on a hypercube multiprocessor. Pseudocode is provided for the algorithms, which take advantage of various matrix partitioning and mapping schemes. Results are based upon implementation with varying parameters on an NCUBE with 2-64 processors.

Relevance: 2

[Iof93] L. Ioffe and S. S. Pinter, "Applying Asynchronous Parallel Characteristic Methods for Solving Systems of Hyperbolic PDEs," *Journal of Scientific Computing*, Vol. 8, No. 3, Sept., 1993, pp. 195-218.

This paper examines asynchronous parallel characteristic algorithm for numerically solving systems of hyperbolic PDEs. Time performance and implementation of the algorithm are addressed for parallel computers.

Relevance: 2

[Isr93-1] M. Israel, L. Vozovoi, and A. Averbuch, "Spectral Multidomain Technique with Local Fourier Basis," *Journal of Scientific Computing*, Vol. 8, No. 2, June, 1993, pp. 135-149.

This paper describes a domain decomposition method using an adapted local fourier basis for solving both elliptic PDEs and time-discretized parabolic problems. Mathematical basis for the method, as well as experiments involving stiff problems on an MIMD machine, are provided.

Relevance: 2

[Isr93-2] M. Israel, L. Vozovoi, and A. Averbuch, "Parallelizing Implicit Algorithms for Time-Dependent Problems by Parabolic Domain Decomposition," *Journal of Scientific Computing*, Vol. 8, No. 2, June, 1993, pp. 151-166.

This paper furthers the work developed in [Isr93-1] for parabolic problems. Specifically, the method decouples parts of the problem such that local computations require only minimal communication between neighboring subdomains.

Relevance: 2

[Jac94] M. Z. Jacobson and R. P. Turco, "SMBGEAR: A Sparse-Matrix, Vectorized Gear Code for Atmospheric Models," *Atmospheric Environment*, Vol. 28, No. 2, Jan., 1994, pp. 273.

This paper could not be locate. The journal volume was at the bindery.

Relevance: 1

[JáJ93] J. JáJá and K. W. Ryu, "Optimal Algorithms on the Pipelined Hypercube and Related Networks," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 5, May, 1993, pp. 582-591.

This article presents algorithms for several combinatorial problems, such as all nearest smaller values problems, monotone polygon triangulation, and line packing. Lower bounds are established for each algorithm, all of which scale linearly on the pipelined hypercube.

Relevance: 2

[Jia91] H. Jiang and Y. S. Wong, "A Parallel Alternating Direction Implicit Preconditioning Method," *Journal of Computational and Applied Mathematics*, Vol. 36, No. 2, Aug., 1991, pp. 209-226.

This paper describes the alternating direction implicit method which is used both as a solver for systems of linear equations resulting form discretization of PDEs, and as a preconditioner for other iterative methods, such as the conjugate gradient method. The algorithm's high performance is achieved through increased parallelism and decreased memory contention, although additional computation is introduced. Results of experiments are included for the Myrias SPS-2 with 64 PEs.

Relevance: 2

[Jor89] H. F. Jordan, M. S. Benten, G. Alaghband, and R. Jakob, "The Force: A Highly Portable Parallel Programming Language," *Proceedings of the International Conference of Parallel Processing*, Vol. II, August, 1989, pp. 112-117.

See [Ala93].

[Jwo92] J. S. Jwo, S. Lakshmivarahan, and S. K. Dhall, "Comparison of Performance of Three Parallel Versions of the Block Cyclic Reduction Algorithm for Solving Linear Elliptic Partial Differential Equations," *Computers and Mathematics with Applications*, Vol. 24, Nos. 5-6, Sept., 1992, pp. 83-101.

This paper provides a comparison of three versions of the block cyclic reduction (BCR) algorithm based on polynomial factorization, partial fraction expansion, and rational approximation. Each method is implemented on an Alliant FX/8 using the vector-oriented LU decomposition method and the scalar cyclic reduction method, the latter of which performed better in combination with BCR. Short pseudocode segments are provided for each version, along with results of comparisons between the versions.

Relevance: 2

[Kah91] D. K. Kahaner, E. Ng, W. E. Schiesser and S. Thompson, "Experiments with an Ordinary Differential Equation Solver in the Parallel Solution of Method of Lines Problems on a Shared-Memory Parallel Computer," *Journal of Computational and Applied Mathematics*, Vol. 38, Nos. 5-6, Dec., 1991, pp. 231-253.

This paper discusses the solution of method of lines problems using a stiff ODE solver under three strategies: dense Jacobian formation and dense linear algebra, sparse Jacobian formation and dense linear algebra, and fully sparse solutions. Numerical results on a Sequent Balance with 1-10 PEs are given for two example problems: hyperbolic fluid flow and humidification. Speedups are good and are problem-independent for the dense-dense scheme, while the sparse-dense strategy exhibits problem-dependent speedup for the Jacobian formation and problem-independent speedup for the linear algebra.

Relevance: 2

[Key90] D. E. Keyes and W. D. Gropp, "Domain Decomposition Techniques for the Parallel Solution of Nonsymmetric Systems of Elliptic Boundary Value Problems," *Applied Numerical Mathematics*, Vol. 6, No. 4, May, 1990, pp. 281-301.

This paper describes parallel block-preconditioned domain-decomposed Krylov methods for sparse linear systems arising in the solution of elliptic boundary value problems. Although the target application is a fluid dynamics problem, the results can be applied to a broader range of problems. Results are included for an Encore Multimax with 1-16 PEs.

Relevance: 2

[Kha93] A. Q. M. Khaliq, E. H. Twizell, and D. A. Voss, "On Parallel Algorithms for Semidiscretized Parabolic Partial Differential Equations Based on Subdiagonal Padé Approximations," *Numerical Methods for Partial Differential Equations*, Vol. 9, No. 2, March, 1993, pp. 107-116.

Second-order diagonal [1/1] Padé approximations can produce poor numerical results if the time steps are too large with respect to the spatial aspects. This paper presents a method of using sub-diagonal Padé approximations to free the algorithm from time-step restrictions normally imposed upon it. These results are confirmed for MIMD machines, such as the Alliant FX/8.

Relevance: 1

[Kie94] M. Kiehl, "Parallel Multiple Shooting for the Solution of Initial Value Problems," *Parallel Computing*, Vol. 20, No. 3, Mar., 1994, pp. 275-295

This paper describes multiple shooting methods used in the solution of stiff differential equations. Although no actual parallel performance figures are given, the author concludes that this method does not work well for low-dimension stiff problems and does not work at all for high-dimensional stiff problems.

Relevance: 2

[Kra92] S. G. Kratzer, "Massively Parallel Sparse LU Factorization," *The Fourth Symposium on the Frontiers of Massively Parallel Computation*, Oct., 1992, pp. 136-140.

This paper presents a technique, termed multifrontal factorization, for sparse LU factorization on parallel machines. The sparse factorization is decomposed into small, dense, factorizations with little overhead for communication and memory accesses. Good processor utilization is confirmed through implementation on the MasPar MP-1 with 4096 processors.

Relevance: 2

[Kru94] P. Krueger, T.-H. Lai, and V. A. Dixit-Radiya, "Job Scheduling is More Important than Processor Allocation for Hypercube Computers," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 5, May, 1994, pp. 488-497.

This article presents a job scheduling discipline called Scan, which borrows ideas from the C-Scan disk scheduling algorithm, to improve overall performance on parallel systems with hypercube interconnection networks. The authors show that such a scheme allows greater performance gains than the most sophisticated processor allocation algorithms; thus, they propose using Scan in combination with a simple O(n) processor allocation strategy to achieve maximal gains in performance.

Relevance: 2

[Kuo90] C. -C. J. Kuo and T. F. Chan, "Two-Color Fourier Analysis of Iterative Algorithms for Elliptic Problems with Red/Black Ordering," *SIAM Journal on Scientific and Statistical Computing*, Vol. 11, No. 4, July, 1990, pp. 767-793.

This paper presents the two-color Fourier analysis to study the convergence rates of the following iterative algorithms for elliptic PDE problems with the red/black ordering: successive over-relaxation (SOR) method; symmetric successive over-relaxation (SSOR) method; preconditioned iterative methods with SSOR, ILU, and MILU preconditioners; and multigrid methods. The SOR and multigrid methods can be reordered to get more parallelism without sacrificing convergence rates; however, SSOR and preconditioned iterative methods achieve more parallelism and faster convergence.

Relevance: 2

[LeB92] T. J. LeBlanc and E. P. Markatos, "Shared Memory vs. Message Passing in Shared-Memory Multiprocessors," *Proceedings of the Fourth IEEE Symposium on Parallel and Distributed Processing 1992*, pp. 254-263.

This paper describes how the cost of communication and computation as implemented on the hardware, and the degree of load imbalance in the application affect the choice between shared-memory and message-passing models. Results are produced on the Sequent Symmetry S81, the Silicon Graphics 4D/480 GTX Iris, the BBN Butterfly Plus, and the Encore Multimax. The authors conclude that the shared-memory model is desirable for applications with inherent load imbalance, while the message-passing model should be used on machines with relatively expensive communication.

Relevance: 3

[Lee90] F. Lee, "Partitioning of Regular Computation in Multiprocessor Systems," *Journal of Parallel and Distributed Computing*, Vol. 9, No. 3, July, 1990, pp. 312-317.

This research note describes problem partitioning of regular computation, such as that for the numeric solution of PDEs by the point Jacobi iteration, over two-dimensional meshes on multiprocessors. Various partitioning schemes and their influence are compared on the basis of the computation to communication ratio.

Relevance: 2

[Lee94] S. Lee and K. G. Shin, "Interleaved All-to-All Reliable Broadcast on Meshes and Hypercubes," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 5, May, 1994, pp. 449-458.

This article presents strategies for achieving all-to-all reliable broadcasts on meshes and hypercubes (i.e., the problem of reliably distributing information from every node to every other node in a point-to-point interconnection network). Some general properties of the problem for the hypercube, torus-wrapped square mesh, and C-wrapped hexagonal mesh (a mesh of nodes arranged such that neighbors are connected in six oriented directions and special end-node wraparound) are followed by the IHC algorithm pseudocode for the proposed solution and a brief analysis of its performance.

Relevance: 2

[Lev92] J. M. Levesque, “FORGE 90: A Parallel Programming Environment,” *Spring COMPCON ‘92 - 37th IEEE Computer Society International Conference Digest of Papers*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 291-294.

This paper introduces FORGE 90, a parallel version of ANSI 77 Fortran, that parallelizes existing code without significant programmer effort. FORGE 90 provides an environment for developing Fortran code that can be converted to run on any existing parallel architecture.

Relevance: 3

[Li90] X. Li and Y. -L. Chang, “Simulating Parallel Architecture in a Distributed Environment,” *Journal of Parallel and Distributed Computing*, Vol. 9, No. 2, June, 1990, pp. 218-223.

This paper introduces the Simulated Parallel Architecture in a Distributed Environment (SPADE) tool to provide an affordable and flexible environment for the verification and analysis of parallel algorithms. SPADE uses a network of workstations running Unix and NFS to simulate parallel computers on differing machines (SIMD or MIMD) with varying topologies (hypercube, mesh, etc.). Simulation results obtained from using SPADE on an object labeling application compare favorably with an implementation of the same program on a CM-2.

Relevance: 3

[Lie93] I. Lie and R. Skålin, “A Multidomain Algorithm for Advection Problems and its Application to Atmospheric Models,” in G. Hoffman and T. Kauranne (Eds.), *Parallel Supercomputing in Atmospheric Science - Proceedings of the Fifth ECMWF Workshop in the Use of Parallel Processing in Meteorology*, World Scientific, Singapore, 1993, pp. 414-435.

This paper demonstrates the use of Chebyshev spectral collocation (for space discretization) and Runge-Kutta (for time discretization) methods for solving PDEs arising in advection problems. Results are included for implementation on a network of 16 Sun 3/60 workstations and a Cray Y-MP with 4 PEs, as well as discussion on how this algorithm can be applied in atmospheric models.

Relevance: 1

[Lin90] J. Lin and J. A. Storer, “A New Parallel Algorithm for the Knapsack Problem and its Implementation on a Hypercube,” *The Third Symposium on the Frontiers of Massively Parallel Computation*, Oct., 1990, pp. 2-7.

This paper presents pseudocode and analysis of a parallel algorithm for the knapsack problem implemented on the CM-2 hypercube machine with 8k processors.

Relevance: 3

[Lin91] A. Lin, “Parallel Algorithms for Boundary Value Problems,” *Journal of Parallel and Distributed Computing*, Vol. 11, No. 4, April, 1991, pp. 284-290.

This paper gives a general approach for solving boundary value problems, which has low communication complexity and is flexible enough to run on both SIMD and MIMD platforms. Tests involved solving the two-point non-linear boundary value problem using three schemes: the adaptive high-order scheme, the shooting scheme using the fourth-order Runge-Kutta method, and the high-order three-point scheme.

Relevance: 1

[Lio92] W. M. Lioen, "Parallelizing a Highly Vectorized Multigrid Code with Zebra Relaxation," *Proceedings of Supercomputing '92*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1992, pp. 180-189.

This paper discusses some of the algorithmic choices and tuning performed in MGZEB, a parallel vectorized multigrid solver for elliptic PDEs. Overall performance using autotasking is presented as executed on a Cray Y-MP4/464 with standard Fortran.

Relevance: 2

[Lop93] L. Lopez, "Two-Step Boundary Value Methods in the Solution of ODEs," *Computers and Mathematics with Applications*, Vol. 26, No. 1, July, 1993, pp. 91-100.

