Sparse Matrix Computations

David Baud

Sparse Matrix Computations:

   Sparse Matrix Computations James Raymond Bunch,Donald J. Rose,1976   **Sparse Matrix Computations** James R. Bunch,Donald J. Rose,1976 The papers in this volume were presented at the Symposium on Sparse Matrix Computations held at Argonne National Laboratory in September 1975 It presents research in applied numerical analysis but with considerable influence from computer science Most of the papers deal explicitly or implicitly with the design analysis implementation and application of computer algorithms Such an emphasis includes not only the establishment of space and time complexity bounds as well as an attempt to understand the algorithms and the computing environment in enough detail to make design decisions for effective mathematical software to be used as tools in science and engineering   Sparse Matrix Computations : Proceedings James R. Bunch,Donald J. Rose,1976   **Sparskit** National Aeronautics and Space Administration (NASA),2018-07-11 Presented here are the main features of a tool package for manipulating and working with sparse matrices One of the goals of the package is to provide basic tools to facilitate the exchange of software and data between researchers in sparse matrix computations The starting point is the Harwell Boeing collection of matrices for which the authors provide a number of tools Among other things the package provides programs for converting data structures printing simple statistics on a matrix plotting a matrix profile and performing linear algebra operations with sparse matrices Saad Youcef Unspecified Center DE FG02 85ER 25001 NCC2 387   Efficient and Parallel Sparse Matrix Computations on the Web Prabhjot Sandhu,2022 Large and sparse matrices occur in various scientific and compute intensive applications including popular targets such as big data analytics and machine learning applications The sparse matrix computations involved in these applications are considered critical for the overall performance due to their recurring nature At the same time we are witnessing a surge of such applications on the web due to the ease of accessibility and potential for interactive collaborative features In this context the heavy computation requirements of sparse computations pose a challenge Recent advancements in JavaScript and WebAssembly engines for web browsers however provide opportunities to enable better performance In this work we present SciWasm Sparse a web based computing framework that offers efficient and scalable sparse matrix CPU kernels to support high performance computing in web browsers It provides hand tuned implementations of Sparse BLAS Basic Linear Algebra Subroutines Level 2 operations element wise sparse operations and conversion routines for sparse storage formats Starting with exploratory research to discover the distinctive nature of the performance of sparse matrix vector multiplication SpMV for WebAssembly compared to native C we built optimized and parallel SpMV for different sparse storage formats Our selection of low level code and data optimization techniques is based on a structure based performance analysis that identifies several performance bottlenecks via different matrix structure features We evaluate the performance of our web based SpMV with its native counterparts from the well known taco C and Intel MKL C libraries on 2000 real life sparse matrices We demonstrate that our design can offer performance competitive with even highly tuned and

well established native implementations Apart from SpMV we develop a novel and efficient synchronization algorithm for parallel sparse triangular solve SpTS It shows impressive performance speedups for a number of matrices over the classic level set technique Our framework will facilitate solving large sparse computational problems for performance critical web applications such as ML frameworks that train and deploy models in the browsers Our hand tuned kernels and well defined parameter space will be valuable for enabling application specific adaptive capabilities for sparse systems on the web

