

IMSL®

C Numerical Library

Advanced Mathematical & Statistical Numerical Library for C, C++ and Python Programmers

"We partnered with Visual Numerics because their numerical libraries offer the most comprehensive, tested statistical functionality available, support major computing platforms, and were easily embeddable into the GlyphWorks solution."

JON ALDRED
PRODUCT MANAGER
NCode INTERNATIONAL

"By using IMSL Numerical Libraries I can definitely say that 50% of my research time is saved by simply calling functions like linear/nonlinear equation solvers and random number generators instead of coding and testing these subroutines myself."

DR. BHAIKAVAJJULA NAGESWARA RAO
ASSISTANT PROFESSOR
IIT MADRAS

The IMSL C Numerical Library provides advanced mathematical and statistical functionality for programmers to embed in applications that are written in one of the most widely used programming environments in use today, C/C++. Developers can also access IMSL C Library functions from Python by using PyIMSL™, a collection of Python wrappers to the algorithms in the IMSL C Numerical Library. PyIMSL is available at no charge to IMSL C Library customers.

Developers can save weeks, months or even years of effort by embedding IMSL C Library algorithms versus building in-house. Instead of writing hundreds of lines of code to create new algorithms, a developer can make one simple call to a routine that is fully tested, supported and documented. The IMSL C Library takes full advantage of the intrinsic characteristics and desirable features of the C language. The functions support variable length argument lists and the concise set of required arguments contains only information necessary for usage. Optional arguments provide added functionality and power to each function. This flexibility reduces unnecessary code and enables users to adapt each function call by activating optional arguments.

Key Features

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| Cost-Effectiveness and Value | Significantly shortens development time and promotes standardization. |
| Breadth of Numerical Functions | Hundreds of thoroughly tested, documented and seasoned mathematical and statistical functions. |
| Depth of Functions | Numerical functionality ranges from basic mathematics and statistics to advanced solvers such as Feynman-Kac, genetic algorithms and Naïve Bayes classification. |
| 100% Pure C Code | <p><i>Simplified Development:</i> The IMSL C Library allows developers to write, build, compile and debug code in a single environment. Other solutions use code wrappers, which require the developer to access external compilers and pass arrays or user-defined data types to ensure compatibility between the different languages.</p> <p><i>Robustness:</i> Pure C code increases robustness because wrappers are not required. Wrappers can cause server crashes, security violations and data corruption.</p> |
| Portability | Tested on hundreds of popular platform combinations, simplifying platform migration. |
| Intuitive Programming | Uses descriptive, explanatory function names where each function has a concise set of required arguments, thereby streamlining the coding process. |
| Thread Safe | Can be confidently integrated into web and database servers in which multiple threads are used to handle multiple, independent computations. |
| Diagnostic Error Handling | Diagnostic error messages are clear and informative, designed not only to convey the error condition, but also to suggest corrective action, if appropriate. |
| SMP High-Performance Technology | Takes advantage of multi-core and multi-CPU systems by leveraging OpenMP and hardware vendor-supplied functionality. |

WHAT'S NEW IN VERSION 7.0

- **Parallelization of numerous algorithms using OpenMP**
- **New function that solves the generalized Feynman-Kac PDE and Black-Scholes problems**
- **New data mining functions including Genetic Algorithm for optimization and Naïve Bayes for classification problems and text mining**
- **Many other new functions, including:**
 - Kochanek-Bartels Cubic Splines
 - Non-central chi-square, Non-central student's T PDFs
- **Enhancements to many existing algorithms, including:**
 - Faster normal random number generation
 - Neural network classification capability
 - Multiple options for selecting Auto_ARIMA models

Mathematical Functionality

- Matrix Operations
- Linear Algebra
- Eigensystem Analysis
- Interpolation and Approximation
- Quadrature
- Differential Equations
- Feynman-Kac Solver
- Transforms
- Nonlinear Equations
- Optimization
- Special Functions
- Utilities

Statistical Functionality

- Basic Statistics
- Time Series and Forecasting
- Nonparametric Tests
- Correlation and Covariance
- Data Mining
- Regression
- Analysis of Variance
- Goodness of Fit
- Distribution Functions
- Random Number Generation
- Neural Networks
- Genetic Algorithm
- Naïve Bayes Classification

Leveraging Multi-Core Hardware

Version 7.0 of the IMSL C Library enables customers to better take advantage of multi-core and many-core hardware for improved performance. Numerous algorithms leverage OpenMP directives on supported environments to distribute calculations across available resources. In areas such as linear algebra and fast Fourier transforms, vendor libraries leverage SMP capabilities on a variety of systems. The following tables show performance comparisons for several algorithms across multiple cores. For each of these benchmark comparisons, a dual quad core Xeon E5420, 2.5GHz with Windows Server 2003 R2 was used.



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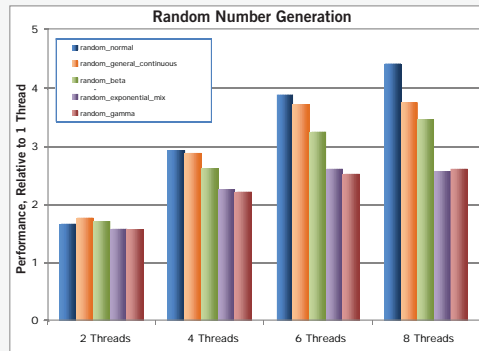


Table 1: Random number generation algorithms showing performance, relative to one thread

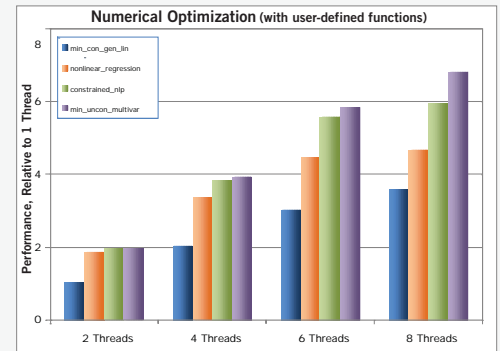


Table 2: Numerical optimization algorithms showing performance, relative to one thread

Typical Application Areas

Today, major corporations, academic institutions, and research laboratories worldwide use the IMSL C Library. Example application areas include:

- Risk management in financial services and insurance
- Portfolio optimization in financial services
- Business intelligence extensions for data warehouse software
- Statistical analysis of manufacturing test data
- Inventory management and demand forecasting
- Medical and biological system R&D and modeling