Success Brief

Intel® Developer Products

Intel® Parallel Studio

Realistic Simulation

Helping bring greater realism to manufacturing simulation

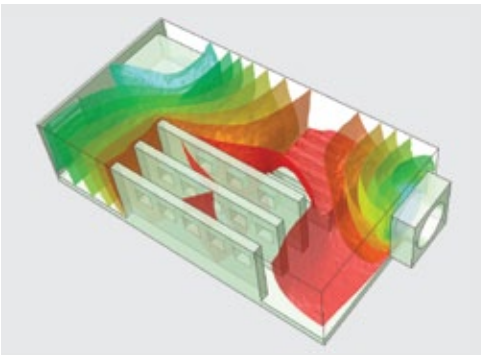
SIMULIA turns to Intel® Parallel Studio to enable easier model construction and boost engineering efficiencies.

Company	SIMULIA is the Dassault Systèmes brand that delivers a scalable portfolio of realistic simulation solutions including the Abaqus product suite and SIMULIA SLM. By building on established technology, respected quality, and superior customer service, SIMULIA makes realistic simulation an integral business practice that improves product performance, reduces physical prototypes, and drives innovation. Headquartered in Providence, RI, USA, SIMULIA provides sales, services, and support through a global network of regional offices and distributors.
Mission	SIMULIA's realistic simulation solutions are designed to deliver significant business value when applied as an integral part of overall design, engineering, and research processes, helping accelerate the delivery of innovative, high-quality products to market.
Product	SIMULIA's realistic simulation solutions include the Abaqus product suite for Unified Finite Element Analysis, multiphysics solutions for insight into challenging engineering problems, and SIMULIA SLM for managing simulation data, processes, and intellectual property.
Challenge	Harness multicore/multinode through parallel programming techniques, including shared and distributed memory architectures.
Results	SIMULIA found a more efficient way to detect traditionally hard-to-find errors like race conditions and deadlocking.
Impact	Use of Intel Parallel Studio contributed to better engineering efficiency and effectiveness, which in turn led to improved customer satisfaction. SIMULIA has achieved realistic simulations, more accurate representations of real physics, easier model construction, and faster results.

"The performance benefits of multicore and manycore are critical to SIMULIA's business. Intel® Parallel Inspector provides a powerful way to develop parallel code compared to traditional methods, which can be lengthy and costly—especially if the price of unstable code is paid by the customer."

Mark Dunbar
Chief Architect
SIMULIA

The performance, mesh editing, and selection improvements in Abaqus 6.10 make it easier to work on large models containing a mixture of geometric and orphan mesh components.



The native CFD capability in Abaqus 6.10 enables full system structural and thermal analysis in conjunction with natural/forced convection cooling, which can be used to study thermal performance of electronic products. This model shows temperature isosurfaces on an electronic circuit board model.

Intel® Parallel Studio includes Intel® Parallel Composer, Intel® Parallel Inspector, and Intel® Parallel Amplifier. Together, these components bring comprehensive parallelism to C/C++ Microsoft* Visual Studio* application development.

Designed to support the entire development lifecycle, the tools enable those new to parallelism to learn as they go, while experienced parallel programmers can work with greater confidence and efficiency. Intel Parallel Studio is interoperable with common parallel programming libraries and API standards, providing an immediate opportunity to realize the benefits of multicore platforms.

Intel Parallel Studio also provides all the tools necessary to dramatically benefit legacy serial efforts, thereby preserving existing investments in source code and development environments.

Build Applications for Multicore

Intel® Parallel Composer is part of the larger Intel Parallel Studio and brings an unprecedented breadth of parallelism development options for developers using Microsoft* Visual C++*. Its combination of compilers, libraries, and an extension to the Microsoft Visual Studio debugger supports easier, faster multithreading of serial and parallel applications.

Easily Find Memory and Threading Errors

Intel® Parallel Inspector combines threading and memory error checking into one powerful error checking tool. It helps increase the reliability, security, and accuracy of C/C++ applications from within Microsoft Visual Studio. Intel Parallel Inspector uses dynamic instrumentation that requires no special test builds or compilers, so it is easier to test code more often.

Optimize Performance and Scalability

Intel® Parallel Amplifier makes it simple to quickly find multicore performance bottlenecks without needing to know the processor architecture or assembly code. Intel Parallel Amplifier removes the guesswork and analyzes performance behavior in Windows* applications, providing quick access to scaling information for faster and improved decision making.

Challenge: Why SIMULIA's products benefit from utilizing parallelism

Today, the industry trend is toward introducing more realistic conditions into product simulations. Customers are seeking to simulate more complex physical behavior, including multiphysics, or they are attempting to use simulation in areas in which it has not historically been used. And while better simulation leads to better engineering, it comes at a cost of increased compute resources. Multicore is an answer to increased compute demand.

Specifically, SIMULIA faced two broad programming challenges:

1. Performance: Increased demand for more accurate/realistic simulations increases compute requirements. Intel® multicore architectures provide this necessary compute performance.
2. Programming complexity: The parallel programming required to harness the compute power of multicore is significantly more difficult to program than conventional serial programming, requiring greater parallel programming expertise. Errors associated with parallel programming for multicore, such as managing memory and multithreading code, can also take weeks to months to diagnose and fix.

Results

SIMULIA was able to harness low-cost hardware architectures and systems, while still achieving improved performance, leading to faster computations. Abaqus uses a one- to four-core laptop, four- to 16-core workstation, and 16+-core cluster.

Multicore Intel® Architecture: Performance gains

Head gasket simulation: Sparse linear equations with 5.3M variables, 2.6E13 Flops (26 Teraflops) per iteration:

- 1 core: 3 days
- 16 cores: 24,000 seconds (06:40:40)
- 32 cores: 12,000 seconds (03:20:20)
- 64 cores: 6,000 seconds (01:40:40)
- 128 cores: 4,000 seconds (01:06:06)

How Intel Parallel Studio assisted

Intel Parallel Studio gave SIMULIA an avenue for consistently and efficiently detecting traditionally hard-to-find errors like race conditions and deadlocking. A dedicated, full-time Intel account executive worked with SIMULIA to ensure that those using the product suite were able to incorporate the tools into the engineering workflow as quickly and smoothly as possible. Intel forums also proved helpful in answering more generic programming questions.

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