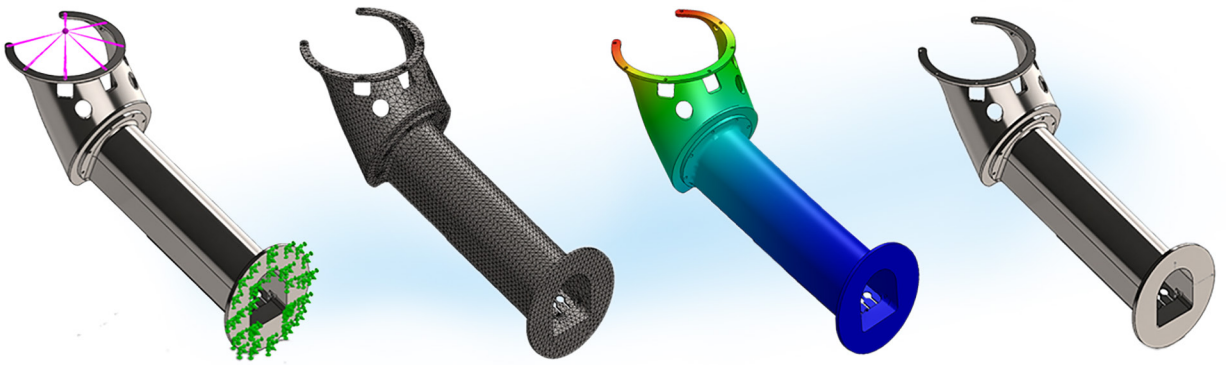
White Paper

## The Simulation Desktop

# Fast, CAD-Integrated FEA is a Critical Solution for Every Engineer




## Summary

Harnessing the power of CAD-integrated finite element analysis (FEA) demands speed. That's why Dassault Systèmes SolidWorks Corporation (DS SolidWorks) embarked on a project two years ago to make the SolidWorks Simulation* desktop substantially faster and more efficient, so you can leverage this critical design tool to deliver innovative products to market faster than ever. DS SolidWorks achieved its goal with SolidWorks Simulation* 2014 software. Using this top-performing FEA solution on workstations based on the latest Intel® Xeon® processor E5-2600 v2 product family and Intel® Solid-State Drives (Intel® SSDs), it's now not only possible but also extremely efficient—more than 10 times as fast in some cases—to drive product experimentation right at your desk; or with mobile workstations, right in your lap. The performance gains documented in this paper can help you accelerate your workflows and enable you to quickly create, interrogate, and improve your product designs in a fast-paced iterative loop.

# The Simulation Desktop – Performance Gains Transform FEA Usability for Creating Innovative Products

Everyone involved in product development knows the benefits of identifying and addressing potential design performance issues early in the development process. The sooner in the design cycle that functional issues are pinpointed and resolved, the less detrimental the impact they have in terms of time delays and unnecessary costs.

However, the advantages of using FEA tools to simulate design behavior extend beyond basic design validation. Instead of just using FEA to verify a design's behavior prior to its release to manufacturing, design engineers can now leverage the insights provided by FEA studies to discover new approaches, create product innovations, and deliver better-performing, more successful products on time and on budget.

For design engineers to fully maximize the positive impact of simulation technology, FEA tools must be powerful, accurate, intuitive, and efficient. In short, design engineers need a new simulation desktop—a timely convergence of computer hardware and FEA software performance and usability enhancements that make simulation studies as fast and as easy to run as other 3D CAD operations.

## Simulating the effects of the solar wind

The Smithsonian Astrophysical Observatory (SAO), part of the Harvard-Smithsonian Center for Astrophysics (CFA), works with leading astrophysicists and scientists on the development of cutting-edge research instruments and systems. SAO leverages SolidWorks Simulation* Premium software running on Intel® processors to tackle some of the most difficult engineering challenges, such as mankind's first visit to a star.

The U.S. National Aeronautics and Space Administration (NASA) Solar Probe Plus (SPP) will launch in 2018. The car-sized spacecraft will plunge directly into the sun's atmosphere. SAO's role is to develop the Solar Wind Electrons Alphas and Protons (SWEAP) payload, including a Faraday sensor that will measure the properties of electrons, protons, and helium ions in the solar wind. What makes the project so challenging is that the sensor resides on the exterior of the spacecraft, where it will be subjected to intense heat and radiation.

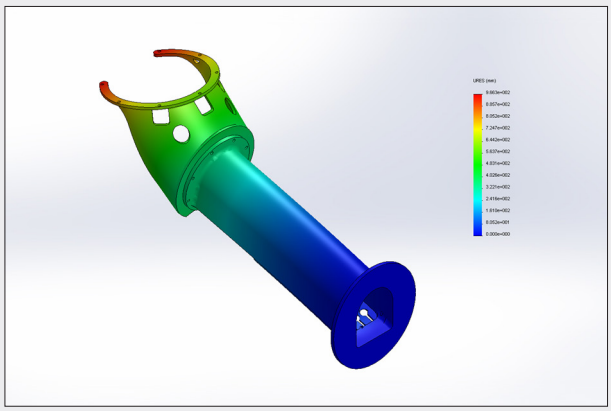


Image courtesy of Smithsonian Astrophysical Observatory

"The sensor operates in an environment so extreme that we have to use integrated analysis tools," says Project Engineer David R. Caldwell. "We recently ran prototype tests at the Solar Wind Facility at the Marshall Space Flight Center, and the sensor performed as predicted by our SolidWorks simulations.

