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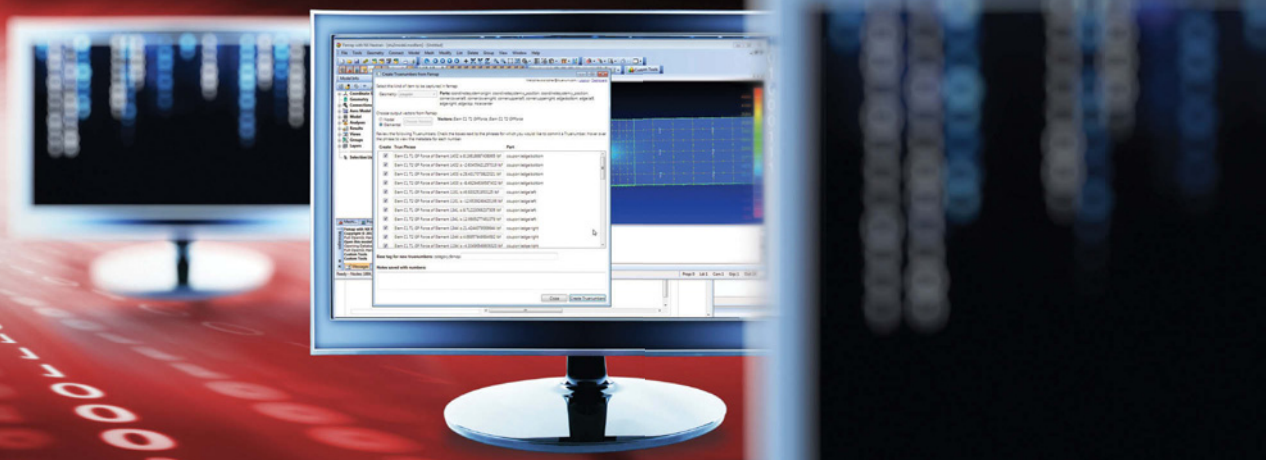

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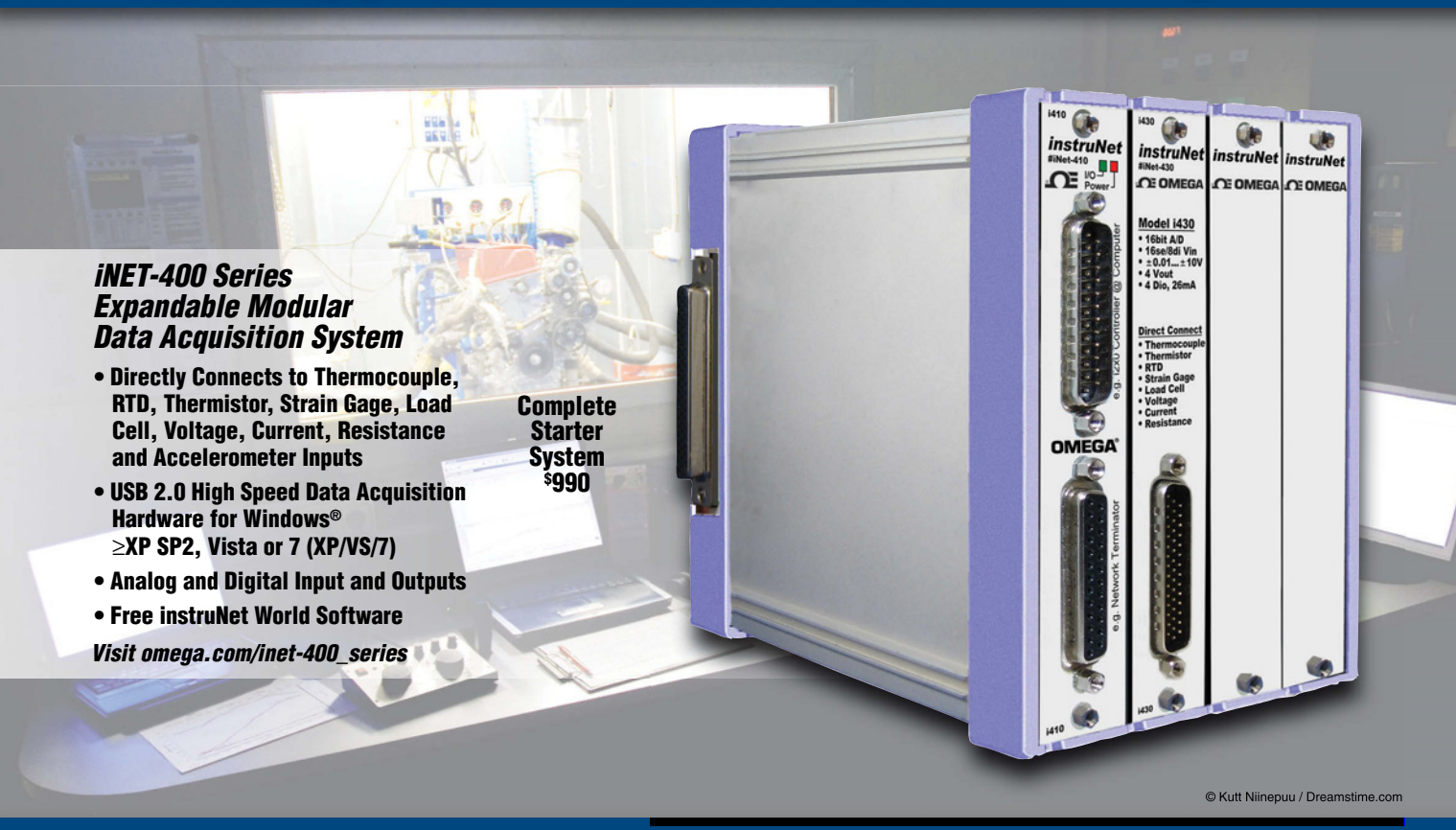

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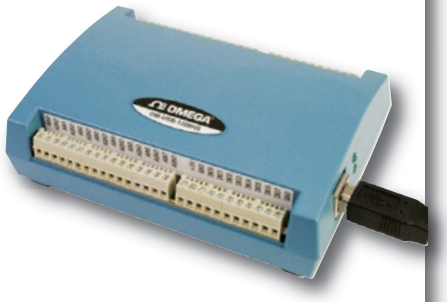

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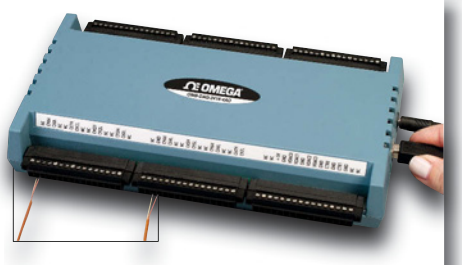

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by Jamie J. Gooch

Rapid Planning

When I was 18, I wrecked my car. It wasn't the first time, nor would it be the last, but it was the most embarrassing. Thankfully, the only casualty was my car's front end. The grill was toast, the headlight surrounds — along with the headlights — were gone. As a poor college student, I didn't have the cash for a body shop to make the repairs. I needed the car to get back and forth to classes, so my dad came to the rescue.

He could've loaned me the money to have a professional make the fix, but that would have taught me nothing. Instead, we fashioned an entire front end out of leftover plywood, attached it to the car, and installed new headlights through holes jigsawed into the wood. I was both impressed with my father's ingenuity and horrified at the thought of anyone seeing me drive such a "Frankencar." I don't know if it was street legal, but I do know that the girl I was dating took one look at it and decided it was time we saw other people. It certainly motivated me to be more careful driving and to save up for the proper replacement parts.

This year's RAPID conference will be held May 22-25.

Finding Rapid Tech Solutions

If only we would have had a 3D printer in the garage. Maybe my kids will have better luck. We seem to be approaching the day when parts will be downloaded and printed in every weekend engineer's workshop. You can get a sneak peek at that future, as well as the state-of-the-art tools and software available to engineers now at the RAPID 2012 Conference and Exposition.

This year's RAPID conference, which will be held in Atlanta May 22-25, is a great place to see the amazing capabilities of today's rapid technologies and learn how others are using it to save time and money.

Keynote speakers for the event include Paul Doe, chief designer at Prodrive Rally Programs and Terry Wohlers, president of Wohlers Associates. Doe could no doubt have solved my teenage fender bender troubles without the use of plywood. His presentation will provide an overview of Prodrive's development of the MINI John Cooper Works World Rally Car. Wohlers will address additive manufacturing during his State of the Industry report.

The conference and event provides great networking opportunities, as well as a display of the latest equipment and software. You can also sit in on briefings to get up to date on additive manufacturing and 3D imaging, attend workshops led by industry experts, and choose from a number of conference sessions.

The Urbee 3D-printed car was on display last year.

Rapid 2012 Details

Networking receptions will be held Tuesday and Wednesday. The exhibition hall hours run from 9 a.m. to 6 p.m. on Wednesday and Thursday. Briefings and workshops will be offered on additive manufacturing, 3D imaging and reverse engineering, and making metal parts using additive technologies.

The more than 60 conference sessions are broken into the following tracks:

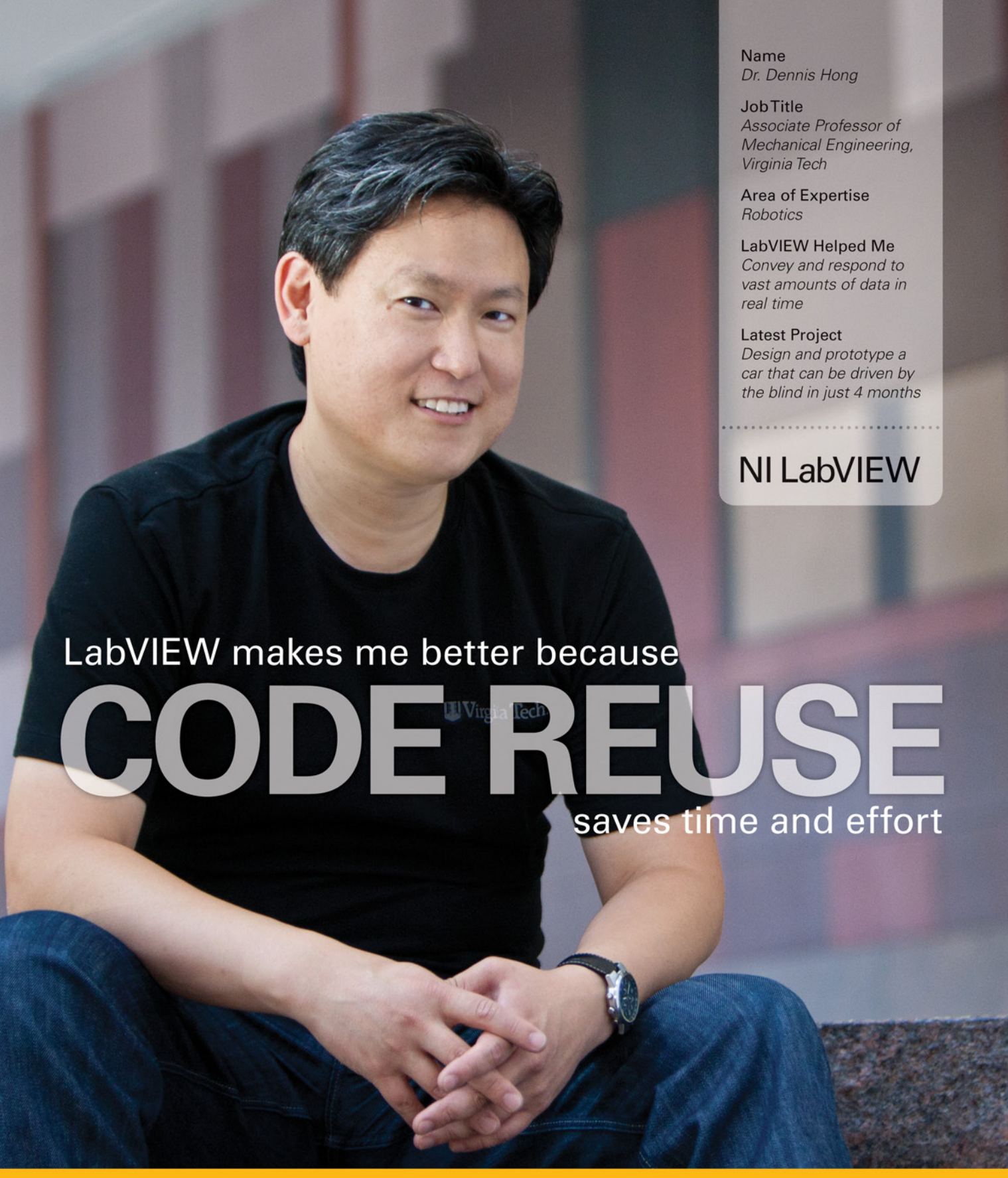
- 3D Imaging
- Medical and Dental
- Transportation
- Final Part Production
- Creative/Innovative
- Casting (including a seminar of metalcasting processes)
- Additive Manufacturing Applications
- Developing the Additive Manufacturing Workforce
- Direct Write Printed Materials/Electronics

If you learn better by seeing real-world examples, sign up for one of the tours that run from 9 a.m. till noon on Friday. One set of tours takes you to the rapid prototyping lab at Newell/Rubbermaid to see Objet, Z Corporation, Stratasys and EOS 3D printers in action; and then to the Slingshot Product Development Group, which uses rapid prototyping, 3D scanning and artisan sculpting in the product development cycle. Tour 2 takes you out to the Georgia Institute of Technology to see how polyjetting, stereolithography and laser sintering technologies are used in the Manufacturing Research Center and the School of Mechanical Engineering; and then to the Inferno Art Foundry to check out its casting process.

An example of how far 3D printing is penetrating into other industries and be seen in RAPID 2012's inaugural 3D Print Fashion Show, as well its Contemporary Art Gallery that presents innovative uses of additive manufacturing.

Visit rapid.sme.org for registration information and to learn more about the show. If you go, stop by *DE's* booth to say hello. DE

Jamie Gooch *is the managing editor of* Desktop Engineering. *Contact him at de-editors@deskeng.com.*



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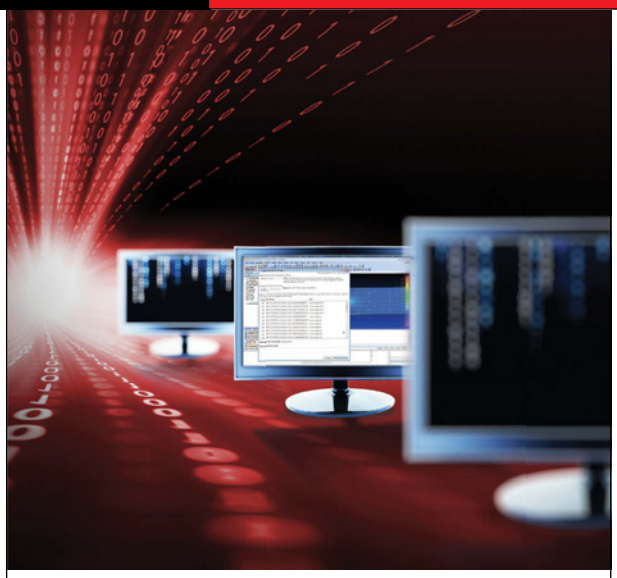


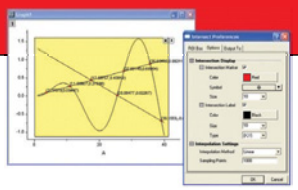
COVER STORY

Do You Know Where Your Numbers Have Been?

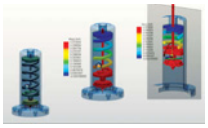
16 Allen Razdow, who invented Mathcad, thinks you should be able to interrogate numbers. You don't necessarily have to drag a suspicious number into a room and bombard it with questions under a bright light, in a good-cop-bad-cop routine. Rather, in Razdow's vision, you should be able to just hover a mouse over a number to get its source, citation, reference and usage history.

ON THE COVER: An increasingly large stream of data can be managed by today's software. *Images courtesy of iStockphoto and True Engineering Technology, LLC.*

CORRECTION: An incomplete version of "We Gather Here Today to Reconcile Direct and Parametric" was incorrectly published in the March issue of *DE*, page 32. The full version can be found at deskeng.com/articles/aabeft.htm. *DE* regrets the error.



TEST



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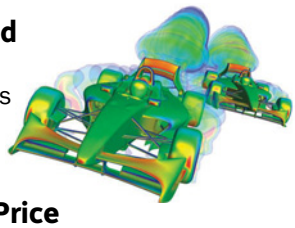
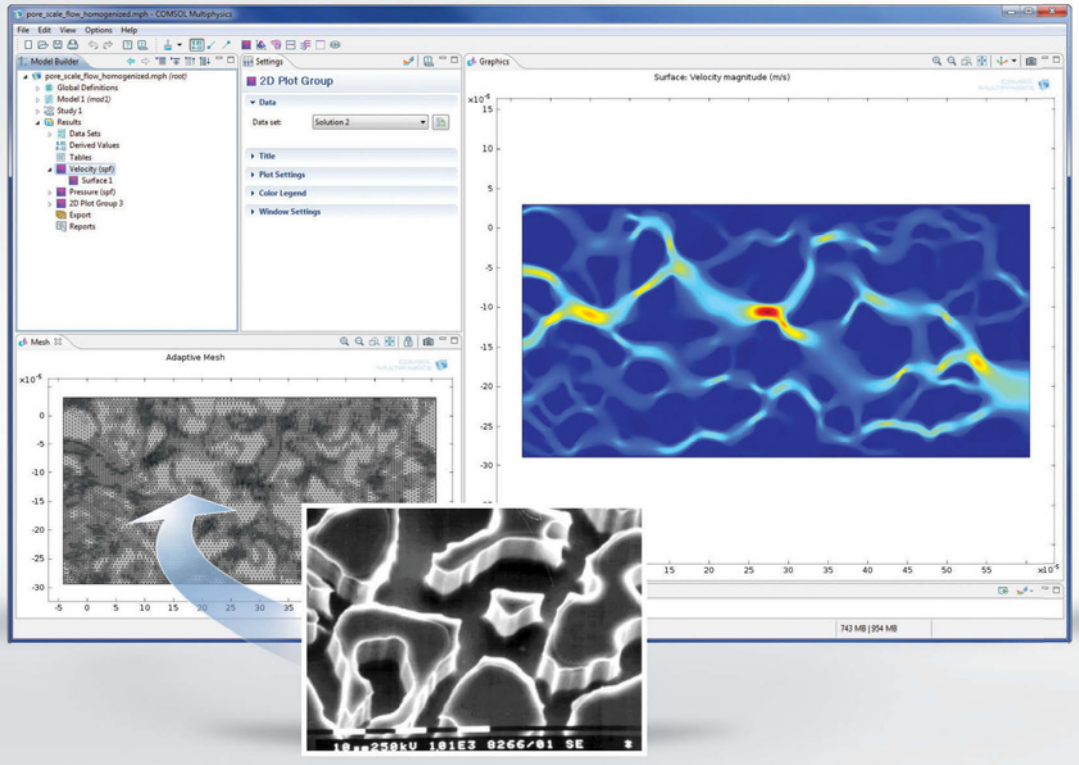


PROTOTYPE

FOCUS: DATA MANAGEMENT

MODELING IMAGE DATA: Image data from a SEM photograph is used to represent material distribution of a porous media. This can then be meshed, using adaptive meshing, and the flow through this media then simulated.



