Accelerate Your Simulation with Abaqus/CAE – now powered by AMD FirePro™ graphics and OpenCL™ technology

The technology partnership between Dassault Systèmes and AMD extends to optimizations in simulation using the massively parallel compute power of AMD FirePro™ graphics GPUs to accelerate performance of SIMULIA Abaqus.

Dassault Systèmes and AMD have a long-standing relationship involving both computing and graphics products. This has been a solid basis to build on for development of GPU-accelerated simulation, with the team collaborating on the key code segments to be optimized in Abaqus. The work has been very specific and has a focus on better understanding and optimizing for AMD FirePro graphics hardware.

Dassault Systèmes' opportunity to accelerate simulation with GPUs

The developers of Abaqus saw the potential to accelerate an entire class of simulation solutions for FEA (Finite Element Analysis) by using GPU computing, solving static and low-speed dynamic events. With desktop workstations for CAD using professional graphics, these GPU-accelerated optimizations turbo-charge the typical engineering desktop workstation used in the CAD simulation-analysis workflow.

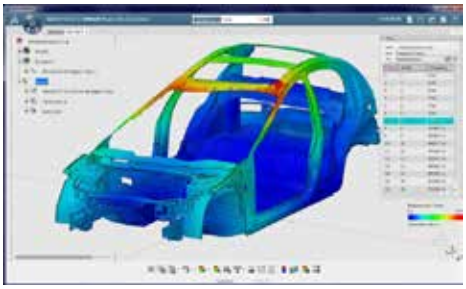
Who Benefits from GPU acceleration?

The current optimizations for GPU-accelerated simulations in Abaqus/Standard provide a tremendous benefit for large solid model simulations. This type of problem involves solving large systems of linear equations. The resulting simulations concentrate the problem into a large number of calculations which can be performed in parallel. This matches well with key capabilities of GPUs for general-purpose computing.

The challenges in optimizing for a heterogeneous computing environment

In the past, simulation developers could focus mostly on a computing environment which was standard across hardware platforms with a relatively homogeneous x86 computing platform. When simulations were running on a modern CAD workstation, the simulation application virtually ignored a powerful computing resource: the GPU.

For the Dassault Systèmes team, its 3DEXPERIENCE platform exists to deliver more productivity tools to customers when they need them. The Abaqus developers want to make simulation capabilities more ubiquitous to their customers and more valuable to their engineering work. And in simulation, more value means solving simulations faster.



Industry:

CAD & Engineering

Application:

Abaqus from SIMULIA, the Dassault Systèmes brand for realistic simulation

Challenges:

- Increasingly complex engineering problems
- Compress Product development time and reduce costs
- Deliver innovative, high-quality products to market faster

Solution:

- GPU-accelerated Abaqus using OpenCL™ and AMD FirePro™ graphics on Windows or Linux
- Delivers drastically improved performance that drives product decisions and time to market across the complete product lifecycle (see chart on page 2)
- Multi-GPU support to turn your workstation into a "personal supercomputer"

Value Propositions:

- AMD FirePro™ graphics present a powerful, fully optimized and certified solution for CATIA and SIMULIA users to design and simulate on the same workstation
- Optimized and certified by Dassault Systèmes for Dassault Systèmes SIMULIA solutions
- Up to 2.62TFLOPS of peak double-precision floating point performance
- Up to 16GB of dedicated GPU memory to accelerate simulation process for very large models

The AMD FirePro Advantage:

- Three-year warranty and extended availability – Compared to consumer graphics, AMD FirePro™ graphics cards have an extended lifecycle
- Highest level of customer support – Customers have the ability to contact the AMD technical team directly
- Energy efficiency – AMD FirePro™ graphics cards are based on a highly efficient GPU design and feature power saving technologies like AMD PowerTune and AMD ZeroCore[2]
- AMD Eyefinity – A single card can power up to 3, 4 and even 6 displays with up to 4K resolution with each output (4096 x 2180 pixels using DisplayPort 1.2)[1]

"By incorporating the OpenCL™ programming interface into our current Abaqus release, we are providing more graphic hardware choices, such as AMD FirePro™ graphics, and accelerating compute performance which will enhance our customers' ability to deliver innovative, high-quality products to market faster."