"With space flight systems, weight is critical," Caldwell adds. "SolidWorks Simulation Premium gives us the information we need to change thicknesses or materials and truly optimize our designs."

### FEA Type

- Nonlinear Buckling
- Vibration
- Thermal
- Frequency

### Hardware Specs

- Intel® Core™ processor i7-2960XM CPU (2.50 GHz) with 4 cores and an 8 MB cache
- 16 GB RAM

### Results

- Reduced development and machining time and costs
- Shortened nonlinear analysis time from a week to half an hour
- Cut system weight while ensuring performance
- Improved design visualization

With the solver improvements in SolidWorks Simulation 2014 software, which cut solution times to a small fraction of previous run times, and the combination of powerful multi-core Intel® Xeon® processors and Intel SSDs, which make hardware performance as much as three times faster, design engineers have access to an amazingly fast CAD-integrated FEA solution. Together, Dassault Systèmes SolidWorks Corporation (DS SolidWorks) and Intel Corporation offer a combination of simulation software and hardware solutions that raise the efficiency, usability, and impact of simulation technology to an entirely new level—making the simulation desktop an idea whose time has come.

## Building the Simulation Desktop – Configuring a Balanced Workstation

Fast, state-of-the-art multi-core Intel Xeon processors—paired with Intel SSDs—supply the hardware muscle that powers the new simulation desktop. Performance advances in both processing and drive speed provide engineers with a wider range of options for efficiently running simulations, especially when you consider that Intel Xeon processors provide enhanced opportunities to scale your desktop solution across a greater number of processor cores to further shorten run times.

For example, a workstation powered by an entry-level Intel® Xeon® processor E3-1200 v3 product family utilizes a total of four processor cores. This contrasts with a high-end workstation equipped with two Intel® Xeon® processors E5-2600 product family, which provides access to 12 cores in each processor for a total of 24 cores. When an FEA is run on multi-core processors, the software divides the computational calculations across cores. The degree to which multiple cores are utilized depends on many factors, such as geometry, study options, solver selection, etc. Generally, the more processor cores you have, the faster an FEA study will run, although the speed increase related to adding more cores is not linear. The ability to utilize additional cores provides the flexibility to scale your particular workstation to accelerate solution results.

## Facilitating the rescue of trapped Chilean miners

Center Rock, Inc., is a leading manufacturer of drilling supply equipment. The company's pneumatic bits utilize wear-resistant carbide and diamond tips on a series of rotating hammers. Center Rock's percussive hammer bits can tunnel through even the hardest, most abrasive rock. In fact, a redesigned Center Rock drill head made the miraculous rescue of 33 Chilean miners—trapped 2,000 feet underground for two months in the San José Mine—possible.

Using SolidWorks Flow Simulation* software running on Intel® processors, Center Rock customized one of its bits to let drill cuttings fall into the mine while expanding the 5 ½-inch probe hole to 28 inches to accommodate the escape capsule, through which the miners were pulled to safety.

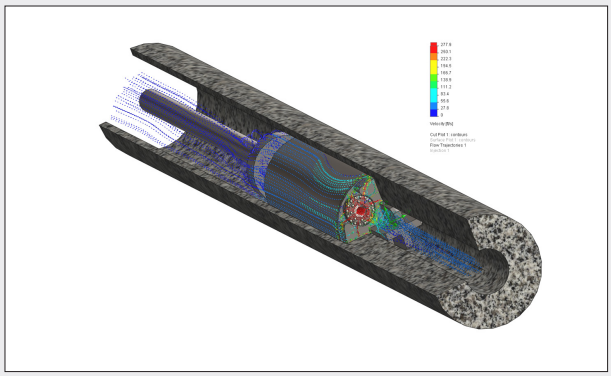


Image courtesy of Center Rock

"The SolidWorks Flow Simulation studies enabled us to customize the tool by putting a band around the bit, so that two-thirds or more of the air went down the shaft," recalls Senior Engineer and Product Development Manager Rudy Lyon. "We needed an adequate split of air to let the cuttings fall by gravity, where the trapped miners kept busy clearing about eight dump-truck loads of spoil. SolidWorks Flow Simulation allowed us to reconfigure the tool and reach the miners faster."

When the bit hit a metal rock-bolt support, Center Rock used SolidWorks nonlinear analysis studies to redesign the bit, resolve the snag, and continue drilling.