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by Kenneth Wong

SolidWorks World 2012: Hinting at Changes to Come

SolidWorks World 2012 marked Gian Paolo Bassi's first official appearance as the company's new point man for research and development. As successor to longtime SolidWorks veteran Austin O'Malley, Bassi will oversee the development of future releases of SolidWorks. (Author's Note: For more on Bassi, read "SolidWorks in Transition," Oct. 12, 2011, at the Virtual Desktop blog.)

During his meeting with the press, Bassi noted, "Design software are great at modeling something precisely for manufacturing, but not so good for capturing early concepts." He's hinting at the possibility of a more flexible 3D modeler, with a low learning curve—but it's unclear whether it'll come in the form of a direct modeler or something else entirely.

SolidWorks CEO Bertrand Sicot greets SolidWorks World 2012 attendees in San Diego.

As SolidWorks 2013 went into development, some wondered whether SolidWorks would change its modeling kernel, from its current Parasolid kernel (licensed from competitor Siemens PLM Software) to something else based on parent company Dassault Systèmes' technology. But on the third day of the conference, Fielder Hiss, SolidWorks' vice president of product marketing, explicitly said, "SolidWorks' kernel is not changing."

Last November, responding to the discussion thread "Rumors of a kernel change in SolidWorks … Is this true?" SolidWorks' Social Media Manager Matt West clarified, "Our next-generation software, which will be released in the next few years, will include a different modeling engine than the one we use today. This software will be offered in addition to the software we currently sell. No customers will be forced to move from the current version to this next-gen version. The current version of SolidWorks, which we will continue to develop and support in parallel to the next-gen system, will continue to be based on the Parasolid kernel."

Whatever the next generation software may be, SolidWorks is promising customers that it'll be another option, not a mandatory upgrade that'll be forced upon current SolidWorks users. In his keynote address on Day One, SolidWorks CEO Bertrand Sicot said, "We cannot build the latest platform without the latest technology. We think our next-generation [product] is the way to move forward. And we will deliver that next year … In case you're wondering, we're going to continue to invest in developing [current SolidWorks software] until you tell us you don't need it anymore—with no change in the data format. When our next-generation [product] is ready, you'll be able to choose which application you want to use. No one will be forced to migrate to the new platform. And when you do choose to switch, we will make sure the transition is seamless."

In recent years, SolidWorks' major rivals—Autodesk, Siemens PLM Software and PTC—have moved ahead considerably with direct-editing technologies and mobile apps, while SolidWorks remained on the sideline. SolidWorks' next-generation technology—the dark horse coming from SolidWorks, currently still hibernating in its R&D stable—has a heavy burden on its shoulders. It must not only catch up with, but also bypass what its competitors have done.

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by Kenneth Wong

A Template-driven Approach to Simulation

If spontaneous uprisings by common people across the Middle East are the source of the recent Arab Spring that has toppled several long-established authoritarian regimes (with more teetering on the edge), then a template-driven approach that makes simulation accessible to the common folks may be the way to democratize a practice once reserved for the elites and experts.

In CIMdata's recent paper titled "The Democratization of Simulation with Intelligent Templates," the authors argued, "The core enabler for intelligent templates is the idea of an 'abstract model.' This functional model of the product and of the associated simulations remains independent of a particular instance of a product design, and independent of the physics or fidelity of a particular performance simulation."

The key to this proposition is, the authors point out, "experts must create the templates, but non-experts can use them reliably."

Even though simulation is widely practiced among large enterprises, the authors noted, "The promise of simulation-driven design has not been achieved … Today, that solution represents a complex environment requiring a major investment." To unlock simulation for a wider audience, the paper recommended "[getting] away from single-point tools that solve individual problems … [and] moving away from working directly with geometry."

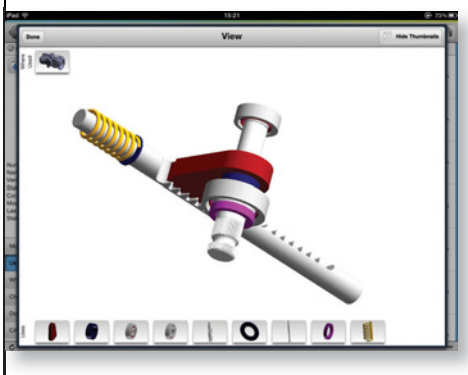
The expert-created template will ultimately simplify a simulation scenario into a series of inputs non-experts can supply. These input parameters may be "system-level description, CAD-level description, or an optics description," the paper suggested. "The simulation environment is set up to run the process quickly as the geometry changes … It can keep changing as engineers learn more about the behavior of the product."

The CIMdata paper concluded that the template-driven approach is best suited to "capture and reuse best practices in an executable form."

The paper is written by CIMdata's Design and Simulation Council. It's based on a keynote presentation by Malcolm Panthaki, Comet Solutions, at CIMdata's PLM Road Map 2011 conference. The paper also discussed the role of direct editing tools like SpaceClaim in the simulation workflow. (*Editor's Note: For more on this topic, read "Direct Modelers as FEA Pre-Processors," on page 24.*)

PTC Gets Ready to Mobilize Windchill

In June 2011, during the PlanetPTC Live user conference, Brian Shepherd, PTC's executive vice president of product development, decided to shake things up a bit, quite literally. He previewed an iPad app (only a prototype at the time) that lets you explode an assembly model by shaking the device. This year, what Shepherd demonstrated could become available commercially.



PTC's Windchill Mobile app with embedded visualization feature showing where a design has been used and what its subcomponents are.

The first mobile app coming from PTC will be Windchill Mobile, according to Michael Distler, product marketing manager for Windchill. "You'll be able to pick an object, view your assignments, look at the object's details, understand where it was used, and understand its components. Embedded within [the app] will be a viewer, so you can interrogate the product," he said.

PTC plans to deliver the Windchill app for iPhone and iPad, to be followed by an Android version. PTC hasn't decided on its pricing, so it could be free or fee-based, depending on the number of users it needs to accommodate in collaboration sessions. The company is also developing a mobile viewer, based on its Creo View (currently available for Windows PCs for MCAD, ECAD or both). It's an "active project," said Distler, but no delivery target date is available. "That will have the shake-and-bake feature Brian demonstrated," he revealed.

Whereas the Windchill mobile app will focus on product lifecycle management (PLM) users, the mobile viewer will be targeted at general CAD users who need to view, annotate and share 3D design files, he said.

Other PTC products in the queue to get the mobile treatment include Creo Sketch, a paint and sketch program; Windchill SocialLink, an enterprise networking app with social media features; and Arbortext, a technical publication program.

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by Kenneth Wong

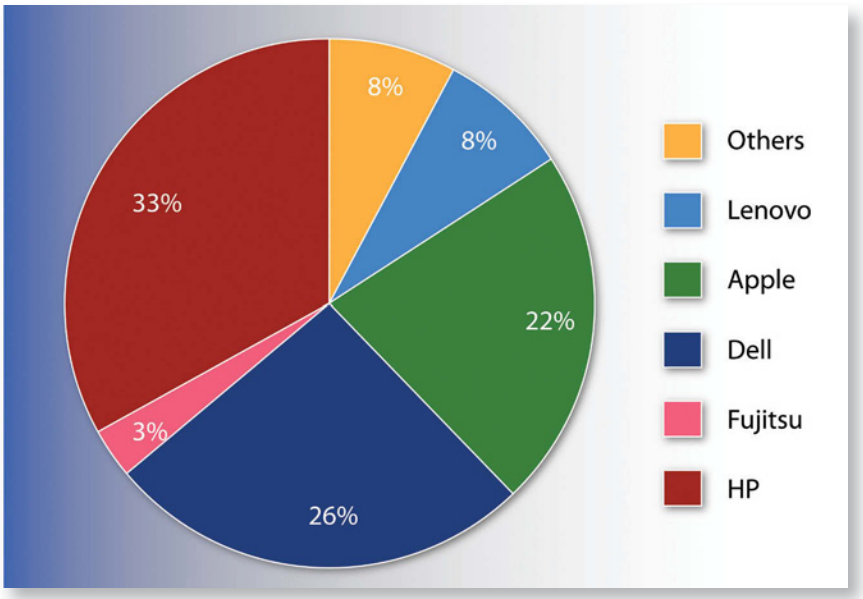
Study: Workstation Market Shows Return of Momentum

Jon Peddie Research (JPR), which publishes a number of market reports, observed, "From mid-2008 to mid-2011, we lived through the biggest economic downturn in a generation, followed by a relatively steady, but not stutter-free, recovery." But when it tallied up the latest numbers for workstations for 2011 Q3, it saw some signs of a return to normalcy.

Releasing its Workstation Report, JPR said, "The neither-hot-nor-cold results from the workstation market's second quarter might not elicit any celebration, but we imagine they at least calmed some still-frayed nerves."

According to Jon Peddie, president of JPR: "HP has steadily grown its market share over the past five years to take first place, but Lenovo has had the highest growth rate." The market share chart published by JPR in its report shows HP with 33%, and Lenovo 8%. He also noted that, compared to last year's market share division, market share is down for both Apple and Dell.

If you're looking for where the action is, Peddie would tell you, "The mid- and entry-level is where the majority of the growth in workstations is now, along with mobile workstations." Last April, HP launched its first entry-level workstation Z210, aimed at prosumers and consumers who may not typically consider purchasing workstations. The Z210's price begins at $569 for the small form factor unit and $659 for the convertible mini-tower model. (See page 30 for David Cohn's review of the HP Z210.) Earlier this year, at SolidWorks World, HP launched the HP Z1, an all-in-one 27-in. workstation priced beginning at $1,899. (See page 48 for more details on the HP Z1.)



This chart shows top performers in the workstation market, according to Jon Peddie Research's market report for 2011. Peddie observed, "HP has steadily grown its market share over the past five years to take first place, but Lenovo has had the highest growth rate."

"The impact of the economic crash of 2009 is finally behind us, and the markets seem to be back on track for growth," Peddie said. "The compounded annual growth rate for 2011 to 2013 is expected to be a healthy 10.8%, barring unforeseen calamities in Europe and/or the Mideast."

JPR's press release on the Workstation Report states, "Among vendors, HP reinforced its top position in workstations, despite the company's awkward about-face in its plans for the Personal Systems Group (PSG), the business unit that houses the company's workstation business. Dell remained at No. 2, though lagging further, while Lenovo gained ground at No. 3, in part thanks to its nascent joint venture with NEC. And in the closely related market for professional graphics hardware, NVIDIA continued its dominance of the market, with its Quadro brand stubbornly refusing to cede much share to a more competitive FirePro line from AMD." DE

Kenneth Wong *is* Desktop Engineering's *resident blogger and senior editor. You can send him e-mail to DE-Editors@deskeng.com.*

How to Buy a Workstation

Technical workstations with Intel's "Uncore" technology deliver performance for innovation.

BY PETER VARHOL

At Intel, there are an assortment of technologies affectionately known as the "uncore." The place to find these innovative technologies is in the recently announced Intel Xeon processor E5 product family. They help provide a significant advantage to power users seeking more performance and agility than what might be available on a typical desktop solution.

Intel Core processor based desktops and Intel Xeon processor E5 product family based workstations are both rooted on the same Intel Sandy Bridge microarchitecture, and they both support an array of processing cores that go from as few as two to as many eight, or 16 if you are using a dual-processor workstation.

They both support Intel Advanced Vector Extensions (Intel AVX); and depending on which Intel Core processor based desktop you use, it will support either Intel Hyperthreading Technology or Intel Turbo Boost Technology, or both.

To understand the differences between Intel Core processor based desktops and Intel Xeon processor E5 product family based workstations, we can start by looking at uncore technologies. The uncore technologies are the building blocks of a fast system, and that is why you find Intel Xeon E5 processors powering some of the world's fastest supercomputers. They are also at the heart of the workstations that professionals use.

The uncore technologies found in the new Intel Xeon processor E5-1600/2600 product families help you move your data through Intel's processors faster. They are the core, pun intended, behind driving processor efficiency—the time processors spend computing—to new heights. The uncore technologies include:

- Intel Direct I/O technology, which increases I/O performance by up to 2.3x.
- Intel Integrated I/O, which increases available bandwidth by up to 2x and is the first Intel Xeon processor product to integrate PCI Gen 3 on the processor die.

Two other technologies worth noting as part of the new Intel Xeon processor E5-1600/2600 product families are:

- Intel AVX. This is a new 256-bit instruction set extension to Intel Streaming SIMD Extensions that is designed for floating point intensive applications. It improves floating performance due to wider vectors, new extensible syntax, and rich functionality. This results in better management of data. Image, audio/video processing, simulations, financial analytics, and 3D modeling and analysis can see significant performance improvements.
- Intel vPro Technology. This technology gives your organization an opportunity to efficiently and securely manage a workstation client environment in the same way you manage a business client desktop solution.

The payoff of uncore technologies

The Intel uncore technologies found in the Intel Xeon processor E5-1600/2600 product families combine to deliver some amazing performance differences and increased processor efficiency. Let's compare the Intel Xeon E3-1200 product family or Intel Core i7 based solutions that are not supported by these uncore technologies.

Single core performance and uncore technologies

- Spec Int speed numbers were up to 1.2x faster for a 3.1-GHz Intel Xeon E5-2600 processor than a 3.2-GHz Intel Xeon E3-1200 processor.
- SPEC FP speed numbers were up to 1.4x faster for a 3.1-GHz Intel Xeon E5-2600 processor than a 3.2-GHz Intel Xeon E3-1200 processor.

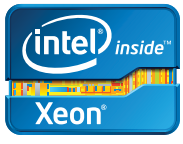
Multicore performance and uncore technologies

- Spec Int rate numbers were up to 4.2x faster for a 3.1-GHz Intel Xeon eight-core E5-2600 processor than a 3.2-GHz four-core Intel Xeon E3-1200 processor.
- SPEC FP speed numbers were up to 4.3x faster for a 3.1-GHz Intel Xeon eight-core E5-2600 processor than a 3.2-GHz four-core Intel Xeon E3-1200 processor.

Available memory bandwidth

- A 3.3-GHz Intel Xeon E5-1600 processor provided 2.1x more memory bandwidth than a 3.6-GHz Intel Xeon E3-1200 processor.
- A 3.1-GHz Intel Xeon E5-2600 processor provided 4.2x more memory bandwidth than a 3.6-GHz Intel Xeon E3-1200 processor.

Technical desktops with Intel's uncore technology deliver the performance you need to innovate faster. If you need to find your answers quickly, explore the advantages available to you with workstations and high performance computing solutions based on the new Intel Xeon processor E5-1600/2600 product families. DE



INFO → Intel Corp: intel.com/go/workstation

Collier Returns to NASA

Two decades ago, Collier Research Corp.'s head, Craig Collier was part of the NASA Langley team developing software to reduce the mass on high-speed aircraft designs. Now, Collier's HyperSizer is used at NASA centers from early preliminary design to final analysis test certification.

Collier Research's software was the first NASA software to be licensed and commercialized some 17 years ago. It is now used at NASA centers around the country and in commercial and military aircraft as well. The technology, which optimizes composite as well as metal structures for weight, strength and durability, is also applicable in wind blade design, high-speed rail and shipbuilding.

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Generate Portable Power

Eenterprising engineers across the country are coming up with portable means of generating energy without resorting to bulky battery packs.

The nPower Personal Energy Generator (PEG) is a 9-in. rod that gathers kinetic energy from the up-and-down movement produced by walking. It comes with a power cord that fits most handheld mobile devices. Walking for a minute provides a minute of power for an iPod Nano; 11 minutes of walking will charge up a minute worth of time for an iPhone 3G.

A Salt Lake City company, Goal Zero, has created miniature solar generators that can be strapped to your back, laid out in the sun outside or placed in a window.

Canada's Bionic Power, meanwhile, has created a set of leg braces that create power based on the torque of a user's knees, producing up to 12 watts of energy by walking at a modest speed. And SpringActive, working in conjunction with the U.S. Military, has produced a biomechanical device that gathers power from a combat boot add-on called SPaRK. The device gathers power from movement in the ankle joint.

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Hybrid Approach Could Speed Processing

Multicore processors have provided a significant boost for graphics processing, but researchers at North Carolina State University are taking things a step further with their CPU-assisted general purpose computation on graphics processor units, which would allow the CPU and GPU to collaborate on a computing task.

Although hybrid CPU/GPU systems improve energy efficiency, the cores primarily work on separate functions. The NCSU team wanted to improve processing functionality by having the CPU's L3 cache pre-fetch and feed data to the GPU, so that process threads running in the GPU go directly to the L3 cache, reducing latency.

In preliminary testing, performance has improved by an average of 21.4%.

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Mirror Testing Quiets Cars

Engineers at Ford recently used an elliptical acoustic mirror to help reduce noise in the Ford Escape, and make changes to the vehicle's shape early in the design phase. The mirrors look a bit like a satellite dish with an attached microphone. Ford used them to locate areas where noise penetrated the interior of the vehicle.

Using data gathered during the tests, the design team made changes to the mirrors and A-pillar of the vehicle during the clay model phase. Wind noise performance was optimized via 160+ hours of testing and engineering.

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Jobs Council Recommends Increased Engineering Innovation

The President's Council on Jobs & Competitiveness released its "Road Map to Renewal" recommendations earlier this year. The report lays out an agenda for investing in education and innovation as part of the overall plan the group is developing to increase job growth.

While most of the six primary recommendations revolved around tax and regulatory reforms, education reforms, and energy policy, two segments could directly impact the engineering field.

One involves increasing our national investment in innovation, with the Jobs Council hoping to see national spending on research and development rise to at least 3% of GDP or more.

Also of potential interest to designers and engineers, the Council recommends increasing development of a highly skilled workforce by emphasizing more science, technology, engineering and math (STEM) education, doubling the number of engineering graduates we produce each year and recruiting those grads to teach in K-12 environments.

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High Temperature Lasers Open Up New Possibilities

Created by EOS, high temperature laser sintering (HTS) is a relatively new process of additive manufacturing that is being put to use mainly in the aerospace and medical industries. HTS has been embraced by Paramount Industries and the University of Exeter, among others.