This paper presents boundary value methods for solving initial value problems based on linear two-step schemes. These methods can be used to solve stiff systems of ODEs on parallel machines. Results provided on a machine with 1-16 transputers indicates that these methods are efficient for solving systems of stiff ODEs over a long time period.

Relevance: 2

[Lov93] D. B. Loveman, "High Performance Fortran," *IEEE Parallel and Distributed Technology*, Vol. 1, No. 1, Feb., 1993, pp. 25-42.

This article provides an introduction to Fortran-90, the High-Performance Fortran (HPF) extensions, and some of the weaknesses of the language's parallel features. Some coding examples are provided to describe the parallel constructs of the language.

Relevance: 3

[Luh92] A. K. Luhar and J. J. Modi, "Parallel Processing of a Random-Walk Model of Atmospheric Dispersion," *Atmospheric Environment*, Vol. 26A, No. 16, June, 1992, pp. 1783-1789.

This paper presents a parallel algorithm for random-walk models of turbulent one-dimensional dispersion in the atmosphere. The algorithms were written in Fortran for the DAP 610 with 4096-8192 PEs, although MIMD machines are also good target platforms for these models. Results show only seven-fold speedup over the sequential algorithm on the IBM 3084; however, the far greater computing power of the IBM CPU over a single DAP PE must be taken into consideration.

Relevance: 1

[Lus91] L. Lustman, B. Neta, and C. P. Katti, "Solution of Linear Systems of Ordinary Differential Equations on an Intel Hypercube," *SIAM Journal on Scientific and Statistical Computing*, Vol. 12, No. 6, Nov., 1991, pp. 1480-1485.

This paper presents a parallel algorithm for solving linear systems of ordinary initial value problems based on the box scheme and a modified recursive doubling technique. This method, however, applies only to linear ODEs.

Relevance: 2

[Lus92] L. Lustman, B. Neta, and W. Gragg, "Solution of Ordinary Differential Initial Value Problems on an Intel Hypercube," *Computers and Mathematics with Applications*, Vol. 23, No. 10, May, 1992, pp. 65-72.

This paper presents a method for solving linear or non-linear initial value problems based on an "extrapolation to the limit," in which each processor solves the system independently using different step sizes, with all results being combined by extrapolation. Numerical results and conclusions are provided for an Intel hypercube with 2-8 PEs using polynomial and rational extrapolation under the Euler and Gragg schemes.

Relevance: 1

[Mac90] P. D. MacKenzie and Q. F. Stout, "Practical Hypercube Algorithms for Computational Geometry," *The Third Symposium on the Frontiers of Massively Parallel Computation*, Oct., 1990, pp. 75-78.

This paper provides some algorithms for solving common computational geometry problems (e.g., closest pair, all points nearest neighbors, and rectangle intersection) on the hypercube using the cross-stitching technique, which combines prefix and merge operations.

Relevance: 3

[Mal91] J. Malard, "Threshold Pivoting for Dense LU Factorizations on Distributed Memory Multiprocessors," *Proceedings of Supercomputing '91*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1991, pp. 600-607.

This paper addresses the LU factorization of matrices stored by row, and efficient broadcast of pivot data. Through numerical comparisons on a BBN GP1000, the authors conclude that row wrapping and threshold pivoting reduce the number of messages while preserving good load balance.

Relevance: 2

[Mal92] A. D. Malony, D. A. Reed, and H. A. G. Wijshoff, "Performance Measurement Intrusion and Perturbation Analysis," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 3, No. 4, July, 1992, pp. 433-450.

This paper presents the instrumentation perturbation of software event tracing on the

Alliant FX/80 in sequential, vector, concurrent, and vector-concurrent modes. Through the use of appropriate models of performance perturbation, execution time, which can be inflated tree orders of magnitude through instrumentation, can be reduced to within 20% of actual execution time. The authors conclude that in general, simple models can be used to correct for these perturbations.

Relevance: 3

[Mar93] D. C. Marinescu, J. R. Rice, and E. A. Vavalis, "Performance of Iterative Methods for Distributed Memory Machines," *Applied Numerical Mathematics*, Vol. 12, No. 5, July, 1993, pp. 421-430.

This paper analyzes iterative methods for the large linear systems arising from PDE problems on nonrectangular domains. Performance results are included for several iterative methods on an NCUBE I with 2-128 PEs for a nearly rectangular domain and with 4-64 PEs for the irregular domain. These experiments reveal poor speedups and efficiency due to high communication and synchronization costs; therefore, some suggestions for implementation improvements are presented.

Relevance: 2

[Mat93] R. M. M. Mattheij and S. J. Wright, "Parallel Stable Compactification for ODEs with Parameters and Multipoint Conditions," *Applied Numerical Mathematics*, Vol. 13, No. 4, Nov., 1993, pp. 305-333.

This paper presents parallel stabilized compaction algorithms for solving linear systems of ODEs which include some global parameters and multipoint side conditions. Numerical results provided for the Intel Touchstone Delta with 1-128 PEs show good performance.

Relevance: 2

[McG91] J. R. McGraw and A. C. Hindmarsh, "An Examination of the Conversion of Software to Multiprocessors," *Journal of Parallel and Distributed Computing*, Vol. 13, No. 1, Sept., 1991, pp. 1-16.

This paper describes the problems encountered and solutions attempted in converting a serial Fortran ODE solver, LSODE, to a shared-memory multiprocessor machine, the Cray X-MP/48. Two approaches were explored: a minimal conversion whereby the software could be used concurrently and a conversion to exploit parallelism within each individual problem. Steps toward these conversions, as well as some pseudocode and performance figures, are included.

Relevance: 1

[Meh93] M. R. Mehrabi and R. A. Brown, "An Incomplete Nested Dissection Algorithm for Parallel Direct Solution of Finite Element Discretizations of Partial Differential Equations," *Journal of Scientific Computing*, Vol. 8, No. 4, Dec., 1993, pp. 373-387.

This paper describes a multilevel algorithm for solving large sparse systems of equations generated by discretizations of partial differential equations on MIMD computers. To exploit parallelism as much as possible, the algorithm uses a combination of domain decomposition and nested dissection, which also reduces communication between processors. Results are produced on an iPSC/860 hypercube with 32 nodes.

Relevance: 1

[Meu91] G. Meurant, "Numerical Experiments with a Domain Decomposition Method for Parabolic Problems on Parallel Computers," in R. Glowinski, Y. A. Kuznetsov, G. Meurant, J. Périaux, and O. B. Widlund (Eds.), *Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations*, SIAM, 1991, pp. 394-408.

This paper describes the application of a domain decomposition preconditioner and the conjugate gradient method for solving linear systems arising in the solution of PDEs. Minimal communication is required between subdomains that are solved on independent PEs. Implementation is straight-forward and results are given for a Sequent Symmetry S81 with 8 PEs and a Cray Y-MP/832 with 8 PEs, both of which show good speedup.

Relevance: 2

[Mou92] Z. G. Mou and M. Goodman, "A Comparison of Communication Costs for Three Parallel Programming Paradigms on Hypercubes and Mesh Architectures," in J. D. Dongarra, K. Kennedy, P. Messina, D. C. Sorensen, and R. G. Voigt (Eds.), *Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computers*, SIAM, 1992, pp. 491-500.

This paper reports on the communication costs of recursive doubling (RD), odd-even reduction (OR), and divide-and-conquer (DC) schemes on hypercube and mesh computers. Of the three, DC algorithms generally have the lowest communication cost on both machines; furthermore, any problem which can be computed by canonical RD or OR can also be computed by DC. Of course, if the total number of operations is considered over communication costs, one of the other methods may be preferred.

Relevance: 3

[Mu92-1] M. Mu and J. R. Rice, "A Grid-Based Subtree-Subcube Assignment Strategy for Solving Partial Differential Equations on Hypercubes," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 3, May, 1992, pp. 826-839.

This paper proposes a method for assigning discrete equations and their associated subtasks to processors connected by a hypercube structure such that communication costs and traffic volume are reduced. This technique, which is mostly applicable to non-symmetric sparse matrix algorithms, results in good load balancing and high parallelism. Performance of the method is based on the included complexity analysis, and confirmed with implementation on two NCUBES with 64 and 128 processors.

Relevance: 1

[Mu92-2] M. Mu and J. R. Rice, "Performance of PDE Sparse Solvers on Hypercubes," in P. Mehrotra, J. Saltz, and R. Voigt (Eds.), *Unstructured Scientific Computation on Scalable Multiprocessors*, MIT Press, Cambridge, MA, 1992, pp. 345-370.

This paper investigates the five major aspects of nonsymmetric sparse solvers for elliptic PDEs on hypercubes: domain decomposition, assignment, discretization, indexing, and solution. The authors predict that there is no best choice for any of the algorithmic components, due to their interaction with other components and specifics of the application; however, good combinations do exist. Experimental results on an NCUBE1 and NCUBE2 with 16 PEs for a new organization of sparse Gauss elimination reveal better performance over other sparse solvers.

Relevance: 2

[Mur91] C. S. R. Murthy, "Solving Hyperbolic PDEs on Hypercubes," *Computers and Mathematics with Applications*, Vol. 21, No. 5, March, 1991, pp. 79-82.

This paper presents an efficient parallel algorithm for solving hyperbolic PDEs on hypercubes. An expression for speedup is given, along with results from a performance study which show good speedup for 16-64 PEs.

Relevance: 2

[Naa91] G. Naadimuthu, K. W. Wang, and E. S. Lee, "Air Pollution Modeling by Quasilinearization," *Computers and Mathematics with Applications*, Vol. 21, Nos. 11-12, Nov./Dec, 1991, pp. 153-164.

This paper presents an air pollution and diffusion model involving 15 ODEs with given initial conditions. Bellman's quasilinearization technique is used in solving the system and convergence data is provided.

Relevance: 1*

[Odm92] M. T. Odman, N. Kumar, and A. G. Russel, "A Comparison of Fast Chemical Kinetic Solvers for Air Quality Modeling," *Atmospheric Environment*, Vol. 26A, No. 9, June, 1992, pp. 1783-1789.

This paper analyzes two methods for solving stiff systems of ODEs for nonlinear chemical kinetics in air quality models: the hybrid and quasi-steady state approximation (QSSA). These models experience a tradeoff between accuracy and efficiency and are compared with the Gear method. Experiments run on a Cray Y-MP suggest that although some parts of the problem are not inherently parallelizable, the hybrid method is more accurate and displays better speedup.

Relevance: 1*

[Oka90] Y. Okawa and N. Haraguchi, "A Linear Array of Processors with Partially Shared Memory for Parallel Solution of PDE," *Proceedings of Supercomputing '90*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1990, pp. 41-48.

This paper introduces a multiprocessor architecture that is particularly well-suited to solving PDEs. A description of the ring-like architecture and its bank-switchable memory is presented, along with a dynamic load balancing algorithm. The researchers provide test results for their system using 16 processors and 32 memory banks on a heat diffusion problem.

Relevance: 3

[Pai93] P. Pai and T. H. Tsang, "On Parallelization of Time-Dependent Three-Dimensional Transport Equations in Air Pollution Modeling," *Atmospheric Environment*, Vol. 27A, No. 13, 1993, pp. 2009-2015.

This paper describes a parallel time-splitting finite element scheme for three-dimensional first- and second-order closure dispersion models. Numerical results, which show a speedup of about 5, are provided on the IBM 3090-600J with 6 PEs.

Relevance: 1

[Pap93] M. Paprzycki and I. Gladwell, "A Parallel Chopping Algorithm for ODE Boundary Value Problems," *Parallel Computing*, Vol. 19, No. 6, June, 1993, pp. 651-666.

This paper examines the effectiveness of the parallel chopping method for solving ODE boundary value problems. The sequential and parallel chopping methods are discussed, as well as the evaluation of the error growth which is linear at worst. Experimental results, which compare the implementation on a Sequent Balance with 1- 20 processors against the serial version using the COLNEW package, show that good speedup is achieved, despite the usual disadvantages associated with macroscale parallelization of this kind.

Relevance: 1

[Par92] M. Parashar, S. Hariri, A. G. Mohamed, and G. C. Fox, "A Requirement Analysis for High Performance Distributed Computing over LAN's," *Proceedings of the First International Symposium on High-Performance Distributed Computing*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 142-151.

This paper explores the requirements for clusters of workstations (and ultimately clusters of workstations and supercomputers) connected by a LAN to act as high-performance distributed computing platforms. Execution of a sample program, a blocked LU decomposition of dense matrices, is measured on a cluster of SPARCstations and is compared with performance on an iPSC/860 hypercube. The predominant limiting factor of the distributed system is the data transfer rate between the workstations; however, this drawback may be overcome by using a High Performance Interface Processor (HiP), also described here.

Relevance: 2

[Pli92] S. Plimpton, S. Dosanjh, and R. Krall, "Is SIMD Enough for Scientific and Engineering Applications on Massively Parallel Computers?" *Spring COMPCON '92 - 37th IEEE Computer Society International Conference Digest of Papers*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 95-102.

This paper describes some basic issues involved in matching an application, such as a PDE solver, with a distributed memory parallel machine. Specifically, data communication and process synchronization considerations are analyzed in relation to SIMD and MIMD machines. Through implementation of several sample problems, the authors give general guidelines for pairing scientific problems with particular computer architectures.

Relevance: 2

[Pom91] C. Pommerell and W. Fichtner, "PILS: An Iterative Linear Solver Package for Ill-Conditioned Systems," *Proceedings of Supercomputing '91*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1991, pp. 588-599.