### FEA Type

- Nonlinear Nodal Stress
- CFD

### Hardware Specs

- Customer-Assembled Workstation
- Intel® Core™ processor i7-965 CPU (3.20 GHz)
- 8 GB RAM

### Results

- Reached trapped miners two months ahead of projections
- Redesigned drill bit in three days
- Cut design cycles by 66 percent
- Quadrupled product offering

This processor flexibility allows you to configure your workstation as the best-balanced simulation desktop for your particular type of work. If you're designing standard parts and conducting common simulations, a machine with four to six cores should be sufficient. If you are working on more complicated parts or running more sophisticated analyses, you may want to leverage eight or more cores for better performance. Lastly, if you are working on large, complex assemblies—with elaborate, heavily featured components—and are running contact or nonlinear analyses, you may want to scale up by adding more cores, to a maximum of 24.

Intel SSDs, which utilize cache technology to read and write intermediate simulation results faster, can also help you shorten simulation run times. Machines equipped with SSDs generally run three times faster than those using traditional mechanical hard drives. SSDs can add a significant performance boost to simulation operations, even if a single SSD is only used for FEA and the rest of your workstation applications use conventional hard disks.

Configuring a balanced simulation workstation also extends to the amount of memory and type of graphics card required. A general rule of thumb on memory is to have at least twice the memory as the size of the largest model on which you want to run FEA. This rule is only a guideline, and in many cases you may use more or less memory. From a simulation standpoint, a mid-range graphics card should work fine.

## Fast FEA accelerates transmission systems design

Litens Automotive Group is the global leader in the design and manufacture of engineered power transmission systems and components. A tier 1 supplier to the automotive industry, Litens has maintained its market leadership position by continuously developing innovative products that solve vehicle performance and noise, vibration, and harshness (NVH) challenges.

By using SolidWorks Simulation* Premium software, running on Intel® Xeon® processors, to conduct simulations as an integral part of the design process, Litens has reduced prototyping iterations and associated costs, while accelerating its development process. The company's engineers conduct very complicated contact analyses—as well as kinematics, dynamics, fatigue, displacement, and thermal simulations—directly within the SolidWorks design environment.

"Time is the critical factor, and with the fast solver in SolidWorks Simulation Premium software, we can solve a full-assembly contact analysis in a couple of hours. Who else can do that?" says Chief Engineer Dr. Steve Jia. "When you consider the time and prototyping costs that virtual product development using CAE helps us save, it amounts to millions of dollars each year.

"The beauty of SolidWorks Simulation Premium software is that it offers a robust mesher, a fast solver, and the ability to handle very large assembly simulations with very complicated contact situations easily," Dr. Jia adds. "We've realized outstanding ROI (return on investment) with SolidWorks Simulation Premium and rely on the software for our daily work."

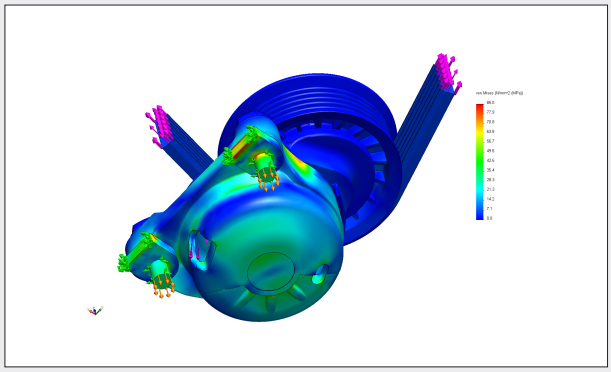


Image courtesy of Litens Automotive

### FEA Type

- Contact
- Kinematics
- Dynamics
- Fatigue
- Displacement
- Thermal
- Design Optimization

### Hardware Specs

- Intel® Xeon® processor E5-2687W CPU (3.10 GHz), 8 cores, 20 MB cache with 4 Intel® SSDs
- 64 GB RAM

### Results

- Saved millions of dollars annually
- Cut solving of complicated contact analyses from days to hours
- Reduced prototyping iterations
- Accelerated new product design and development

## Running the Simulation Desktop – Fast, Accurate, and Powerful CAD-Integrated FEA with SolidWorks Simulation

The release of SolidWorks Simulation 2014 software includes important groundbreaking enhancements and productivity improvements that provide the fast, accurate, and powerful CAD-integrated FEA tools that engineers need to develop successful products. The software includes the Large Problem Direct Sparse Solver, a completely new solver for efficiently running FEA simulations that contain more than a million degrees of freedom (DOFs), as well as important enhancements to file operations—files open faster when SolidWorks Simulation is active—and existing direct and iterative solver performance.

SolidWorks Simulation software leverages multi-core processor architectures—including the Intel Xeon processor CPU— to quickly provide accurate FEA results in a fraction of the time of previous versions of the software. For example, the software's FFE Plus iterative solver boasts an overall general improvement in solution time of 10 to 15 percent. This performance gain increases to 40 percent for contact problems with no penetration. The FFEPlus iterative solver's performance becomes even faster as you increase the number of processor cores.