The process uses a CO_2 laser that can run at temperatures of 725°F (385°C) to build layers with a thickness of .004 in. (0.1mm). The high temperature allows the EOS P800 to sinter high-performance polymers, such as polyether ether ketone (PEEK) and polyaryl ether ketone (PAEK).

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PCB Rapid Prototyping

LPKF's Protomat S-Series of bench-sized machines are designed to be used in-house. Features include automatic tool change, solder paste dispensing and automatic milling depth adjustment. Each machine comes pre-loaded with software to assist with the prototyping process.

The Protomat S63 can deploy up to 15 tools automatically, produce isolation lines to 100 µm, and drill holes to 150 µm. The automatic conical milling of the S63 can create different insulation channels varying by depth and, according to the company, maintain uniform track widths.

It is designed to build multilayer boards when used with a board lamination press, and can be used to rework bare boards. Other applications include single and double-sided circuit boards, plated-through holes, routing slots, cut outs and board profile.

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Speakers Announced for AMUG

The Additive Manufacturing Users Group's (AMUG) annual conference will be held April 22-26 in Costa Mesa, CA. Keynote speakers include Todd Grimm, president of T. A. Grimm & Associates, Jeff DeGrange, vice president of direct digital manufacturing from Stratasys, and Dr. Ofer Shochet, Objet's executive vice president of research and development.

The conference agenda will include an AM materials workshop, a discussion of on-demand AM-created fashion and consumer goods, a CAD workshop by Objet, and metal forming by Stratasys. Other events include part finishing and hydro printing workshops, an overview of how Objet's ABS-like material has performed over the last year, and aerodynamic applications of additive manufacturing.

The AMUG Conference will also include a technical competition. Submissions should push the boundaries of AM or use the technology in a novel and original fashion. The competition will have two different categories. The first category, advanced concepts, focuses on actual applications of 3D printing, while the second category, advanced finishing, will concentrate on post-production work

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3D Printing Company Profile: Stratasys Inc.

Stratasys began in 1989 and delivered its first product in 1991. Stratasys shipped around 90 systems in its first year. By way of comparison, last year (2011), the company shipped about 2,200 additive manufacturing (AM) solutions.

Today, Stratasys produces 3D printers in the uPrint SE, Dimension and Fortus lines. It also operates the RedEye on-demand rapid prototyping service. The company offers 10 different thermoplastic options.

The company has seen the beginnings of a trend as more manufacturers turn to 3D printing. Instead of warehousing the tools to build and assemble their products, companies are recycling plastic production tools after the run ends, and maintaining the CAD files needed to print replacements.

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3D Printing Company Profile: Objet Ltd.

Objet Ltd. is a global manufacturer of 3D printers based in Rehovot, Israel, with a U.S. headquarters in Boston. The company features multi-material 3D printing technology offering 14 cartridge-ready materials to choose from, including ABS-like rigid plastics, different grades of transparency and rubbery materials.

The company targets professionals with three 3D printer lines, which include the multi-material Connex line, the Desktop line and the Eden line. Objet's materials are capable of simulating properties ranging from varying grades of rubber to clear transparency, all they way to rigid, ABS-grade engineering plastics.

In addition to supporting standard STL files that can be output by CAD programs, the company has developed software plug-ins for Autodesk Inventor, SolidWorks and PTC ProEngineer.

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Do You Know Where Your Numbers Have Been?

A data management system with a sense of history leads to traceability at NAVAIR.

BY KENNETH WONG

Antique and art dealers often talk about an item's provenance, its historical record. If someone is paying $140 million for a paint-dripped fiberboard titled Jackson Pollock's No. 5, 1948 (which did happen at a private sale brokered by Sotheby's), he would expect a paper trail proving subsequent ownership records, or expert authentication proving the item as Pollock's masterpiece. But what about the tensile strength of an industrial material, the anticipated load specified in a simulation run, or the shear rate associated with a piece of metal?

Current product data management (PDM) and product lifecycle management (PLM) systems are quite good at giving you a history of engineering changes, material substitutions, and successes/failures in physical/digital tests. But the provenance of critical values and parameters employed in an engineering project is not usually the domain of PDM or PLM.

Why, for example, did someone choose to run a thermal simulation with 120°F as the threshold? Why did someone decide the new cockpit needs to withstand 600mph wind speeds? The answer is often buried in someone's report, in an email from a safety specialist who recommended the parameter, or a white paper that outlines the industry standards.

A paint-spattered board is worth $140 million only if it is, in fact, the work of an abstract expressionist genius. By the same token, simulation results are reliable only if the parameters employed are trustworthy. Otherwise, it's outright dangerous to make decisions based on them.

In many engineering projects, provenance of parameters still remains a black hole. To navigate this territory, you may need a new kind of PDM/PLM system—one that cares as much about history as it does about geometry.

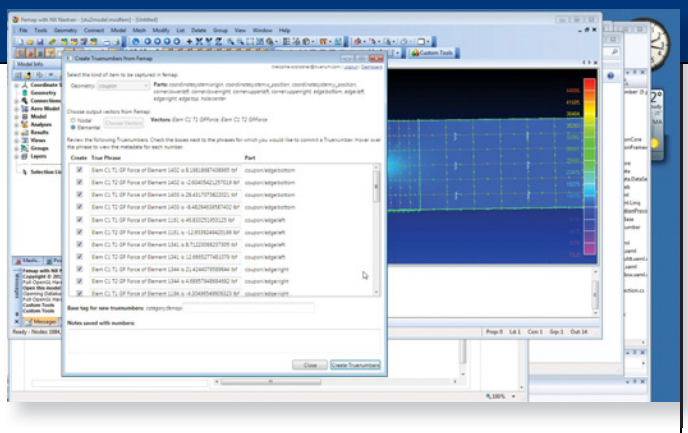
truenumbers with True Histories

Allen Razdow, who invented Mathcad (now part of PTC's software lineup), thinks you should be able to interrogate numbers. You don't necessarily have to drag a suspicious number into a room and bombard it with questions under a bright light, in a good-cop-bad-cop routine. Rather, in Razdow's vision, you should be able to just hover a mouse over a number to get its source, citation, reference and usage history. And if you happen to know about the reliability of a number (maybe you were once part of the academic research team that came up with that number), you can tag it and comment on it, just as you would with a Facebook picture where you recognize a familiar face. In doing so, you contribute to the growing provenance of the number.

Should you choose to reference this number in an email or a document, instead of just typing the digits, you may use a link. Such a number, called a truenumber in Razdow's vocabulary, comes with its own history—a digital paper trail to tell you where it has been. Razdow's company, True Engineering Technology, offers enterprise solutions based on the concept. Your company may deploy what True Engineering Technology calls Your Numberflow Server to store critical numbers and their histories.

When Razdow's company launched the first commercial product in June 2011, the announcement read, "Engineers can

use truenumbers to create an accurate record of any number which can be inserted into documents, used for calculations and shared with other engineers. And with the ability to verify the source of any truenumber from within a document or email, engineers will be able to know everything about a number all the time. truenumbers can be used in Word, Excel and PowerPoint documents, emails and HTML pages. truenumbers are also compatible with PTC's Mathcad 15, ensuring that calculated numbers and their units stay intact outside of Mathcad."



With an interface to automatically export parameters and values to Femap analysis software, truenumbers users can simply select the desired region with a few mouse clicks.

Floating Numbers in Simulation

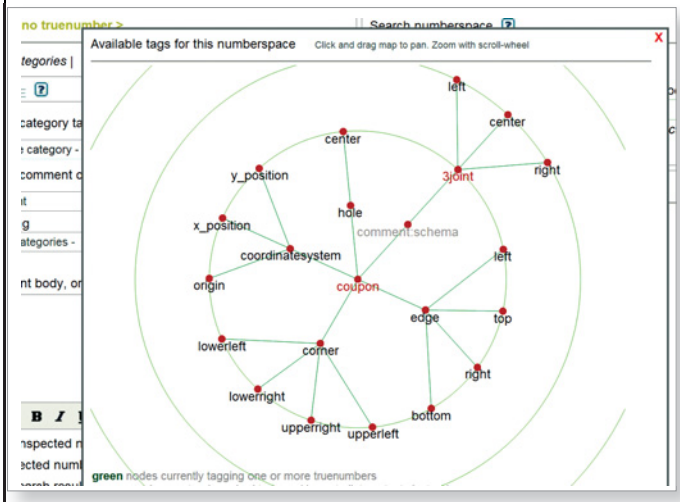
When engineers at NAVAIR (short for Naval Air Systems Command) talk about a coupon, they're not referring to a slip of paper that guarantees 20% discount at their naval base's cafeteria. More likely, they're talking about a set of values associated with a hotspot, an area on an aircraft they've singled out for close examination. A hotspot on the wingspan of an F-18 Hornet, for instance, comprises the loads and stresses that fall on the region, along with the parameters of its left and right edges.

To determine the loads and stresses, engineers at NAVAIR would model the coupon's region, along with a proposed fastener, in Siemens PLM Software's simulation package Femap. Using the loads and stresses obtained from Femap, they would then use StressCheck from Engineering Software and Research Development Inc. (ESRD) to simulate the coupon and obtain its stiffness and elasticity. Once these values were obtained, the authenticated values were imported back into the digital model of the aircraft.

Though adequate, the workflow required a fair amount of manual input when transferring values from one software to another—leaving room for possible errors. With True Engineering Technology's Your Numberspace Dashboard application installed, however, NAVAIR engineers can tag the coupon's geometry as truenumbers, making them easier to digitally store, search and locate.

The same approach was taken with material properties. A custom-developed Femap export tool lets engineers point and select

CMPRO from Professional Systems Associates serves as the standard interface for NAVAIR employees to submit and retrieve engineering instructions.



truenumbers from True Engineering Technology lets NAVAIR engineers create coupons (references to critical regions on aircrafts) by tagging appropriate values. The system makes it possible to automatically load coordinates and parameters associated with the referenced region when conducting simulation.

the appropriate region and values directly on the 3D model. They could tag chosen values with appropriate metadata in a series of dialog boxes. When the coupon is sent to StressCheck for load and stress verification, the user simply picks the right coupon. Using intelligence embedded in the imported truenumbers, StressCheck automatically populates the input fields (through a harness developed using Truenumber SDK) with values associated with the selected coupon.

"With truenumbers, we will be able to manage and share critical data, including design parameters and materials properties, ensuring that anyone on the team can easily get the most up-to-date information available at any time, from anywhere," says NAVAIR's Ricardo Garcia, an early adopter of truenumbers. "When you are keeping a fleet of sophisticated military airplanes flying to support U.S. combat troops, confusion over a simple calculation that goes unchecked can have catastrophic results."

Saving Numbers in Context

The standard interface at NAVAIR for submitting a request for engineering instructions is powered by CMPRO, a configuration management system from Professional Systems Associates (PSA). PSA describes itself as a PLM vendor, but because of its history of working with sectors within the U.S. Department of Defense, its solutions have become almost tailor-made for the DOD's needs. Using CMPRO, an authorized person at NAVAIR might, for instance, submit a request to verify whether a certain sample has the required tensile bond strength, hardness and metallography.

Announcing the deployment of its technology, PSA wrote, "The Materials Engineering Database System (MEDS) module was written by PSA (the developers of CMPRO), and is now being utilized by Material Labs at various NAVAIR sites across the U.S. It first went into production at the Jacksonville Materials Laboratory and is installed on the CMPRO server riding in PAX River. The module is now being expanded throughout the other NAVAIR sites providing PLM functions (and other specialized functionality) to thousands of users on NAVAIR and contractor facilities across the globe."

The depots where MEDS is deployed, according to Moe Parker, CEO of PSA, are sites responsible for performing detailed maintenance work on aircraft that goes beyond routine checkups.

"At these places, they just don't do simple changes like oil and air filter," Parker says. "They'll strip [aircraft] down to their metal rivets, identify issues, and engineer new solutions if needed."

At sites where hundreds of aircraft are under analysis, where many different physical and digital tests occurring simultaneously, CMPRO's single point of inquiry and reporting keeps the data traffic flowing efficiently.

"Over time, a plane will return for more service work," explains Parker. "[The engineering staff] can then go look at the CMPRO archive for a record of the plane's maintenance history. This allows the staff to retrieve an analysis that might have been performed two years ago and see the results: Was there a crack? What did the crack look like? What was the diagnosis? Did it

say it should last 2,000 hours more? All these findings will be on record, along with the associated data [from the analysis software used] for engineers to review."

With an eye toward the increased use of mobile devices by field crews, PSA has begun supporting mobile devices. If an engineer is retrieving an analysis report from a mobile device, he or she may click on a link, with the option to view the results archived online in a mobile-friendly format (not a mobile app). For NAVAIR, consistent with strict security guidelines, CMPRO requires users to supply additional authentication before he or she is allowed to access the data, whether someone is accessing the data from a mobile device, laptop or desktop.

"A website is never going to be an ideal way to share analysis results," Parker admits, "but engineers need a way to share that data with the rest of the organization. Promoting changes in how engineers interface with one another—that's our specialty."

Micro- vs. Macro-history

At the micro level, truenumbers provides NAVAIR with a way to nest history, intelligence and comments in the critical parameters used in projects, which makes data flow from one software to another smoothly. Certain manual routines, such as entering input fields in analysis systems, gets simpler as selected truenumbers can automatically query and load the associated data.

At the macro level, PSA's CMPRO provides NAVAIR with the ability to retrieve and review the series of digital and physical tests performed on its aircraft. Because aircraft tend to outlive personnel changes and engineers' assignments, a data management system with a single requisition interface and a consolidated view ensures crew members new and old are working with the same understanding of an aircraft's maintenance history.

As engineering projects become more complex, and multi-tiered collaboration becomes standard practice, establishing data provenance and reviewing project history may become everyone's responsibility. DE

Kenneth Wong *is* Desktop Engineering's *resident blogger and senior editor. Contact him via de-editors@deskeng.com.*

INFO ➜ Engineering Software and Research Development Inc.: ESRD.com

➜ **NAVAIR:** NAVAIR.Navy.mil

➜ **Professional Systems Associates Inc.:** PSAsys.com

➜ **Siemens PLM Software:** Siemens.com/PLM

➜ **True Engineering Technology:** truenum.com

For more information on this topic, visit deskeng.com.

Fläkt Woods Creates Environment for Quality Management

Manufacturer uses M-Files for ISO documentation, supplier management and project reporting.

Headquartered in Switzerland, Fläkt Woods is one of the leading manufacturers of air-handling units and air terminal devices for non-residential buildings. It ranks second in fan production for cement plants, tunnels and subways. With more than 3,500 employees serving customers in 75 countries, Fläkt Woods generates more than $881 million in revenue annually.

In 2009, Fläkt Woods realized it required a solution for managing product designs and all other support documentation, which included CAD drawings, Microsoft Word files, Excel documents and PDFs. The company selected M-Files' document management solution.

"Fläkt Woods initially utilized M-Files for the same reason as many other companies," recalls Jouni Akras, IM manager at Fläkt Woods. "We were employing a standard, ad-hoc, folder-based system for storing and managing documentation, which was inefficient and error-prone. For example, important design documents were sometimes accidentally placed into the wrong folder location, or the same file was saved in multiple places—one version on a server, and one on a workstation."

Management Through Metadata

The M-Files interface replaces the file-path trees—what you find in Windows Explorer or in the application dialogue boxes when saving or opening, for example —with a set of metadata fields. Instead of clicking through folder structures to indicate a location, users enter keywords that define the document, such as the product or customer associated with a project, or general categories, such as which phase a document in a particular workflow is in, or its status ("waiting for approval," for example).

Along with date and author information, the metadata becomes the identification for the file, which is stored in one repository, or "vault." M-Files removes the need to know the document location.

Fläkt Woods also connected the M-Files document vault to its main customer and supplier databases. The M-Files vault tracking system ensures that files are uniquely identified without multiple versions. "Check-in" and "check-out" features treat a collaborative document like a library book: Only one user at a time can modify the file,

which prevents one user from overwriting another user's edits, whether it is a 3D model or an Excel spreadsheet.

Fläkt Woods has a direct presence in 30 different countries throughout Europe, Asia and North America. The company generates a huge number of documents related to manufacturing and production, including design drawings, quality control documents, product reports, customer invoices and other business information.

"After the successful M-Files implementation in our design department, we decided to widen our M-Files deployment to other parts of the organization," says Paul Ellison, business IM manager with Fläkt Woods.

In 2010, Fläkt Woods expanded its use of M-Files to its Global Infrastructure & Industry (GII) Växjö site, to provide a foundation for enforcing consistent quality management processes and to ensure all personnel are managing documentation according to standard operating procedures.

Reducing Design Errors

At its GII Växjö site, Fläkt Woods uses M-Files to implement process control mechanisms to ensure proper project management and document handling for ISO documentation, supplier invoice approval process automation, project reporting, and supplier agreement management.

Since implementing M-Files, the GII group has seen a significant reduction in design errors due to outdated versions of documents, which has resulted in fewer claims from quality issues.

With M-Files, Fläkt Woods can instantly see the current stage of a particular document workflow, have a clear understanding of changes that have taken place, and can follow all interactions that have taken place with customers and suppliers. Staff members can type in a certain project number and determine where it stands in the development process.

"The M-Files implementation in Fläkt Woods' GII unit has enabled our project managers to efficiently handle the vast amount of technical, commercial and quality-related documentation associated with large commercial projects," says Fredrik Albertson, general manager at Fläkt Woods GII Växjö. "By using M-Files to automate processes and implement strict workflow procedures on critical documents, we've radically reduced the number of manually introduced errors, resulting in higher quality products and improved profitability." DE

This article was adapted from a case study originally published by M-Files. For more Fast Apps, visit deskeng.com/fastapps.

INFO ➜ Fläkt Woods: FlaktWoods.com

➜ **M-Files:** M-Files.com

Store Your Data

Penguin Computing (penguincomputing.com) will offer DataDirect Networks's (ddn.com) suite of HPC and Big Data storage solutions to its global customer base. Penguin has an installed base of more than 18,000 systems in more than 40 countries. Customers will be able to source DDN products from Penguin Computing, including the SFA storage platforms, the GridScaler and ExaScaler parallel file storage systems, NAS Scaler, DDN's enterprise scale-out NAS platform, and WOS, DDN's hyperscale object storage system.

Manage Processes in the Cloud

Kenesto (kenesto.com) demonstrated its business process automation system publicly for the first time at SolidWorks World 2012.

Kenesto, now in beta testing, is a new, cloud-based system that is designed to allow users in all departments of the manufacturing enterprise to create processes and manage work easily. The company says it "learns" processes as users simply attach data and route it to the next person or organization in the process.

Kenesto runs in any HTML5-capable browser, including mobile devices running Android and iOS.

Database Gets Flexible

ACS Software Inc.'s (acssoftware.com) AutoEDMS Version 6.5 SR5 engineering data management system has been enhanced with new features, functions and overall improvements. It is designed to manage engineering data and documents with a flexible multi-user database that the company says can manage millions of files.