This paper presents a software package for iteratively solving large systems of linear equations arising in the solution of time-dependent non-linear PDEs and ODEs. PILS (Package of Iterative Linear Solvers) contains a variety of algorithms for ordering, preconditioning, and equation solving suited for ill-conditioned problems. PILS runs on Sun workstation, Alliant FX/80, Convex C-220, Cray-2, Cray X-MP, and Cray Y-MP platforms.

Relevance: 2

[Rib92] C. J. Ribbens, "A Moving Mesh Scheme for Adaptive Domain Decomposition," in P. Mehrotra, J. Saltz, and R. Voigt (Eds.), *Unstructured Scientific Computation on Scalable Multiprocessors*, MIT Press, Cambridge, MA, 1992, pp. 205-219.

This paper presents a moving mesh adaptation scheme in the context of domain decomposition to solve PDEs. Using this method, the subdomains are adaptively chosen to reflect the characteristics of the problem. Numerical results for 8 problems are given for implementation on a serial machine and a Sequent Symmetry S81 with 26 PEs.

Relevance: 2

[Rib93] C. J. Ribbens, L. T. Watson, and C. Desa, "Toward Parallel Software for Elliptic Partial Differential Equations," *ACM Transactions on Mathematical Software*, Vol. 19, No. 4, Dec., 1993, pp. 457-473.

This paper discusses three techniques used for parallelizing the ELLPACK software package for solving partial differential equations: an explicit approach using compiler directives available on a particular target machine, an automatic approach using an optimizing and parallelizing compiler, and a two-level approach using a set of low-level computational kernels. Results are reported for a Sequent Symmetry S81 with 1-16 processors, and general implications are noted for porting mathematical software to shared-memory machines. The authors conclude that identifying and parallelizing the low-level kernel routines provide the best performance results.

Relevance: 3

[Rog93] A. Rogers and K. Pingali, "Compiling for Distributed Memory Architectures," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 3, March, 1994, pp. 281-298.

This article describes a parallelizing compiler that, given a sequential program and memory layout of its data, decomposes the process and balances parallelizing against locality of reference. The source language, Id, is a C-like language augmented with special data structures. From this source, the compiler generates C for the Intel iPSC/2, which is up to 60-70% as efficient as a carefully hand-written parallel program.

A fairly good overview of parallel languages and compilers is provided in Section XII, "Related Work."

Relevance: 2

[Rub93] N. Rubin, "Data Flow Computing and the Conjugate Gradient Method," in M. Cosnard, K. Ebcioglu, and J. -L. Gaudiot (Eds.), *Architectures and Compilation Techniques for Fine and Medium Grain Parallelism - Proceedings of the IFIP WG 10.3 Working Conference on Architectures and Compilation Techniques for Fine and Medium Grain Parallelism*, North-Holland, Amsterdam, 1993, pp. 257-264.

This paper explores the implementation of the conjugate gradient method to solve large linear systems arising from discretized PDEs. Most of the computation occurs in the preconditioning step, which generally does not vectorize or parallelize well. Performance of programs written in Fortran and Id, a data flow language for conjugate gradients, is reported for execution on the Motorola Monsoon, a data flow processor.

Relevance: 2

[Sab93] G. Sabot, S. Wholey, J. Berlin, and P. Oppenheimer, "Parallel Execution of a Fortran 77 Weather Prediction Model," *Proceedings of Supercomputing '93*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1993, pp. 538-545.

This paper describes modifications to the atmospheric modeling program ARPS (Advanced Regional Prediction System) to make it run on a CM-5 with 1-1024 PEs. The Fortran 77 code was vectorized and transformed by CMAX translation into CM Fortran, which was then compiled on the CM-5. Speedups of 907 on 1024 PEs were achieved, as well as twice the price/performance ratio of a Cray Y-MP.

Relevance: 2

[Sag93] G. Saghi, H. J. Siegel, and J. L. Gray, "Predicting Performance and Selecting Modes of Parallelism," *Journal of Parallel and Distributed Computing*, Vol. 19, No. 3, Nov., 1993, pp. 219-233.

This paper discusses cyclic reduction mapping, an approach for the parallel solution of tridiagonal systems, and consequently for ordinary differential equations, on parallel machines. Results are reported for the MasPar MP-1 (SIMD) with 1-16,384 PEs, the NCUBE 2 (MIMD) with 1-32 PEs, and the PASM (mixed-mode SIMD/MIMD) with 1-16 PEs. Although the hybrid method performed best in these studies, the authors warn that several factors must be considered to guarantee minimum execution time, such as the relationship of the number of equations to the number of processors; therefore, a good prediction method, such as the one describe here, is recommended.

Relevance: 2

[Sal90] J. H. Saltz, "Aggregation Methods for Solving Sparse Triangular Systems on Multiprocessors," *SIAM Journal on Scientific and Statistical Computing*, Vol. 11, No. 1, Jan., 1990, pp. 123-144.

This paper presents efficient parallel methods for solving large sparse triangular systems generated by incomplete factorization of two-dimensional PDEs. Performance results are provided for the Encore Multimax with 1-16 PEs, although the author claims the method is extendible to a wide variety of parallel architectures. Tradeoffs between load imbalance and synchronization costs are examined in conjunction with partitioning strategies.

Relevance: 2

[Say93] R. D. Saylor and R. I Fernandes, "On the Parallelization of a Comprehensive Regional-Scale Air Quality Model," *Atmospheric Environment*, Vol. 27A, No. 4, 1993, pp. 625-631.

This paper describes the parallelization of the STEM-II acid decomposition and photochemical model for use in modeling air quality. Specifically, the one-dimensional time splitting algorithm is analyzed and implemented in IBM Parallel Fortran for the IBM 3090-600J with 5 processors. Pseudocode is provided and performance measurements, which show a 4.65 speedup, are given.

Relevance: 1

[Sca92] C. D. Scarbnick, M. C. Chang, M. H. Schultz, and A. B. Sherman, "A Parallel Software Package for Solving Linear Systems," *The Fourth Symposium on the Frontiers of Massively Parallel Computation*, Oct., 1992, pp. 397-401.

This paper introduces the MP-PCGPAK2 software package that implements a parallel version of the Conjugate Gradient method for MIMD message-passing architecture. Performance results for systems with 1-11 million equations are provided on an NCUBE with 1024 processors and an iPSC/860 with 128 processors. The authors conclude that the iPSC/860 is an inefficient machine for this problem due to the increased percentage of solution time spent on communication.

Relevance: 3

[Sch90] I. D. Scherson, A. Mehra, and J. L. Rexford, "Toward Scalable Algorithms for Orthogonal Shared-Memory Parallel Computers," *The Third Symposium on the Frontiers of Massively Parallel Computation*, Oct., 1990, pp. 12-21.

This paper explores the problem of developing scalable and near-optimal algorithms for execution on orthogonal shared-memory parallel computers with a multidimensional access (MDA) memory array. Specifically, algorithms for matrix multiplication and FFT are implemented and analyzed on an OMP with 8 processors and 64 memory modules and an MDA with 16 processors and 64 memory modules. The authors remark that the presented algorithms scale well onto higher dimension MDA architectures, but are not always optimal; thus, a trade-off exists between an algorithm's scalability and its optimality for MDA machines.

Relevance: 3

[Scr91] J. S. Scroggs and J. Saltz, "Distributed Computing and Adaptive Solution to Nonlinear PDEs," in R. Glowinski, Y. A. Kuznetsov, G. Meurant, J. Périaux, and O. B. Widlund (Eds.), *Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations*, SIAM, 1991, pp. 409-417.

This paper presents a parallel algorithm for the efficient solution of nonlinear time dependent convection diffusion equations. Perturbation analysis aids in the adaptive aspects of the algorithm, giving appropriate scales for a coarse grid and fine grid used to adaptively refine singularity regions. Results are given for the iPSC2/860 with 32-128 PEs.

Relevance: 2

[Sha92] J. N. Shadid and R. S. Tuminaro, "Iterative Methods for Nonsymmetric Systems on MIMD Machines," in J. D. Dongarra, K. Kennedy, P. Messina, D. C. Sorensen, and R. G. Voigt (Eds.), *Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computers*, SIAM, 1992, pp. 123-129.

This paper compares the performance of parallel iterative solvers for large sparse nonsymmetric systems used to approximate solutions of PDEs. These methods, which are based on preconditioned Krylov subspace and multigrid techniques, are tested on a 1024-PE NCUBE 2 hypercube.

Relevance: 2

[Sha94] J. N. Shadid and R. S. Tuminaro, "A Comparison of Preconditioned Nonsymmetric Krylov Methods on a Large-Scale MIMD Machine," *SIAM Journal on Scientific Computing*, Vol. 15, No. 2, March, 1994, pp. 440-459.

This paper compares the parallel performance of a number of preconditioned Krylov subspace methods for solving PDEs on MIMD machines. Among these methods are the generalized minimum residue (FMRES), the conjugate gradient squared (CGS), biconjugate gradient stabilized (Bi-CGSTAB), and the quasi-minimal residual CGS (QMRCGS). Results on an NCUBE 2 hypercube with 128-1024 nodes show that all of these methods are parallelizable and exhibit good speedup.

Relevance: 2

[Ske92] S. Skelboe, "Methods for Parallel Integration of Stiff Systems of ODEs," *BIT*, Vol. 32, No. 4, 1992, pp. 689-701.

This highly mathematical paper presents a class of parallel numerical integration methods for stiff systems of ordinary differential equations, based on decoupled backward differentiation formulas.

Relevance: 2

[Som92] B. P. Sommeijer, W. Couzy, and P. J. van der Houwen, "A-stable Parallel Block Methods for Ordinary and Integro-Differential Equations," *Applied Numerical Mathematics*, Vol. 9, Nos. 3-5, April, 1992, pp. 267-281.

This paper discusses the stability of a class of block methods used in the solution of ODEs on parallel computers. Numerical results for the block methods and their stability on an Alliant FX/4 with 1-4 processors show near-optimal performance and good stability.

Relevance: 2

[Som93] B. P. Sommeijer, "Parallel-Iterated Runge-Kutta Methods for Stiff Ordinary Differential Equations," *Journal of Computational and Applied Mathematics*, Vol. 45, No. 1, April, 1993, pp. 151-168.

This article presents an iterative approach for solving ordinary differential equations which uncouples the normally highly coupled equations for the stage values of Runge-Kutta methods. This scheme can be cast into the class of Diagonal Implicit Runge-Kutta (DIRK) methods, which allow the solution to exploit higher levels of parallelism. In addition to descriptions of the algorithms, analysis of implementation on an ALLIANT FX/4 machine (4 parallel vector processors and shared memory) is included, as well as comparisons with some other ordinary differential equation algorithms.

Relevance: 1

[Sta92] A. K. Stagg and G. F. Carey, "Asynchronous Nonlinear Iteration and Domain Decomposition," in J. Dongarra (Ed.), *Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computing*, SIAM, Philadelphia, 1992, pp. 281-286.

This paper presents a spectral domain decomposition method which is formulated for a class of nonlinear problems. The resulting nonlinear systems are solved using a Gauss-Seidel Newton partial relaxation method appropriate for shared-memory multiprocessors. Numerical results are provided for the 8-node Alliant FX/8 with a speedup of 5; however, further performance gain for these procedures may be realized by using these with other discretization techniques and with preconditioners.

Relevance: 2

[Sun94] X. -H. Sun and D. T. Rover, "Scalability of Parallel Algorithm-Machine Combinations," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 5, No. 6, June, 1994, pp. 599-613.

This paper presents a new definition of scalability based on the isospeed metric: "an algorithm-machine combination is scalable if the achieved average speed of the algorithm [work divided by time divided by the number of processors] on the given machine can remain constant with increasing numbers of processors, provided the problem size can be increased with the system size." The Burg algorithm and modified SLALOM benchmark program were evaluated under the revised scalability definition and associated derived formulas on the 64-node NCUBE 2 with a hypercube interconnection topology and a 8192-node MasPar MP-1 with toroidal mesh.

Relevance: 2

[Tam92-1] H. W. Tam, "One-Stage Parallel Methods for the Numerical Solution of Ordinary Differential Equations," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 5, Sept., 1992, pp. 1039-1061.

This paper, along with [Tam92-2], present one-stage and two-stage block methods in the solution of non-stiff ODEs. These methods exhibit good stability and low interprocessor communication costs. Not many implementation details are given as these papers are primarily mathematically-based.

Relevance: 2

[Tam92-2] H. W. Tam, "Two-Stage Parallel Methods for the Numerical Solution of Ordinary Differential Equations," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 5, Sept., 1992, pp. 1062-1084.

See [Tam92-1].

Relevance: 2

[Tay92] V. E. Taylor, B. Nour-Omid, and D. G. Messerschmett, "The Effects of Communications Overhead on the Speedup of Parallel 3-D Finite Element Applications," *Proceedings of the Sixth International Parallel Processing Symposium*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 531-536.

This paper analyzes the effects of interprocessor communication on the speedup of the parallel execution of regular 3-D finite element applications used in solving PDEs. The iterative method, Preconditioned Conjugate Gradient, and a hybrid method are considered on the mesh and hypercube. The included speedup equations can be used to evaluate different partitioning and mapping techniques.

Relevance: 2

[van der91] P. J. van der Houwen and B. P. Sommeijer, "Iterated Runge-Kutta Methods on Parallel Computers," *SIAM Journal on Scientific and Statistical Computing*, Vol. 12, No. 5, Sept., 1991, pp. 1000-1028.