With multi-core support, the Large Problem Direct Sparse Solver is much faster than the Direct Sparse Solver for problems with millions of DOFs, cutting solution time on a chassis simulation with 3,360,485 DOFs from hours to minutes.

SolidWorks Simulation software allows you to take advantage of its fast, intuitive meshing tools, including an automatic mesher. You can also leverage flexible manual mesh refinement tools, including h-adaptive and p-adaptive capabilities for improving simulation accuracy.

While CAD-integrated SolidWorks Simulation software is arguably the easiest FEA tool to use, it's just as powerful and accurate as any other FEA solution, actually more so because of its integration inside the SolidWorks modeling environment. Because SolidWorks Simulation is fully integrated, there's no need to import or export files, jump back and forth between CAD and FEA applications, or remove FEA results from your modeling environment, all of which saves time and effort. You can view FEA results and apply your findings directly to your CAD model, then re-run the simulation. You can even take advantage of CAD tools to further improve FEA performance. For example, you can use design configurations to run a family of analyses on a single model, a single analysis on a family of models, or some mixture of the two. You can also take advantage of CAD data—such as material properties, parts positioning (mates), or fastener definitions—to accelerate simulation setup.

When combined with Intel Xeon processor-based workstations, the performance improvements in SolidWorks Simulation 2014 software, ranging from new solvers to increased multi-core support, provide you with a dramatically faster CAD-integrated FEA solution.

SolidWorks Simulation* 2014 is now enhanced so you can scale performance with more cores and computing capacity.

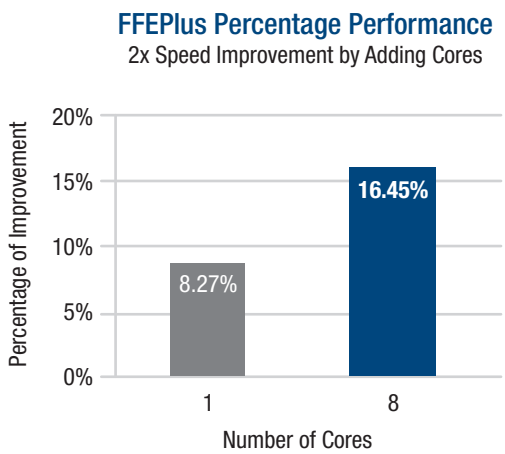



**Figure 1.** Improve Solution Times by Adding Cores

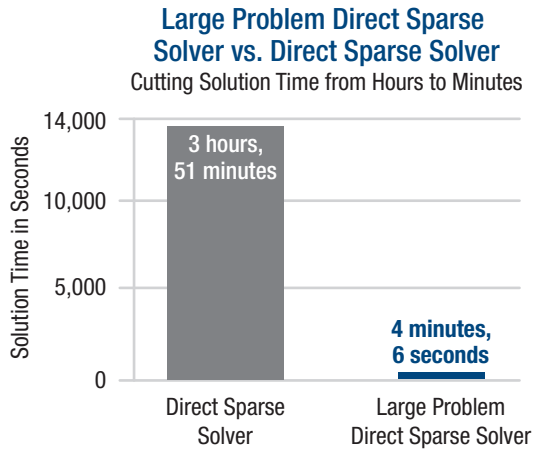
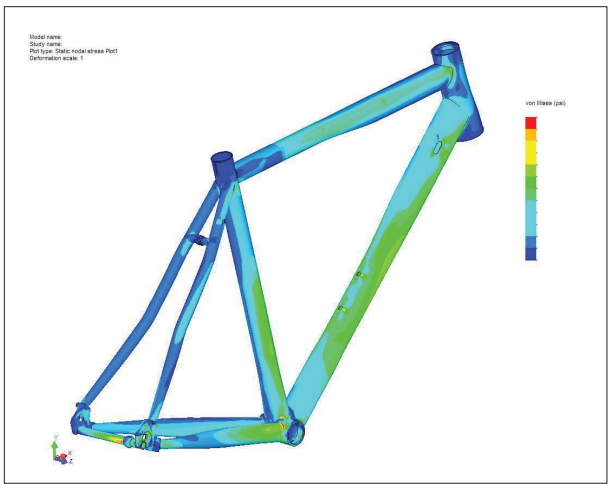



**Figure 2.** Large Problem Direct Sparse Solver Cuts Solution Times from Hours to Minutes

## Simulating the Real World – What Can You Simulate with SolidWorks Simulation FEA

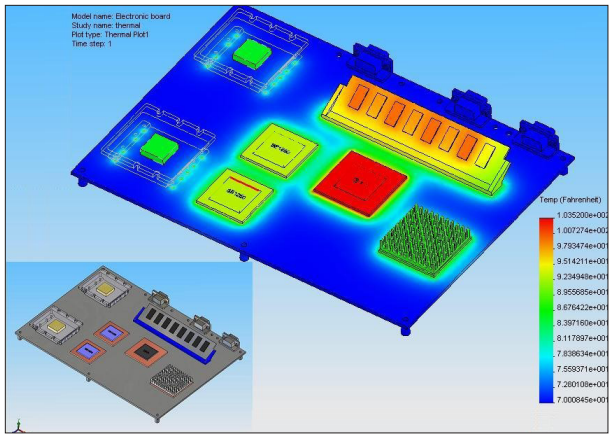
SolidWorks Simulation software provides a complete range of analysis types to meet virtually any FEA need. With these capabilities and the fast performance of the new simulation desktop, you can analyze the complex phenomena of the physical universe, including structural, heat transfer, fluid flow, and dynamic behaviors, as they apply to your design. Capabilities include:

- **Structural Analysis –** from simple linear to highly nonlinear problems
- **Linear and Nonlinear Vibration Analysis**
- **Thermal Analysis –** steady-state and transient
- **Fatigue Life Analysis**
- **Fluid Flow Analysis**
- **Plastics Injection Simulation**
- **Motion Simulation**
- **Coupled-Field Multiphysics Analysis**, where the above capabilities are combined.



### Structural Analysis

You can use SolidWorks Simulation software to understand the solid mechanics and structural characteristics of your design, including stress, displacement, buckling, contact, and motion.

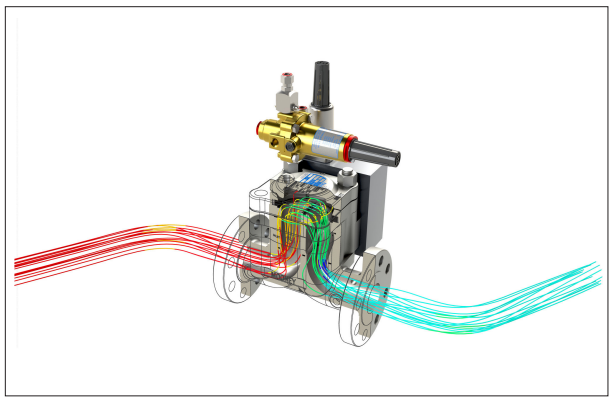


### Thermal Analysis

You can use SolidWorks Simulation software to simulate how heat transfer impacts design performance—especially useful when dealing with materials that have temperature-dependent properties. You can simulate different types of heat transfer—including conduction, convection, or radiation—as well as transient and steady-state effects.

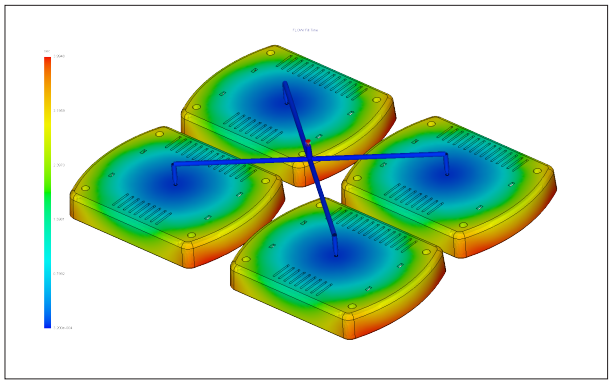
*"I can solve a nonlinear simulation problem that used to take a week in a few hours. With that kind of speed, I can quickly optimize and deliver a design that will perform."*

– David R. Caldwell, Project Engineer,
Smithsonian Astrophysical Observatory



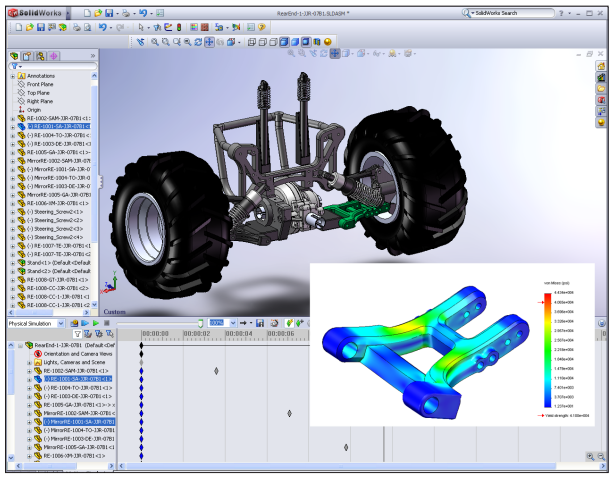
### Computational Fluid Dynamics Analysis

You can use SolidWorks Flow Simulation computational fluid dynamics (CFD) analysis software to simulate the behavior and dynamics of fluids—both liquids and gases. These capabilities can help improve aerodynamics, cool electronics, and maximize the performance of heating, ventilation, and air-conditioning (HVAC) systems.



## Plastics Injection Analysis

You can use SolidWorks Plastics* software to simulate injection of plastics within molds, enabling you to optimize the flow of molten plastics within molds to identify, address, and avoid manufacturing issues.



## Multiphysics Analysis

Although most simulation problems examine a particular type of physical phenomena, there are situations that require a combined multiphysics approach. You can use SolidWorks Simulation software to conduct thermal-stress or thermo-mechanical (thermal/structural) analysis, simulate fluid-structural interaction (flow/structural) by using CFD results as input for a structural analysis, study fluid flow with heat transfer (flow/thermal), and gain insights into fluid-structural interactions with heat transfer (flow/thermal/structural).