AutoEDMS includes the AutoEDMS Navigator, an Explorer-style database navigation and file selection tool. It also includes the built-in AutoEDMS Workflow Engine to automate document revision and approval processes.

Triumph Over Data Management

PTC (ptc.com) has announced that Triumph Motorcycles Ltd., the largest British motorcycle manufacturer, has selected Windchill for product lifecycle management (PLM). The use of Windchill is expected to help Triumph better support business growth and product development needs.

As a long-time user of PTC solutions—Creo Parametric for product design and Pro/INTRALINK solution for data management—Triumph was aware of PTC's technology and capabilities. According to PTC, Windchill enables all product development parties to instantly access all necessary data.

Improve Engineering Collaboration

Synergis Software's (SynergisSoftware.com) Adept engineering data management solution is said to deliver advanced vault replication, two classes of web clients, and integration with Microsoft SharePoint. It is designed to improve global enterprise collaboration on engineering projects while providing a unified view of data and documents to all stakeholders. Adept has been integrated with AutoCAD-based applications since 1991 and Autodesk Inventor since 2001. It has been a SolidWorks Gold Certified PDM Product since 2003 and is tightly integrated with MicroStation. Most recently, the company announced its designation as an Autodesk Platinum Tier value-added reseller.

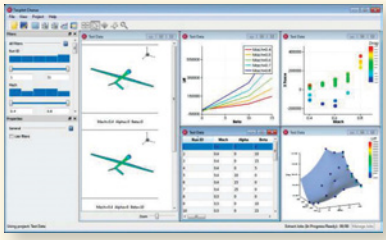
EDM Solution Connects with AutoCAD

Formtek, Inc.'s (formtek.com), Engineering Data Management (EDM) solution for Alfresco includes a Connector for AutoCAD. It works in conjunction with the Formtek EDM Module for Alfresco, and allows users to interact with the Alfresco content repository directly from within the AutoCAD application. Together, Formtek says these products provide a pre-packaged, installation-ready, minimal services solution for secure, enterprise engineering document and drawing management and collaboration on the Alfresco Open Content Platform. DE

Simulation Analytics Tool Released

Tecplot, Inc. (tecplot.com/chorus) has released the 2012 version of Tecplot Chorus, the company's simulation analytics tool. It is said to offer improved data loader support, case management, and advance data extraction features.

Tecplot Chorus is designed to enable engineers to manage computational fluid dynamics (CFD) projects by bringing together results from simulation cases, derived quantities, and plot images in a single environment. The company says an engineer using Tecplot Chorus can evaluate overall system performance and visually compare tens, hundreds, or thousands of simulation cases without writing scripts. It also allows them to analyze a single parameter over the entire project both visually and quantitatively. It pre-computes plots, making downstream analysis faster.



Tecplot Chorus is available on 64-bit versions of Windows 7, Vista, and XP, 64-bit Linux platforms, and can interface with SQL databases stored locally or on a server.

Points of Origin

Origin, the base version, and OriginPro, with extended functionality, provide control over every visual and contextual parameter of a plot.

BY VINCE ADAMS

Since our last review of Origin and OriginPro from OriginLab Corp., Northampton, MA, in July 2011, their developers have been hard at work to improve the processing power and level of insight offered by large amounts of critical data.

Version 8.6 of the data analysis and graphing software was released in November 2011, and shows that Origin fans won't be disappointed. As OriginLab founder Dr. CP Yang states, "We are committed to developing a product portfolio that caters specifically to the needs of our users."

For engineers, scientists and researchers who still rely on Microsoft Excel for plotting and data analysis, the ability to extract insight from data offered by Origin will hit you like a shot of triple espresso. You won't look back. Anyone who works with large datasets knows that the more ways you can visualize data will help in identifying non-intuitive trends and correlations. Origin has truly set the bar for plot types and richness of graphics.

One of the most notable improvements in version 8.6 is the implementation of a native 64-bit version. Users of large datasets have already noticed the increased speed of data manipulation and analysis. Additionally, the 2GB file size restriction of the 32-bit version is removed, allowing users to leverage the installed RAM on their PC to its fullest.

The User Interface

As shown in Figure 1, Origin is toolbar-driven with two primary sections: the Project Explorer, on the left, and the working or active window. In version 8.6, the Project Explorer is now dockable so that with a single click, that extra space is returned to either a table or graph view in the workspace. Other dockable windows include a new Message Log Window and Quick Help, previously accessible from the View dropdown menu.

Other interface improvements in Origin 8.6 that regular users will welcome are additional pan and zoom options that clearly acknowledge some people are mouse-centric and others are keyboard-centric. By using the Control key, one can zoom in and out with either the mouse wheel or keystrokes.

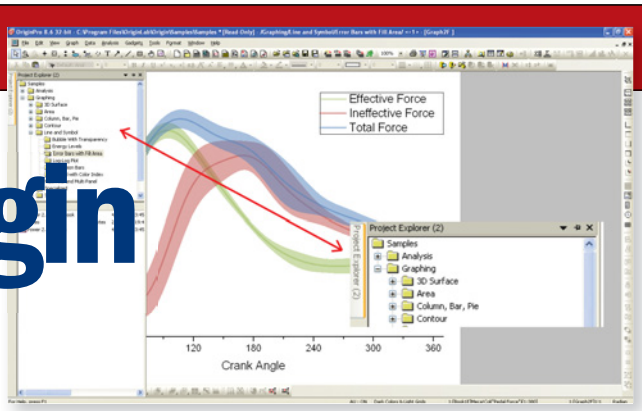


FIGURE 1: The Origin 8.6 user interface.

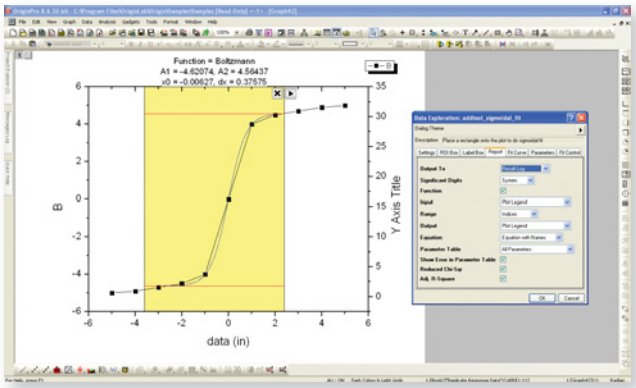


FIGURE 2: Region of interest in the Quick Sigmoidal Fit Gadget.

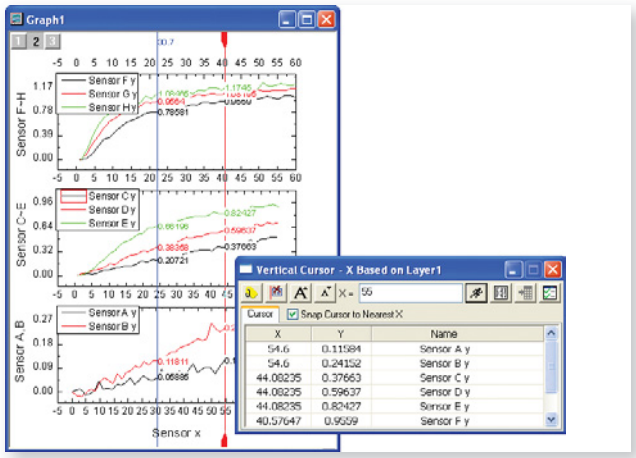


FIGURE 3: The Vertical Cursor can be used across multiple plots.

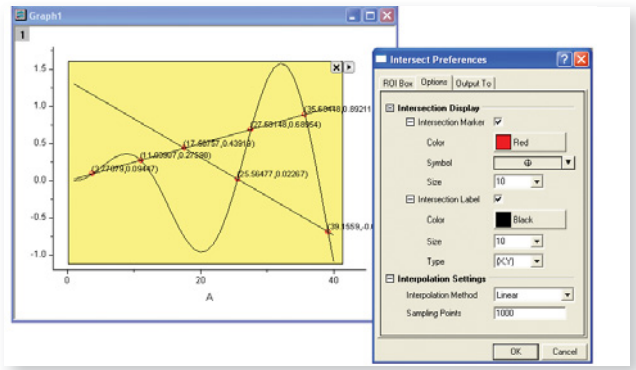


FIGURE 4: The Intersect Gadget tags and labels all curve intersections within the region of interest.

Similarly, the Control and Shift keys give access to vertical and horizontal panning.

New Gadgets in Origin 8.6

Gadgets in Origin are tools that perform quick analyses on regions of interest (ROI) within a graph, as shown by the yellow rectangle in Figure 2. Gadgets, introduced in OriginPro v8.5, are transient selections, using a rectangle, circle or ellipse on an existing graph, that report back information. The results calculated within a Gadget are updated dynamically as the ROI is dragged within a graph. Version 8.6 added three new Gadgets:

- The **Quick Sigmoidal Fit Gadget** will parameterize a dataset to a true sigmoidal function, with numerous user-definable options based on the data source and end goals. This Gadget is shown in Figure 2.
- The **Vertical Cursor Gadget** provides a mouse-draggable cursor across the "X" or independent variable that displays its intersection with the data in one or multiple plots, as shown in Figure 3.
- The **Intersect Gadget** tags and labels all curve intersections within the ROI, as shown in Figure 4.

Additional New Features

Many other enhancements have been included in OriginPro 8.6, including a new Spider/Radar plot, Parametric Function Plots, Import Menu Customization, Worksheet Navigation Dialog, Nonlinear Fitting with Integrals, and a Split Worksheet Tool. This last feature allows users to easily create a new worksheet with a portion of the columns from an existing sheet.

As in previous releases, OriginPro 8.6 contains all the features of Origin, plus some high-end data plotting and analysis tools. In this release, Principal Component Analysis, K-Means Cluster, Hierarchical Cluster and Discriminant Analysis have been added.

As before, the vast majority of improvements to Origin & OriginPro are driven by customer input collected by the Technical Support team at OriginLab.

Users receive 90 days' free support with each purchase, and ongoing maintenance plans are available. Current maintenance customers also receive upgrades during their maintenance period. DE

Vince Adams, *currently an account manager for LMS, is a longtime simulation educator, consultant and speaker. He has authored three books on finite element analysis and numerous magazine articles. Contact him via de-editors@deskeng.com.*

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Direct Modelers as FEA Pre-Processors

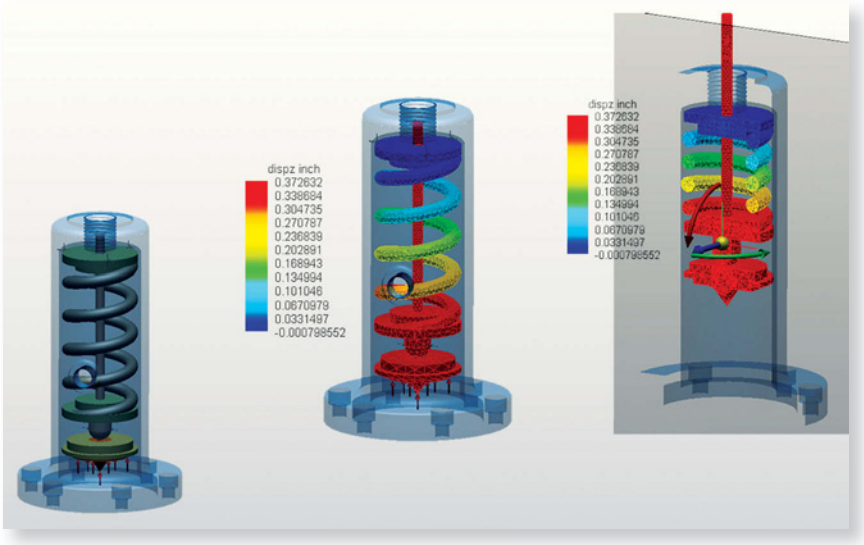
Ease of use and a short learning curve make direct modeling ideal for analysis and simulation experts.

BY KENNETH WONG

Do you know that simulation and analysis experts routinely perform cosmetic surgery on CAD models? Before they load a model into finite element analysis (FEA) software, they often strip the model of unnecessary details. Cosmetic features that make a design look pleasant but don't serve any practical purpose, like rounded corners, would have to go. Next to go are minor features that do serve a purpose, but don't make a difference in stress and load distribution, like small holes. Removing these details simplify the geometry, reducing it to its basic building blocks. This goes a long way toward reducing the time required to mesh the model.

Surfaces with curvatures take more time to subdivide, so if you have too many of them, your meshing time increases exponentially. Conversely, primitive shapes like squares and cylinders are easier to subdivide, so the simpler the design, the faster it is to mesh and solve.

But a history-based CAD program may not be the best environment to make the geometry edits mentioned above. Because of its adherence to feature history, or the sequential steps in which the model is created, history-based CAD programs don't allow deleting or removing features on a whim. To delete a feature in a history-based CAD modeler, you would have to identify the step previously used to create the feature, then make the edit—a daunting task for simulation and analysis experts who are not necessarily CAD experts.



With the launch of KeyCreator 2012, Kubotek begins offering KeyCreator Analysis, an FEA program nested inside a direct modeler. The module allows you to run flow and thermal analysis, then adjust the geometry to refine your design based on analysis results.

In the resurgence of direct modelers, analysis and simulation experts found a better alternative. Because a direct modeler allows you to modify CAD geometry without concerns for its construction history, it's often the preferred choice in performing the geometry edits required to prepare a design for FEA. The matchmaking has already begun, as seen in the pairings of SpaceClaim and ANSYS (see the related article on page 30), and KeyCreator and AMPS. More will likely follow.

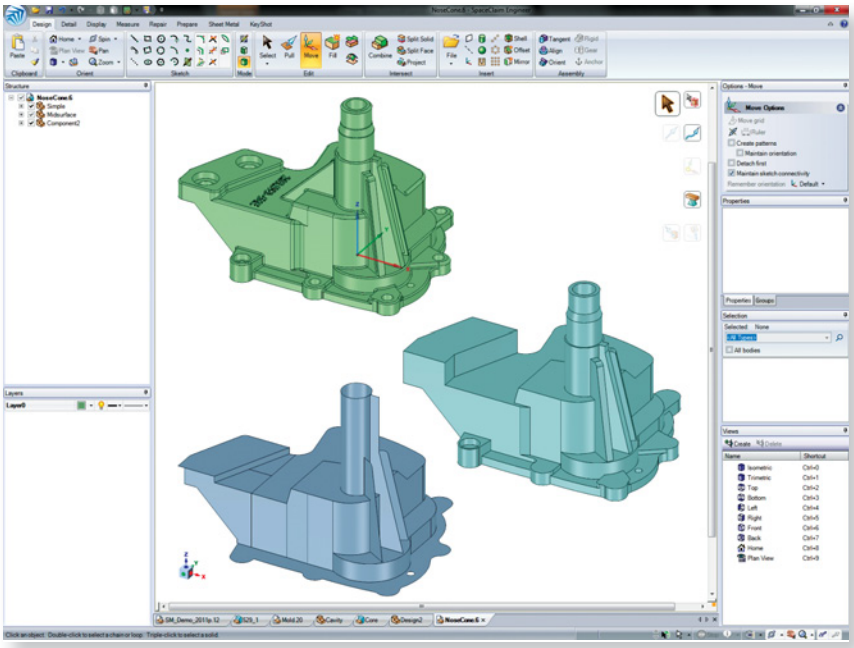
A Brief History

In October 1995, HP published an article titled "HP PE/SolidDesigner, Dynamic Modeling for Three-Dimensional Computer-Aided Design" (*HP Journal*, October 1995). Authors Klaus-Peter Fahlbusch and Thomas D. Roser wrote, "HP Pre-

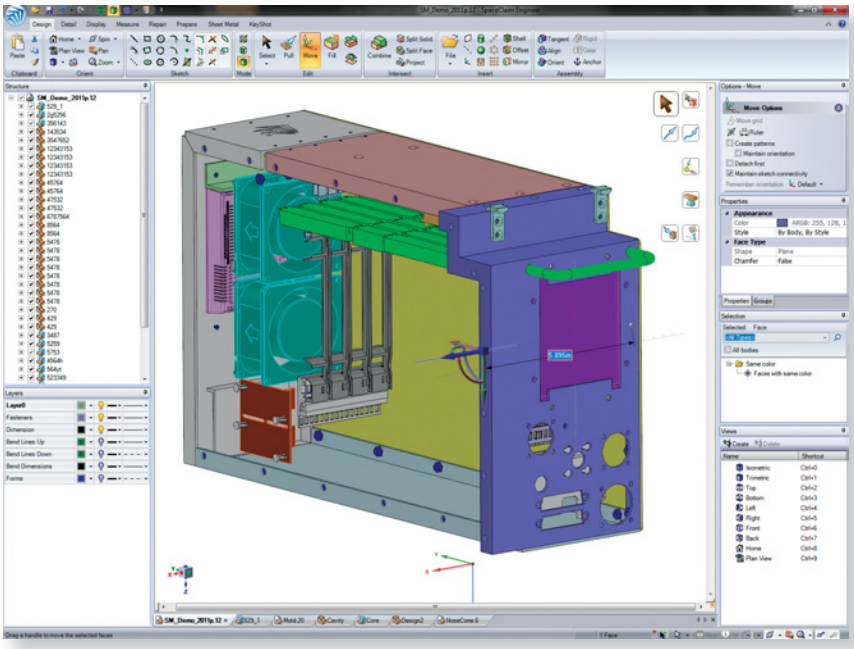
cision Engineering SolidDesigner (PC/SolidDesigner) is a 3D solid modeling design system based on the ACIS Kernel ... The system's dynamic modeling technology gives the designer the freedom to incorporate changes at any time and at any stage of product development, without dependence on the history of the product design ... It supports the coexistence of surface data with solid data, and provides the ability to import and modify surface and solid design data from a variety of CAD systems ... The flexible, non-history-based, intuitive design technique provides direct interaction with modeling tools and designs ..." It was one of the earlier examples of a direct modeler.

Subsequently, SolidDesigner evolved into CoCreate, now owned and marketed by PTC as Creo Elements/Direct Modeling. In the late '90s, IronCAD LLC and Kubotek joined the direct modeling market with their products, IronCAD and CADKey, respectively. Although some manufacturers adopted the technology, the majority continued to rely on traditional history-based modelers, such as SolidWorks, Solid Edge, Autodesk Inventor, NX and CATIA. The birth of SpaceClaim in 2007, however, prompted many to re-examine the role of direct modeling.

By reducing direct modeling into a series of pushing, pulling and rotations, SpaceClaim managed to popularize a technology that has been around for more than a decade. Its swift penetration into a market dominated by history-based modelers forced history-based CAD software developers to take a second look at direct modeling. The outcome was Autodesk's introduction of Inventor Fusion, Siemens PLM Software's debut of Synchronous Technology, and PTC's renewed efforts to refine Creo Elements/Direct Modeling. (For more on the difference between direct modeling and history-



In a direct modeler like SpaceClaim, removing cosmetic details to prepare a model for analysis is much easier than performing the same operations in a history-based modeler.



