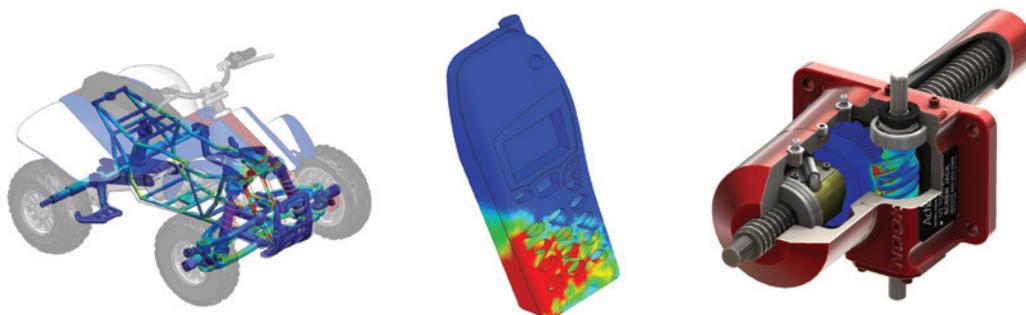


Simulation-Driven Design

Faster, Easier Simulation Helps You Create Better Products



Summary

Analysis and simulation technologies have advanced dramatically in recent years on both the hardware and software sides of the equation. Finite element analysis (FEA) is no longer the resource-intensive, esoteric discipline of the past and has become a viable, strategic tool for driving product development efforts for manufacturers large and small. The combination of easy-to-use SolidWorks® Simulation software and powerful Intel® Xeon® processor-based workstations allows you to save time, control costs, and improve quality. No matter what types of products you develop, these simulation technologies can help you shorten time-to-market, increase profitability, and minimize returns and warranty claims. Here's how.



Engineers have a new workbench

Just as the workbench in your basement or garage evolves to provide you with access to the best tool for a particular task, the workbench of the design engineer – his or her design workstation – is changing as well. Product designers and engineers have seen their inventory of hardware and software tools mature over the years: from 2D to 3D CAD design software and from single 32-bit CPUs to multi-core 64-bit processor-based systems. These advances have made additional space on the engineer’s workbench for a tool once relegated to specialized analysts.

Traditionally, simulation technology assumed the role of the final design checker in product development. Analysis was performed at the end of the process – prior to physical testing – to validate design performance. Yet, today’s lightning fast workstations and fully integrated simulation software packages enable engineers to leverage analysis in an entirely new way: to drive design optimization and innovation upfront rather than just checking design performance at the end.

New processors, software turn desktop into supercomputer

What’s changed that makes simulation tools more accessible to design engineers? Simply put, faster computers combined with more finely tuned and easier-to-use software have truly brought analysis capabilities to the desktop. You used to need a supercomputer – and the time to wait for days or even weeks for a solution to the more complex types of simulations, such as computational fluid dynamics (CFD) and nonlinear structural analyses – to run FEA programs.

With the development of Intel Xeon processors with multi-threaded, multi-core capabilities and CAD-integrated SolidWorks Simulation software, which is optimized to take advantage of multi-core processing during both the meshing and solution steps, analysis problems that used to run for hours can now be done in minutes, and those that used to run for days finish in hours.

SolidWorks Simulation was designed to make analysis faster and easier. For example, to make nonlinear studies run faster, the software reduces the number of equations used for the system stiffness matrix, providing an accurate, reliable solution in a fraction of the time.

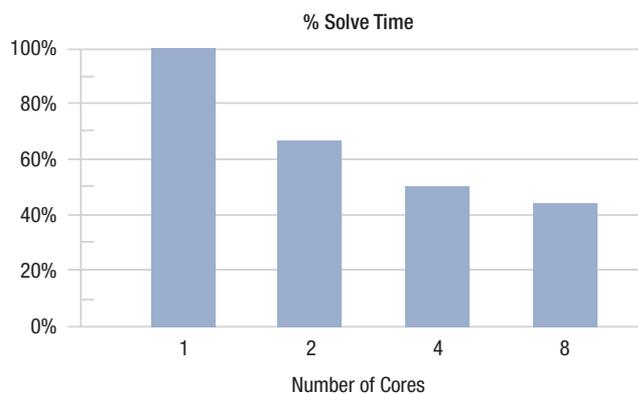
The largest performance boosts in SolidWorks Simulation relate to multi-core processing. The more processing cores that you have available, the faster your model will mesh and solve with SolidWorks Simulation. By taking advantage of Intel multi-core

processing technology to split and run multiple simultaneous processes on multiple cores – during both meshing and solving computations – SolidWorks Simulation provides dramatic improvements in analysis run times. These performance gains make SolidWorks Simulation software and multi-core Intel Xeon processor-based workstations the perfect combination for driving simulation-based design.

