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May 2010 • Vol. 15, Issue 9 • $9.00

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Speed Enables Pushing the Boundaries of Design

STEVE ROBBINS
steverobbins@deskeng.com

The big deal in design engineering over the past few years has been speed. Everyone is talking about it. Rendering and designing large complex models is blazingly fast on new workstations. Simulations are taking minutes instead of hours. Intel and AMD are in a race to add even more cores to their microprocessors to trim time from calculations and do more in narrower windows. During a recent conversation, an Intel executive touted a 10X speed increase over existing technology in the next two and a half years.

I keep asking myself, "how are software vendors going to keep up?" Toolsets for multicore programming are becoming more functional. Microsoft's Visual Studio 2010 combined with Intel Parallel Studio, helps software developers to take advantage of multicore processing. All of this means better tools for design engineering teams. Still, blazing speed doesn't improve functionality.

I use Microsoft Word in my profession. It is as instrumental to me as your CAD platform is to you. Word has evolved over 27 years and is a great word processor. I've been using it since 1988. Yet, in the version I currently use, I still can't figure out how to stop the annoying help window from appearing every time I start the program. Even worse, some changes occurred during the last upgrade of our network. This change has blocked my ability to add tools to my toolbar. Even my network administrator, a genius in my opinion, can't find the solution. I've even tried the help function!

> There's that speed thing again. We just can't get away from it.

I recently attended the launch of AutoCAD 2011. I was impressed with the effort Autodesk is making to add user requested features and to integrate functionally across all AutoCAD platforms. While learning CAD isn't rocket science, rocket scientists use it, and at the beginning

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most of them had to learn CAD. Autodesk has created a consistent user interface across all platforms to smooth the transition between different versions of Autodesk products. A designer could start with AutoCAD LT, move to AutoCAD Mechanical, and ultimately end up using Autodesk Inventor without having to relearn menus and functions for each program.

Autodesk has also added new design tools including point cloud support, new surface modeling tools, inferred constraints and hatch command enhancements, as well as transparency for objects, multifunctional polyline grips that make editing polylines faster and easier, and the ability to select or create similar objects that use the properties of existing objects.

Inventor 2011 has included some new features that make simulation more accessible and faster for designers. Digital prototyping is enhanced with a visualization tool that renders amazingly fast. Inventor iLogic is now fully integrated, simplifying rules-based design.

Still, according to Autodesk, because of simplification and enhancements to the user interface and functionality, AutoCAD and Inventor have cut the time it takes to complete common design tasks by as much as 40%. There's that speed thing again. We just can't get away from it, faster is better. And that's the beauty of design software for engineers.

Software developers will always find a way to use all that computing power and speed to amaze us, creating functionality that continues to push the boundaries of the designs you create. ■

***Steve Robbins** is the CEO of Level 5 Communications and executive editor of DE. Send comments about this subject to DE-Editors@deskeng.com.*

ADVERTISING, BUSINESS, AND EDITORIAL OFFICES

Desktop Engineering® Magazine
Level 5 Communications, Inc.
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E-mail: DE-Editors@deskeng.com
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Desktop Engineering® Magazine
PO Box 677 • Northbrook, IL 60065
847-559-7581 • Fax 847-564-9453
E-mail: den@omeda.com

Desktop Engineering® (ISSN 1085-0422) is published monthly by Level 5 Communications, Inc., 1283D Main Street, P.O. Box 1039, Dublin, NH 03444, 603-563-1631. Periodicals postage paid at Dublin, NH, and at additional mailing offices. *Desktop Engineering*® is distributed free to qualified U.S. subscribers. Subscription rates for non-qualified: U.S. $108 one year; Canada and Mexico $126 one year; all other countries $195 one year. LIST RENTALS: For information on list rentals, contact Statlistics, Danbury, CT: 203-778-8700.

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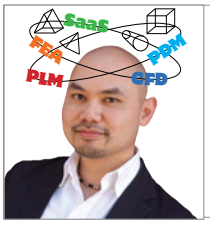
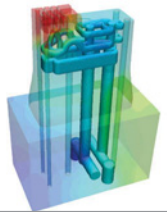
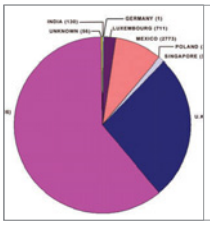
"The most overlooked advantage to owning a computer is that if they foul up there's no law against wacking them around a little."