The ability to make geometry edits without being hampered by the feature history makes direct modelers a better alternative for simulation and analysis experts. The preference has led to a partnership between SpaceClaim and ANSYS, with the release of ANSYS SpaceClaim Direct Modeler.

based modeling, read "We Gather Here Today to Reconcile Direct and Parametric," March 2012, at deskeng.com/articles/aabeft.htm.)

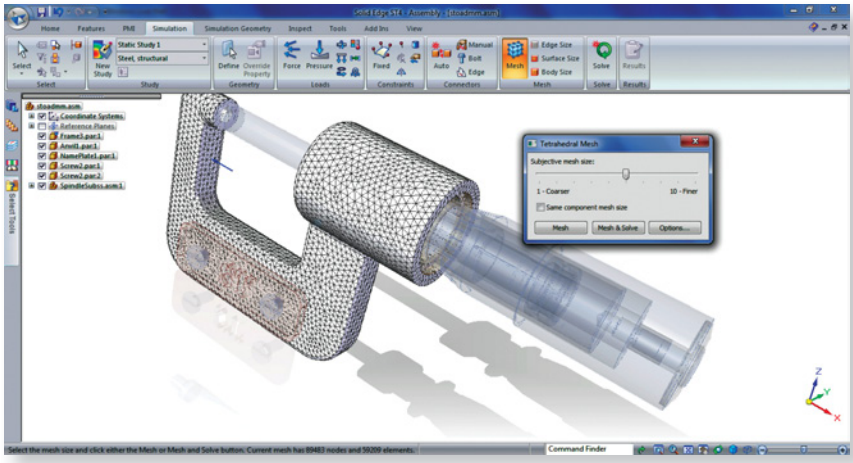
A New Key from an Old Creator

Kubotek's KeyCreator (formerly CADKey) is a direct modeler in its own right, with its own loyal following. This April, with the launch of KeyCreator 2012, the software enters a new phase and a new market. Delivered in partnership with AMPS Technologies, KeyCreator Analysis is a component of the new KeyCreator, aimed at those who wish to conduct sophisticated FEA tests (thermal, structural and electromechanical, among others) within their CAD modeling environment. Think of it as a direct modeler (in this case, KeyCreator 2012) with FEA solvers nested within it (KeyCreator Analysis, powered by AMPS).

KeyCreator Analysis is a post-processor, with multithreaded 64-bit code. That means the software can take better advantage of the multicore CPUs in your workstation (it currently supports CPU multithreading only, not GPU). Among its features are automatic meshing of solids and automatic contact detection.

Part of KeyCreator Analysis' strength is the use of Sefea meshing procedures (it stands for Strain-Enriched Finite Element Analysis). According to AMPS, Sefea lets you use "automatic generated low-order tetrahedron elements to achieve results virtually equivalent to legacy methods employing large numbers of second-order tetra or brick elements." In laymen's terms, even if you're using coarse meshing (which saves you time and computing power), you can expect the same accurate results normally associated with finer meshes.

Close integration with a direct modeler like KeyCreator lets you refine the geometry and experiment with various alternatives, such as building the same product with thin-



Siemens PLM Software's Solid Edge with Synchronous Technology comes with basic linear stress analysis, as shown here. You may also use it to easily remove unnecessary details in imported 3D designs before submitting them to FEA software.

ner or thicker walls or reducing diameters of cylindrical elements. These changes, though simple enough in a direct modeler, could prove difficult in a history-based modeler, as they may violate the modeling steps previously taken by the original designer—causing the software to spit out the dreaded "regeneration failure" error message.

In the latest releases, KeyCreator began shedding some of its legacy interface elements, which relied heavily on menu choices. The addition of DynaHandle and previews makes push-pull editing much more intuitive in modifying patterned features, adjusting bosses and ribs, and assembly configuration.

A Different Kind of Coupling

ANSYS, like many high-end FEA programs, offers code coupling, defined as the use of more than one solver to simulate a scenario involving materials and mechanics with different physical properties and behaviors. But a different kind of coupling took place when the analysis software developer struck a partnership with SpaceClaim in 2009. The pairing gave birth to ANSYS SpaceClaim Direct Modeler (ANSYS SCDM), a version of SpaceClaim customized to work with ANSYS DesignModeler, part of ANSYS Workbench.

The bidirectional association between ANSYS SCDM and DesignModeler ensures that the edits you make in one is reflected in the other environment with a simple update. DesignModeler lets you easily defeature (remove unnecessary features from) CAD models.

Ideally, a simulation expert would like to try out different design iterations—the same design with different material thickness, for example—to discover the best configuration that can withstand the load or stress anticipated. The ability to rely on ANSYS DesignModeler and ANSYS SCDM to keep models synchronized during different iterations goes a long way in avoiding the need to export the model back to the modeling software to make changes for each analysis session.

Among PTC's Creo app lineup is Creo Elements/Direct Finite Element Analysis. It's offered as a plug-in to PTC's direct modeling software (Creo Elements/Direct, formerly CoCreate) with FEA features. The bundle lets you conduct standard analyses, such as linear static, modal, buckling and steady-state thermal analysis. In ad-

dition, it incorporates stress, strain, deformation and temperature distribution throughout your product design, with combined thermal and structural analysis.

FEA Early and Often

Last fall, IronCAD, LLC and NEi Software released NEi Nastran for IronCAD, an FEA solution designed to run inside the IronCAD Design Collaboration suite products IRONCAD and INOVATE. (The capitalization differentiates the products from the company name and the name of the product suite). The suite includes products designed to provide collaboration between 2D and 3D, allowing users to leverage 3D within a 2D design process.

According to the companies' press release at the time, NEi Nastran for IronCAD allows product design teams to perform FEA pre-processing, analysis and post-processing within the same associative design environment.

"Integrating simulation early and throughout the design process is the wave of the future for design engineers," stated Philip Potasiak, president of NEi Software at the time of the release. "NEi Software and IronCAD have partnered to develop NEi Nastran for IronCAD to address this critical need."

The FEA solution allows IronCAD software users to run linear static and steady-state heat transfer, normal modes, buckling, composites, and prestress; advanced dynamics like transient response and frequency response; nonlinear analysis and nonlinear transient heat transfer.

Independent Direct Modelers

Other direct modelers in the market—most notably, Siemens PLM Software's Solid Edge and NX with Synchronous Technology, and Autodesk's Inventor Fusion—currently have no formal integration with analysis and simulation software packages, but they still serve as better alternatives to history-based CAD programs in dealing with imported 3D designs that need to be submitted to analysis programs.

In its acquisition of Blue Ridge Numerics, Autodesk got what it needed to launch its very own CFD package. Autodesk Simulation CFD, released in August 2011, contains a license of Autodesk Inventor Fusion, the company's direct-editing software. Siemens PLM Software' Solid Edge with Synchronous Technology contains a set of tools for conducting basic, linear stress analysis on models. While the integrated analysis tools may not be sufficient for those seeking CFD, thermal and other, higher-end analysis tools, they are more than adequate

for designers looking to validate their concepts or visualize how certain loads and pressures might affect their designs. Beside its short learning curve, the software's comprehensive support of neutral and native 3D file formats makes Solid Edge with Synchronous Technology ideal for those who need a 3D editor for analysis models.

Accidental Discovery

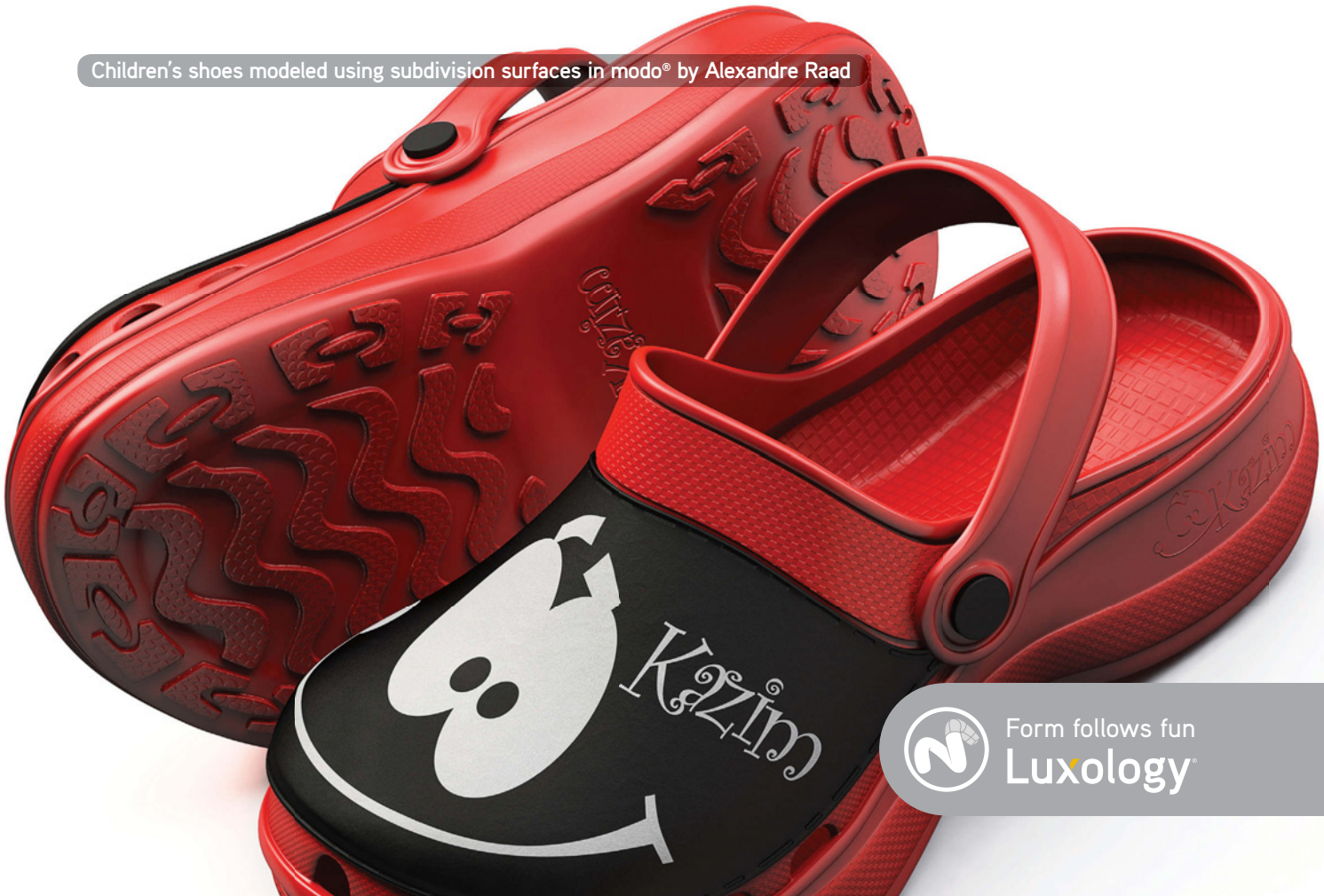
Direct modelers were initially developed to ease the pain in using history-based modelers for concept exploration. The very nature of exploration demands a tool that lets you digitally build, modify and rebuild design concepts with speed and agility—something for which history-based CAD packages aren't known. Addressing the needs of analysis and simulation experts was a market direct modeling vendors stumbled upon.

But now that they have discovered a new territory to conquer, existing and new direct modeling vendors may look at perfecting their technology to tailor it to the analysis and simulation market. They may, for instance, begin offering tools you can use to automatically detect and remove holes, bosses and rounded corners below a certain threshold. If the first batch of direct-FEA marriages prove successful, expect FEA programs to offer basic direct-modeling functions as standard features in upcoming releases. DE

Kenneth Wong *is* Desktop Engineering's *resident blogger and senior editor. He is convinced future CAD software will incorporate both history-based and direct-modeling functions. If you disagree, email him at kennethwong@deskeng.com, or share your thoughts on deskeng.com/facebook.*

INFO

- **AMPS Technologies:** AMPStech.com
- **ANSYS:** ANSYS.com
- **Autodesk:** Autodesk.com
- **Dassault Systèmes:** 3DS.com
- **HP:** HP.com
- **IronCAD LLC:** IronCAD.com
- **Kubotek USA Software:** KubotekUSA.com
- **NEi Software:** nenastran.com
- **PTC:** PTC.com
- **Siemens PLM Software:** Siemens.com/PLM
- **SpaceClaim Corp.:** SpaceClaim.com



CAD-based FEA: A Marriage of Convenience

How to perform finite element analysis in conjunction with direct modeling software.

BY DIMITRIOS KARAMANLIDIS

In the early days of computer-aided engineering (CAE) someone coined the phrase "islands of automation" to collectively describe its various components such as CAD, finite element analysis (FEA), resource planning and the like. Now, islands are not bad per se (think Mykonos!) except there were no bridges connecting them.

Before long someone created a link between CAD and resource planning so that your solid model could be sent from the screen to stereolithography (SLA) — hence, the 3D printer. Likewise, it became possible to upload a computer-generated 3D model of, say, a steel building frame to a computer numerically controlled (CNC) machine and have beams and columns laser cut to size, beveled and coped as desired, bolt holes punched, base and cap plates prepped and so forth.

In contrast to that, CAD and FEA still continued to exist mostly in isolation somewhere out there in the archipelago.

And then somewhere around the early '90s, SDRC (later to become a part of Siemens) launched the I-DEAS Master Series, in which one could create a solid model, switch to FEA and run the analysis, go back to the modeler and redesign and so forth—all within the same software suite. To be sure, there were some "warts" to be taken care of every time the model was imported into the FEA module, but compared to everything else available, it sure felt like heaven.

Now fast forward to today's scenario. Integration between design and analysis has reached the point that a number of robust CAD-FEA combos are available from vendors such as ANSYS, Altair, Autodesk, IronCAD, NEi Software, MSC, PTC, Siemens, Simulia, and SolidWorks to name but a few.

The Combo Platter

When talking about a CAD-FEA combo, two distinctly different flavors can be had. In one case, the link is materialized by way of an application programming interface (API), whereby a click of the mouse from within the CAD software fires up the FEA package. In the second case, the user exports the CAD model to a neutral geometry file (IGES, SAT, etc.) and then imports the same into the FEA software.

No matter how it's done, keep in mind that moving from CAD to FEA is never as trivial a task as some vendor promotional materials may lead you to believe. For starters, the geometry model used for manufacturing purposes is, for a number of reasons, almost never adequate for FEA.

For instance, think of all the bolt holes, welding fillets, bevels, rounds, cutouts, copes, etc. They are important features of the CAD geometry as far as FEA goes, they are in most cases irrelevant and thus must be cleaned away before a sensible stress analysis may be attempted. In the case of a history-based modeler, the cleaning is done by turning off unwanted entities—whereas in the case of a direct modeler, such as SpaceClaim, it is done using the various repair tools provided by the software.

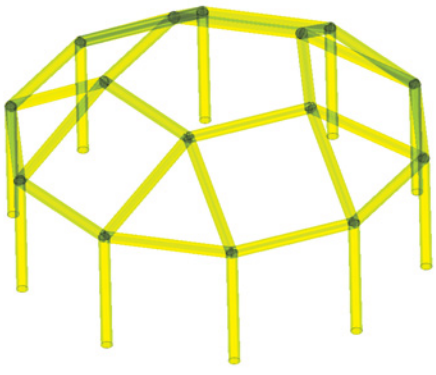


FIGURE 1: Truss/Frame Structure.

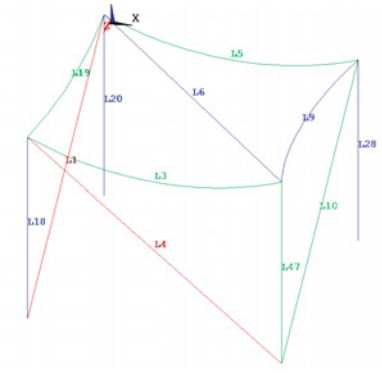


FIGURE 2: Truss created in SpaceClaim.

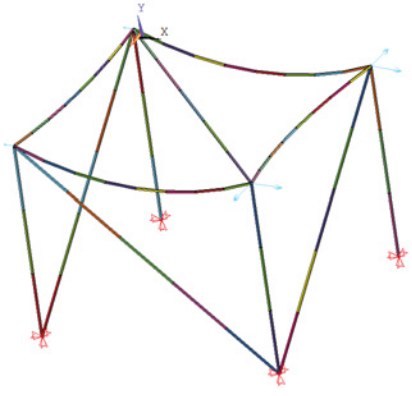


FIGURE 3: FEA model for truss structure.

Another reason why a CAD geometry model cannot be used "as is" for FEA: In many cases, the geometry of a model possesses certain symmetries, and it is advisable that when the element mesh is created, these properties are preserved. To accomplish that, it may be necessary that entities in the CAD model (volumes, surfaces or lines) be split into multiple segments. Now what happens if you skip the prepping and proceed to analyze a model cluttered with all kinds of little nooks and crannies? The consequences could range from prolonged runs to totally meaningless results, and everything else in between.

In what follows, the goal is to illustrate how CAD-based FEA is done utilizing the SpaceClaim/ANSYS combo as an example. The basic points made should have validity for any other software configuration, while the specific details would naturally differ from case to case, depending on the available tools.

Truss/Frame Structures

Trusses and frames are integral parts of many product and machine designs, yet when it comes to defining which one is which, it's not uncommon to encounter confusion. For both, their respective solid models look exactly the same—yet their responses to applied loadings are significantly different.

Let's start by stating that trusses and frames are simplified models (whether two- or three-dimensional) of "real-world" structures (see Figure 1) whose components are represented by curved or straight line elements. In a truss, the joints connecting the individual members provide for the transfer of forces across elements, but not moments of any kind. By contrast, in a frame, forces as well as moments are typically transferred from an element to its neighbor(s).

In developing a truss/frame model, the underlying assumption is that for each component, its thickness and width are much smaller than the member's length. The member's mechanical behavior is modeled quite accurately by a line, making it unnecessary to use two- or even three-dimensional representations, which require more effort to prepare and to solve. Naturally, there are situations where a line representation would not provide for a detailed enough analysis, in which case a surface model or a volume model is the only recourse.

Consider the structure depicted in Figure 2. One starts out by creating a 2D sketch, from which using the Pull tool a 3D solid is obtained. Next we select the four vertical edges along with the four horizontal edges on the top of the solid; activate the Prepare ribbon; select the desired profile; and create the beams. The profile may be either created from the CAD ge-

Is Direct Modeling At the Tipping Point of Universal Acceptance?