Faster Solve Times with Multi-Core Processors

SolidWorks® Flow Simulation

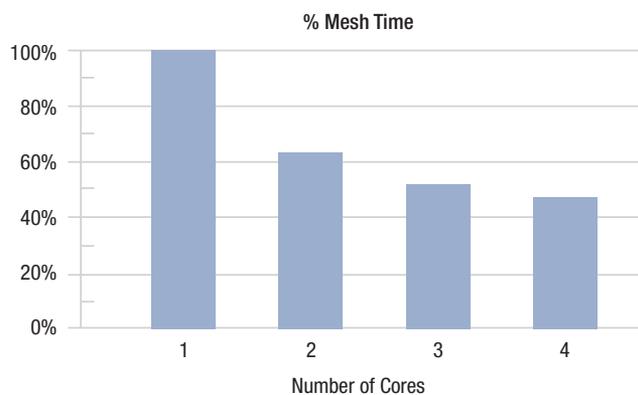
% Solve Time	Number of Cores			
	1	2	4	8
64 bit	100%	66%	50%	44%



Faster Mesh Times with Multi-Core Processors

SolidWorks® Simulation

% Mesh Time	Number of Cores			
	1	2	3	4
64 bit	100%	64%	52%	47%



Fast-running simulations for design, not just validation

The ability to run even the more sophisticated types of analysis in the time it takes to attend a meeting really opens the door to utilizing simulation to move beyond functional design into optimal design. At the root level, simulation technology answers questions and provides information, opening a window through which designers can peer to predict how a design will perform within the confines of its operating environment. Analysis results are the closest thing an engineer has to a crystal ball in terms of understanding product behavior.

Such insight can help designers go beyond a design that is merely adequate to a concept that performs optimally. This process of optimizing designs not only leads to innovations, but also produces a range of productivity benefits, including time savings, cost reductions, and higher quality. In today's competitive global market, designers can take advantage of easy-to-use SolidWorks Simulation software and fast-running Intel Xeon processors to work smarter by creating optimal designs that contribute to their company's bottom line in a big way.

Ratcheting up radar systems development

A worldwide leader in radar technology – including the development of radar systems for the Norwegian Navy, the World Cup Soccer Final, and several open-pit mining operations – Reutech Radar Systems (RRS) believed that using integrated simulation tools would enable it to better predict system performance, accelerate development, and control costs.

“We need to be able to simulate shock, vibration, stress, thermal, and aerodynamic phenomena with a high degree of accuracy and confidence,” notes Chief Mechanical Engineer Carel Kriek. “I have been exposed to other finite element analysis (FEA) packages and find SolidWorks Simulation to be the best fit for us. It allows us to stay within the same environment, can handle anything we need to do, and eliminates the potential for model translation problems.”

Routine simulations at South Africa-based RRS take 25 to 40 minutes. Run times for more complex analyses average as follows: structural, one hour; fluid flow, two hours; and thermal with fluid flow, four hours.

Simulation Types:

- Nonlinear Structural/Dynamics
- Dynamics
- Kinematics
- Shock
- Vibration
- Structural
- Thermal
- CFD

Hardware Specs:

- Dell Precision* T5400 Workstation
- Dual Intel® Xeon® processor E5420 (Quad-Core, 2.50 GHz)
- 8 GB RAM

Results:

- Reduced time-to-completion by 50 percent
- Saved 30 to 60 percent in prototyping/testing costs
- Expanded product offering into new markets
- Increased profit margins

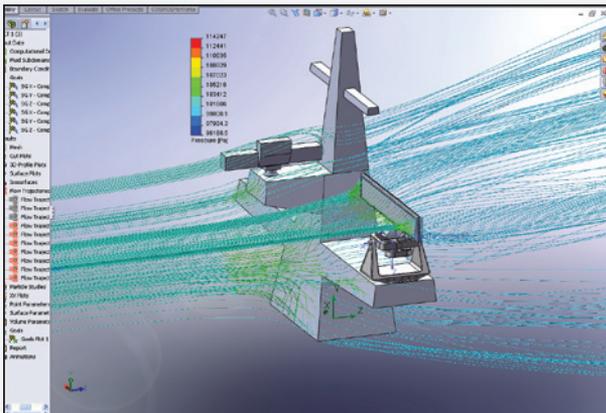


Image courtesy of Reutech Radar Systems

Perform multi-physics simulations inside your CAD system

Although structural analysis represents the yeoman's share of simulation needs, development of a growing number of products can benefit from simulation of other physical aspects of a design – better known as multi-physics analysis. In addition to structural stress and strain, designers need to know about the effects of motion, temperature, pressure, and even electromagnetics. With SolidWorks Simulation Premium and SolidWorks Flow Simulation software, designers can access multi-physics analysis capabilities from directly within the CAD modeling environment.