This paper examines diagonally implicit parallel, efficient iteration methods for solving Runge-Kutta methods with high stage order; these methods in turn can be used to solve stiff initial-value problems for first-order ODEs. Additionally, after a finite number of iterations, these methods revert to diagonally implicit Runge-Kutta (DIRK) methods. Some comparisons of corrector methods are also given to show that this scheme does not exhibit the usual inaccuracy of other DIRK methods.

Relevance: 1

[van der92] P. J. van der Houwen and B. P. Sommeijer, "Parallel Diagonally Implicit Runge-Kutta-Nyström Methods," *Applied Numerical Mathematics*, Vol. 9, No. 2, Feb., 1992, pp. 111-131.

This paper explores diagonally implicit iteration methods for solving implicit Runge-Kutta-Nyström methods arising from the solution of ODEs. These methods are tested on parallel computers with 2-4 groups of processors.

Relevance: 3

[van der93-1] P. J. van der Houwen, "Parallel Step-by-Step Methods," *Applied Numerical Mathematics*, Vol. 11, Nos. 1-3, Jan., 1993, pp. 45-68.

This paper briefly surveys step-by-step methods for solving initial value problems in parallel for non-stiff and stiff problems. For the stiff problems, diagonally implicit block methods, diagonally implicit iteration (with Runge-Kutta correctors), and Richardson extrapolation are covered.

Relevance: 2

[Van der93-2] R. F. Van der Wijngaart, "Efficient Implementation of a 3-Dimensional ADI Method on the iPSC/860," *Proceedings of Supercomputing '93*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1993, pp. 102-111.

This paper compares three domain decomposition strategies for the solution of 3-dimensional partial differential equations on an Intel iPSC/860 hypercube: static block-Cartesian, dynamic block-Cartesian, and Bruno Cappello multi-cell. Tests were conducted on 1-121 PEs with the Bruno Cappello multi-cell decomposition's performing best due to its near-perfect load balancing, low communication requirements, and ability to overlap computation and communication. The relative benefits of this method are expected to be even greater on ring, mesh, and torus connection schemes on MIMD machines since their connectivity is weaker than that of a hypercube.

Relevance: 2

[Vandew91] S. Vandewalle and R. Piessens, "Numerical Experiments with Nonlinear Multigrid Waveform Relaxation on a Parallel Processor," *Applied Numerical Mathematics*, Vol. 8, No. 2, Sept., 1991, pp. 149-161.

This paper demonstrates a method for increasing parallel performance of standard time-stepping techniques applied to solving parabolic PDEs through calculating the solution on several time levels simultaneously (waveform relaxation). Results are based on an Intel iPSC/2 using 1 and 16 processors.

Relevance: 1

[Vandew92] S. Vandewalle and R. Piessens, "Efficient Parallel Algorithms for Solving Initial-Boundary Value and Time-Periodic Parabolic Partial Differential Equations," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 6, Nov., 1992, pp. 1330-1346.

This paper presents numerical solution techniques using waveform relaxation for solving linear and nonlinear PDEs. Normally, such solutions are not justified for small problems and/or large numbers of processors; however, the algorithm presented overcomes some of these disadvantages at the cost of higher memory usage. Results are included for the Intel iPSC/2-VX hypercube with 1 and 16 PEs.

Relevance: 1

[Ven91] S. Venugopal and V. K. Naik, "Effects of Partitioning and Scheduling Sparse Matrix Factorization on Communications and Load Balance," *Proceedings of Supercomputing '91*, IEEE Computer Society Press, Los Alamitos, CA, Nov., 1991, pp. 866-875.

This paper presents block-based automatic partitioning and scheduling, as compared with the wrap-around column assignment scheme, for sparse matrix factorization on a distributed memory system. Experimental results show that the block-based scheme results in reduced communication overhead but more load imbalance than the wrap-mapped scheme; therefore, for message-passing architectures, block-based methods are better.

Relevance: 2

[Wag93] A. S. Wagner, "Embedding All Binary Trees in the Hypercube," *Journal of Parallel and Distributed Computing*, Vol. 18, No. 1, May, 1993, pp. 33-43.

This paper presents an algorithm for mapping binary trees into the hypercube and ensuring that the communication load is evenly distributed across the system.

Relevance: 2

[Wan93] H. C. Wang and K. Hwang, "Multicoloring for Fast Sparse Matrix-Vector Multiplication in Solving PDE Problems," in S. Hariri and P. B. Berra, (Eds.), *Proceedings of the 1993 International Conference on Parallel Processing - Vol. III, Algorithms and Applications*, CRC Press, Inc., Boca Raton, FL, 1993, pp. 215-222.

This paper introduces a multicoloring technique that can be used for parallel sparse matrix-vector multiplication, which dominates the computing cost of iterative PDE solvers. This technique, which has low execution overhead, aids in the parallel solution of grid-structured nonsymmetric PDEs in shared-memory machines through the resolution of memory access conflicts. Performance results on an Alliant FX/80 with 1-8 PEs show substantial performance improvement.

Relevance: 2

[Wan94] M. -C. Wang, W. G. Nation, J. B. Armstrong, H. J. Siegel, S. D. Kim, M. A. Nichols, and M. Gherrity, "Multiple Quadratic Forms: A Case Study in the Design of Data-Parallel Algorithms," *Journal of Parallel and Distributed Computing*, Vol. 21, No. 1, April, 1994, pp. 124-139.

This paper compares various modes of parallelism (SIMD, MIMD, and SIMD/MIMD mixed mode) used for executing multiple quadratic form algorithms. No single algorithm performed best for all data-size/machine-size ratios; therefore, to achieve good scalability, the researchers propose maintaining a set of algorithms from which the most appropriate algorithm is selected based on the ratio calculated from the scaled machine size. These results were verified using the 16K-PE MasPar MP-1 (SIMD), the 64-PE NCUBE 2 (MIMD), and the 16-PE PASM prototype (mixed-mode). This work can be generalized to other algorithms running on SIMD, MIMD, or mixed-mode machines with a multistage cube, hypercube, or mesh-connected topology.

Relevance: 2

[Web90] H. Weberpals, "Improving the Vector Performance via Algorithmic Domain Decomposition," in H. Burkhart (Ed.), *CONPAR 90-VAPP IV - Joint International Conference on Vector and Parallel Proceedings*, Springer-Verlag, Berlin, 1990, pp. 458-466

This paper gives some guidelines for improving the vector performance of algorithms by decomposing the data domain to comply with and take advantage of the memory hierarchy. The IBM 3090E is used as an example architecture to illustrate the domain decomposition techniques.

Relevance: 3

[Wol90] M. Wolfe, "Massive Parallelism through Program Restructuring," *The Third Symposium on the Frontiers of Massively Parallel Computation*, Oct., 1990, pp. 407-415.

This paper demonstrates some simple programming techniques to map algorithms to parallel processors more efficiently. Among the techniques presented are loop interchanging, loop skewing, loop reversal, and loop rotation.

Relevance: 2

[Wom90] D. E. Womble, "A Time-Stepping Algorithm for Parallel Computers," *SIAM Journal on Scientific and Statistical Computing*, Vol. 11, No. 5, Sept., 1990, pp. 824-837.

This paper examines a time-stepping algorithm for solving parabolic and hyperbolic differential equations on parallel computers. In such an algorithm, processors perform useful work on many time levels in the problem simultaneously. Performance results on both linear and nonlinear problems are provided for an NCUBE/ten with 1-128 PEs.

Relevance: 2

[Wor90] P. H. Worley, "The Effect of Time Constraints on Scaled Speedup," *SIAM Journal on Scientific and Statistical Computing*, Vol. 11, No. 5, Sept., 1990, pp. 838-858.

This paper explains the effect of problem time constraints on scaled speedup, the speedup obtained when the size of the problem grows with the number of processors. Specifically, allowing the size of a problem to grow to fill available memory can produce dramatically different results from allowing the problem to grow subject to time constraints. Some general guidelines are given for interpreting scaled speedup on fixed-sized problems.

Relevance: 2

[Wor91] P. H. Worley, "Limits on Parallelism in the Numerical Solution of Linear Partial Differential Equations," *SIAM Journal on Scientific and Statistical Computing*, Vol. 12, No. 1, Jan., 1991, pp. 1-35.

This paper analyzes the approximation of the solution of linear scalar PDEs at one or more locations in their domains. An algorithm-independent lower bound is established for the amount of data required to stay within a certain error range; consequently, a lower bound can be established on the execution time of the parallel algorithm used in the approximation. Some problems, therefore, cannot be solved in a fixed amount of time no matter how many processors are available.

Relevance: 2

[Wor92] P. H. Worley, "Parallelizing Across Time When Solving Time-Dependent Partial Differential Equations," in J. Dongarra (Ed.), *Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computing*, SIAM, Philadelphia, 1992, pp. 246-252.

This paper describes algorithms for parabolic and hyperbolic PDEs that can be parallelized in both time and space. These algorithms are variants of the waveform relaxation multigrid method where the scalar ODEs that make up its kernel are solved differently. Generalizations are made for the waveform relaxation with cyclic relaxation ODE solver, waveform relaxation multigrid with the standard ODE solver, and a timestepping algorithm that uses multigrid at each time step.

Relevance: 2

[Wor93] P. B. Worland, "Parallel Methods for ODEs with Improved Absolute Stability Boundaries," *Journal of Parallel and Distributed Computing*, Vol. 18, No. 1, May, 1993, pp. 25-32.

This paper explores the manipulation of predicted and corrected values in block predictor-corrector methods to extend the stability interval.

Relevance: 2

[Wri92] S. J. Wright, "Stable Parallel Algorithms for Two-Point Boundary Value Problems," *SIAM Journal on Scientific and Statistical Computing*, Vol. 13, No. 3, May, 1992, pp. 742-764.

This paper presents a structured orthogonal factorization technique to solve a system of linear equations, which are often used in algorithms for two-point boundary value ordinary differential equations. Performance analysis and implementation are performed using the Alliant FX/8 and the Cray Y-MP at NCSC. Additionally, some general guidelines are given describing when this technique is useful.

Relevance: 1

[Wri93] K. Wright, "Parallel Treatment of Block-Bidiagonal Matrices in the Solution of Ordinary Differential Boundary Value Problems," *Journal of Computational and Applied Mathematics*, Vol. 45, Nos. 1-2, April, 1993, pp. 191-200.

This paper presents an algorithm for a shared memory machine which reduces a block-diagonal system of size $n \times (n + 1)$ to a system of size 1×2 blocks. This reduction uses ideas similar to those in recursive doubling and block-cyclic reduction, but includes full row interchanges. This algorithm has been implemented on the 14-processor Encore Multimax shared memory machine. The extra overhead required for this algorithm, however, does not make it a clear winner over row and column interchange methods.

Relevance: 1

[Yan92] J. A. Yang and Y. -I. Choo, "Formal Derivation of an Efficient Parallel 2-D Gauss-Seidel Method," *Proceedings of the Sixth International Parallel Processing Symposium*, IEEE Computer Society Press, Los Alamitos, CA, 1992, pp. 204-207.

This paper presents a highly efficient implementation of the 2-D Gauss-Seidel method used in solving PDEs by iterative finite difference. The derivation of this method begins with a simple program, to which equation transformations are applied to partition the abstract problem onto processors, to make communication among processors explicit, to pipeline the computation by wavefront scheduling, and to map logical processors onto physical processors for perfect processor utilization. This technique is based on the 2-D mesh of processors, although it can be applied to other architectures, such as hypercubes and shared-memory MIMD machines, as well.

Relevance: 2

[You93] A. Youssef, "A Parallel Algorithm for Random Walk Construction with Application to the Monte Carlo Solution of Partial Differential Equations," *IEEE Transactions on Parallel and Distributed Systems*, Vol. 4, No. 3, March, 1993, pp. 355-360.

This paper includes a parallel algorithm for the construction of random walks and applies it to the Monte Carlo solution of elliptical and parabolic partial differential equations. The algorithm, which is based on parallel prefix computation, is suited ideally to a hypercube structure and performs well for regions of a rectangular grid, an irregular grid, and multi-dimensional grids.

Relevance: 1

[Zha94] W. Zhang and R. E. Korf, "Parallel Heap Operations on an EREW PRAM," *Journal of Parallel and Distributed Computing*, Vol. 20, No. 2, Feb., 1994, pp. 248-255.

This paper presents some parallel heap operations (creation, root deletion, etc.) on the exclusive-read exclusive-write (EREW) parallel random-access machine (PRAM).

Relevance: 3

[Zla91] Z. Zlatev, J. Wasniewski, M. Venugopal, and J. Moth, "Optimizing Air Pollution Models on Two Alliant Computers," in A. E. Fincham and B. Ford (Eds.), *Parallel Computation Conference Proceedings*, Clarendon Press, Oxford, 1991, pp. 115-133.

This paper describes methods for optimizing code written for modeling the long range transport of air pollutants. Numerical results are included for the following portions of the model as implemented on an Alliant FX/80 with up to 8 processors and an Alliant FX/2800 model 200PMS with up to 14 processors: advection, diffusion, decomposition, emission, and chemical reactions. Good speedups are achieved on the machines, on which running concurrent tasks on different processors and vectorization on each processor are performed.

Relevance: 1

Note: * indicates recommended reading

Special Issues Bibliography

"Special Issue -- Parallel Methods for Ordinary Differential Equations," *Applied Numerical Mathematics*, Vol. 11, Nos. 1-3, Jan., 1993. Note: This issue has several other papers which may be of interest but are not included here due to their strong mathematical base and lack of computer implementation.