The SolidWorks Simulation solution allows you to run many kinds of FEA studies across all major analysis types, including:

- Static (Stress)
- Frequency
- Buckling
- Fatigue
- Vibration
- Contact
- Assembly
- Nonlinear
- Dynamic
- Modal Time History
- Harmonic
- Random Vibration
- Response Spectrum
- Design Optimization
- Kinematics and Dynamics
- Plastic and Rubber Components
- Fluid Flow
- Electronics Thermal Management
- Thermal Comfort Factors
- Coupled Thermal-Structural
- Coupled Thermal-Fluid
- Plastic Mold-Filling
- Sustainability

*"The beauty of SolidWorks Simulation Premium software is that it offers a robust mesher, a fast solver, and the ability to handle very large assembly simulations with very complicated contact situations easily. We've realized outstanding ROI with SolidWorks Simulation Premium and rely on the software for our daily work."*

– Dr. Steve Jia, Chief Engineer, CAE Technologies and Materials Engineering, Litens Automotive Group

## Putting It All in Perspective – Performance Benchmarking

To put the extent of these simulation hardware and software improvements into context, DS SolidWorks and Intel recently conducted performance benchmarking to compare time-to-solution for SolidWorks Simulation 2014 software using new hardware—equipped with the latest Intel Xeon processors—against SolidWorks Simulation 2010 software running on a hardware configuration that was representative of a few years ago.

Basic system specifications for the machines used in the performance benchmark are as follows:

### Dell Precision* T7400 Workstation x64-based PC, BIOS 2008

- Intel® Xeon® processor X5472 CPU (4 cores, 4 logical processors, 3.00 GHz)
- 20 GB RAM
- 1.09 TB fixed hard disk

### Lenovo E32 ThinkStation* Workstation x64-based PC, BIOS 2013

- Intel® Xeon® processor E3-1275 v3 CPU (4 cores, 8 logical processors, 3.50 GHz) 8 MB cache and Intel® HD Processor Graphics P4600
- 8 GB RAM
- 450 GB fixed hard disk

### Lenovo C30 ThinkStation Workstation x64-based PC, BIOS 2013

- Dual Intel® Xeon® processor E5-2680 v2 CPUs (10 cores, 20 logical processors, 2.80 GHz) 20 physical cores and 40 logical processors
- 32 GB RAM
- 225 GB SSD

## Optimizing injection molding of emergency light components

As the world's largest manufacturer of emergency warning products—backup alarms and warning lights— for commercial and emergency vehicles, ECCO depends on the development of high-quality, injection-molded plastic parts.

The company used to rely on its tool manufacturer to spot and address injection-molding issues. However, in 2012 ECCO acquired SolidWorks Plastics* injection-molding simulation software, which company engineers run on Intel® processors to resolve a range of injection-molding challenges.

"We wanted to independently assess how a mold would fill and where knit lines would be, instead of waiting on iterations with the toolmaker," says Mechanical Design Engineer John Aldape.

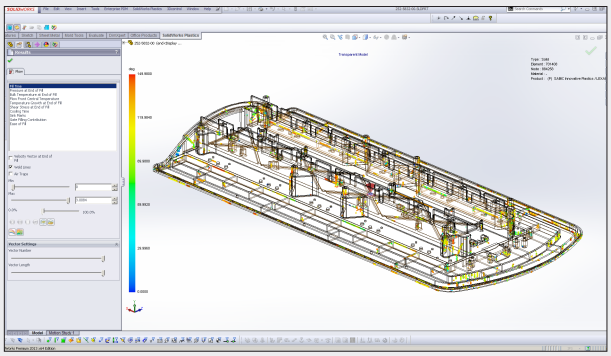


Image courtesy of ECCO Plastics

"If we didn't have SolidWorks Plastics, we wouldn't have as much confidence in the manufacturability of a design. It helps us avoid going back and forth with the moldmaker after the fact, which saves time and reduces costs."

ECCO used SolidWorks Plastics to develop a new base for its four-foot and six-foot emergency light bars. "The light bar base was the largest injected-plastic part that we have made," says Mechanical Design Engineer Nick Thompson. "With SolidWorks Plastics, I was able to modify the design to improve the flow of plastic in the mold. I added a large post for the injection sprue and ribs heading out from the post to serve as runners to improve flow. All the moldmaker had to do was change a gate dimension."