This complete integration of CAD and simulation capabilities eliminates the potential for data conversion and model translation problems and makes it easier to use analysis as a design tool.

Engineers can use simulation results to make design modifications and rerun analysis inside SolidWorks CAD software, which makes it easier to use iterative simulations to optimize designs. Using workstations powered by Intel Xeon processors, you can run simulations without slowing down your other interactive tasks. Providing efficient multi-tasking, this combination of solutions increases your capacity to design, simulate, and optimize in a multi-physics, CAD-integrated environment without compromising your ability to do routine work.

Positive change is a good thing

Gaumer Process helped to develop the electric process heater technology that is used by process industries – including oil, gas, food processing, wastewater treatment, and petrochemical companies. The Houston-based company holds several patents for its electric process heaters, systems, and controls, and looked to integrated simulation technology to meet market demands for accelerated system delivery, cost containment, reduced energy consumption, and optimized material usage.

“Our initial interest in simulation involved flange thicknesses, which we had traditionally made thicker than necessary,” explains Craig Tiras, P.E., vice president of Engineering and Design. “Cutting our flange thicknesses in half really helped to change our company. By simulating the thermal, structural, and fluid flow behavior in and around a flange, we saw that we had been wasting material.”

Tiras adds. “The cost of the SolidWorks Simulation package is insignificant compared to the savings we realized on that very first use. Since then, we have been able to optimize designs and reduce material costs overall by 75 percent.”

Simulation Types:

- Nonlinear Structural
- Vibration
- Structural
- Thermal
- CFD

Hardware Specs:

- HP Z600* Workstation
- Dual Intel® Xeon® processor x5570 (Quad-Core, 2.50 GHz)
- 18 GB RAM

Results:

- Cut development time from three years to three months
- Saved \$100,000 in prototyping costs
- Reduced material costs by 75 percent
- Enhanced visualization of system performance

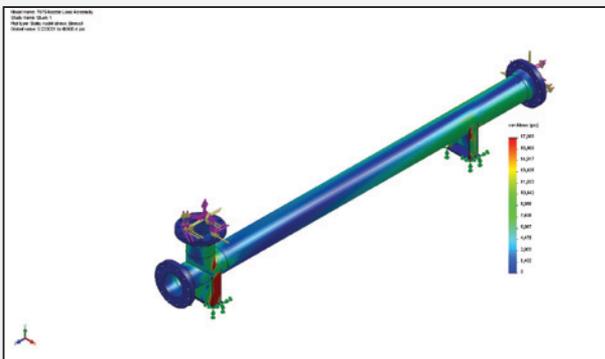


Image courtesy of Gaumer Process

Simulation increases profitability

Using integrated SolidWorks Simulation software on an Intel Xeon processor-based workstation during conceptual design can help your company increase profitability in several ways. First, the technology allows you to shorten time-to-market by optimizing your designs. Leveraging simulation technology to drive your design process ensures that designs are validated, free of errors, and ready for production. This allows you to compress and shorten your prototyping and testing cycles, providing additional time and cost savings.

Secondly, simulation tools streamline manufacturing processes, resulting in more efficient material usage, lower levels of scrap and rework, and reduced manufacturing costs. Instead of producing an adequate design, you can produce optimal designs that decrease costs related to both time and production.

Lastly, designs that you create using integrated simulation tools result in fewer field failures, returns, and warranty claims. Because validation is performed as part of design, the accuracy of your designs, the quality of your products, and the size of your profit margins go up, while your costs go down.

Cycling through a virtual test bench

As the top producer of bicycles in Canada and a worldwide leader in the manufacturing of high-end mountain and road bikes, Cycles Devinci, Inc. invested in integrated SolidWorks® Simulation software on the Intel® Xeon® processor-based systems to create its own virtual test bench. Using simulation to drive design, the company has accelerated time-to-market, reduced the weight of its bikes, improved the performance of its bicycle frames, and cut the number of physical prototypes required.