[Bur93]

"Special Issue on Data Parallel Algorithms and Programming", *Journal of Parallel and Distributed Computing*, Vol. 21, No. 1, April, 1994.

[Ble94], [Chr94], [Cro94], [Fra94], [Wan94]

Books

[Ble90] G. E. Blelloch, *Vector Models for Data-Parallel Computing*, MIT Press, Cambridge, MA, 1990.

This text covers models, algorithms, languages and compilers, and architecture of vector machines. Included in the algorithms section are algorithms for graphs and trees, computational geometry, and numerical problems (e.g., matrix multiplication and linear systems solution).

Relevance: 3
Call Number: QA76.5 .B5456 1990

[Cha92] P. Chaudhuri, *Parallel Algorithms - Design and Analysis*, Prentice Hall, New York, NY, 1992.

Topics include models of parallel computation, complexity of parallel algorithms, merging and sorting, selection and searching, matrix computations, algorithms for unweighted and weighted graphs, and updating algorithms for graphs.

Relevance: 3
Call Number: QA76.58 .C43 1992

[Gea71] C. W. Gear, *Numerical Initial Value Problems in Ordinary Differential Equations*, Prentice-Hall, Englewood Cliffs, NJ, 1971.

This book includes the following topics: higher order one-step methods; systems of equations and equations of order greater than one; convergence, error bounds, and error estimates for one-step methods; the choice of step size and order; extrapolation methods; multivalue or multistep methods; general multistep methods, order and stability; multivalue methods; existence, convergence, and error estimates for multivalue methods; and special methods for special problems. The chapter on special methods for special problems has been recommended.

Relevance: 2 (EPA-recommended)
Call Number: QA372 .G4

[Hat91] P. J. Hatcher and M. J. Quinn, *Data-Parallel Programming in MIMD Computers*, MIT Press, Cambridge, MA, 1991.

This book focuses on programming with Dataparallel C, a variant of C*. General programming guidelines, as well as performance data, is provided for Dataparallel C on the Intel iPSC/2 (1 - 32 processors), the NCUBE 3100 (1 - 64 processors), and the Sequent Symmetry (1 - 24 processors).

Relevance: 3
Call Number: QA76.5 .H42 1991

[JáJ92] J. JáJá, *An Introduction to Parallel Algorithms*, Addison-Wesley, 1992.

Topics include algorithmic techniques for lists and trees; searching, sorting, and merging; graphs; planar geometry; strings; arithmetic computations; and randomized algorithms.

Relevance: 2
Call Number: QA76.58 .J35 1992

[Kar90] R. M. Karp and V. Ramachandran, "Parallel Algorithms for Shared-Memory Machines," in J. van Leeuwen (Ed.), *Handbook of Theoretical Computer Science*, Elsevier, 1990, pp. 869-941.

This often-cited reference provides useful, efficient parallel algorithms for problems commonly encountered (e.g., graph operations, sorting, merging, and selection). Other topics include models of parallel computers, NC-algorithms, and P-complete problems.

Relevance: 3
Call Number: QA76 .H279 1990

[Kum94] V. Kumar, A. Grama, A. Gupta, and G. Karypis, *Introduction to Parallel Computing - Design and Analysis of Algorithms*, The Benjamin/Cummings Publishing Co., Inc., Redwood City, CA, 1994.

Topics include: models of parallel computers, basic communication operators, performance and scalability of parallel systems, dense matrix algorithms, sorting, graph algorithms, search algorithms for discrete optimization problems, dynamic programming, Fast Fourier Transformation, solving sparse systems of linear equations, systolic algorithms and their mapping onto parallel computers, and parallel programming.

Relevance: 3
Call Number: QA76.58 .I58 1994

[Lei92] F. T. Leighton, *Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes*,

Morgan Kaufman, San Mateo, CA, 1992.

The major topics in this book include algorithms for arrays and trees, meshes of trees, and hypercubes. For arrays and trees, algorithms for the following areas, among others, are explored: sorting and counting, matrices, graphs and packet routing. Under hypercubes, algorithms for sorting, packet routing, and FFTs are presented.

Relevance: 2
Call Number: QA76.58 .L45 1992

[Lew92] T. G. Lewis and H. El-Rewini, *Introduction to Parallel Computing*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1992.

Topics include: measures of performance, shared-memory parallel programming, distributed-memory parallel programming, object-oriented parallel programming, data parallel programming, functional dataflow programming, scheduling parallel programming, loop scheduling, parallelizing serial programs, and parallel programming support environments. Additionally, the SLALOM benchmark code and a DataParallel C implementation of Gaussian elimination are provided in the appendices.

Relevance: 3
Call Number: QA76.58 .L48 1992

[Smi93] J. R. Smith, *The Design and Analysis of Parallel Algorithms*, Oxford University Press, NY, 1993.

Topics in this advanced text include: models of parallel computation, distributed memory models, examples of existing parallel computers, numeric algorithms, symbolic algorithms, and probabilistic algorithms. The chapter on numeric algorithms covers linear algebra and partial differential equations.

Relevance: 2
Call Number: QA76.58 .S62 1993

References

Periodicals

ACM Computing Surveys

Vol. 26, Nos. 1-2, Mar. - June, 1994
Vol. 25, Nos. 1-4, Mar. - Dec., 1993
Vol. 24, Nos. 1-4, Mar. - Dec., 1992
Vol. 23, Nos. 1-4, Mar. - Dec., 1991
Vol. 22, Nos. 1-4, Mar. - Dec., 1990

Notes: few references to multiprocessing or mathematics
Call Number: QA76.5 .C646
Annotations: none

ACM Transactions on Computer Systems

Vol. 12, Nos. 1-2, Feb. - May, 1994
Vol. 11, Nos. 1-4, Feb. - Nov., 1993
Vol. 10, Nos. 1-4, Feb. - Nov., 1992
Vol. 9, Nos. 1-4, Feb. - Nov., 1991
Vol. 8, Nos. 1-4, Feb. - Nov., 1990

Notes: numerous articles on parallel machines, but not many specific applications
Call Number: QA76.9 .S88 .A27
Annotations: none

ACM Transactions on Mathematical Software

Vol. 20, Nos. 1, Mar., 1994
Vol. 19, Nos. 1-4, Mar. - Dec., 1993
Vol. 18, Nos. 1-4, Mar. - Dec., 1992
Vol. 17, Nos. 1-4, Mar. - Dec., 1991
Vol. 16, Nos. 1-4, Mar. - Dec., 1990

Notes: good on ODEs, but not much on parallel implementations
Call Number: QA76.6 .A8a
Annotations: [Byr75], [Rib93]

Advances in Computers

Vol. 37, 1993
Vol. 36, 1993
Vol. 35, 1992
Vol. 34, 1992
Vol. 33, 1991
Vol. 32, 1991
Vol. 31, 1990
Vol. 30, 1990

Notes: too broad, high-level
Call Numbers: QA76 .A3 v. 37/36 1993
QA76 .A3 v. 35/34 1992
QA76 .A3 v. 33/32 1991
QA76 .A3 v. 31/30 1991
Annotations: none

Applied Numerical Mathematics

Vol. 14, Nos. 1-4, April - June, 1994
Vol. 13, Nos. 1-6, Sept., 1993 - Feb., 1994
Vol. 12, Nos. 1-6, May - Aug., 1993
Vol. 11, Nos. 1-6, Jan. - April, 1993
Vol. 10, Nos. 1-6, June - Nov., 1992
Vol. 9, Nos. 1-6, Jan. - May, 1992
Vol. 8, Nos. 1-6, Aug. - Dec., 1991
Vol. 7, Nos. 1-6, Jan. - July, 1991
Vol. 6, Nos. 3-6, Mar. - Oct., 1991

Notes: good source; strong emphasis on mathematics
Call Number: QA297 .A68
Annotations: [Ami93], [Bel93], [Bur93], [Far93], [Gea93-1], [Gea93-2], [Key90], [Mar93], [Mat93], [Som92], [van der92], [van der93-1], [Vandew91]

Atmospheric Environment

Vol. 27A, Nos. 1-18, 1993
Vol. 27B, Nos. 1-4, 1993
Vol. 26A, Nos. 1-18, 1992
Vol. 26B, Nos. 1-4, 1992
Vol. 25A, Nos. 1-12, 1991
Vol. 25B, Nos. 1-3, 1991
Vol. 24A, Nos. 1-12, 1990
Vol. 24B, Nos. 1-3, 1990

Notes: excellent source; several articles on air quality/ODEs/parallel processing
Call Number: TD881 .A75 (Natural Resources Library - Jordan Hall)
Annotations: [Jac94], [Luh92], [Odm92], [Pai93], [Say93]

BIT

Vol. 34, Nos. 1-2, 1994
Vol. 33, Nos. 1-4, 1993
Vol. 32, Nos. 1-4, 1992
Vol. 31, Nos. 1-4, 1991
Vol. 30, Nos. 1-4, 1990

Notes: numerous articles on ODE and on parallel computing, but not on both
Call Number: QA76 .B24
Annotations: [Cri94], [Ske92]

Communications of the ACM

Vol. 37, Nos. 1-2, Jan. - Feb., 1994
Vol. 36, Nos. 1-12, Jan. - Dec., 1993
Vol. 35, Nos. 1-12, Jan. - Dec., 1992
Vol. 34, Nos. 1-12, Jan. - Dec., 1991
Vol. 33, Nos. 1-12, Jan. - Dec., 1990

Notes: too general
Call Number: QA76 .A79
Annotations: none

Computers and Mathematics with Applications

Vol. 28, Nos. 1-3, Aug., 1994

Vol. 26, Nos. 1-12, July - Dec., 1993
Vol. 25, Nos. 1-12, Jan. - June, 1993
Vol. 24, Nos. 1-12, July - Dec., 1992
Vol. 23, Nos. 1-12, Jan. - June, 1992
Vol. 22, Nos. 1-12, July - Dec., 1991
Vol. 21, Nos. 1-12, Jan. - June, 1991
Vol. 20, Nos. 1-12, July - Dec., 1990
Vol. 29, Nos. 1-12, Jan. - June, 1990

Notes: nothing appropriate
Call Number: QA76 .C58115
Annotations: [Ami92], [Jwo92], [Lop93], [Lus92], [Mur91], [Naa91]

CWI Quarterly

Vol. 6, Nos. 1-4, Mar. - Dec., 1993
Vol. 5, Nos. 1-4, Mar. - Dec., 1992
Vol. 4, Nos. 1-4, Mar. - Dec., 1991
Vol. 3, Nos. 1-4, Mar. - Dec., 1990

Notes: CWI = Centrum voor Wiskunde en Informatica (Centre for Mathematics and Computer Science); mostly mathematically based; no parallel topics
Call Number: QA1 .C874
Annotations: none

IEEE Computer

Vol. 27, Nos. 1-7, Jan. - July, 1994
Vol. 26, Nos. 1-12, Jan. - Dec., 1993
Vol. 25, Nos. 1-12, Jan. - Dec., 1992
Vol. 24, Nos. 1-12, Jan. - Dec., 1991
Vol. 23, Nos. 1-6, Jan. - June, 1990

Notes: a general, often referenced magazine, but too broad
Call Number: QA76 .C56
Annotations: [Grim93-2]

IEEE Parallel and Distributed Technology

Vol. 2, No. 1, Spring, 1994
Vol. 1, Nos. 1-4, Feb. - Nov., 1993

Notes: easy-to-read articles
Call Number: QA76.58 .I39
Annotations: [Don93], [Grim93-1], [Lov93]

IEEE Transactions on Computers

Vol. 43, Nos. 7-8, July - Aug., 1994

Vol. 42, Nos. 1-12, Jan. - Dec., 1993
Vol. 41, Nos. 1-12, Jul. - Dec., 1992
Vol. 40, Nos. 1-12, Jan. - Dec., 1991
Vol. 39, Nos. 1-12, Jan. - Dec., 1990

Notes: low-level; more hardware-oriented
Call Number: TK7882 .C5 .I2
Annotations: none

IEEE Transactions on Parallel and Distributed Systems

Vol. 5, Nos. 1-8, Jan. - Aug., 1994
Vol. 4, Nos. 1-12, Jan. - Dec., 1993
Vol. 3, Nos. 1-6, Jan. - Nov., 1992
Vol. 2, Nos. 1-4, Jan. - Oct., 1991
Vol. 1, Nos. 1-4, Jan. - Oct., 1990

Notes: very good; oft-cited, highly regarded technical reference
Call Number: QA76.58 .I44
Annotations: [Aba93], [Ala93], [Alv93], [Ang93], [Chak93], [Chau93], [Cor92], [Dow93], [Evr93], [Gar94], [Geh93], [Gu94], [Gup93-2], [Hua94], [JáJ93], [Kru94], [Lee94], [Mal92], [Rog93], [Sun94], [You93]

IMA Journal of Numerical Analysis

Vol. 14, Nos. 1-3, Jan. - July, 1994
Vol. 13, Nos. 1-4, Jan. - Oct., 1993
Vol. 12, Nos. 1-4, Jan. - Oct., 1992
Vol. 11, Nos. 1-4, Jan. - Oct., 1991
Vol. 10, Nos. 1-4, Jan. - Oct., 1990

Notes: too mathematical in nature
Call Number: QA297 .I44
Annotations: none

International Journal for Numerical Methods in Engineering

Vol. 37, Nos. 11-16, 1994

Vol. 37, Nos. 1-4, 1994
Vol. 36, Nos. 1-24, 1993
Vol. 35, Nos. 1-10, 1992
Vol. 34, Nos. 1-3, 1992
Vol. 33, Nos. 1-10, 1992
Vol. 32, Nos. 1-8, 1991
Vol. 31, Nos. 1-8, 1991
Vol. 30, Nos. 1-8, 1990
Vol. 29, Nos. 1-8, 1990