### FEA Type

- Injection Plastics

### Hardware Specs

- Intel® Core™ processor i7-970 (3.2 GHz) with 6 cores
- 12 GB RAM

### Results

- Minimized iterations with moldmaker
- Eliminated mold-related production issues
- Optimized parts for stiffness and mold filling
- Improved lens optics and product aesthetics

## Benchmark Problem Details

- Actual customer model
- Linear static stress analysis
- Assembly with 8 solid bodies
- Custom (user-defined) linear elastic isotropic material properties assigned
- 14 bolt connectors with torque pre-load defined
- 2 no-penetration contact sets, generating approximately 5,000 surface-to-surface contact elements
- Approximate model dimensions (bounding box): 86" x 20" x 30"
- 82,700-lbf force applied to component, which transfers force to a beam that is in turn connected to a longer base beam via 14 bolt connectors. The longer base beam is fixed at both its ends, resulting in bending deformation.
- Minimum geometric thickness: 0.25"
- Global element size: 0.7"; tolerance: 0.035"
- High-quality (second order) tetrahedral mesh elements generated using standard mesher
- Number of nodes: 172,648
- Number of elements 88,265
- Approximately 512,000 DOFs

The benchmarking results demonstrated a 75.6-percent reduction in solution time for the Direct Sparse Solver and a 78.1-percent reduction in solution time for the FFEPlus Iterative Solver on Dell Precision* T7400 Workstation, simply as a result of running the improved SolidWorks Simulation 2014 software on the same machine. When the problem is run on a Lenovo E32 ThinkStation*, the reduction in solution time with the Direct Sparse Solver is 90.2 percent; with the FFEPlus Iterative Solver, the reduction in solution time is 94.8 percent. The Lenovo C30 ThinkStation* was the fastest, with a 90.3-percent reduction in solution time with the Direct Sparse Solver and a 96.4-percent reduction in solution time with the FFEPlus Iterative Solver.

With the new Simulation Desktop — SolidWorks Simulation* 2014 running on multi-core Intel® Xeon® processors — you can take advantage of FEA run times with the potential to be 30 times faster than a three-year-old solution.

**Table 1.** The New Simulation Desktop vs. Circa-2010 Workstation

| | Circa-2010 Intel® Xeon® processor-based workstation | Lenovo E32* | Lenovo C30* |
|---|---|---|---|
| 2010 SP5 Direct Sparse Solver | 01:35:30 (5,730 seconds) | | |
| 2010 SP5 FFEPlus Iterative Solver | 03:38:08 (13,088 seconds) | | |
| 2014 SP0 Direct Sparse Solver | 00:23:17 (1,397 seconds) **4x as fast** | 00:09:23 (563 seconds) **10x as fast** | 00:09:17 (557 seconds) **10x as fast** |
| 2014 SP0 FFEPlus Iterative Solver | 00:47:41 (2,861 seconds) **2.7x as fast** | 00:11:22 (682 seconds) **11.6x as fast** | 00:07:51 (471 seconds) **16x as fast** |

*"If we didn't have SolidWorks Plastics, we wouldn't have as much confidence in the manufacturability of a design. It helps us avoid going back and forth with the moldmaker after the fact, which saves time and reduces costs."*

– John Aldape, Mechanical Design Engineer, ECCO

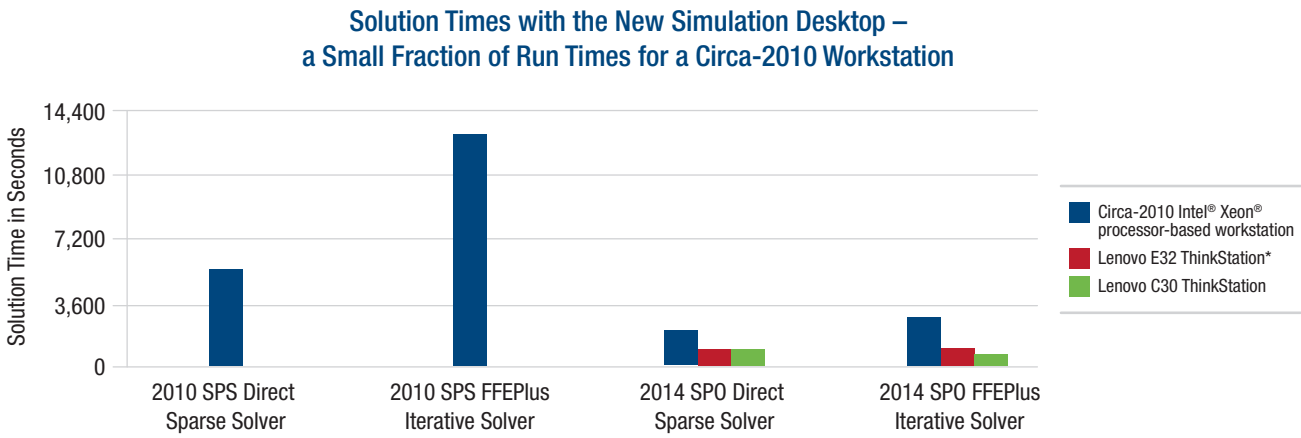



**Figure 3.** Solution Times with the New Simulation Desktop; a Small Fraction of Run Times for a Circa-2010 Workstation.