To the best of my knowledge, the arrival of SpaceClaim 2007 was first announced in this magazine on March 1, 2007. A few months later, another article appeared that introduced SpaceClaim 2007+ as "a new tool in a mature market that offers a fundamentally different way of working with geometry." After showcasing some of the features of the new software and contrasting them with those of history-based modelers, the article closed by stating: "If you're looking at your MCAD system and wondering if there's something else out there, I can tell you there is. Take a look—we might be seeing the next big thing."

Well, as far as yours truly is concerned, that was like preaching to the choir because I had already made the switch months earlier even after having been an enthusiastic user of a certain history-based modeler since it was launched in 1995. Why?

First, it was quite easy to learn the new software. (Full disclosure: At the time, an academic copy of SpaceClaim was made available to me free of charge. Also, I was allowed to call tech support as often as I wanted and ask for help.) Second, coming from the analysis end of things, I knew firsthand that in the case of a model generated by a history-based software, turning features on and off isn't always as benign as it might sound. Often enough things will blow up because of existing dependencies between retained and turned off features. The SpaceClaim folks did not make things up when they pointed out over and over that no such issues pertained to their software.

Did others follow in scores? It depends on your definition of a mass migration. In a recent interview with SpaceClaim's CEO, he asserted they were selling "thousands and thousands" but not "thousands of thousands" of seats. If SpaceClaim's "pure direct modeling" (to borrow an expression used by one of its founders in a recent interview) is the best thing since sliced bread, shouldn't there be a wider proliferation after five years on the market and counting? In a perfect world, governed solely by meritocracy, there should be. But then by the same token, outstanding software such as Cadkey, CADRA, Ashlar's Vellum, and who knows what else would be widely used members of today's MCAD scene. So in short, (and to no one's surprise) I do not have the answer why direct modeling has not taken the CAE world by storm. What I know for sure is that I have a ball using the software and hope to continue that for many years to come. *— D. Karamanlidis*

ometry by cutting a cross-section of the respective solid(s), or from the available library of shapes. If the default library shape is not satisfactory, it can be altered with a few clicks of the mouse.

One of SpaceClaim's strong points is that beams ("children") remain linked to the original solid ("parent")—that is, if the geometry of the solid changes, then that of the truss/frame will change as well. To create curved members, the solid is modified using the Bend tool. To create unequally long legs, the top plane of the solid is rotated with respect to one of the edges. Now how about diagonal braces? Because our 3D solid has no diagonal edges, one has to first create the respective center lines, and then place the beams.

Once the model is completed, it is exported to a neutral geometry file such as IGES, which can be read by ANSYS. To successfully complete the export, it is required that not just the beams (their centerlines to be more precise), but also the underlying solid(s) be transferred to the neutral file. In ANSYS, the imported geometry is automatically converted into basic building blocks, according to the hierarchy keypoints, lines, areas and volumes, listed in ascending order. In our case, areas and volumes are not needed and should therefore be deleted.

To check that the model is error-free, invoke the LGLUE and LOVLP commands, which generate new lines by "gluing" input lines and removing duplicate lines, respectively.

To model the structure as a truss, the three-dimensional LINK8 element may be used, for which the only two real constants are the cross-sectional area and the initial strain. Assuming a linear isotropic material, the two material constants to be

specified are the modulus of elasticity and the specific weight.

In creating the element mesh, the user has several options to control element sizes. For example, one may specify either the maximum element length or alternatively the number of segments each line is to be subdivided.

The final step prior to invoking the solver consists of specifying the pertinent boundary conditions along with the external loads (see Figure 3). If the above structure is to be modeled as a frame, it would be necessary to use a 3D beam element such as BEAM4 or BEAM44. In this case, not only are more real constants to be defined than just the cross-sectional area, it is also necessary to specify the beam section's orientation relative to the 3D space. By default, all joints are assumed to be moment-resistant—thus defining hinged connections is the user's responsibility.

Plate/shell structures

When analyzing a 3D part or assembly, the use of a plate/shell model is justified in cases where each component is built so that one of its dimensions (thickness) is much smaller than the other two. In the case of a plate, only bending is considered—whereas in a shell membrane action is also accounted for. Figure 4 depicts a simple shell structure that was created in SpaceClaim following the steps listed below:

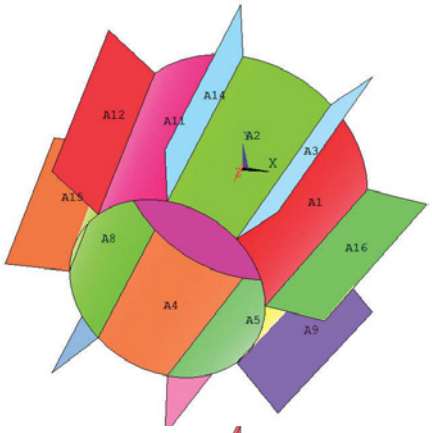


FIGURE 4: Geometry model for shell structure.

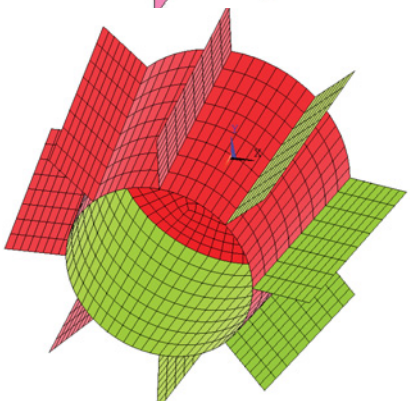


FIGURE 5: FEA model for shell structure.

1. Drew a circular sketch and pulled it to create a cylinder.
2. Added draft to create a cone.
3. Created a thin shell and removed the top face of the cone.
4. Inserted a plane passing through the axis of the solid, and using that as the sketch plane, drew the profile of the fin.
5. Used the Pull tool on both sides.
6. Used the Move tool to create a pattern of eight solids.

Prepping the created CAD geometry for FEA requires:

1. Extracting the midsurfaces of all solids making sure there are no gaps in the model.
2. Using the Combine tool to divide the conical surface into eight segments so that the circular symmetry of the model is preserved when the ANSYS mesh generator is invoked.

As in the previous example, when the geometry model is imported into ANSYS the aforementioned precautionary clean-up should be performed to ascertain that no overlapping lines and/or areas exist in the model. For the analysis in ANSYS, we use a flat shell element such as SHELL63—for which thickness (uniform or variable) is its only real constant. The element size may be controlled through the number of subdivisions of each line in the model, resulting in the mesh (see Figure 5).

To summarize, we have illustrated the steps to be taken to perform a CAD-based FEA. The transfer from CAD to FEA was done manually for two main reasons. First, APIs are typically tied to certain versions of the interlinked software, or else they won't work (e.g., SpaceClaim 2010 and ANSYS 10). Second, and more importantly, in the hands of an untrained analyst, an API may very well become the enabler of a garbage-in-garbage-out exercise. DE

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INFO ➜ **ANSYS:** ANSYS.com

➜ **Altair Engineering:** AltairHyperWorks.com

➜ **Autodesk:** USA.Autodesk.com

➜ **IronCAD LLC:** IronCAD.com

➜ **MSC Software:** MSCsoftware.com

➜ **NEi Software:** nenastran.com

➜ **PTC:** PTC.com

➜ **Siemens PLM Software:** Siemens.com/PLM

➜ **SIMULIA:** SIMULIA.com

➜ **SolidWorks:** SolidWorks.com

➜ **SpaceClaim Corp.:** SpaceClaim.com

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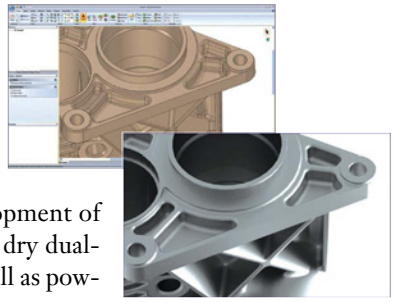
Vicura Drives Improved Simulation and Analysis with SpaceClaim



Founded in January 2011 and based in Sweden, Vicura has a long track record of complete virtual development of manual transmissions and dry dual-clutch transmissions, as well as powertrain integration in a large amount of front-wheel- and all-wheel-drive applications.

Martin Schagerlind is a Vicura simulation engineer. He and his team of 20 engineers are responsible for a range of complex simulation and analysis testing, including system, structure and fluid mechanics. Schagerlind performs simulation and analysis to ascertain the strength, stiffness, thermal and dynamic behaviors of all possible transmission assemblies and components, including housings, shafts, gears, synchronizers, clutches, and more. Designs created in CAD software are sent to Schagerlind for simulation and analysis.

Before importing the designs into a meshing program, the geometry has to be simplified—and this process was difficult and time-consuming. Schagerlind would have to send files back and forth to CAD experts, often taking days for each iteration. Schagerlind starting using SpaceClaim's 3D Direct Modeler more than a year ago, and found it to be a software solution that solved many of his simulation and analysis challenges. Today, when designers send him CAD models, he uses SpaceClaim to sort out what to include in the analysis—saving time and improving the simulation process.

For each design, Schagerlind starts by opening the CAD data in SpaceClaim. He uses SpaceClaim to remove features that would complicate the mesh, such as rounds, small holes, and geometry outside the region that needs to be analyzed. When performing CFD, SpaceClaim extracts volumes to be analyzed.

Once ready, Schagerlind sends a Parasolid file to SimLab or to HyperMesh to create a mesh and add couplings, contact information, and boundary conditions. Finally, he saves the mesh as an Abaqus input file, finishes the preprocessing and runs the simulation in Abaqus.

Once Schagerlind has results, he uses SpaceClaim to modify the geometry—for example, adding material, fillets and bolts until he is confident that the concept will address issues discovered in the simulation.

After he has optimized the design, Schagerlind sends the CAD team his version of the model, where they can reconcile the changes in the detailed model.

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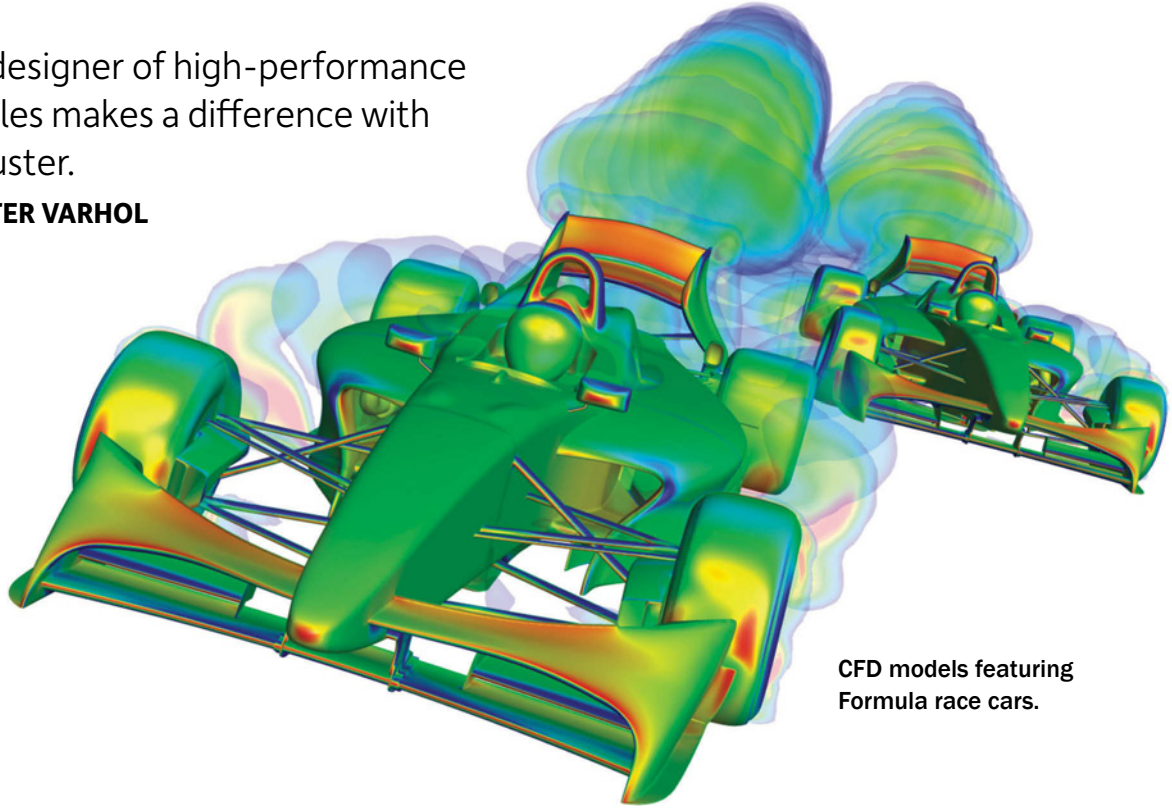
Swift Engineering Races Ahead with Cluster Computing

This designer of high-performance vehicles makes a difference with its cluster.

BY PETER VARHOL



CFD models featuring Formula race cars.

Swift Engineering is a multi-disciplined engineering and manufacturing company that specializes in the design, development and manufacturing of lightweight composite structures, components and vehicles. The company is notable for producing racing cars for a variety of open-wheel racing series, including Champ Car World Series, Formula Atlantic and Formula Nippon. It also designs and manufactures critical components for aircraft and unmanned aviation vehicle (UAV) systems.

Swift is especially well known for its exacting engineering and manufacturing of critical airflow components, including wings, spoilers and control surfaces. Swift's services include tooling and build-to-print composite manufacturing with materials such as carbon fiber, Kevlar and fiberglass.

"We started in the early 1980s, designing Formula 4 racing cars," said Dr. John F. Winkler, Swift's chief aerodynamicist. "In the mid-1990s, we decided to go for the big time, and began designing Formula 1. A decade later, we branched out into aviation, building new aircraft designs."

The company has always prided itself on its ability to take a project all the way through the design process. It is often presented with a concept on paper, and then takes that concept to design, analysis, testing, prototyping and actual production. The staff consists of an engineering group, administrative staff and a group of manufacturing specialists.

Swift Engineering used a pair of Cray CX1s (above) and a Cray CX1000 HPC system (left) to advance its simulations to the point where it no longer needed a dedicated wind tunnel.

Cluster Beginnings

Computing has always been an important part of Swift Engineering's design practices. In 2001, the company began using a 16-node cluster specifically for computational fluid dynamics (CFD) analysis. Two linked Linux Dell 960 workstations, with a total of eight cores and 32GB of memory, replaced this system in 2006—and increased computing power on the order of two-fold.

In conjunction with these computing resources, Swift used a dedicated wind tunnel in a building at its facility. Prospective designs were initially analyzed using CFD software, which provided some insight into their behaviors. More promising designs were prototyped in Swift's small fabrication facility, and tested in the wind tunnel. Based on the data collected in the wind tunnel experiments, the company designers went back to the design software and made changes to improve its characteristics.

Swift Engineering produced the prototype Eclipse 400 single-engine very light jet aircraft under contract to Eclipse Aviation. It also designed and built a UAV platform. This consisted of the aircraft itself, as well as the launch and recovery systems. On the Eclipse project, speed was paramount, and Swift Engineering was able to get from paper to flight at the Oshkosh Experimental Aircraft Association gathering in seven months. Both of these projects were done primarily using the Dell 960 systems.

Using the two-PC Linux configuration, Swift Engineering continued to turn up the dial on CFD, finite element analysis (FEA), and other types of simulations, reducing the number of physical prototypes produced. This relatively conventional iterative design process resulted in world-class racing and aerospace designs, but was both costly and time-consuming.

The need to fabricate prototypes and physically test them was a slow process, especially when there were several iterative prototypes. Physical prototypes provided a solid test bed for experimentation and evaluation, but could slow down a project.

Virtual Prototypes

With the steady improvement of CFD and other analysis software available, Swift Engineering decided that the time had come to make more of a commitment to computational analysis and simulation. The company believed that it could improve the quality of designs and time to market with better up-front computational work.

As a result of its success with the Eclipse project, it didn't take long for Swift Engineering to outgrow its Linux workstations. The increased use of simulation meant that it needed more computing horsepower. Fortunately, more powerful systems were in the process of becoming less expensive, and there were several different technologies that could fulfill their growing needs.

Swift quickly determined that the best way to get that additional computational power was through a cluster that offered a large number of processors and cores. According to Winkler, the firm knew what it was going after in a cluster solution. While such a configuration doesn't help with largely single-threaded design computational work, it is essential for performing CFD and other simulations.

Requirements for an Engineering Cluster

As Swift Engineering made the transition to its current high-performance computing (HPC) environment, it had several challenges to overcome. One of the most significant challenges, Winkler says, was manageability.

"An HPC solution had to be simple and require minimal management," he explains. "We're a small design and manufacturing firm, and we have no dedicated system or network administration staff." The company needed to be able to focus on its engineering work, rather than spend a large amount of time managing the cluster.

Performance was another important consideration. A high-performance cluster not only makes it possible to solve larger and more complex problems; it also makes possible solving the same problems in less time.

Today, Swift Engineering uses Altair's HyperWorks suite, Metacomp Technologies' CFD++ and Platform Computing cluster management software (Platform HPC) on its pair of Cray CX1s and Cray CX1000 HPC systems. The CX1s are entry-level systems set up as workstations, while

the CX1000 incorporates dual-socket Intel Xeon 5600s that provide 18 nodes with 144 cores—essentially eight cores per node. Each node has 24GB of memory, for a total of 432GB of memory.

"This system is quite small in terms of true supercomputers," Winkler admits. "But it was sized to solve 95% of our problems in-house." For the remaining problems, he adds, the company outsources to larger computing facilities.

One CX1 is configured as a visualization workstation, with 192GB of memory. The second CX1 has a bit more computational horsepower for FEA for structural analysis, such as crash simulation.

With Platform HPC and Cray's CX1000 compact computing cluster, Swift Engineering was up and running on the CX1000 and the CX1s within a week. Platform provides the level of manageability needed to allocate cluster resources with an ongoing jobs queue, and to keep systems online at a high level of reliability. Together, these systems enable the CFD simulations Swift Engineering needs to take a concept and a set of performance specifications, and move from concept to design to simulation—and from there into production, more quickly than ever.

Looking ahead

Swift Engineering hasn't entirely abandoned the use of a wind tunnel for testing designs, Winkler points out.

"We don't need a dedicated wind tunnel anymore," he continues. "But we will still use one on occasion, either to do a reality check on our simulations, or when we're finalizing a design. In those cases, we'll contract with a commercial wind tunnel to provide us the time to use."

But a dedicated wind tunnel was expensive to support and maintain, so Swift Engineering moved beyond that expense. The company will instead use the facilities for manufacturing using composites, which better meets the evolving needs of its customers, Winkler says. DE

Contributing Editor **Peter Varhol** *covers the HPC and IT beat for* DE. *His expertise is software development, math systems, and systems management. You can reach him at deeditors@deskeng.com.*

INFO ➜ **Altair:** AltairHyperWorks.com

➜ **Cray Inc.:** Cray.com

➜ **Intel:** Intel.com

➜ **Dell:** Dell.com

➜ **Metacomp Technologies:** MetacompTech.com

➜ **Platform Computing:** Platform.com

➜ **Swift Engineering:** SwiftEngineering.com

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Solid Performance at a Great Price

HP's updated entry-level CAD workstation delivers great value and solid performance.