Notes: several articles on PDEs and parallel computing, but nothing appropriate
Call Number: TA335 .I57
Annotations: none

International Journal of Parallel Programming

Vol. 22, Nos. 1-2, Feb. - April, 1994
Vol. 21, Nos. 1-6, Feb. - Dec., 1992
Vol. 20, Nos. 1-6, Feb. - Dec., 1991
Vol. 19, Nos. 1-6, Feb. - Dec., 1990

Notes: not many application-specific articles; unpublished in 1993
Call Number: QA76.5 .I56
Annotations: none

International Journal of Supercomputer Applications
International Journal of Supercomputer Applications and High Performance Computing

Vol. 8, Nos. 1, Spring, 1994
Vol. 7, Nos. 1-4, Spring - Winter, 1993
Vol. 6, Nos. 1-4, Spring - Winter, 1992
Vol. 5, Nos. 1-4, Spring - Winter, 1991
Vol. 4, Nos. 1-4, Spring - Winter, 1990

Notes: large amount of information on matrix operations and some on differential equations
Call Number: QA76.5 .I567
Annotations: none

Journal of Computational and Applied Mathematics

Vol. 49, Nos. 1-3, Dec., 1993

Vol. 48, Nos. 1-3, Oct. - Nov., 1993
Vol. 47, Nos. 1-3, June - Sept., 1993
Vol. 46, Nos. 1-3, June, 1993
Vol. 45, Nos. 1-3, April, 1993
Vol. 44, Nos. 1-3, Dec., 1992
Vol. 43, Nos. 1-3, Nov. - Dec., 1992
Vol. 42, Nos. 1-3, Sept. - Oct., 1992
Vol. 41, Nos. 1-3, Aug., 1992
Vol. 40, Nos. 1-3, June - July, 1992
Vol. 39, Nos. 1-3, Feb. - May, 1992
Vol. 38, Nos. 1-3, Dec., 1991
Vol. 37, Nos. 1-3, Nov., 1991
Vol. 36, Nos. 1-3, Aug. - Sept., 1991
Vol. 35, Nos. 1-3, June, 1991
Vol. 34, Nos. 1-3, Feb. - April, 1991
Vol. 33, Nos. 1-3, Dec., 1990
Vol. 32, Nos. 1-3, Nov. - Dec., 1990
Vol. 31, Nos. 1-3, July - Oct., 1990
Vol. 30, Nos. 1-3, April - July, 1990
Vol. 29, Nos. 1-3, Jan. - March, 1990

Notes: some good articles; strong emphasis on math
Call Number: QA1 .J5524
Annotations: [Jia91], [Kah91], [Som93], [Wri93]

Journal of Computational Mathematics
Vol. 12, Nos. 1-2, Jan. - April, 1994
Vol. 11, Nos. 1-4, Jan. - Oct., 1993
Vol. 10, Nos. 1-4, Jan. - Oct., 1992
Vol. 9, Nos. 1-4, Jan. - Oct., 1991
Vol. 8, Nos. 1-4, Jan. - Oct., 1990

Notes: too mathematical in nature
Call Number: QA297 .J68
Annotations: none

Journal of Environmental Engineering
Vol. 120, Nos. 1-4, Jan./Feb. - July/Aug., 1993
Vol. 119, Nos. 1-6, Jan./Feb. - Nov./Dec., 1993
Vol. 118, Nos. 1-6, Jan./Feb. - Nov./Dec., 1992
Vol. 117, Nos. 1-6, Jan./Feb. - Nov./Dec., 1991
Vol. 116, Nos. 1-6, Jan./Feb. - Nov./Dec., 1990

Notes: not many computer/mathematical/air quality models
Call Number: TD1 .A4
Annotations: none

Journal of Environmental Quality
Vol. 24, Nos. 4, July/Aug., 1994

Vol. 22, Nos. 1-12, Jan./Feb. - Nov./Dec., 1993
Vol. 21, Nos. 1-12, Jan./Feb. - Nov./Dec., 1992
Vol. 19, Nos. 1-12, Jan./Feb. - Nov./Dec., 1991
Vol. 18, Nos. 1-12, Jan./Feb. - Nov./Dec., 1990

Notes: no computer implementations
Call Number: S1 .J78
Annotations: none

Journal of the ACM

Vol. 41, Nos. 1-3, Jan. - May, 1994
Vol. 40, Nos. 1-5, Jan. - Nov., 1993
Vol. 39, Nos. 1-4, Jan. - Oct., 1992
Vol. 38, Nos. 1-4, Jan. - Oct., 1991
Vol. 37, Nos. 1-4, Jan. - Oct., 1990

Notes: nothing appropriate
Call Number: TA1 .J635
Annotations: none

Journal of the IES (Institute of Environmental Sciences)

Vol. 37, Nos. 1-6, Jan./Feb. - July/Aug., 1994
Vol. 36, Nos. 1-6, Jan./Feb. - Nov./Dec., 1993
Vol. 35, Nos. 1-6, Jan./Feb. - Nov./Dec., 1992
Vol. 34, Nos. 1-6, Jan./Feb. - Nov./Dec., 1991
Vol. 33, Nos. 1-6, Jan./Feb. - Nov./Dec., 1990

Notes: nothing appropriate
Call Number: TA1 .J635
Annotations: none

Journal of Parallel and Distributed Computing

Vol. 21, Nos. 1-3, April - June, 1994
Vol. 20, Nos. 1-4, Jan. - April, 1994
Vol. 19, Nos. 1-4, Sept. - Dec., 1993
Vol. 18, Nos. 1-4, May - Aug., 1993
Vol. 17, Nos. 1-4, Jan. - April, 1993
Vol. 16, Nos. 1-4, Sept. - Dec., 1992
Vol. 15, Nos. 1-4, May - Aug., 1992
Vol. 14, Nos. 1-4, Jan. - April, 1992
Vol. 13, Nos. 1-4, Sept. - Dec., 1991
Vol. 12, Nos. 1-4, May - Aug., 1991
Vol. 11, Nos. 1-4, Jan. - April, 1991
Vol. 10, Nos. 1-4, Sept. - Dec., 1990
Vol. 9, Nos. 1-4, May - Aug., 1990
Vol. 8, Nos. 1-4, Jan. - April, 1990

Notes: very good; oft-cited, highly regarded technical reference
Call Number: QA76.6 .J72
Annotations: [Ble94], [Bro93], [Car94], [Cha92], [Chr94], [Cox91], [Cro94], [Don90], [Fra94], [Göt91], [Gup93-1], [Iba94], [Lee90], [Li90], [Lin91], [McG91], [Sag93], [Wag93], [Wan94], [Wor93], [Zha94]

Journal of Scientific Computing

Vol. 9, Nos. 1, Mar., 1994
Vol. 8, Nos. 1-4, Mar. - Dec., 1993
Vol. 7, Nos. 1-4, Mar. - Dec., 1992
Vol. 6, Nos. 1-4, Mar. - Dec., 1991

Notes: mostly mathematical, but some topics involve computers
Call Number: Q183.9 .J68
Annotations: [Bla92], [Gup92], [Iof93], [Isr93-1], [Isr93-2], [Meh93]

Journal of Supercomputing
Vol. 8, Nos. 1-2, Mar. - June, 1994
Vol. 7, Nos. 1-4, Mar. - Dec., 1993
Vol. 6, Nos. 1-4, Mar. - Dec., 1992
Vol. 5, Nos. 1-4, June, 1991 - Feb., 1992

Notes: good topics, but no specific one on ODEs
Call Number: QA76.88 .J68
Annotations: none

Parallel Computing
Vol. 20, Nos. 1-7, Jan. - July, 1994
Vol. 19, Nos. 1-12, Jan. - Dec., 1993
Vol. 18, Nos. 1-12, Jan. - Dec., 1992
Vol. 17, Nos. 1-12, Apr. - Dec., 1991
Vol. 16, Nos. 1-3, Nov. - Dec., 1991
Vol. 15, Nos. 1-3, Sept., 1990
Vol. 14, Nos. 1-3, May - Aug., 1990
Vol. 13, Nos. 1-3, Jan. - Mar., 1990

Notes: fairly good source, though some algorithm implementations are not on commercially available machines
Call Number: QA76.9 .D5 .P2
Annotations: [Eva90-1], [Eva90-2], [Kie94], [Pap93]

Proceedings of the IEEE
Vol. 82, Nos. 7-8, July - Aug., 1994

Vol. 81, Nos. 1-12, Jan. - Dec., 1993
Vol. 80, Nos. 1-12, Jan. - Dec., 1992
Vol. 79, Nos. 1-12, Jan. - Dec., 1991
Vol. 78, Nos. 1-12, Jan. - Dec., 1990

Notes: low-level; more hardware-oriented
Call Number: TK5700 .I6
Annotations: none

SIAM Journal on Computing
Vol. 23, Nos. 1-4, Feb. - Aug., 1994
Vol. 22, Nos. 1-6, Feb. - Dec., 1993
Vol. 21, Nos. 1-6, Feb. - Dec., 1992
Vol. 20, Nos. 1-6, Feb. - Dec., 1991
Vol. 19, Nos. 1-6, Feb. - Dec., 1990

Notes: broad; no mention of ODEs
Call Number: QA76 .S2
Annotations: none

SIAM Journal on Scientific and Statistical Computing

SIAM Journal on Scientific Computing

Vol. 15, Nos. 1-4, Jan. - July, 1994
Vol. 14, Nos. 1-6, Jan. - Nov., 1993
Vol. 13, Nos. 1-6, Jan. - Nov., 1992
Vol. 12, Nos. 1-6, Jan. - Nov., 1991
Vol. 11, Nos. 1-6, Jan. - Nov., 1990

Notes: highly referenced for parallel ODE applications; subject treatment is mostly mathematical, although computer methods and results are often reported
Call Number: QA297 .S480
Annotations: [Bab92], [Bas91], [Bro89], [Cha90], [Col90], [Gal92], [Gro92], [Kuo90], [Lus91], [Mu92-1], [Sal90], [Tam92-1], [Tam92-2], [van der91], [Vandew92], [Wom90], [Wor90], [Wor91], [Wri92], [Elm93], [Sha94]

SIAM Review

Vol. 36, Nos. 1-2, Mar. - June, 1994
Vol. 35, Nos. 1-4, Mar. - Dec., 1993
Vol. 34, Nos. 1-4, Mar. - Dec., 1992
Vol. 33, Nos. 1-4, Mar. - Dec., 1991
Vol. 32, Nos. 1-4, Mar. - Dec., 1990

Notes: survey papers; parallel and math topics covered, but no specific ODE/parallel
Call Number: QA1 .S2
Annotations: none

Note: ---------- denotes a gap in the sources covered due to the journal bindery process

Conferences

ACM Annual Computer Science Conference

1993 ACM 21st Annual Computer Science Conference Proceedings, S. C. Kwasny and J. F. Buck (Eds.), ACM, New York, NY, 1992, Feb. 16-18, 1993, Indianapolis, IN.

1992 ACM 20th Annual Computer Science Conference Proceedings, J. P. Agrawal, V. Kumar, and V. Wallentine (Eds.), ACM, New York, NY, 1992, March 3-5, 1992, Kansas City, MO.

1991 ACM 19th Annual Computer Science Conference Proceedings, ACM, New York, NY, 1991, March 5-7, 1991, San Antonio, TX.

1990 ACM 18th Annual Computer Science Conference Proceedings, ACM, New York, NY, 1990, Feb. 20-22, 1990, Washington, DC.

Notes: highly referenced but too generally too broad, although there is a section on parallel computing
Call Numbers: QA75.5 .A137 1993/1992/1991/1990
Annotations: none

ACPC Conference

Parallel Computation - Proceedings of the Second International ACPC (Austrian Center for Parallel Computation) Conference, J. Volkert (Ed.), Springer-Verlag, Berlin, 1993, Oct. 4-6, 1993, Gmunden, Austria.

Parallel Computation - Proceedings of the First International ACPC (Austrian Center for Parallel Computation) Conference, H. P. Zima (Ed.), Springer-Verlag, Berlin, 1992, Sept. 30 - Oct. 2, 1991, Salzburg, Austria.

Notes: not very useful
Call Numbers: QA76.58 .I5 1993/1991
Annotations: [Hor92]

Application Specific Array Processors

1992 Proceedings of the International Conference on Application Specific Array Processors, J. Fortes, E. Lee, and T. Meng (Eds.), IEEE Computer Society Press, Los Alamitos, CA, 1992, Aug. 4-7, 1992, Berkeley, CA.

1990 Proceedings of the International Conference on Application Specific Array Processors, S. -Y. Kung, E. E. Swartzlander, Jr., J. A. B. Fortes, and K. W. Przytula (Eds.), IEEE Computer Society Press, Los Alamitos, CA, 1990, Sept. 5-7, 1990, Princeton, NJ.

Notes: mostly signal processing
Call Numbers: TK5102 .I5253 1992
QA76.5 .I542 1990
Annotations: [Amr92]

COMPCON

Spring COMPCON '93 - 38th IEEE Computer Society International Conference Digest of Papers, IEEE Computer Society Press, Los Alamitos, CA, 1993, Feb. 22-26, 1993, San Francisco, CA.

Spring COMPCON '92 - 37th IEEE Computer Society International Conference Digest of Papers, IEEE Computer Society Press, Los Alamitos, CA, 1992, Feb. 24-28, 1992, San Francisco, CA.

