

BENEFITS FOR FINANCE

- Proven and accurate results using pre-built numerical algorithms for finance applications
- Deeper understanding of customers through visualization of data
- Positive return on investment
- Improved quantitative analyst and programmer productivity
- Deliver and maintain a competitive edge

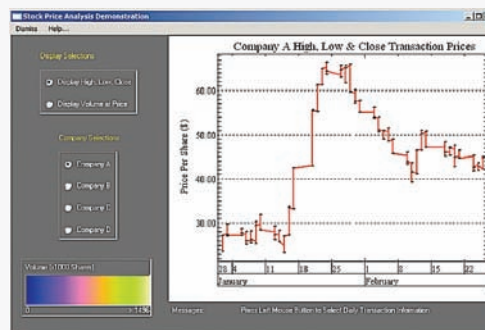
Analysis Requirements for Financial Services

In this era of volatile financial markets, making data-driven decisions based on sound numerical models is necessary for achieving maximum return with minimal risk. While the huge increase in computing power makes it possible to process vast quantities of data, proven and reliable numerical models are needed to enable organizations to analyze, understand and make optimal decisions based on data as well as greater customer, market and competitive trends.

Visual Numerics' IMSL® Numerical Libraries and PV-WAVE® Family of products help financial services companies analyze and visualize vast quantities of financial data. Whether for risk or portfolio management or forecasting and financial modeling, accurate numerical algorithms and visualization functions help quantitative analysts efficiently and effectively develop applications to manage financial data.

Financial applications that can be built with the IMSL Libraries and PV-WAVE include:

- Risk management
- Portfolio optimization
- Forecasting
- Trading strategy optimization
- Options and derivatives pricing
- Interest rate modeling
- Fixed income analysis
- Equity price modeling and analysis
- Exchange rate analysis
- Performance monitoring



This graphic displays a stock price analysis application. The application shows Date/Time Plots; High, Low Close Displays; Bid, Ask Spreads; and overall stock trend analysis.

The IMSL Libraries and PV-WAVE deliver a robust set of mathematical, statistical, and graphics building blocks for rapid development of sophisticated financial analysis applications. Having a reliable, time tested set of algorithms and graphics frees highly valuable business analysts from writing code so they can focus on solving financial problems.

"We were looking for a numerical toolkit that included optimization and other functions that we could quickly and easily embed into our offering. We also wanted a native Java-based solution to ensure easy integration with our development environment and future growth plans. The IMSL Library met all our needs."

Director of Financial Engineering
Investor Analytics

IMSL Numerical Libraries

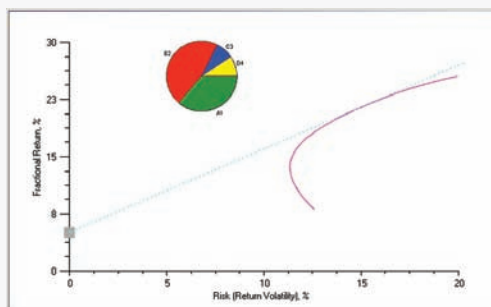
Algorithms used for numerical analysis need functionality that ranges from basic numerical building blocks such as functions to calculate interest income to advanced functions that offer specialized optimization and forecasting techniques.

The IMSL Libraries provide a broad set of pre-written mathematical, statistical and finance algorithms in C, C# for .NET, Java™ and Fortran. 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. The libraries provide users with the software and technical expertise needed to quickly develop and execute scalable numerical analysis applications, improving programmer productivity and guaranteeing a positive return on investment.