BY DAVID COHN

The HP Z210 marks the entry-level point in the company's Z-series workstation line. Targeted at mainstream CAD users, prices start at $569—making it one of the most affordable independent software vendor (ISV)-certified systems.

The HPZ210 we received looked similar to its predecessor. The front panel has three exposed 5.25-in. drive bays. The topmost bay contains a tray-loading 16X SATA dual-layer SuperMulti LightScript DVD+/-RW optical drive, while the lower bay houses a 22-in-1 media card reader. These bays can be rotated 90° to convert from a mini-tower to a desktop configuration, and a Blu-ray Disc writer is an option.

Below these bays, vertical fins conceal the air intake and internal speaker while a power button, three USB ports, headphone and microphone jacks, and an IEEE 1394a FireWire connector occupy a narrow vertical panel down the right side. The other ports mentioned in the info box below are found on the rear panel.

INFO ➜ HP: hp.com

HP Workstation Z210

Price: $2,269 as tested ($645 base price)

System Requirements:

- **Size:** 7.0x17.9x17.6-in. (WxDxH) tower
- **Weight:** 27 lbs.
- **CPU:** Intel Xeon E3-1245 3.36GHz quad-core with 4MB L2 cache
- **Memory:** 8GB (32GB max) DDR3 1333MHz
- **Graphics:** NVIDIA Quadro 2000 w/1GB GDDR5
- **Hard Disk:** Samsung 1TB 7,200 rpm SATA
- **Optical:** 16X SATA dual-layer SuperMulti LightScribe DVD+/-RW
- **Audio:** high-definition integrated Realtek ALC262 audio
- **Network:** Integrated Intel 82578 Gigabit LAN
- **Drive bays:** three external 5.25-in. bays, three internal 3.5-in. bays
- **Ports (front):** three USB 2.0, one IEEE 1394a (FireWire), one microphone in, one headphone out
- **Ports (rear):** six USB 2.0, two USB 3.0, one audio out, one audio-in, one microphone in, two PS/2, one RJ-45 to integrated LAN, DVI-I, DisplayPort

Lots of Expansion Options

Removing the left-side panel on the tool-less chassis reveals a well-organized interior. Below the external drive bays are three 3.5-in. internal drive bays, one of which contained a Samsung 1TB 7,200 rpm SATA drive. Drives of up to 2TB are available, and HP also offers solid state drives ranging from 128 to 300GB.

CPU options for the Z210 range from a 2.6GHz Intel Pentium processor to various Core i3, i5 and i7 processors—and all the way to the 3.6GHz Intel Xeon E3-1290 processor. Our evaluation unit came with a 3.36GHz Intel Xeon E3-1245 quad-core CPU with an 8MB Smart Cache mounted in the single CPU socket. The processor supports HyperThreading and also includes Intel HD Graphics' P3000 integrated graphics.

Our system included 8GB of 1333MHz DDR3 ECC memory, installed as four 2GB dual in-line memory modules (DIMMs). But using two 4GB DIMMs would only add $40 to the overall cost, if you contemplate adding more memory in the future. The Z210 supports up to 32GB of RAM. Power was provided via a 400-watt, 90% efficient power supply.

The motherboard includes seven expansion slots: two PCIe2 x16 graphics slots, one PCIe2 x8 slot, two PCIe2 x1 slots, and two full-length PCI slots. One of the graphic slots was filled with an NVIDIA Quadro 2000 graphics accelerator with 1GB of dedicated GDDR5 memory.

The two PCIe2 x1 slots were also filled: one contained a FireWire IEEE 1394a card, and the other a USB 3.0 host controller with a pair of additional USB 3.0 ports. There are also five more internal USB ports available. Despite fans on the graphics card, CPU, power supply and rear panel, the Z210 was nearly silent.

A Price/Performance Leader

The Intel Xeon E3-1245 is a pretty fast quad-core processor, and the Quadro 2000 is one of NVIDIA's more powerful graphics accelerators, so we were prepared for some pretty good performance. The system turned in the best SPECviewperf performance we've recorded to date for a system equipped with a single CPU running at its standard processor speed.

We also repeated the SPECviewperf test using just the integrated Intel graphics. While the Intel HD P3000 graphics

Engineering Workstations Compared

		HP Z210 workstation (one 3.36GHz Intel Xeon E3-1245 quad-core CPU [3.7GHz turbo], NVIDIA Quadro 2000, 8GB RAM)		**BOXX 3DBOXX 3970 EXTREME** workstation (one 3.4GHz Intel Core i7-2600K quad-core CPU over-clocked to 4.5GHz, NVIDIA Quadro 4000, 8GB RAM)		**Dell Precision T1600** workstation (one 3.4GHz Intel Xeon E3-1270 quad-core CPU, NVIDIA Quadro 2000, 4GB RAM)		**@Xi Computer MTower** workstation (one 3.4GHz Intel Core i7 2600K quad-core CPU over-clocked to 4.1GHz, NVIDIA Quadro 5000, 16GB RAM)		**Digital Storm PROTUS 226060** workstation (one 3.33GHz Intel i7-X980 six-core CPU, NVIDIA Quadro FX 3800, 12GB RAM)		**BOXX 3DBOXX 8550XTREME** workstation (two 3.33GHz Intel Xeon X5680 six-core CPUs over-clocked to 4.2GHz, NVIDIA Quadro 5000, 24GB RAM)		**Dell T5500** workstation (two 3.33GHz Intel Xeon X5680 six-core CPUs, NVIDIA Quadro 5000, 6GB RAM)	
Price as tested		$2,269		$4,048		$1,875		$4,465		$6,545		$11,396		$9,242	
Date tested		2/12/12		10/12/11		9/11/11		4/30/11		12/13/10		3/20/11		1/14/11	
Operating System		Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit
SPECviewperf	higher								n/a						
3dsmax-04		80.67	79.46	n/a	99.03[1]	83.61	81.72	n/a	89.36	88.15	87.07	95.97	95.44[1]	76.05	78.72
catia-02		94.20	91.47	n/a	124.75[1]	96.38	93.28	n/a	121.7[1]	75.35	84.85	120.44	121.1[1]	98.48	100.25
ensight-03		75.78	73.57	n/a	109.56[1]	76.62	74.16	n/a	131.19[1]	62.22	58.33	132.41	130.13[1]	118.29	121.70
maya-02		291.17	270.83	n/a	399.43[1]	297.27	270.53	n/a	465.88	174.45	218.33	529.89	476.95[1]	490.95	435.44
proe-04		88.48	84.83	n/a	120.33[1]	89.24	85.86	n/a	128.25	83.16	77.29	113.84	113.24	92.19	90.61
SW-01		168.06	161.45	n/a	231.44[1]	169.31	160.61[1]	n/a	239.78	174.74	157.70	221.31	214.06	180.49	169.75
tcvis-01		56.41	54.43	n/a	79.05[1]	56.76	54.24	n/a	97.45	40.16	37.36	98.58	94.17	93.99	90.34
ugnx-01		43.41	42.49	n/a	65.91[1]	43.40	42.47	n/a	88.87[1]	37.46	35.49	89.32	86.90	89.31	87.95
SPECapc SolidWorks	lower														
Score	seconds	110.91	n/a	n/a	n/a	106.63[1]	n/a	n/a	n/a	106.51[1]	n/a	106.56[1]	n/a	146.86	n/a
Graphics	seconds	35.71	n/a	n/a	n/a	34.24[1]	n/a	n/a	n/a	32.17[1]	n/a	35.33[1]	n/a	58.42	n/a
CPU	seconds	25.89	n/a	n/a	26.44[1]	25.05[1]	n/a	n/a	27.48[1]	26.87[1]	n/a	25.99[1]	n/a	32.27	n/a
I/O	seconds	50.74	n/a	n/a	47.01[1]	48.26[1]	n/a	n/a	49.48[1]	47.99[1]	n/a	46.51[1]	n/a	60.76	n/a
SPECapc SolidWorks	higher														
Score	ratio	7.92	n/a	n/a	n/a	8.04[1]	n/a	n/a	n/a	8.04[1]	n/a	8.23[1]	n/a	5.32	n/a
Graphics	ratio	5.78	n/a	n/a	n/a	5.74[1]	n/a	n/a	n/a	6.07[1]	n/a	6.08[1]	n/a	3.23	n/a
CPU	ratio	12.46	n/a	n/a	12.20[1]	12.88[1]	n/a	n/a	11.74[1]	12.01[1]	n/a	12.61[1]	n/a	10.00	n/a
I/O	ratio	6.24	n/a	n/a	6.73[1]	6.56[1]	n/a	n/a	6.40[1]	6.60[1]	n/a	6.81[1]	n/a	5.21	n/a
Autodesk Render Test	lower														
Time	seconds	71.66[1]	62.33[1]	n/a	45.6[1]	82.2[1]	60.5[1]	n/a	49.8[1]	53.5[1]	46.3[1]	34.0[1]	19.0[1]	42.0[1]	28.0[1]

Numbers in blue indicate best recorded results. Numbers in red indicate worst recorded results. 1=Hyper-threading enabled.

alone is certainly capable of running most CAD applications, its performance was, on average, 77% slower than that of the NVIDIA graphics accelerator.

On the SPECapc SolidWorks benchmark, which is more of a real-world test (and breaks out graphics, CPU and I/O performance separately from the overall score), the results for the Z210 equipped with the Quadro 2000 were also excellent.

The AutoCAD rendering test results also ranked among the fastest we've recorded for a system with a non-over-clocked CPU. Because AutoCAD's Mental Ray rendering engine is multi-threaded, this test shows the benefits of multiple cores: The Z210 averaged 62 seconds to complete the rendering test.

The Z210 starts at $659, but that gets you just 2GB of memory, a smaller hard drive, and integrated Intel HD Graphics 2000. The small form factor (SFF) version starts even lower, at just $569, but its expansion options are a bit more limited.

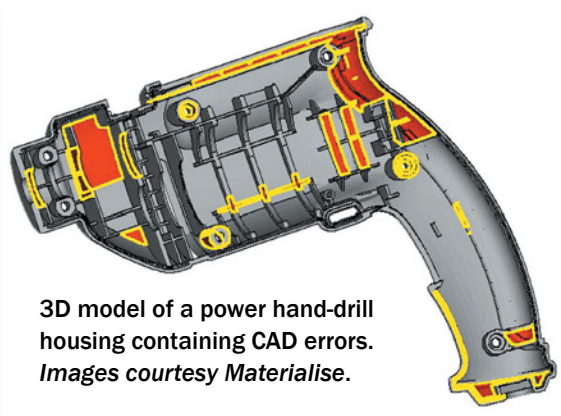
While adding options can certainly boost the price considerably, even as tested our HP Z210 evaluation unit cost just $2,836. To sweeten the deal, HP is currently offering a 20% discount, bringing the price down to $2,269. DE

David Cohn *is the technical publishing manager at 4D Technologies. He also does consulting and technical writing from Bellingham, WA, and has been benchmarking PCs since 1984. He's a contributing editor to* Desktop Engineering *and the author of more than a dozen books. Contact him via email at david@dscohn.com or visit DScohn.com.*

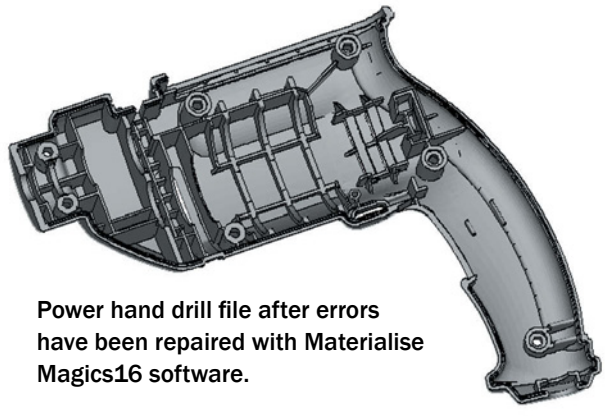
Preparing 3D Models

Repair and optimize files to really get what you want.

BY PAMELA J. WATERMAN



3D model of a power hand-drill housing containing CAD errors. *Images courtesy Materialise.*



Power hand drill file after errors have been repaired with Materialise Magics16 software.

Part of the process of learning a new computer language involves the steps where a) the program crashes or b) it does exactly what you told it to do, but not what you *wanted* it to do. The same holds true for any 3D CAD file you create as the "program" to drive a 3D-printing/additive manufacturing (AM) system. If the information supplied in the original file isn't the best it can be, the AM equipment will either reject the STL version of the part entirely, or build something that's exactly what you defined—but definitely not what you wanted.

How can you improve the chances of getting parts just right, or even better than expected? Go beyond the tools and wizards in your CAD software package, and check out the range of specialized software that helps you prepare 3D models for optimum production.

Starting with STL Files

With virtually every CAD design package, you can save the native file of a 3D model in the STL format, the current standard for AM. The software does so by "wrapping" a triangulated mesh surface around the solid CAD model. However, each software package does it a little bit differently.

For example, one source of variation is the maximum separation of any triangle surface from the true part surface. (For a description of this conversion, see "The Making of an STL File" on page 42.) Other problems with the conversion come because the original file may have surfaces that overlap (indeterminate edges) or don't quite meet (sliver gaps). Or, the data may have originally come from an imported 3D scan with noisy, inaccurate data.

To ensure that the AM system is working from a high-quality STL file, you may have to perform the following intermediary tasks, either manually or automatically:

- Close gaps and holes, which can be tricky on organic surfaces.
- Edit geometry, and verify that normal vectors point outward.
- Smooth surfaces, and avoid "ugly" surfaces.
- Cut/trim/extract features. This is a must for fitting into and working with certain AM machines.
- Reduce triangle count, as unnecessarily large files require long build times.

Beyond these steps, advanced users and service bureau providers may want to modify design elements to improve durability, modify the file for optimized material cost and weight, and set up batch production.

Fortunately, several companies have tackled various angles of these tasks. Materialise is a longtime player in this field, having started out as a one-machine rapid prototyping service bureau in 1990 and releasing the first version of Magics rapid prototyping software for the professional user in 1992; it is now marketing Magics 16.

netfabb and Within Lab offer more recent software solutions with a range of capabilities in this field, while some features of Geomagic software can also be relevant for file preparation. In addition, new web-based packages and printing services offer basic advice and online repair tools oriented to the growing direct-consumer market.

Repair Work Almost Like Magic

Materialise is a Belgian/US company that plays an outstanding role in many aspects of the international AM industry, addressing challenges in the medical, dental and technical fields. With hundreds of software developers on staff, it has deep experience in preparing and improving 3D files for any type of AM production.

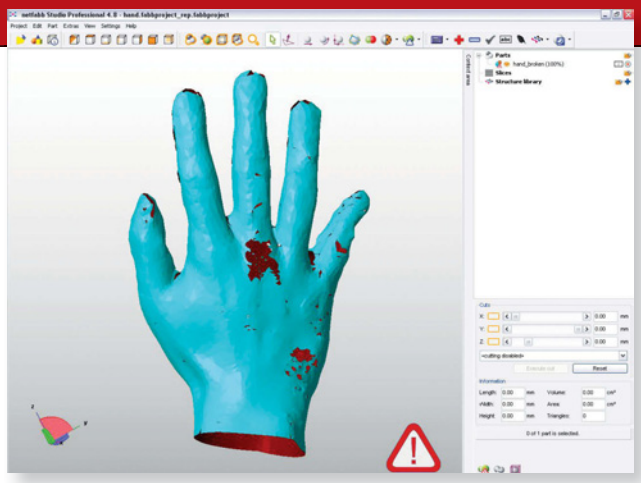
Magics 16 is targeted to the professional immersed in rapid prototyping and manufacturing (RP&M). The software is designed to streamline, automate and boost almost every step of the process—from file import to file repair, editing and enhancement, to setting up the actual build platform. The standard package supports importing dozens of neutral design file formats, including Google Sketchup 8.0 and the new AMF format (see "AMF: Replacing STL for 3D Files?" below), while add-ons let you choose direct support for CAD-oriented formats such as SolidWorks, CATIA, IGES, ACIS and STEP.

The power of Magics has been impressive from the beginning, helping users do in minutes what might have taken hours in a CAD package. For example, Brad Palumbo, senior manufacturing engineer at Phoenix Analysis & Design Technologies (PADT), has been using Magics for almost three years. He says that the software is invaluable in saving time for setting up optimized support structures for SLA part production. Palumbo also notes that it is easier to fix files and cut parts so they will fit into a particular machine's build volume.

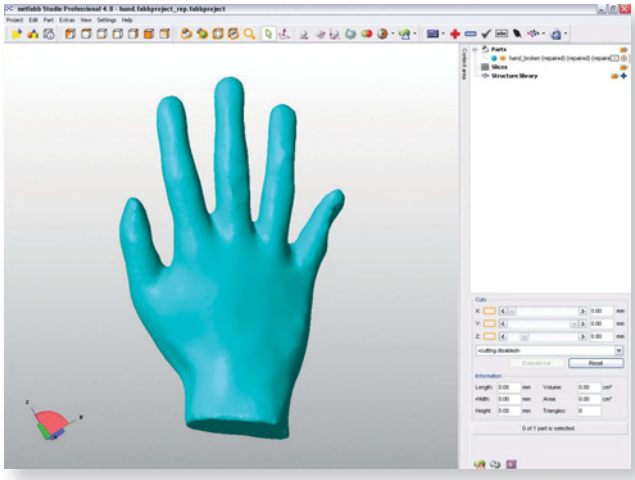
File Prep Options for a Wider Audience

netfabb is the software division of FIT GmbH, an AM service bureau in Germany that works with laser sintering, electron beam melting and 3D printing technologies in both metal and plastic. The parent company started to develop file preparation and enhancement software in the early 2000s, both to simplify manufacturing set-up and to create internal cell structures that optimize part weight, cost and build times. netfabb formed in 2009 to expand these capabilities into netfabb Studio products.

Intended for use across an entire business organization, netfabb Studio comes in two levels, and is complemented by several premium tools for high-end applications. At the core is netfabb Studio Professional, which the company describes as an affordable way for multiple users to take advantage of a professional file-fixing tool. netfabb Studio Basic is free software that provides basic file repair capabilities (see more below) and lets non-experts in the business become literate in 3D printing. Both versions are available for Windows, Mac and Linux, and are supported in an unusual way with extensive Wikipedia entries. netfabb sees its software as a particularly good fit for companies whose AM builds do not require support generation (a feature that is not yet in Studio Professional).