Spring COMPCON '91 - 36th IEEE Computer Society International Conference Digest of Papers, IEEE Computer Society Press, Los Alamitos, CA, 1991, Feb. 25 - March 1, 1991, San Francisco, CA.

Spring COMPCON '90 - 35th IEEE Computer Society International Conference Digest of Papers, IEEE Computer Society Press, Los Alamitos, CA, 1990, Feb. 26 - March 2, 1990, San Francisco, CA.

Notes: a little low-level and general, but sections on parallel processing and high-performance computing are included
Call Numbers: TK7885 .A1 C53 1993/1992/1991/1990
Annotations: [Lev92], [Pli92]

COMPSAC

Proceedings of the 15th Annual International Computer Software and Applications Conference, G. J. Knafl (Ed.), IEEE Computer Society Press, Los Alamitos, CA, 1991, Sept. 11-13, 1991, Tokyo, Japan.

Proceedings of the 14th Annual International Computer Software and Applications Conference, G. J. Knafl (Ed.), IEEE Computer Society Press, Los Alamitos, CA, 1990, Oct. 31 - Nov. 2, 1990, Chicago, IL.

Notes: some parallel applications, but no math
Call Numbers: QA76.6 .C6295 1991/1990
Annotations: none

Computing Methods in Applied Sciences and Engineering

Computing Methods in Applied Sciences and Engineering - Proceedings of the Tenth International Conference on Computing Methods in Applied Sciences and Engineering, R. Glowinsky (Ed.), Nova Science Publishers, Inc., New York, 1991, Feb. 11-14, 1992, Paris, France.

Computing Methods in Applied Sciences and Engineering - Proceedings of the Ninth International Conference on Computing Methods in Applied Sciences and Engineering, R. Glowinsky and A. Lichnewsky (Eds.), SIAM, Philadelphia, 1990, Jan. 29 - Feb. 2, 1990, Paris, France.

Notes: section on parallel computing, but nothing applicable
Call Numbers: QC39 .I49 1992/1990
Annotations: [Gär92]

CONCUR

CONCUR '92 - Proceedings of the Third International Conference on Concurrency Theory, W. R. Cleaveland (Ed.), Springer-Verlag, Berlin, 1992, Aug. 24-27, 1992, Stony Brook, NY.

Notes: not applicable
Call Number: QA76.58 .I53 1992
Annotations: none

CONPAR/VAPP

CONPAR '92-VAPP V - Second Joint International Conference on Vector and Parallel Processing Proceedings, L. Bougé, M. Cosnard, Y. Robert, and D. Trystram (Eds.), Springer-Verlag, Berlin, 1992, Sept. 1-4, 1992, Lyon, France.

CONPAR '90-VAPP IV - Joint International Conference on Vector and Parallel Processing Proceedings, H. Burkhart (Ed.), Springer-Verlag, Berlin, 1990, Sept. 10-13, 1990, Zurich, Switzerland.

Notes: includes linear algebra topics, but not much on ODEs
Call Numbers: QA76.58 .J65 1992/1990
Annotations: [Gro90], [Web90]

debis Workshop

Supercomputer and Chemistry 2 - debis Workshop 1990, U. Harms (Ed.), Springer-Verlag, Berlin, 1991, Nov. 19-20, 1990, Ottobrunn, Germany.

Notes: does not include atmospheric chemistry models
Call Number: QD39.3 .E46 S925 1991
Annotations: none

Distributed Computing Systems

Proceedings of the Twelfth International Conference on Distributed Computing Systems, IEEE Computer Society Press, Los Alamitos, CA, 1992, June 9-12, 1992, Yokohama, Japan.

Proceedings of the Eleventh International Conference on Distributed Computing Systems, IEEE Computer Society Press, Los Alamitos, CA, 1991, May 20-24, 1991, Arlington, TX.

Proceedings of the Tenth International Conference on Distributed Computing Systems, IEEE Computer Society Press, Los Alamitos, CA, 1990, May 28 - June 1, 1990, Paris, France.

Notes: not applicable
Call Numbers: QA76.9 .D5 .I57 1992/1991/1990
Annotations: none

Domain Decomposition Methods for Partial Differential Equations

Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations, R. Glowinski, Y. A. Kuznetsov, G. Meurant, J. Périaux, and O. B. Widlund (Eds.), SIAM, Philadelphia, 1991, May 21-25, 1990, Moscow.

Notes: good source
Call Number: QA402.2 .I57 1990
Annotations: [Chr91-2], [Gro91], [Meu91], [Scr91]

Environment and Tools for Parallel Scientific Computing

Environment and Tools for Parallel Scientific Computing, J. J. Dongarra and B. Tourancheau (Eds.), North-Holland, Amsterdam, 1993, Sept. 7-8, 1993, Saint Hilaire du Touvet, France.

Notes: nothing applicable
Call Number: QA76.642 .E58 1993
Annotations: none

European CM Users Meeting

Science on the Connection Machine - Proceedings of the First European CM Users Meeting, T. Lippert, K. Schilling, and P. Ueberholz (Eds.), World Scientific, Singapore, 1993, June 16-17, 1992, Wuppertal, Germany.

Notes: good range of applications, but nothing appropriate
Call Number: QA76.5 .E912 1992
Annotations: none

ECMWF Workshop on the Use of Parallel Processors in Meteorology

Parallel Supercomputing in Atmospheric Science - Proceedings of the Fifth ECMWF Workshop on the Use of Parallel Processors in Meteorology, G. Hoffman and T. Kauranne (Eds.), World Scientific, Singapore, 1993.

Notes: mostly weather and climate modeling; ECMWF = European Centre for Medium-Range Weather Forecasts
Call Number: QA76.58 .E25 1992 (Natural Resources Library)
Annotations: [Lie93]

European Distributed Memory Computing Conference

Distributed Memory Computing - Proceedings of the Second European Conference, EDMMC2, A. Bode (Ed.), Springer-Verlag, Berlin, 1991, April 22-24, 1991, Munich, Germany.

Notes: not applicable; too much emphasis on distributed memory and transputers
Call Number: QA76.5 .E913 1991
Annotations: none

Frontiers of Massively Parallel Computation

Frontiers '92 - Proceedings of the Fourth Symposium on the Frontiers of Massively Parallel Computation, H. J. Siegel (Ed.), IEEE Computer Society Press, Los Alamitos,CA, Oct. 15-21, 1992, McLean, VA.

Frontiers '90 - Proceedings of the Third Symposium on the Frontiers of Massively Parallel Computation, J. JáJá (Ed.), IEEE Computer Society Press, Los Alamitos, CA, Oct. 8-10, 1990, College Park, MD.

Notes: very good; covers many areas/topics
Call Numbers: QA76.58.S95 1992/1990
Annotations: [Kra92], [Lin90], [Mac90], [Sca92], [Sch90], [Wol90]

GAMM Seminar

Numerical Techniques for Boundary Element Methods - Proceedings of the Seventh GAMM Seminar, W. Hackbush (Ed.), Vieweg, Braunschweig/Wiesbaden, Germany, 1992, Jan. 25-27, 1991, Kiel, Germany.

Notes: too specific to structural and fluid dynamics
Call Number: QA379 .G36 1991
Annotations: none

Heinz Nixdorf Symposium

Parallel Architectures and Their Efficient Use - Heinz Nixdorf Symposium Proceedings, F. Meyer auf der Heide, B. Monien, and A. L. Rosenberg (Eds.), Springer-Verlag, Berlin, 1993, Nov. 11-13, 1992, Paderborn, Germany.

Notes: nothing appropriate
Call Number: QA76.58 .H45 1992
Annotations: none

IEEE Annual Symposium on Foundations of Computer Science

Proceedings - 34th Annual Symposium on Foundations of Computer Science, IEEE Computer Society Press, Los Alamitos, CA, 1993, Nov. 3-5, 1993, Palo Alto, CA.

Proceedings - 33rd Annual Symposium on Foundations of Computer Science, IEEE Computer Society Press, Los Alamitos, CA, 1992, Oct. 24-27, 1992, Pittsburgh, PA.

Proceedings - 32nd Annual Symposium on Foundations of Computer Science, IEEE Computer Society Press, Los Alamitos, CA, 1991, Oct. 1-4, 1991, San Juan, Puerto Rico.

Proceedings - 31st Annual Symposium on Foundations of Computer Science, IEEE Computer Society Press, Los Alamitos, CA, 1990, Oct. 22-24, 1990, St. Louis, MO.

Notes: broad, though some parts on parallel algorithms
Call Numbers: QA75.5 .S97 1993/1992/1991
QA76.5 .S97 1990 v. 1/v. 2
Annotations: none

IEEE International Symposium on High-Performance Distributed Computing (HPDC)
Proceedings of the First IEEE International Symposium on High-Performance Distributed Computing (HPDC-1), IEEE Computer Society Press, Los Alamitos, CA, 1992, Nov. 9-11, 1992, Syracuse, NY.

Notes: good reference for distributed applications
Call Number: QA76.9 .D3 .D599 1992
Annotations: none

IEEE Symposium on Parallel and Distributed Processing
Proceedings of the Fourth Symposium on Parallel and Distributed Processing 1992, IEEE Computer Society Press, Los Alamitos, CA, Dec. 1992, Arlington, TX.

Notes: good mix of low-level architecture and algorithms
Call Number: QA76.58 .I42 1992
Annotations: [LeB92]

IFIP WG 10.3 Working Conference on Architectures and Compilation Techniques for Fine and Medium Grain Parallelism
Architectures and Compilation Techniques for Fine and Medium Grain Parallelism - Proceedings of the IFIP WG 10.3 Working Conference on Architectures and Compilation Techniques for Fine and Medium Grain Parallelism, M. Cosnard, K. Ebcioglu, and J. - L. Gaudiot (Eds.), North-Holland, Amsterdam, 1993, Jan. 20-22, 1993, Orlando, FL.

Notes: somewhat low-level, but contains a section on experiences with parallel computing
Call Number: QA76.58 .I45 1993
Annotations: [Rub93]

IFIP WG 10.3 - Workshop in Programming Environments for Parallel Computing
Programming Environments for Parallel Computing - Proceedings of the IFIP WG 10.3 - Workshop in Programming Environments for Parallel Computing, N. Topham, R. Ibbet, and T. Bemmerl (Eds.), North-Holland, Amsterdam, 1992, April 6-8, 1992, Edinburgh, Scotland.

Notes: not general; mostly machine-specific
Call Number: QA76.642 .I35 1992
Annotations: none

International Conference on Parallel Computing
Parallel Computing '91 - Proceedings of the International Conference on Parallel Computing, D. J. Evans, G. R. Joubert, and H. Liddell (Eds.), North-Holland, Amsterdam, 1992, Sept. 3-6, 1991, London.

Notes: good applications
Call Number: QA76.58 .I545 1991
Annotations: [De K92], [Gir92]

International Conference on Parallel Processing

Proceedings of the 1993 International Conference on Parallel Processing, CRC Press, Inc., Boca Raton, FL, 1993, Aug. 16-20, 1993, Syracuse University, Syracuse, NY.
Volume I: Architecture - C. R. Y. Chen and P. B. Berra (Eds.)
Volume II: Software - A. N. Choudhary and P. B. Berra (Eds.)
Volume III: Algorithms and Applications - S. Hariri and P. B. Berra (Eds.)

Proceedings of the 1992 International Conference on Parallel Processing, CRC Press, Inc., Boca Raton, FL, 1992, Aug. 17-21, 1992, University of Michigan, Ann Arbor, MI.
Volume I: Architecture - T. Mudge (Ed.)
Volume II: Software - K. G. Shin (Ed.)
Volume III: Algorithms and Applications - Q. F. Stout (Ed.)

Notes: highly referenced and reputable source
Call Numbers: QA76.58 .I55 1993/v. 1/v. 2/v. 3
QA76.6 .I548 1992/v. 1/v. 2/v. 3
Annotations: [Fij93], [Wan93]

International Parallel Processing Symposium

Proceedings of the Sixth International Parallel Processing Symposium 1992, IEEE Computer Society Press, Los Alamitos, CA, March 23-26, 1992, Beverly Hills, CA.

Notes: good; good mix of topics; highly referenced
Call Number: QA76.58 .I56 1992
Annotations: [Tay92], [Yan92]

International Symposium on Computer Architecture

Proceedings of the 18th Annual International Symposium on Computer Architecture, Association for Computing Machinery, New York, 1992, May 19-21, 1992, Gold Coast, Australia.

Proceedings of the 19th Annual International Symposium on Computer Architecture, Association for Computing Machinery, New York, 1991, May 27-30, 1991, Toronto, CA.

Notes: some parallel applications, but no ODEs
Call Numbers: QA76.9 .A73 .S97 1992/1991
Annotations: none

IMACS/IFAC International Symposium on Parallel and Distributed Computing in Engineering Systems

Parallel and Distributed Computing in Engineering Systems, Proceedings of the IMACS/IFAC International Symposium on Parallel and Distributed Computing in Engineering Systems, S. Tzafestas, P. Borne, and L. Grandinetti (Eds.), North-Holland, Amsterdam, 1992, June 23-28, 1991, Corfu, Greece.

Notes: nothing applicable
Call Number: QA76.58 .I48 1991
Annotations: none

Iterative Methods for Large Linear Systems

Iterative Methods for Large Linear Systems, D. R. Kincaid and L. J. Hayes (Eds.), Academic Press, Boston, 1990, Oct. 19-21, 1988, Austin, TX.