“We have deployed the SolidWorks virtual test bench on all four of our product lines, which include road, mountain, and hybrid bikes, as well as the new BIXI Public Bike System in Montréal,” notes Bruno Gauthier, R&D Department director. “Our product development process has become faster and more cost-effective, and the quality of our bikes continues to improve. Since implementing its

SolidWorks-enabled virtual test bench, Cycles Devinci has realized significant productivity gains, while simultaneously increasing the number of innovative concepts it develops. Dynamic and kinematic motion analyses take between 5 and 15 minutes to run, while static stress simulations complete in one to five minutes.”

Simulation Types:

- Dynamics
- Kinematics
- Vibration
- Structural

Hardware Specs:

- Dell Precision* T5400 Workstation
- Intel® Xeon® processor 5260 (Dual-Core, 3.33 GHz)
- 3.25 GB RAM

Results:

- Shortened time-to-market from 18 to 10 months (44 percent)
- Decreased number of prototypes from three to one
- Reduced frame weight by 25 percent
- Increased frame stiffness by an average of 30 percent



Image courtesy of Cycles Devinci, Inc

Optimize manufacturing processes

In addition to helping engineers create better-performing designs, integrated SolidWorks Simulation tools enable you to investigate, optimize, and streamline your manufacturing processes. Product design and manufacturing are no longer separate, autonomous functions. By using simulation capabilities on faster Intel Xeon processor-based workstations, you can analyze and address manufacturing issues during conceptual design.

It doesn't matter which production processes you use – whether you are machining parts, shooting molds, fabricating sheet-metal, forging or casting metal components, or assembling pieces or

subassemblies – analysis can help you to pinpoint and resolve otherwise unforeseen manufacturing issues. With this information, you can avoid potential production pitfalls, such as manufacturing delays, cost overruns, and shop-floor retrofits, which detract from your company's success and competitiveness.

With integrated simulation technology, you can examine the physics surrounding your manufacturing processes and avoid production surprises. Simulation-driven design provides benefits at every phase of product development, from conceptual design through manufacturing.

Cooking up better bakeware

Manufacturer of many well-known brands of dinnerware, cookware, cutlery, and household tools, World Kitchen LLC used integrated SolidWorks® Flow Simulation software to streamline production of its Pyrex® bakeware products.

"If the forming equipment is too cool, the glass will have a wrinkled appearance. If the forming equipment is too hot, the glass will fuse itself to the metal, making it impossible to remove from the mold," explains Senior Mold Designer Mark Cooley. "SolidWorks Flow Simulation allows us to identify cold and hot spots ahead of time. . . . With SolidWorks Flow Simulation, we can create high-heat components and quality products without thermal issues, down time, or additional costs."

Reaching this thermal balance faster has saved the company time and money, and the move to a computer powered by two quad-core Intel® Xeon® processors is producing additional dividends. Routine thermal/fluid-flow analyses that used to take three hours

now finish in 15 minutes or less, and larger, more complex thermal/fluid-flow simulations that processed for as long as 11 hours – while consuming all computing resources – now complete in one hour while the designer continues designing other parts, managing e-mail, and performing routine tasks.

Simulation Types:

- Thermal
- CFD

Hardware Specs:

- Dell Precision® T7400 Workstation
- Dual Intel® Xeon® processor E5405 (Quad-Core, 2.00 GHz)
- 8 GB RAM

Results:

- Reduced design times by 40 percent
- Cut annual development costs by over \$230,000
- Improved product quality
- Accelerated thermal balancing of bakeware products

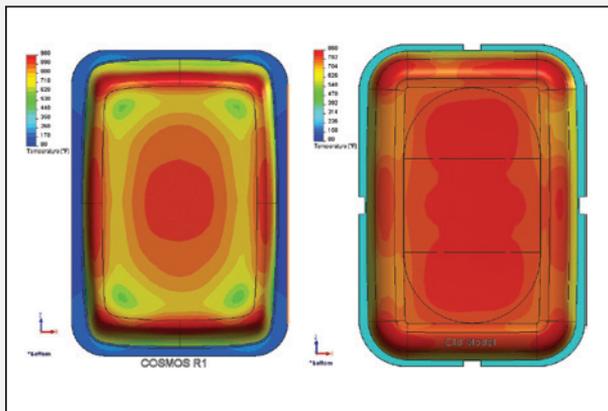


Image courtesy of World Kitchen LLC

Demonstrate feasibility of new technology

The fact that integrated SolidWorks Simulation software is easier to use and takes advantage of multi-threaded processing on the multi-core Intel Xeon processor-based systems, resulting in much faster run times, makes simulation technology more accessible, viable, and practical for use by a wider group of engineers. As already noted, simulation-driven design can provide substantial productivity benefits in terms of both optimizing product designs and manufacturing processes. And the potential power of simulation design doesn't stop there.