Compiler Support for Sparse Matrix Computations Tatiana Shpeisman,1999 **Sparse Matrix Computations and Their I O Complexity** Gero Greiner,2012 **Matrix Computations** Gene Howard Golub,Charles F. Van Loan,1983 An invaluable reference book that should be in every university library Image Bulletin of the International Linear Algebra Society *Graph Theory and Sparse Matrix Computation* Alan George,John R. Gilbert,Joseph W.H. Liu,2012-12-06 When reality is modeled by computation matrices are often the connection between the continuous physical world and the finite algorithmic one Usually the more detailed the model the bigger the matrix the better the answer however efficiency demands that every possible advantage be exploited The articles in this volume are based on recent research on sparse matrix computations This volume looks at graph theory as it connects to linear algebra parallel computing data structures geometry and both numerical and discrete algorithms The articles are grouped into three general categories graph models of symmetric matrices and factorizations graph models of algorithms on nonsymmetric matrices and parallel sparse matrix algorithms This book will be a resource for the researcher or advanced student of either graphs or sparse matrices it will be useful to mathematicians numerical analysts and theoretical computer scientists alike *Sparse Matrix* I.S. Duff,G.W. Stewart,Society for Industrial and Applied Mathematics,1979 **Sparse Matrix Computations with a Special Array-Processor** Philip N. Armstrong,David G. Cantor,ARMSTRONG (PHILIP N) SANTA ANA CA.,1980 This is the final report of a study of special computing machinery for computations on sparse matrices The elements of the computing system and its application to Gaussian elimination are described in some detail in the paper On a Special Purpose Matrix Array Processor by Philip N Armstrong and David G Cantor which has been submitted for publication and comprises the major part of this report This paper describes the system and the algorithms for which it is designed so that a reader who is acquainted with computations on matrices will understand the system s utility for such computations Some additional remarks regarding selected matrix computations may be useful and are included although what is written may be inferred from the substance of the paper Reading the paper is a prerequisite for these remarks Compiler support for sparse matrix computations Aart Johannes Casimir Bik,1996 **Graph Theory and Sparse Matrix Computation** Alan George,John R. Gilbert,Joseph W.H. Liu,1993-10-22 When reality is modeled by computation matrices are often the connection between the continuous physical world and the finite algorithmic one Usually the more detailed the model the bigger the matrix the better the answer however efficiency demands that every possible advantage be exploited The articles in this volume are based on recent

research on sparse matrix computations This volume looks at graph theory as it connects to linear algebra parallel computing data structures geometry and both numerical and discrete algorithms The articles are grouped into three general categories graph models of symmetric matrices and factorizations graph models of algorithms on nonsymmetric matrices and parallel sparse matrix algorithms This book will be a resource for the researcher or advanced student of either graphs or sparse matrices it will be useful to mathematicians numerical analysts and theoretical computer scientists alike **Sparse Matrix Computations Using the Intelligent File Store** Ahmad A. El-Zein,1992 **Massively Parallel Sparse-matrix Computations** Institute for Defense Analyses. Supercomputing Research Center,Steven G. Kratzer,1990 Abstract This paper shows that QR factorization of large sparse matrices can be performed efficiently on massively parallel SIMD Single Instruction stream Multiple Data stream computers such as the Connection Machine CM 2 The problem is cast as a dataflow graph using existing techniques for symbolic manipulation of the structure of the matrix Then the nodes in the graph which represent units of computational work are mapped to a virtual dataflow machine in such a way that only nearest neighbor communication is required This virtual machine is implemented by programming the CM 2 processors to support the static dataflow protocol Execution results for standard test matrices show that good performance is obtained even for unstructured sparsity patterns that are not amenable to nested dissection techniques **Sparse Matrix Computation** James R. Bunch,Donald J. Rose,1976 Benchmark Package for Sparse Matrix Computations University of Illinois at Urbana-Champaign. Center for Supercomputing Research and Development,Youcef Saad,Harry A. G. Wijshoff,1988 Parallel Sparse Matrix Computations Arno C. N. van Duin,1998-01-01 *Linear Algebra and Matrix Computations with MATLAB®* Dingyü Xue,2020-03-23 This book focuses the solutions of linear algebra and matrix analysis problems with the exclusive use of MATLAB The topics include representations fundamental analysis transformations of matrices matrix equation solutions as well as matrix functions Attempts on matrix and linear algebra applications are also explored

Predicting Structure in Sparse Matrix Computations John R. Gilbert,1986 We describe the results of an experiment in which the Nuprl proof development system was used in conjunction with a collection of simple proof assisting programs to constructively prove a substantial theorem of number theory We believe that these results indicate the promise of an approach to reasoning about computationally meaningful mathematics by which proof construction and the results of formal reasoning are mathematically comprehensible

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