



SparSol Sparse Linear Solver

Highlights

- High-performance tool for solving large sparse linear systems of equations – easily handles millions of unknowns
- Can quickly be integrated into existing analysis applications
- Fully customizable to provide unmatched performance for customer-specific problems
- Proven results in demanding, real-world applications providing from tens to several hundred percent improvement in performance

SparSol™ is a library of highly-efficient algorithms intended for the preconditioned iterative solution of large sparse linear algebraic systems of equations with real coefficients.

Sparse linear systems often arise when numerically solving partial differential equations that are common in scientific and engineering applications. Virtual prototyping applications, like those used in the aerospace, automotive and semiconductor industries, may handle millions of these equations when simulating complex products. Power grid simulation, oil and gas reservoir modeling and financial engineering are examples of large-scale modeling applications that struggle with sparse linear systems. The ability to solve these systems quickly and efficiently can have a direct and significant impact on productivity and profitability for many companies.

SparSol – developed initially for ExxonMobil Upstream Research Company’s reservoir modeling application – is now available worldwide from NeurOK Software to accelerate the most demanding scientific and engineering applications.

High-performance Computational Core

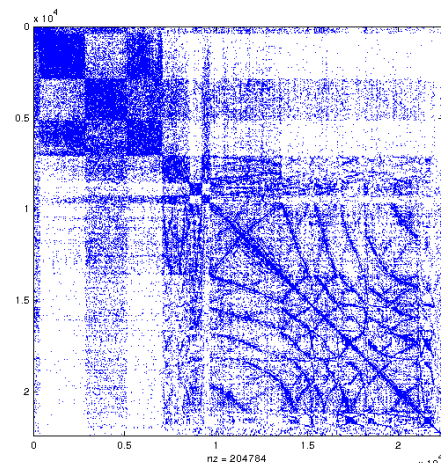
SparSol provides a rich set of cutting-edge algorithms based on a high-performance computational kernel that allows users to choose the optimal combination of algorithms for the most efficient solution of their problem.

- Custom library of basic linear algebra operations and grouped functions
- Robust set of highly-tuned preprocessing and preconditioning algorithms
- High-performance implementations of multiple iterative sparse linear solvers
- Highly-efficient and scalable parallel algorithms with support for both multi-core (SMP) and distributive (MPI) architectures
- Designed for multistep applications, optimizing memory usage and algorithm reuse

Advanced Solver Capabilities

SparSol provides many advanced capabilities not found in standard sparse linear solvers including a special set of algorithms intended for the solution of very ill-conditioned systems.

- Solution of very large systems
- Solution of very ill-conditioned systems – gives approximate solution with required accuracy
- Solution of symmetrical and unsymmetrical systems including systems with block structures
- Adaptive convergence schemes guarantee fast convergence
- Incorporates a large collection of custom, problem-specific algorithms with numerous widely-used, public domain algorithms

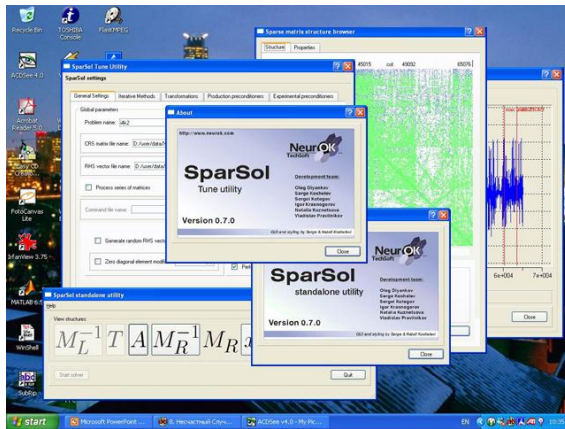




Object-oriented Framework

SparSol's algorithms can quickly be integrated into existing applications as an external dynamic library (DLL) through a rich set of application programming interfaces (APIs).

- Well-documented APIs allow easy integration with external C++, C or FORTRAN applications
- Framework allows easy inclusion of new, custom algorithms
- Fully-parametric environment can be tuned for a wide variety of applications
- Supported on Windows®, Linux and Unix operating systems



SparSol Components

SparSol is available in thread-safe, serial and parallel versions with the following features:

- Preprocessing Algorithms
 - Scaling, reordering, filtration
- Serial Preconditioners
 - Incomplete LU: RILU0, FILU, ILU2, ILUDP
 - Incomplete Cholesky: RIC0, RIC2
 - Nested factorization: NF, GNF, UNF
 - Algebraic multilevel
- Parallel Preconditioners
 - Parallel ILU-type: MLParFILU, ParMLILUC, ParOverlapILU
 - Parallel IC-type: ParOverlapIC
- Iterative Methods
 - Conjugate gradient-type
 - Minimal residual-type with different convergence criteria
 - IDR-type with different convergence criteria and special control scheme

- Parallel Partitioners
 - Multilevel partitioning
 - Partitioning with overlap
- GUI interface for finding and tuning optimal parameters and for data visualization
- Command-line interface for stand-alone use
- HTML documentation includes description of program interfaces, command-line options and usage examples

Supported Matrix Formats

- Text Formats
 - Compress Row Storage (CRS)
 - Compress Column Storage (CCS)
 - Coordinate (Matlab-like)
 - Matrix-Block CRS
 - Matrix-Market
 - Harwell-Boeing
 - Rutherford-Boeing
 - Block Modified Sparse Row format
 - Block CRS format
- SparSol Binary
 - Internal matrix representation is in CRS format
- OP4 format
- XML format (with possible data compression)
- Custom formats

Evaluation and Support

To determine if SparSol is the right solution for a specific application, the following options are available:

- Prospective customers can provide representative samples of the linear systems from their application and a specialist at NeurOK Software will test them and provide a report outlining the algorithms used and performance obtained
- Prospective customers can receive a free, limited-time trial version of SparSol for their own in-house testing

Each SparSol license comes with several hours of technical support included (via email or phone). Additional technical support and consulting are also available for purchase. In addition, our highly-qualified specialists are available to develop custom algorithms to meet specific, custom needs.



Complex Linear Systems

SparSol is tuned to provide breakthrough performance for solving large sparse linear systems with real coefficients. For systems based on complex coefficients, particularly those defined by Helmholtz or Maxwell equations, we offer LinCoS™, a high-performance, parallel iterative solver intended for the solution of large, sparse linear systems with complex coefficients.

Its unique data model is optimized for handling complex numbers and provides a significant increase in performance over other solvers.

Like SparSol, LinCoS includes a rich library of partitioners, preconditioners and iterative methods for both serial and parallel computing environments and can quickly be integrated into existing analysis applications to deliver significant increases in performance.

Our Company

NeurOK Software is a computational mathematics firm that develops high-performance solutions for the largest, most computationally challenging problems faced by businesses.

We provide consulting, custom development, service and support to customers across numerous industries.

NeurOK Software has an extensive team of professional mathematicians, physicists, machine learning experts and computer scientists with exceptional expertise in:

- Computational modeling and simulation
- Mathematical programming and optimization
- Linear systems solutions and linear programming
- Learning algorithms and machine learning technologies
- Parallel programming techniques and architectures

We help our customers achieve their goals by delivering innovative solutions based on superior mathematics.

For More Information

For more information on SparSol and how it can help you improve the performance of your data analysis application, please contact NeurOK Software at:

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