Original 3D CAD file of a scanned hand.



Scanned hand 3D CAD file repaired using netfabb Studio 4.8 3D-file repair and enhancement software. *Images courtesy netfabb.*

netfabb Studio offers auto-repair, part editing, retriangulation, file reduction, Boolean operations and mesh refinement; a handy feature is that calculations can be paused, resumed and canceled. New features in v4.8 include polygon cut, advanced part selection, multiple part export and reduced memory consumption.

One US reseller, Will Shambley of Viridis3D, notes that the software is great if you need to add material, create an input channel for a casting application or pack dozens of files in one run.

netfabb Premium Tools include 3S (Selective Space Structures), Engines and Cloud Solutions. The 3S product lets users develop amazingly complex cell structures (or use a standard

AMF: Replacing STL for 3D Files?

For all the amazing work that has been produced with design files in the STL format, there's room for improvement. A basic issue is that this de-facto standard format only describes surface mesh geometry and has no way to include any information about materials. Ditto for color, texture, labeling, build orientation and more.

Enter additive manufacturing file (AMF), an XML-based open standard interchange format proposed as the replacement for STL, initially released by ASTM International Subcommittee F42.04, May 2, 2011, as ASTM F2915-11. As of December 2011, several companies have announced AMF support, including Materialise, netfabb and Sculpteo. Wikipedia has an extensive write-up on the topic (en.wikipedia.org/wiki/Additive_Manufacturing_File_Format) that is well-worth reading.

The Making of an STL File

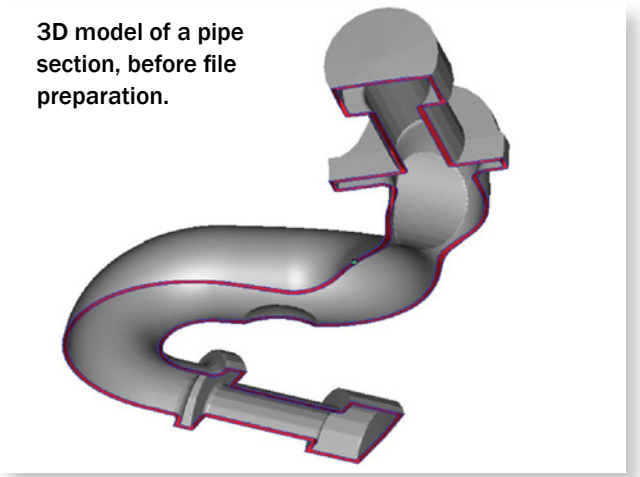
Stereolithography.Com was the first online supplier of stereolithography services, developing a user interface that allowed remote file uploads, quotes, support and production. Based in Atlanta, the company has fulfillment partners around the country for fast part production and shipment, and has been using 3D Systems stereolithography machines since 1994. Here is the company's perspective on STL file creation, adapted from its website, Stereolithography.com.

"Generating STL files is usually a fairly simple process. Virtually all modern CAD systems now include STL output as a standard feature and, for the most part, the files created are suitable for rapid prototyping. But the extra step of converting CAD models into STL format still presents a barrier to rapid prototyping novices or occasional users. Imagine how annoying it would be if you had to select parameters and convert word-processing documents or spreadsheets into a special file format before you could print them.

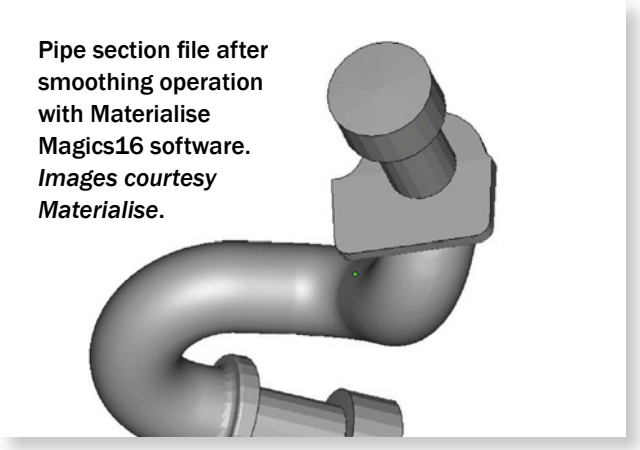
"Making STL files is further complicated by the fact that every CAD system uses different terms and parameters for defining the STL file's resolution, requiring users to interpret such mystifying terms as chord height, absolute facet deviation, angle control, and adjacency tolerance. Such terms are needlessly confusing. The STL file format is simple. It's not necessary to understand precisely what all the CAD system parameters mean in order to create useful files.

"An STL file is simply a mesh of triangles wrapped around a CAD model. CAD system settings specify how closely the STL mesh conforms to the actual surface geometry of a part. A mesh with triangles that are too large will create a small STL file, but the prototype made from it will have visible facets. A mesh with triangles approximately the size of the layers used by the rapid prototyping systems (typically about 0.003 inches or 0.075 mm) will produce a prototype with the best fidelity. A mesh with even smaller triangles will increase the size of the STL file and take longer to process, but it won't increase prototype accuracy or resolution.

"If you're using a standard solid-modeling CAD system, the automated STL save function should produce a good file. If you're using a surface modeler or lesser-known CAD package, we'd suggest discussing file preparation with your service provider or in-house prototyping shop. Surface-modeling CAD systems describe part geometry using mathematical patches with no thickness. In order to create good STL files, all of these surfaces must be joined so that there are no gaps or overlaps. This stitching or sewing, as it is frequently called, can be a tedious process, and it's easy to miss small flaws that can crash a rapid prototyping system."



3D model of a pipe section, before file preparation.



Pipe section file after smoothing operation with Materialise Magics16 software. *Images courtesy Materialise*.

library) that are particularly helpful with metal work for both medical and industrial applications. netfabb Engines offers user-oriented interfaces for machine-specific build files, and Cloud Solutions offers a portfolio of server- and subscription-based functions that help users handle the business side of AM service.

A third, niche, player in the file-prep field is Within Lab, a UK company that recently started marketing four versions of its previously internal product Within Enhance. This software is focused on helping you create internal lattice structures and variable-density surface skins for optimized AM part production. Everything from surgical finger implants and hip replacement cups to engine blocks and heat exchangers are candidates for improvement with customized internal structures.

At the core of the Within technology (no pun intended) is an optimization engine that uses such input parameters as desired weight, maximum displacement and stiffness, and creates a lattice structure that satisfies these requirements. Within Enhance is the top-of-the-line product; Within Lite, Variable and Analyse offer subsets of the full capabilities at different price points.

Geomagic, whose family of software creates digital models of scanned physical objects, offers some STL editing tools within its Geomagic Wrap software. This package creates and edits 3D polygon meshes, providing "cleaner" files for manipulation, but is not sold just for file repair.

Helping Consumers Print Their Models

netfabb Studio Basic, the free version of netfabb Studio, brings STL file preparation to the consumer and educational user. It provides basic display, mesh-edit, repair and part-placement capabilities in a package that uses just a few megabytes. A fun, free extra is the company's netfabb Mobile software, a viewing app for the iPhone, iPod Touch and Android, for sharing STL files any time, anywhere.

In 2010, Shapeways, the online 3D printing company based in New York City, introduced its Mesh Medic Service powered by the netfabb Cloud Solutions installed on Shapeways servers. All files uploaded to Shapeways are examined and "health checked." If needed, the netfabb Cloud Solutions software system enables Mesh Medic to repair holes, correct inverted normals, repair manifolds and generally fix the files for proper manufacturing. This process catches 95% of all problems, saving time for producing the more than 20,000 uploads received per month.

Sculpteo, another entry in the growing field of online 3D printing services, helps consumers submit standard design files, not STLs. Its website does a nice job offering tips on making the 3D model file as print-ready as possible. A tutorial also explains how to document colors and textures as an additional file. The suggestion is to use OBJ files for the model, its accompanying MLT file that contains color-indexing and texture data, and the texture file itself (JPG, PNG, GIF, etc.)

Recently partnered with Dassault Systèmes, Sculpteo has also begun offering a 3D Printing Cloud Engine that gives companies embeddable tools to develop and market their own 3D printed parts. Sculpteo will concentrate on providing support for all facets of such businesses, including an algorithm for design repairs. DE

Contributing Editor **Pamela Waterman**, DE's *simulation expert, is an electrical engineer and freelance technical writer based in Arizona. You can send her e-mail to de-editors@deskeng.com.*

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Editor's Picks

by Anthony J. Lockwood

Each week, Tony Lockwood combs through dozens of new products to bring you the ones he thinks will help you do your job better, smarter and faster. Here are Lockwood's most recent musings about the products that have really grabbed his attention.

Integrated Cluster Optimized for Life Science Research

Microway's SimCluster optimized for simulating large models. Benchmarking offered.

Microway has announced SimCluster, which it describes as an off-the-shelf, integrated cluster designed for life science researchers. SimCluster is said to be fully optimized for simulating large models and achieving higher accuracy. It comes with NVIDIA Tesla M2090 GPUs and Intel Xeon 5600 series CPUs connected by InfiniBand, Linux or Windows, NVIDIA Tesla Bio Workbench applications, the NVIDIA CUDA parallel programming environment, and cluster management tools.

What I like about Microway's SimCluster announcement is they offer a "try before you buy" program. Your participation in it is a no-brainer that you can handle from your desk.

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3D Metrology Solutions Enhanced

InnovMetric unveils relational inspection architecture and reverse engineering capabilities.

InnovMetric Software came out with version 12-dot-something of its PolyWorks 3D metrology, 3D inspection, and reverse engineering platform. This software is built on a new relational inspection architecture. What does "relational inspection architecture" mean? Well, first, it means that PolyWorks/Inspector v12 analyzes each step in your part measurement workflow. From this analysis, it creates a logic-based representation of design intent, using objects, parameters, and relationships between objects to do so.

It also means that you can modify the recorded parameters and object relationships knowing that PolyWorks will update in real time.

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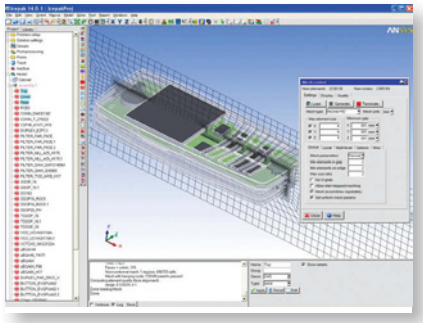

ANSYS 14.0 Automates Time-Intensive Operations

Automatically create meshes prior to setting up fluid dynamics simulations.

ANSYS has introduced version 14.0 of its range of engineering simulation solutions. As with recent releases of ANSYS, 14.0 has a ton of stuff going on in every capability area. That means choosing one or a handful of new functionalities does not do the depth of ANSYS 14.0 justice, but that's not going to deter me from mentioning a couple of cool things.

A theme throughout ANSYS 14.0 is enabling engineers to innovate. On its website, ANSYS outlines what it's doing this way: Amplifying engineering, simulating complex systems, and driving innovation with HPC (high-performance computing). That boils down to ease of use and increased productivity.

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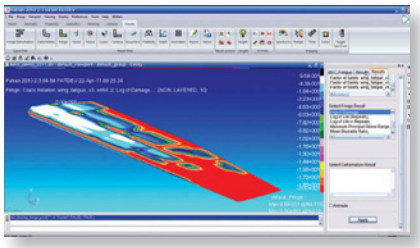

Patran and MSC Fatigue Updated

New releases help engineers model and simulate nonlinear and failure events.

MSC Software has announced the 2012 version of its Patran pre-/post-processing system as well as the 2012 edition of its durability/damage tolerance solver, MSC Fatigue. Any upgrade to Patran is, of course, news since it's probably the most widely deployed FEA pre-/post-processor. Both solutions offer several new tools worthy of your attention. Let's start with Patran.

Patran 2012 offers a slew of new tools, upgrades, and enhancements, some of which you knew were coming. For example, it now supports many new 1D, 2D, and 3D element formulations recently implemented in MSC Nastran and Marc.

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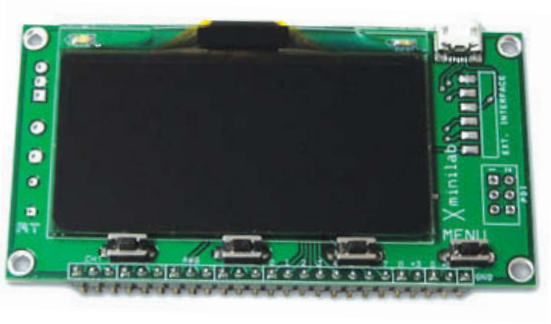
SPOTLIGHT

Directing your search to the companies that have what you need.

Tools of the Month

Electronic Test & Measurement Products

1



2

1 Agilent Releases 1GHz Oscilloscopes

Agilent Technologies (agilent.com) has added four 1GHz models to its line of InfiniiVision 3000 X-Series oscilloscopes. According to the company, these new oscilloscopes address the growing need for higher-bandwidth bench scopes with lower costs. With these new models, Agilent also announced a new 1GHz active probe. The N2795A probe is designed to match the performance needs of the 3000 X-Series oscilloscopes, at a price comparable to equivalent-bandwidth passive probes—without the impedance trade-offs of a passive approach. In addition, both the 2000 and 3000 X-Series now offer the option to add a three-digit voltmeter (DVM) and five-digit counter that operate through the same probes as the oscilloscope channels.

RIO Embedded Devices Have Multifunction I/Os

National Instruments (ni.com) has announced four new NI Single-Board RIO board-level embedded devices featuring a real-time processor, Spartan-6 field-programmable gate array (FPGA), analog and digital I/O and more built-in peripherals for custom embedded control and monitoring applications. The new devices provide engineers with off-the-shelf FPGA and real-time processor technology through NI LabVIEW while maintaining the custom I/O often required for high-volume deployments through the option of a RIO Mezzanine Card connector. The connec-

tor provides direct access to FPGA digital input/output (DIO) lines and certain processor-specific functions for mating custom daughter cards. NI Single-Board RIO alleviates the effort of designing an entire system from scratch so designers can focus on the custom parts of their applications, such as the I/O.

2 Combining Oscilloscope, Waveform Generator, and Protocol Sniffer

Saelig (saelig.com) is offering Xminilab, which combines a mixed signal oscilloscope, an arbitrary waveform generator, and a protocol sniffer. Measuring 3.3 x 1.75 in., it can be mounted directly on a breadboard or PCB for in situ testing and verification. A graphic 2.4-in. 128x64 pixel OLED is mounted on the board, displaying the monitored signals with automatic measurements, adjustable persistence, cursors, and grids. As a mixed signal oscilloscope, the unit offers simultaneous 2MSa/s sampling of 2 analog signals (d.c. to 200kHz) as well as 8 digital lines.

Omega Releases New Web-Enabled Thermocouple Input Module

Omega (omega.com) has introduced its OM-WEB-TC series of thermocouple measurement devices with built-in Web servers. The embedded Web interface provides viewing access to thermocouple data and configuration settings using a standard web browser. This product features eight thermocouple input channels and supports thermocouple types J, K, T, E, N, R, S, and B. The OM-WEB-TC has built-in cold junction compensation and open thermocouple detection, a 24-bit measurement system, and eight digital I/O-user configurable channels for alarms. Free configuration and logging software is included. The units can be used for remote monitoring of temperature data in any type of manufacturing or R&D facility.

3 Fluke 430 Series II Three Phase Power Analyzers Now Available

Fluke (fluke.com) has released its 430 Series II Three Phase Power Analyzers, which use a patented algorithm to measure energy wasted by power quality issues and quantify its cost. By providing the return-on-investment data needed to justify power quality improvements, the 430 Series II helps facilities reduce electrical power consumption and improve the performance and lifespan of electro-mechanical equipment. Features include energy monetization, which calculates the fiscal cost of energy waste due to poor power quality; PowerWave data capture to determine fast RMS values to show how the voltage, current and frequency values are interacting; power inverter efficiency; frontline troubleshooting; predictive maintenance; long-term analysis; and load studies.

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HP Z1 Workstation

Form Factor

1 HP recently introduced what it calls the world's first 27-in. all-in-one workstation, which starts at $1,899. The all-in-one form factor takes up less room than a traditional tower. HP packs a 27-in. white LED diagonal display with a 178° viewing angle, front-facing dual cone speakers, and a high-definition web cam into the front of the workstation.

Tool-less Chassis

2 Engineers might be right to wonder about how they would upgrade and maintain an all-in-one. HP's engineers designed the chassis to snap open, allowing users to add hard drives, upgrade memory or access the graphics card.

Processing Power

3 The HP Z1 supports quad-core Intel Xeon processors, NVIDIA Quadro graphics and ECC memory for faster renders. It also includes HP Performance Advisor and HP Remote Graphics Software.

Custom Options

4 Users can choose from a variety of storage types, including SSD options, RAID configurations and a media card reader. The Z1 can be configured with different USB 3.0 options and a choice of optical drives.

➜ DO YOU HAVE A COOL TOOL? *Desktop Engineering* editors are always on the hunt for great tools to share with our readers. Send us your ideas at de-editors@deskeng.com.

TECH SPECS

- Operating systems: Windows 7 (32- or 64-bit), HP Linux Installer Kit, SUSE Linux Enterprise Desktop 11, Red Hat Linux Desktop/Workstation (1 year license, not preloaded)
- Processors: Intel Core i3-2120, Intel Xeon E3-1245 or Intel Xeon E3-1280; Intel C206 Chipset.
- Memory: Four slots with up to 32GB DDR3 ECC/8GB DDR3 nECC, 1600MHz
- Storage: SATA 7200 3.5-in. drives (250, 500 GB, 1, 2TB); SATA 10K 2.5-in. Drives (300, 600GB) SATA Solid State Drives (160, 300GB)
- Optical storage: DVD +/- RW Super-Multi Slot-Load or Blu-ray Writer Slot-Load
- Expansion: Up to two internal 2.5-in. HDDs, up to one internal 3.5-in. HDD; 4 slots (1 PCIe x16 full, 3 miniPCIe)
- Graphics: Integrated Intel HD Graphics 2000 or P3000; NVIDIA Q500M, NVIDIA Q1000M, NVIDIA Q3000M, or NVIDIA Q4000M
- Network: Intel Gb LAN, 802.11a/b/g/n Wireless LAN, Bluetooth 2.1, 2.1+EDR, 3.0 and 3.0+HS
- Ports: Two USB 3.0, one IEEE 1394a, Mic, Headphone, 6-in-1 Media Card Reader (side); four USB 2.0, RJ-45 Gb-LAN, Line-in, Line-out, Display Port In/Out, SPDIF, Subwoofer (rear) 5 USB 2.0 (internal)
- Display: 27-in., 2560x1440 pixel, diagonal LED-backlit IPS2 display; supports up to one external display via display port
- Price: Starting at $1,899 in the U.S.

For more information, visit hp.com/z1

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