Because analysis technology allows engineers to observe and study physical behavior in a virtual environment – without incurring

the time and cost required for building and testing something – it can literally open the floodgates to unbridled creativity and unbounded innovation. In addition to helping you make better products more efficiently, simulation technology enables you to study, innovate, and demonstrate new technologies in an efficient, cost-effective manner.

Of course, turning new technology into a reality requires building a physical prototype, but simulation technology can help you to unleash your creativity – weeding out the bad ideas from those with promise – without breaking the bank.

Simulating the next-generation superconductor

The Facility for Rare Isotope Beams (FRIB) will accelerate elements from hydrogen to uranium to 40 percent of the speed of light and prepare rare isotope beams – short-lived nuclei not normally found on Earth – to advance research into the origin of elements, the birth of stars, and the evolution of the cosmos.

To win the U.S. Department of Energy award to design and establish FRIB – a \$550 million facility that will take about a decade to build – Michigan State University had to propose a pre-conceptual design for the FRIB accelerator and demonstrate how the system would work. SolidWorks® Simulation software's thermal analysis capabilities helped the team analyze the performance of the FRIB system's graphite target wheel, which operates in a temperature range of 1600° to 1630° K, and the aluminum beam dump system, which requires its own cooling system.

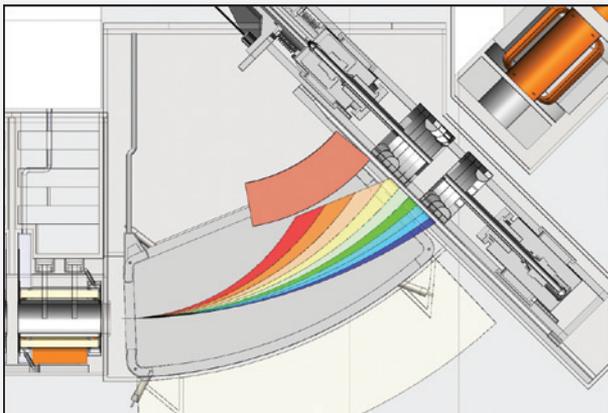


Image courtesy of the Facility for Rare Isotope Beams

“Using SolidWorks allowed us to prepare a strong proposal. The ability to virtually test the accelerating cryomodules was an important factor in substantially improving our credibility,” says Dr. John Oliva, Mechanical Analysis and Simulation Group leader. “Having integrated design and analysis software like SolidWorks has enabled us to cut time and expense in creating prototypes. By running hundreds of virtual simulations, we avoid repetitive prototyping, which we anticipate will result in huge cost savings.”

Simulation Types:

- Nonlinear Structural/Dynamics
- Dynamics
- Kinematics
- Shock
- Vibration
- Structural
- Thermal

Hardware Specs:

- Dell PowerEdge* R410 Server
- Dual Intel® Xeon® processor 5600 (Quad-Core, 2.53 GHz)
- 32 GB RAM

Results:

- Won \$550 million award to design and build FRIB
- Proved concept validity with virtual simulations
- Cut time and expense of creating prototypes
- Demonstrated accelerator concept with 3D animations

Let integrated SolidWorks Simulation drive your designs

Analysis and simulation technologies have come a long way since their introduction a couple decades ago and barely resemble the FEA packages used by the previous generation. Integrated SolidWorks Simulation software is much more accessible, viable, and practical for use by a wider set of engineers. It's easier to use, takes advantage of multi-threaded processing, and provides fast answers within the SolidWorks 3D design environment.

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

Run simulations faster on the Intel® Expert Workbench

Not all workstations are created equal, and when it comes to running fast simulations for optimizing designs, the Intel® Expert Workbench is the king of the hill. Powered by two Intel Xeon processor 5600 series CPUs – with up to 12 computational cores, 24 Hyperthreads, and memory configurations up to 192 GB – these powerful systems provide supercomputing-like performance on the desktop and provide the perfect platform for simulation-based design.

To learn more about how powerful Intel Xeon processor-based workstations can help you take advantage of simulation-based design to work smarter, more efficiently, and more productively, visit www.intel.com/go/workstation.



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