## Run SolidWorks Simulation on Your Simulation Desktop

By implementing SolidWorks Simulation 2014 software, you can equip your simulation desktop with the fast, accurate, and powerful CAD-integrated FEA solution that you need to develop successful products. With important groundbreaking enhancements and productivity improvements—including a new Large Problem Direct Sparse Solver, improved multi-core support, and enhancements to existing direct and iterative solver performance—you'll enjoy the benefits of running FEA in your SolidWorks modeling environment as just another CAD operation.

To learn more about how SolidWorks Simulation software can help you reap the benefits of simulation-supported design—including faster time-to-market, reduced costs, and improved quality—visit **www.SolidWorks.com** or call 1 800 693 9000.

*"The ease of use and integration of SolidWorks Simulation analysis tools helped the process go much faster and provided comfort that we had done the best we could."*

– Rudy Lyon, Senior Engineer and Product Development Manager, Center Rock, Inc.

## Cooling high-performance scientific camera electronics

Photometrics designs and manufactures high-performance charge-coupled device (CCD) and electron-multiplied charge-coupled device (EMCCD) cameras for life science research. Researchers worldwide rely on Photometrics cameras to quantify, measure, reproduce, and standardize results for the world's most demanding bioresearch applications, such as the low-light, microscopic environments involved at the cellular level.

To provide the precision that its customers demand, Photometrics needs to cool its cameras to very low temperatures (often to below 0ºC) to minimize background noise and eliminate its effects on the digital image. This is achieved through a variety of cooling systems, which utilize gas-filled chambers, fans, heat sinks, heat pipes, and thermoelectric coolers (TECs).

Photometrics used to perform lengthy physical prototyping to validate the effectiveness of its sophisticated cooling systems. However, in 2011 Photometrics engineers began running SolidWorks Flow Simulation* software and its Electronics Cooling Module on Intel® processors. The company also takes advantage of SolidWorks Simulation Premium software to solve nonlinear dynamics and vibration problems.

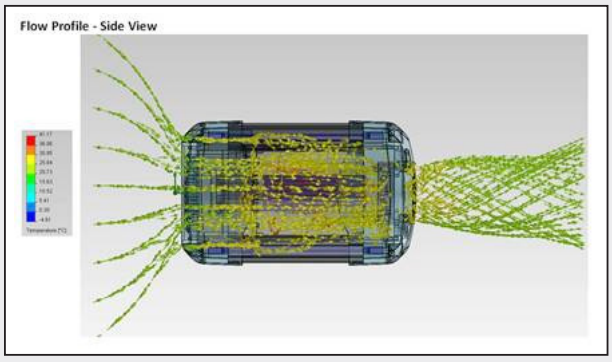



Image courtesy of Photometrics

"Because SolidWorks Flow Simulation enables us to characterize temperature, we can more rapidly develop approaches for cooling board components," says Mechanical Engineer Bob Chanapan. "We validated the software's accuracy through final testing and now rely on simulation results. SolidWorks Flow Simulation paid for itself and showed a return in the first year. We project these savings will total $50,000 annually within five years."

### FEA Type

- Nonlinear Dynamics
- Vibration
- CFD
- Electronics Cooling
- Thermal

### Hardware Specs

- Intel® Core™ processor i7-3930K CPU (6 cores, 12 MB cache, 3.9 GHz) with 256 GB SSD
- 16 GB RAM

### Results

- Cut development time in half
- Eliminated three prototyping cycles
- Laid groundwork for $50,000 in annual cost savings
- Strengthened customer relationships by adding value

## Power Your Simulation Desktop with Intel Multi-Core Processors

By configuring your workstation to leverage the performance gains possible with multi-core Intel Xeon processors and Intel SSDs, you'll realize the power of a true simulation desktop. Productivity-enhancing Intel solutions give you a wider range of options for efficiently running simulations and scaling your desktop solution—from four to 24 processor cores—to satisfy your unique requirements. This flexibility enables you to configure a balanced workstation that is especially tailored to help you succeed at the specific type of work that you do.

To learn more about how powerful Intel Xeon processor-based workstations can help you realize the benefits of a true simulation desktop, visit **www.intel.com/go/workstation**.

## Take Advantage of the New Simulation Desktop

Considering the dramatic time savings available through the combination of SolidWorks Simulation 2014 software and Intel Xeon processors, ask yourself if you can really afford to continue working without this new simulation desktop. Can you continue to develop innovative product designs that consistently edge out the competition without having the ability to efficiently simulate, validate, and optimize designs? Will not having this type of speed, power, and flexibility put you at a disadvantage? Will your product designs win out over competitors who enjoy this type of performance?

The new simulation desktop represents the convergence of Intel® hardware and SolidWorks Simulation software performance and usability enhancements to provide a CAD-integrated FEA solution that helps you develop innovative products. With the solver improvements in SolidWorks Simulation 2014 software, which cuts solution times to a small fraction of previous run times, and the combination of powerful multi-core Intel Xeon processors and SSDs, which make hardware performance as much as three times faster, design engineers now have access to one of the fastest simulation desktops to date.

Intel and SolidWorks would like to thank Lenovo for use of their E32 ThinkStation* and C30 ThinkStation workstations to conduct this study.



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