Matt Dunbar, Chief Architect SIMULIA, Dassault Systèmes

For the initial stage of GPU-accelerated optimizations, the Abaqus developers identified the key areas to apply GPU computing code. This narrowed the effort for porting solutions to the GPU and impacted less of the application's code. Reducing the effort for porting to the GPU allowed the team to address other important challenges.

Balancing the workload is critical. When porting computationally intensive applications from a CPU-based homogeneous computing environment to take advantage of the power of a GPU in a GPU-plus-CPU heterogeneous computing environment as found in modern 3D workstations, a challenge for developers is to balance the workload in the system so that all of the computing resources are being effective.

Using OpenCL™ to unlock the computational performance of the AMD FirePro graphics GPUs, and focusing on optimizing a selected set of computationally intensive areas of the application, the Abaqus team was able to spend time on critical issues such as load-balancing the processing within the system.

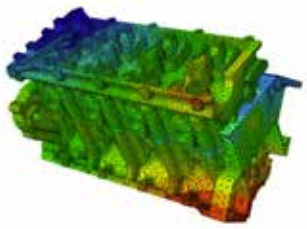
How can GPUs accelerate simulation results?

For the current optimizations, double-precision floating-point computing performance in critical. This supports the goal of solving large sets of linear equations as fast as possible to deliver better simulation performance.

Abaqus 6.14 Performance with OpenCL™

Benchmark: S4B 5M DOF (Cylinder head bolt-up*)

Time to complete
(Lower is better)



Looking to potential, future applications of GPU computing in Dassault Systèmes simulation products requires not only high-performance, parallel computing abilities in Abaqus, but also high-performance, parallel data processing abilities. To successfully expand GPU computing to these new areas of their application, the Abaqus team needs extremely high performance for memory bandwidth.

Conclusion

For the Abaqus team, using AMD FirePro graphics GPUs is a way to turbo-charge the engineer's simulation workstation. Fast simulation performance allows the engineer to perform more simulations and to explore more design alternatives. This can lead to better designs and more competitive products.

Recommended for SIMULIA Abaqus:

	AMD FirePro W7100	AMD FirePro W8100	AMD FirePro W9100
GPU Memory	8 GB	8 GB	16 GB
Memory Bandwidth	up to 160 GB/s	320 GB/s	320 GB/s
Compute Performance (Single Precision)	3.3 TFLOPS	4.2 TFLOPS	5.24 TFLOPS
Compute Performance (Double Precision)	206 GFLOPS	2.1 TFLOPS	2.62 TFLOPS
AMD Eyefinity Technology	4 4x DP 1.2	4 4x DP 1.2	6 6x mini-DP 1.2
Ready for 4K (UHD)	Yes	Yes	Yes
System Interface	PCIe 3.0	PCIe 3.0	PCIe 3.0
Form-factor:	Single-slot	Dual-slot	Dual-slot

For more information, visit in.amdfireprohub.com

AMD

* This benchmark is a mildly nonlinear static analysis that simulates bolting a cylinder head onto an engine block.
** Workstation with AMD Opteron 6176 SE 2.3GHz, 64GB RAM, OpenSUSE 11.3 (2.6.34 kernel), AMD driver 13.35, AMD APP SDK v2.9, FirePro W9000 GPU

[1] AMD Eyefinity technology supports up to six DisplayPort™ monitors on an enabled graphics card. Supported display quantity, type and resolution vary by model and board design; confirm specifications with manufacturer before purchase. To enable more than two displays, or multiple displays from a single output, additional hardware such as DisplayPort-ready monitors or DisplayPort 1.2 MST-enabled hubs may be required. Maximum two active adapters supported. See www.amd.com/eyefinityfaq for full details.

[2] AMD PowerTune and AMD ZeroCore Power are technologies offered by certain AMD FirePro™ graphics products, which are designed to intelligently manage GPU power consumption in response to certain GPU load conditions. Not all products feature all technologies - check with your component or system manufacturer for specific model capabilities.