**VERSION 6.0**

# IMSL™
## C Numerical Library

# Advanced Mathematical & Statistical Functionality
## for C and C++ Programmers

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++. This comprehensive set of thread safe functions is based upon the same algorithms contained in the highly regarded IMSL Fortran Library.

The IMSL C Library saves time and money by offering a more cost-effective solution. Instead of writing hundreds of lines of code to create new algorithms, users 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

| | |
|---|---|
| **Thread Safe** | Can be confidently integrated into Web and database servers in which multiple threads are used to handle multiple, independent computations. |
| **World Renowned Documentation** | Easy access to extensive documentation, including code examples. |
| **100% Pure C Code** | *Simplified Development:* 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. |
| | *Increased Robustness:* Pure C code increases robustness because code wrappers are not required. Code wrappers can cause server crashes, security violations and data corruption. |
| **Portability** | Available on common platform combinations. Simplifies platform migrations. |
| **Cost-Effectiveness and Value** | Significantly shortens program development time and promotes standardization. |
| **Intuitive Programming** | Uses descriptive, explanatory function names for intuitive programming. Each function has a concise set of required arguments, thereby streamlining the coding process. |
| **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 symmetric multiprocessor (SMP) systems by leveraging hardware vendor-supplied functionality. Computationally intensive algorithms in the areas of linear algebra and fast Fourier transforms will leverage SMP capabilities on a variety of systems. |

*"The flexibility and learning potential of our neural net forecasting application has significant potential to help government agencies and commercial businesses improve their predictive analysis capabilities, moving well beyond traditional tools into high end business intelligence. This application would not exist without Visual Numerics' mathematical and statistical libraries and the top-notch work of their professional services experts."*

Larry Northington
Vice President of Strategic Planning and
Corporate Development for Teksouth, and
a retired U.S. Air Force Major General

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*"We were extremely pleased to find that once the IMSL CNL routines were put into the system, there weren't any compatibility problems or bugs. The routines worked together perfectly."*

Anju Gupta
Director, RiskLink Product Management
Risk Management Solutions

## WHAT'S NEW IN VERSION 6.0

- **New High Performance Linear Programming Optimizer**
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- **New Neural Network engine for data mining and forecasting**
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- **Auto_ARIMA for advanced forecasting**
  ..............................................................
- **Time series forecasting preprocessing algorithms for:**
  - Outlier detection
  - Outlier classification
  - Missing value estimation
  ..............................................................
- **Differential Equations package for financial engineering and scientific computing**
  ..............................................................
- **New random number generator technique using Mersenne Twister algorithm**
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- **New LAPACK functionality**

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## Mathematical Functionality

- Linear Systems
- Eigensystem Analysis
- Interpolation and Approximation
- Integration and Differentiation
- Differential Equations
- Transforms
- Nonlinear Equations
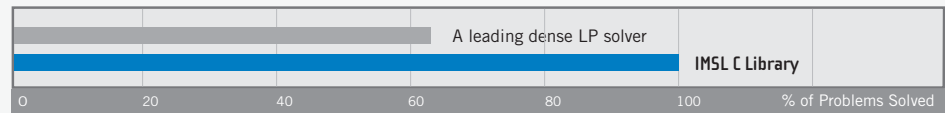- Optimization
- Special Functions
- Utilities

## Statistical Functionality

- Basic Statistics
- Regression
- Correlation and Covariance
- Analysis of Variance and Designed Experiments
- Non parametric Statistics
- Tests of Goodness-of-Fit
- Time Series and Forecasting
- Multivariate Analysis
- Survival Analysis
- Probability Distribution Functions and Inverses
- Random Number Generator
- Neural Networks

## Linear Programming Optimization  Robustness and Performance

Studies using 91 dense LP problems from Netlib produced the following robustness and performance results.

**TABLE 1. Problems Solved for Dense LP Solvers**

| | | | | | |
|---|---|---|---|---|---|
| A leading dense LP solver | | | | | |
| IMSL C Library | | | | | |
| 0 | 20 | 40 | 60 | 80 | 100 | % of Problems Solved |

IMSL C Library solves 100% of sample Netlib problems.

**TABLE 2. Average Solving Time For IMSL Versus a Competitve Dense LP Solver** (44 Measurable Example Problems)

| | | | | | |
|---|---|---|---|---|---|
| | | | | A leading dense LP solver | |
| IMSL C Library | | | | | |
| 0.00 | 2.00 | 4.00 | 6.00 | 8.00 | 10.00 | Relative Solving Time |

IMSL C Library solves linear programming problems in 1/10 the time.

## Typical Application Areas

- Portfolio optimization in financial services
- Risk management in financial services
- Medical and biological system R&D and modeling
- Risk management in insurance
- Finance revenue and expense forecasting
- Inventory management and demand forecasting

## Team of Professionals Ready to Help

Augment development productivity by utilizing Visual Numerics' Professional Services team to help find the best solution to any problem and deliver the support needed to ensure continued success. The highly-skilled technical experts in Visual Numerics' Professional Services organization collaborate with customers to identify specific application requirements at the initial phase of every project. Visual Numerics' consultants provide all levels of support from custom algorithm development to simply helping customers better understand their analysis and visualization needs. Customers can rely on Visual Numerics' technical expertise and dedicated, hands-on help to achieve the highest return on investment.