Cray Reduces Analysis Turnaround Time with SIMULIA's Abaqus FEA Software

DASSAULT SYSTEMES

Abaqus Unified FEA

The Abaqus Unified FEA product suite by SIMULIA, a division of Dassault Systemes, offers powerful and complete solutions for both routine and sophisticated engineering problems covering a variety of industrial applications. For example, aerospace manufacturers can consider full vehicle loads, dynamic vibration, multibody systems, safety, nonlinear static, thermal coupling, and acoustic-structural coupling factors using a common model data structure and integrated solver technology. Organizations take advantage of Abaqus Unified FEA to consolidate their processes and tools, reduce costs, increase efficiency and gain a competitive advantage.

Cray Solutions

Computing
Cray computing technologies are built to solve high-fidelity simulation challenges. Solutions range from the highly configurable Cray® CS400™ cluster systems to the scalable and integrated Cray® XC40™ capability supercomputer.

Storage & Data Management
Solutions include the integrated Sonexion® scale-out Lustre® storage system; the Tiered Adaptive Storage open archiving solution; Cray Cluster Connect™ (C3); and configurable component-based solutions.

Data Analytics
Cray solutions include the Urika-XA™ extreme analytics platform; the Urika-GD™ graph discovery appliance; and scalable, flexible big data storage.
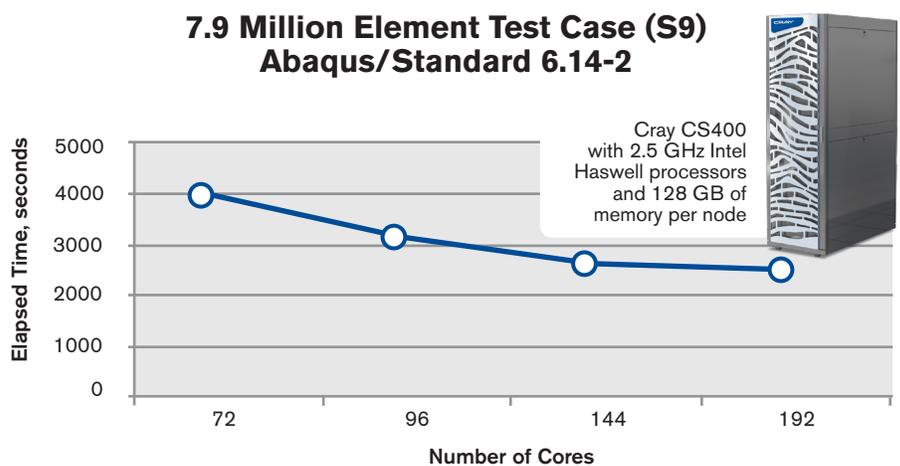
Situation

Manufacturing companies rely on realistic simulations to gain insight into product behavior. But running high-fidelity simulations often results in lengthy turnaround times, creating unacceptable delays in design cycles.

In order to reduce that critical turnaround time, application architecture can be designed to exploit advances in high performance computing (HPC) and the system can be customized to produce larger, more detailed physical models with a specific application.

Solution

Cray systems running Abaqus/Standard from SIMULIA's Abaqus Unified FEA (finite element analysis) product suite can speed up time to results and improve performance as the number of cores increases.

One example is a benchmark test where Cray and SIMULIA achieved a dramatic reduction in turnaround time using Abaqus/Standard on an Intel® Xeon® processor-based Cray CS400 cluster supercomputer. This static analysis subjects a section of airplane fuselage to axial tension. The fuselage is meshed with a mix of conventional and continuum shell elements having either isotropic or composite section properties. The composite shell sections have either nine or 13 layers. Linear elastic material behavior is used. The fuselage is fixed at one end using a large kinematic coupling and loaded at the other end using a second kinematic coupling to which a fixed displacement is applied. The fuselage skin, stringers and struts are connected using kinematic ties. Large displacement effects are included in the solution.

7.9 Million Element Test Case (S9)
Abaqus/Standard 6.14-2

Cray CS400 with 2.5 GHz Intel Haswell processors and 128 GB of memory per node

Elapsed Time, seconds (y-axis: 0, 1000, 2000, 3000, 4000, 5000)
Number of Cores (x-axis: 72, 96, 144, 192)

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