ANSYS Release 17 Redefines Simulation Performance

The push for higher performing simulation is not just about the need for speed. Faster simulation delivers real business value to engineering organizations, allowing them to explore more design alternatives earlier in the process while being able to evaluate much more complex and complete designs against myriad multiphysics criteria.

ANSYS, always in the forefront of driving high-performance simulation, has upped the ante once again with the latest release of its CAE portfolio. With ANSYS Release 17 comes a modern HPC solver architecture designed to harness the horsepower of the latest Intel processor technologies to deliver unparalleled simulation performance and return results faster, whether the software is running on a desktop, a workstation, an HPC cluster or in a cloud environment.

The bar was already set pretty high. In a previous benchmark study conducted by ANSYS, *Desktop Engineering*, Dell and Intel, ANSYS Mechanical R16 running on a state-of-the-art Dell Precision 7910 workstation equipped with 3.2GHz dual E5-2667 v3 processors and 16 cores increased simulation performance on one model by more than 6X compared to that same simulation exercise conducted with three-year-old hardware and software. (See deskeng.com/de/benchmark2.) That same model, running on a comparable Dell workstation (with 3.1GHz processors and 20 cores) and with the new ANSYS R17, achieved a speedup of 8.3X, underscoring the ANSYS upgrade's ability to throttle up simulations by leveraging higher core counts.

ANSYS R17's improved robustness and scalability comes in part from leveraging a number of Intel Software Development products to optimize the software for the Intel Haswell processor architecture, including adopting the latest Intel AVX-2 compiler instructions and the Intel Math Kernel Libraries. ANSYS has also implemented a completely new algorithm that optimizes the matrix factorization stage of the sparse solver — which may account for a significant portion of the total solution time — along with other software code optimizations that contribute to the accelerated performance.

Beyond those enhancements, ANSYS R17 supports more robust Distributed Memory Parallel (DMP) processing capabilities at higher core counts (32+ cores), enabling a complex simulation to be divided up into portions that are computed on separate cores and processors. The latest release changes up the default Message Passing Interface (MPI) software — the communications channel that lets each ANSYS process exchange data with other processes involved in the DMP simulation — to Intel MPI, further accelerating performance. These improvements have enabled ANSYS to make DMP the default standard for ANSYS Workbench instead of Shared Memory Parallel (SMP) processing, delivering more efficient performance for simulations involving more than four compute cores running in parallel. Moreover, new DMP features, including a new version of the Block Lanczos eigensolver as well as a support for spectrum analyses such as the PSD method, lead to faster performance, especially at higher core counts.

Iterative Solving Gets a Huge Boost

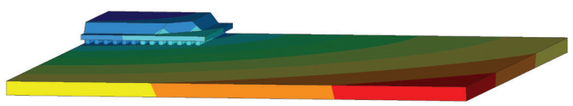
ANSYS R17's performance gains are not limited to the sparse solver. Because today's highly complex structural systems require analysis of a wide range of physics, multiple solving solutions are required, each a beneficiary of R17's enhanced performance. In one such example, iterative solvers, well suited for the current trend toward larger models with solid elements and fine meshes, has also been greatly enhanced to deliver faster solution solving in the new ANSYS release 17.

Consider the Preconditioned Conjugate Gradient (PCG) iterative solver, one of the various solvers in the ANSYS portfolio, as an example. Iterative solvers like PCG use a different approach to solving large systems of linear equations compared to sparse solvers. The PCG starts with an initial guess and goes through an iterative process to update the solution vector in every iteration using the system matrix and a preconditioner matrix to converge the solution. Thanks to improvements made in the PCG solver in ANSYS R17, simulation models now converge faster to the correct solution.

ANSYS R17 sets the standard for high-performance simulation, helping engineers navigate mounting product complexity and giving manufacturers an edge.

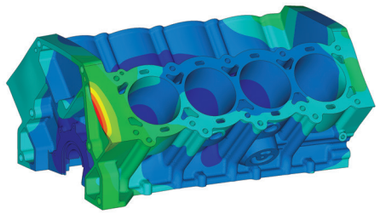
For more information about ANSYS release 17, please visit ANSYS.com/StructuresHPC.

Sparse Solver Model



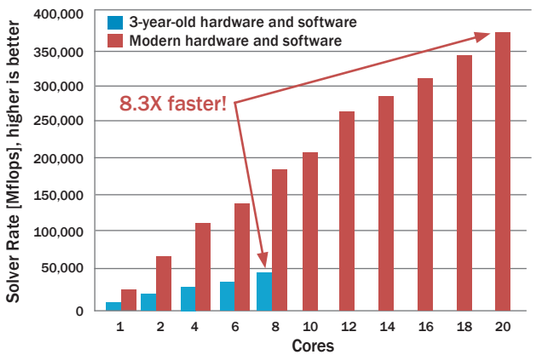
A transient nonlinear structural analysis of an electronic ball grid array. **Model Characteristics:** Sparse solver, symmetric matrix, 6 million DOFs

Iterative Solver Model



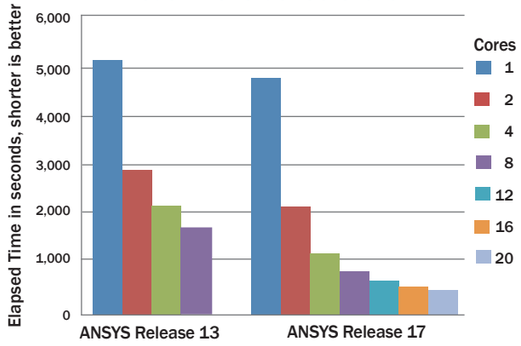
A static, linear structural analysis of an engine block without the internal components. **Model Characteristics:** PCG solver, symmetric matrix, 14.2 million DOFs

Modern vs. Older Hardware and Software



ANSYS release 17 performed a transient nonlinear structural analysis of an electronic ball grid array 8.3X faster than ANSYS release 13.

Modern vs. Older Software



ANSYS release 17 running on a current Dell workstation showed significant reductions in solver times on a linear structural analysis of an engine block as core counts increased.

New HPC Milestone Achieved: ANSYS R17 Scales to Over 1,000 Cores

Thanks to a modern HPC solver architecture that leverages the latest Intel processor technologies, ANSYS R17 has the ability to scale to over 1,000 cores — a milestone for pushing simulation performance beyond workstation capacity to corporate cluster levels.

For example, consider a ball grid array involving a nonlinear transient analysis with creep material properties (no contact). The sparse solver is used to solve the 4 million equations, and there is one load step with 12 substeps, resulting in 22 iterations to reach convergence in the nonlinear analysis. As a point of comparison, the model was run with the latest ANSYS R17 release and the previous R16 release on the same system — the Intel Endeavor cluster with each compute node featuring a pair of Intel Xeon E5-2696v3 (Haswell processors), 64GB of RAM, local SSD storage, and RHEL6.5. Mellanox InfiniBand FDR interconnects were also part of the configuration.

When run on the system with ANSYS R16, performance topped out at approximately 300 cores (see chart). With ANSYS R17, performance continued to improve to 1,024 cores. This results in significantly reduced solution times, helping engineering teams in their quest to perform more complex and complete simulations within reduced product development schedules.

DMP Scaling Comparison