



Intel® Software Development Products for Intel Platforms and Technologies

Optimized Number Crunching

“The Intel MKL routines perfectly complement the quality and coverage of the NAG libraries and they together deliver a wide-ranging set of high-performance components to NAG’s users.”

Dr. Brian Ford
Managing Director, NAG Ltd.

Do the Math

Many companies including government, scientific, commercial, and academic establishments around the world require mathematical software that performs sophisticated number crunching. That’s where the Numerical Algorithms Group (NAG) comes in, authoring high-quality numerical software libraries. To get high performance in Intel architecture systems easily, NAG libraries use the Intel® Math Kernel Library (Intel® MKL), one member of the high performance software development tools from Intel.

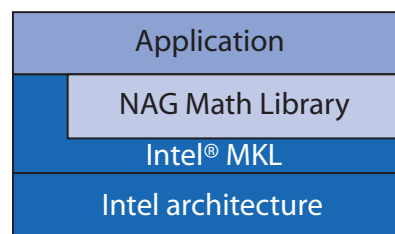
The NAG libraries are available across a broad range of computing systems ranging from PCs to super-computers. To enable the optimal performance of the libraries on such disparate machines, NAG engineers collaborated in the design of a set of Basic Linear Algebra Subprograms (BLAS). BLAS functions are high-quality “building block” routines for performing basic vector and matrix operations. BLAS functions are efficient, portable, and widely available and are commonly used in the development of high-quality linear algebra software.

BLAS is important to NAG and other software vendors because it allows them to concentrate on high level algorithms while making use of the BLAS at the heart of the computation.

“Intel MKL plays a key role in the multiplicative effect of the software developer stack. Along with processor-based performance improvements, Intel’s tuning of MKL for the latest Intel processors ensures excellent performance from key core math routines” comments NAG Managing Director, Dr. Brian Ford.

Intel® MKL software is core

The Intel® Math Kernel Library (Intel MKL) is composed of highly optimized functions for math, engineering, scientific, and financial applications requiring high performance on Intel platforms. The functional areas of the library include linear algebra consisting of LAPACK and BLAS, Fast Fourier Transform (FFT), and vector transcendental functions (vector math library/VML).



Library Stack for Developers

THE APPLICATION

NAG performs mathematical feats

The Numerical Algorithms Group (NAG) develops world-leading software to solve complex mathematical and statistical problems. With offices in the UK, Germany, Japan, and the US, NAG has created a worldwide collaborative network of the world’s best mathematical experts. Nearly thirty years ago NAG developed the first commercial mathematical and statistical algorithms libraries. The range of products and services that NAG offers includes statistical, symbolic, visualization, and numerical simulation software, compilers and application development tools and wide-ranging consultancy.

NAG software libraries span many computing languages and platforms and are continually being upgraded to take advantage of the latest technologies. NAG's consultancy services offers its own expertise in developing software, coupled with expert knowledge of numeric computation. They assist customers who can't develop their own application, or need advice on how to get the best from the NAG Libraries.

THE CHALLENGE

NAG needed to provide portable software that really performs

For NAG's users performance is clearly important and the ability to use the multiplicative effects of the hardware/software stack is essential to achieving top performance. As NAG's customers

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develop and evolve applications and solutions that run on the Intel Itanium®, Intel Xeon™, and Pentium® 4 processors, the requirement for NAG increased to optimize this performance for each processor platform.

THE ANSWER

Intel® MKL smoothes the way

NAG uses Intel MKL as the basis for ongoing performance improvements on Intel platforms. It is the availability of Intel MKL as a very efficient implementation of BLAS that is of the most

Linear Algebra Math Function	CPU Time		% Speed Increase
	NAG only	NAG & Intel MKL	
DGEMM ¹ (BLAS)	49.4	14.1	350%
DPOTRF ² (LAPACK)	511.3	216.9	236%
DGEQRF ³ (LAPACK)	265.3	92.6	287%

Several Fortune Global 100 banking and investment houses are satisfied customers that use the NAG software.

¹DGEMM test: Timing for 100 loops containing five different calls of DGEMM on 1000 x 175 matrices
²DPOTRF test: Timing for 100 loops decomposing a 2000 x 2000 matrix
³DGEQRF test: Timing for 10 loops of QR decomposition of 1000 x 1000 matrix
 All timings were obtained on an Intel Pentium 4 processor-based computer running at 2.2 GHz.

benefit to NAG as it seeks to penetrate new marketplaces with its libraries. Intel MKL improves the majority of NAG routines that use linear algebra, which is at the very heart of many scientific calculations. The increased speed of performance makes NAG software highly valued in, among others, the financial sector.

“It's possible that the next time you use the Internet to calculate your optimal financial portfolio, the calculation may depend upon the NAG optimization routines and beneath them, the Intel MKL Library.”

Dr. David Sayers, Principal Consultant
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Typically financial calculations can be time-critical or extremely large. In either case, it is imperative to obtain maximum efficiency in the calculations. Banks pursue this goal not only by buying the latest hardware technology, such as multiprocessor Intel processor-based systems, but also by utilizing software capabilities that can make best use of the hardware. By linking to Intel MKL, NAG can immediately exploit multiprocessor capabilities of Intel processor-based systems.

One NAG user who has appreciated this capability, is a leading global investment banking and securities firm. The client says, “My team uses NAG mathematical routines wherever possible—NAG are experts here. We can stick to what we are good at.”

THE ADVANTAGE

Performance in financial markets

With the competitive edge that Intel MKL has given them, NAG has penetrated the rich financial markets with its libraries.

Intel provides both the tools and support to enhance the performance, functionality and efficiency of software applications. Compatible with leading Windows* and Linux* development environments, Intel software development products are the fastest and easiest way to maximize the latest features of Intel processors. Designed for use in the full development cycle, Intel software products include Intel Performance Libraries, Intel Compilers (C++ and Fortran, for Windows and Linux), Intel® VTune™ Performance Analyzer, and Intel® Threading Tools. Performance results provided by NAG. Performance depends upon the specific computer systems, components and/or measurement methods used; your results will vary.

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Compatibility.
Support.



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