Notes: not much on parallel algorithms
Call Number: QA432 .I84
Annotations: none

Japan Society for the Promotion of Science Seminar
Parallel Programming Systems - Proceedings of a JSPS Seminar, C. K. Yuen and A. Yonezawa (Eds.), World Scientific, Singapore, 1993, May 27-29, 1992, Tokyo, Japan.

Notes: mostly based on transputer, vector, and dataflow machines
Call Number: QA76.642 .P376 1993
Annotations: none

Languages and Compilers for Parallel Computing
Proceedings of the Languages and Compilers for Parallel Computing Fifth International Workshop, U. Banerjee, D. Gelernter, A. Nicolau, and D. Padua (Eds.), Springer-Verlag, Berlin, 1993, Aug. 3-5, 1992, New Haven, CT.

Notes: not applicable
Call Number: QA76.58 .L36 1993
Annotations: none

NATO Advanced Study Institute on Parallel Computing on Distributed Memory Multiprocessors
Parallel Computing on Distributed Memory Multiprocessors - Proceedings of the NATO Advanced Study Institute on Parallel Computing on Distributed Memory Multiprocessors, F. Özgünar and F. Erçal (Eds.), Springer-Verlag, Berlin, 1993, July 1-13, 1991, Ankara, Turkey.

Notes: some linear algebra, but no ODEs
Call Number: QA76.58 .P3757 1993
Annotations: none

NATO Advanced Workshop on Software for Parallel Computation
Software for Parallel Computation - Proceedings of the NATO Advanced Workshop on Software for Parallel Computation, J. S. Kowalik and L. Gandinetti (Eds.), Springer-Verlag, Berlin, 1993, June 22-26, 1992, Cosenza, Italy.

Notes: a little low-level; not very useful
Call Number: QA76.58 .S629 1993
Annotations: none

Parallel Algorithms and Transputers for Optimization
Parallel Computing and Optimization - Proceedings of the Workshop on Parallel Algorithms and Transputers for Optimization, M. Grauer and D. B. Pressman (Eds.), Springer-Verlag, Berlin, 1991, Nov. 9, 1990, University of Siegen, Germany.

Notes: not applicable; mostly on mathematics and economics
Call Number: QA76.58 .W66 1990
Annotations: none

Parallel Computation
Parallel Computation Proceedings, A. E. Finchman and B. Ford (Eds.), Clarendon

Press, Oxford, England, 1993, Sept. 1991, Oxford, England.

Notes: good mix of mathematics and parallel processing; organized by the Institute of Mathematics and Its Applications
Call Number: QA76.58 .L36 1993
Annotations: none

Parallel Computing: Achievements, Problems, and Prospects
Parallel Computing: Problems, Methods, and Applications - Conference Proceedings, P. Messina and A. Murli (Eds.), Elsevier, Amsterdam, 1992, June 3-7, 1990, Capri, Italy.

Notes: fair
Call Number: QA76.58 .C68 1990
Annotations: [Bel92]

Parallel Computing Technologies (PaCT)
Proceedings of the International Conference - Parallel Computing Technologies, N. N. Mirenkov (Ed.), World Scientific, Singapore, 1991, Sept. 7-11, 1991, Novosibirsk, USSR.

Notes: too general; nothing appropriate
Call Number: QA76.58 .P376 1991
Annotations: none

PARLE
PARLE '93 - Proceedings of the Fifth International Parallel Architectures and Languages Europe Conference, A. Bode, M. Reeve, and G. Wolf (Eds.), Springer-Verlag, Berlin, 1993, June 14-17, 1993, Munich, Germany.

PARLE '92 - Proceedings of the Fourth International Parallel Architectures and Languages Europe Conference, D. Etiembre and J. -C. Syne (Eds.), Springer-Verlag, Berlin, 1992, June 15-18, 1992, Paris, France.

PARLE '91 - Proceedings of the Parallel Architectures and Languages Europe Conference, E. H. L. Aarts, J. van Leeuwen, and M. Rem (Eds.), Springer-Verlag, Berlin, 1991, June 10-13, 1991, Eindhoven, The Netherlands.
Volume I: Parallel Architecture and Algorithms
Volume II: Parallel Languages

Notes: not very useful; dataflow- and transputer-based
Call Numbers: QA76.58 .I564 1993/1992
QA76.5 .P3184 1991 v. 1/v. 2
Annotations: none

SIAM Conference on Parallel Processing for Scientific Computing
Proceedings of the Fifth SIAM Conference on Parallel Processing for Scientific Computing, J. Dongarra, K. Kennedy, P. Messina, D. C. Sorensen, and R. G. Voigt (Eds.), SIAM, Philadelphia, 1992, March 25-27, 1991, Houston, TX.

Notes: excellent (13 papers on differential equations); good applications; D. H. Hill Library should have more proceedings
Call Number: QA76.58 .P76 1992
Annotations: [Cow92], [Sta92], [Wor92]

Singapore Supercomputing Conference

Singapore Supercomputing Conference '90, K. H. Phua and K. F. Loe (Eds.), World Scientific, Singapore, 1991, Dec. 11-12, 1990, Singapore.

Notes: good range of applications, but nothing appropriate
Call Number: QA76.88 .S56 1990
Annotations: none

Supercomputing

Supercomputing '93 - Proceedings of Supercomputing '93, IEEE Computer Society Press, Los Alamitos, CA, 1993, Nov. 15-19, 1993, Portland, OR.

Supercomputing '92 - Proceedings of Supercomputing '92, IEEE Computer Society Press, Los Alamitos, CA, 1992, Nov. 16-20, 1992, Minneapolis, MN.

Supercomputing '91 - Proceedings of Supercomputing '91, IEEE Computer Society Press, Los Alamitos, CA, 1991, Nov. 18-22, 1991, Albuquerque, NM.

*Supercomputing '90 - Proceedings of Supercomputing '9*0, IEEE Computer Society Press, Los Alamitos, CA, Nov. 12-16, 1990, New York, NY.

Notes: good; broad range of topics; highly referenced
Call Numbers: QA76.5 .S8975 1993/1992/1991/1990
Annotations: [Beg91], [Bod93], [Che92], [Chr91-1], [Cve90], [Gra92], [Lio92], [Mal91], [Oka90], [Pom91], [Sab93], [Van der93-2], [Ven91]

Symposium on High Performance Computing

High Performance Computing II - Proceedings of the Second Symposium on High Performance Computing, M. Durand and F. El Dabaghi (Eds.), North-Holland, Amsterdam, 1991, Oct. 7-9, 1991, Montpellier, France.

Notes: application-specific, but no ODEs or atmospheric modeling
Call Number: QA76.5 .I585 1991
Annotations: none

UNICOM Applied Information Technology

Software for Parallel Computers - UNICOM Applied Information Technology 9 Proceedings, R. H. Perrott (Ed.), Chapman and Hall, London, 1992.

Notes: too general; not applicable
Call Number: QA76.58 .S63 1992
Annotations: none

Workshop on Algorithms and Parallel VLSI Architectures

Algorithms and Parallel VLSI Architectures II - Proceedings of the International Workshop on Algorithms and Parallel VLSI Architectures II, P. Quinton and Y. Robert (Eds.), Elsevier, Amsterdam, 1992, June 3-6, 1991, Gers, France.

Algorithms and Parallel VLSI Architectures - Proceedings of the International Workshop on Algorithms and Parallel VLSI Architectures, E. F. Deprettere and A. -J. van der Veen (Eds.), Elsevier, Amsterdam, 1991, June 10-16, 1990, Pont-à-Mousson, France.
Volume A: Tutorials

Volume B: Proceedings

Notes: not applicable; very low-level (some to the circuit level)
Call Numbers: QA76.58 .I57 1991
QA76.58 .I57 1990 v. A/v. B
Annotations: none

Workshop on Distributed Algorithms (WDAG)

Distributed Algorithms - Proceedings of the Sixth International Workshop on Distributed Algorithms (WDAG '92), A. Segall and S. Zaks (Eds.), Springer-Verlag, Berlin, 1992, Nov. 2-4, 1992, Haifa, Israel.

Distributed Algorithms - Proceedings of the Fifth International Workshop on Distributed Algorithms (WDAG '91), S. Teng, P. G. Spirakis, and L. Kirousis (Eds.), Springer-Verlag, Berlin, 1992, Oct. 7-9, 1991, Delphi, Greece.

Distributed Algorithms - Proceedings of the Fourth International Workshop on Distributed Algorithms (WDAG '90), J. van Leeuwen and N. Santoro (Eds.), Springer-Verlag, Berlin, 1991, Sept. 24-26, 1990, Bari, Italy.

Notes: not applicable
Call Numbers: QA76.9 .D5 .D4854 1992
QA76.9 .D5 .D4853 1992
QA76.9 .D3 .D565 1991
Annotations: none

Workshop on Future Trends of Distributed Computing Systems

Proceedings of the Third Workshop on Future Trends of Distributed Computing Systems, IEEE Computer Society Press, Los Alamitos, CA, 1992, April 14-16, 1992, Taipei, Taiwan.

Notes: nothing applicable
Call Number: QA76.9 .D5 .I335 1992
Annotations: none

Workshop on Parallel and Distributed Processing (WD&DP)

Parallel and Distributed Processing '91 - Proceedings of the Third Workshop on Parallel and Distributed Processing (WD&DP '91), K. Boyanov (Ed.), North-Holland, Amsterdam, 1992, April 16-19, 1991, Sofia, Bulgaria.

Parallel and Distributed Processing - Proceedings of the Second Workshop on Parallel and Distributed Processing (WD&DP '90), K. Boyanov (Ed.), North-Holland, Amsterdam, 1991, March 27-29, 1990, Sofia, Bulgaria.

Notes: not applicable; mostly transputer-based
Call Numbers: QA76.58 .W67 1991/1990
Annotations: none

Workshop on Scalable Shared Memory Multiprocessors

Scalable Shared Memory Multiprocessors, M. Dubois and S. Thakkar (Eds.), Kluwer Academic Publishers, Boston, 1992, May 26-27, 1990, Seattle, WA.

Notes: too low-level
Call Number: QA76.5 .S244 1992

Annotations: none

Collections

A. Bode and M. D. Cin (Eds.), *Parallel Computer Architectures - Theory, Hardware, Software, Applications*, Springer-Verlag, Berlin, 1993.

Notes: satisfactory
Call Number: QA76.9 .A73 .P39 1993
Annotations: [Grie91]

G. D. Byrne and W. E. Schiesser (Eds.), *Recent Developments in Numerical Methods and Software for ODEs/DAEs/PDEs*, World Scientific, Singapore, 1992.

Notes: from the American Institute of Chemical Engineering Annual Meeting (Nov. 11-16, 1990, Chicago, IL); not many papers involving parallel computers
Call Number: QA370 .R43 1992
Annotations: none

R. G. Evans and S. Wilson (Eds.), *Supercomputational Science*, Plenum Press, New York, 1990.

Notes: based on a summer school on supercomputational science (Sept. 18-29, 1989, Oxfordshire, UK); nothing appropriate
Call Number: QA76.5 .S89437 1990
Annotations: none

A. Gibbons and P. Spirakis (Eds.), *Lectures on Parallel Computation*, Cambridge University Press, Cambridge, 1993.

Notes: too general; nothing appropriate
Call Number: QA76.5 .L4 1993
Annotations: none

J. Kondo (Ed.), *Supercomputing - Applications, Algorithms, and Architectures - For the Future of Supercomputing*, Springer-Verlag, Tokyo, 1991.

Notes: no specific methods for ODE solvers given
Call Number: QA76.88 .S86 1991
Annotations: none

L. Lapidus and W. E. Schiesser (Eds.), *Numerical Methods for Differential Systems - Recent Developments in Algorithms, Software, and Applications*, Academic Press, New York, 1976.

Notes: a little old
Call Number: QA76.88 .S86 1991

Annotations: [Hin76]

D. J. Lilja (Ed.), *Architectural Alternatives for Exploiting Parallelism*, IEEE Computer Society Press, Los Alamitos, CA, 1991.

Notes: reprints from older journals and conferences; architecturally based
Call Number: QA76.58 .L55 1991
Annotations: [Hwa91]

P. Mehrotra, J. Saltz, and R. Voigt (Eds.), *Unstructured Scientific Computation on Scalable Multiprocessors*, MIT Press, Cambridge, MA, 1992.

Notes: fairly good; ICASE conference in Nags Head, NC
Call Number: Q183.9 .U57 1992
Annotations: [Mu92-2], [Rib92]

R. Mendez (Ed.), *High Performance Computing - Research and Practice in Japan*, John Wiley and Sons, Chichester, England, 1992.

Notes: parallel and chemical processes discussed, but nothing particular about atmospheric chemistry or solving ODEs in general
Call Number: QA76.88 .H54 1992
Annotations: none

P. M. Pardalos (Ed.), *Advances in Optimization and Parallel Computing*, North-Holland, Amsterdam, 1992.

Notes: honorary volume on the occasion of J.B. Rosen's 70th birthday; not applicable
Call Number: QA76.58 .A387 1992
Annotations: none

Index

MasPar	[Fra94], [Kra92], [Sag93], [Sun94], [Wan94]
Siemens	[Gro90]
SIMD/MIMD	[Sag93], [Wan94]
tools	[Ang93], [Beg91], [Cha92], [Chau93], [Che92], [Chr91-2], [Chr94], [Don90], [Grim93-1], [Lev92], [Li90], [Luh92], [Odm92], [Pai93], [Say93], [Lew92]
waveform relaxation	[Bel93], [Gea93-1], [Vandew91], [Vandew92], [Wor92]