Popular IMSL Library algorithms for finance include:

- **Differential Equations:** Feynman-Kac for solving Black-Scholes problems
- **Optimization:** Linear and Nonlinear Programming, Quadratic Programming, Genetic Algorithm
- **Regression:** Linear, Nonlinear, Selection, Stepwise
- **Curve Fitting:** Cubic Splines, B-splines, Nonlinear Least Squares
- **Simulations:** Numerous Cumulative Distribution Function and Random Distributions
- **Classification:** Naïve Bayes, Neural Network
- **Forecasting:** ARMA, Auto_ARIMA, GARCH, Feed Forward Neural Network
- **Pricing Functions:** Bond Pricing, Interest Rate Calculations, Future Value

A few algorithms are only available in specific IMSL Libraries. Contact Visual Numerics for details.



This graphic displays a portfolio optimization application built using the IMSL Libraries. Popular techniques used in portfolio optimization include linear, nonlinear, and quadratic programming.

The IMSL Libraries are tested to run on a wide range of systems, from desktop computers to workstations to the world's most powerful supercomputers, with proven cross-platform consistency. The libraries can be deployed in multiple environments, including applications deployed across the Internet. Multiple processors and compilers are supported as well as common operating systems including Microsoft Windows (32- and 64-bit), Red Hat and SuSE Linux, Solaris and others.

"We have been very successful using PV-WAVE and have seen substantial improvement in performance."

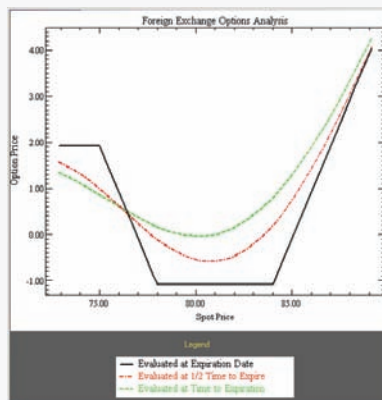
Director of Research
Global Advisors - London

PV-WAVE Visualization Applications

PV-WAVE is an array oriented fourth-generation programming language that can be used by business and financial analysts to build and deploy Visual Data Analysis applications. These applications let users manipulate and visualize complex financial data or extremely large technical datasets to detect and display patterns, trends, anomalies and other vital information.

PV-WAVE allows users to obtain data from multiple sources and offers many options to visualize data. Rapid data analysis and visualization combined with flexibility and power make PV-WAVE the choice among experts. By increasing productivity, accelerating development and illustrating key knowledge contained in data, PV-WAVE gives financial services organizations a competitive advantage.

For users that desire integrated numerical algorithms with data visualization, the PV-WAVE Advantage product includes the IMSL C Library.



This PV-WAVE application compares the Black-Scholes price with the actual market price and shows how much a call option is worth at any given time.

Consulting Services for Finance

Many quantitative groups augment their software development by incorporating Visual Numerics' Consulting Services team to help find, develop and implement the best solution. These highly-skilled technical experts have expertise in many financial application areas, including:

- Data visualization
- Data analysis
- Mathematics and statistics (including custom algorithm development)

With expertise from desktop computing to distributed deployment, Visual Numerics' consultants have the tools and know-how to solve financial analysis problems at any level of complexity.

Visual Numerics – A Proven Partner for Numerical Analysis in the Financial Industry

Visual Numerics develops leading edge data analysis and visualization solutions for technical, financial and scientific communities worldwide. Visual Numerics' products include the gold-standard IMSL Numerical Libraries, written in C, C# for .NET, Java™ and Fortran, as well as the PV-WAVE Family of products. These products help professionals in the financial industry meet their numerical algorithm, accuracy and performance requirements.

The IMSL Libraries and PV-WAVE also help financial professionals address the challenges they face when developing numerical applications, including:

- Proven and accurate results using pre-built numerical algorithms for finance applications
- Ensuring a positive ROI
- Maintaining a competitive edge
- Delivering multi-platform and multi-language support

In addition, Visual Numerics' expert consulting combines technical expertise, decades of hands-on experience and a combination of powerful products to create the highest quality solutions.

For more information, or to view online demos and get an evaluation copy of the IMSL Libraries or PV-WAVE, visit <http://www.vni.com/solutions/finance>.



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