> Joe Martin

COVER STORY







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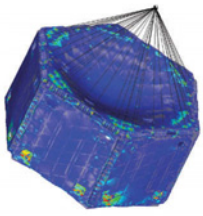

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ON THE COVER >

This automobile suspension assembly was printed on a Z Corporation ZPrinter 650. The Z Corp process creates the model one layer at a time via thin layers of powder solidified with binder and colored via various inks. Read about the latest in rapid technology developments beginning on page 57.

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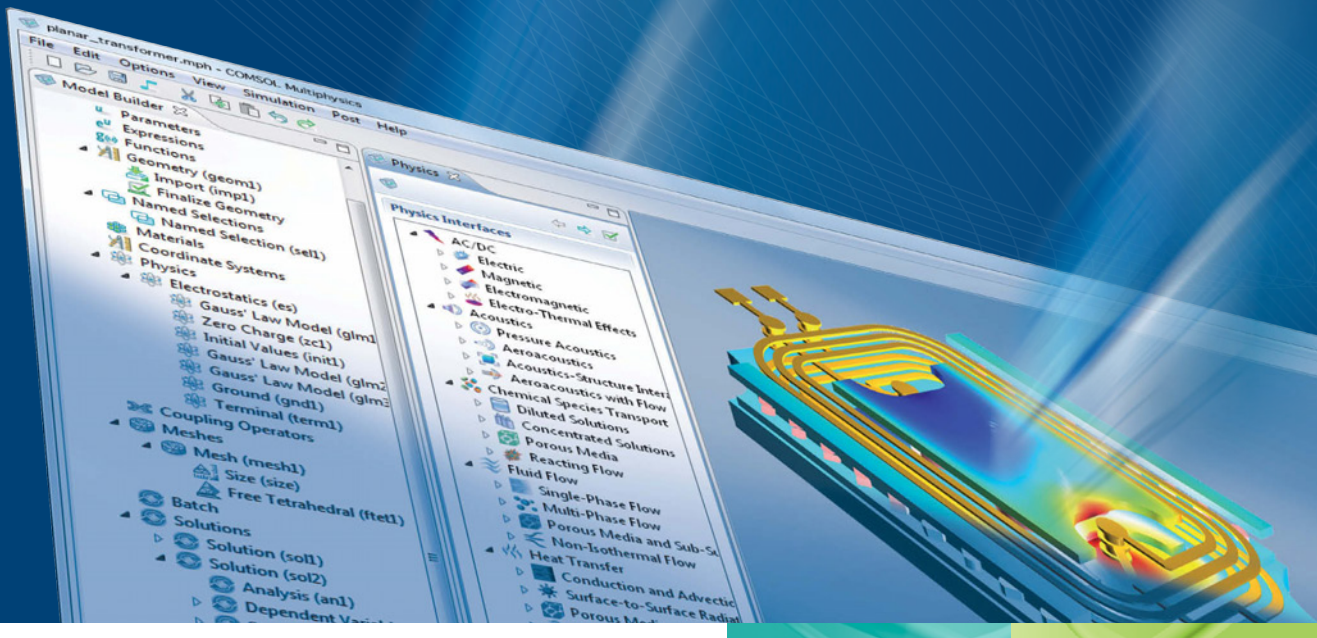

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> Echoes of COFES, a chat with Jon Peddie, Q&A with Terry Swack, and SW on a Mac.

KENNETH WONG
kennethwongsf@earthlink.net

Every morning, I wake up to an inbox brimming with story pitches. Most of them are from marketing and PR people urging me to write about their clients' projects and products. As it happens, I am looking for a story, one that will complement the upcoming special supplement on simulation and analysis (scheduled for October 2010). But before you fire off an e-mail in my direction, please read. I'd like you to make the pitch without words.

That's right. For this one, I'll only consider pitches in movies. What's that? You don't have a camcorder, a film crew, or a budget for special effects? No need. I'm talking about the short 10-15 second movies you export out of an analysis program.

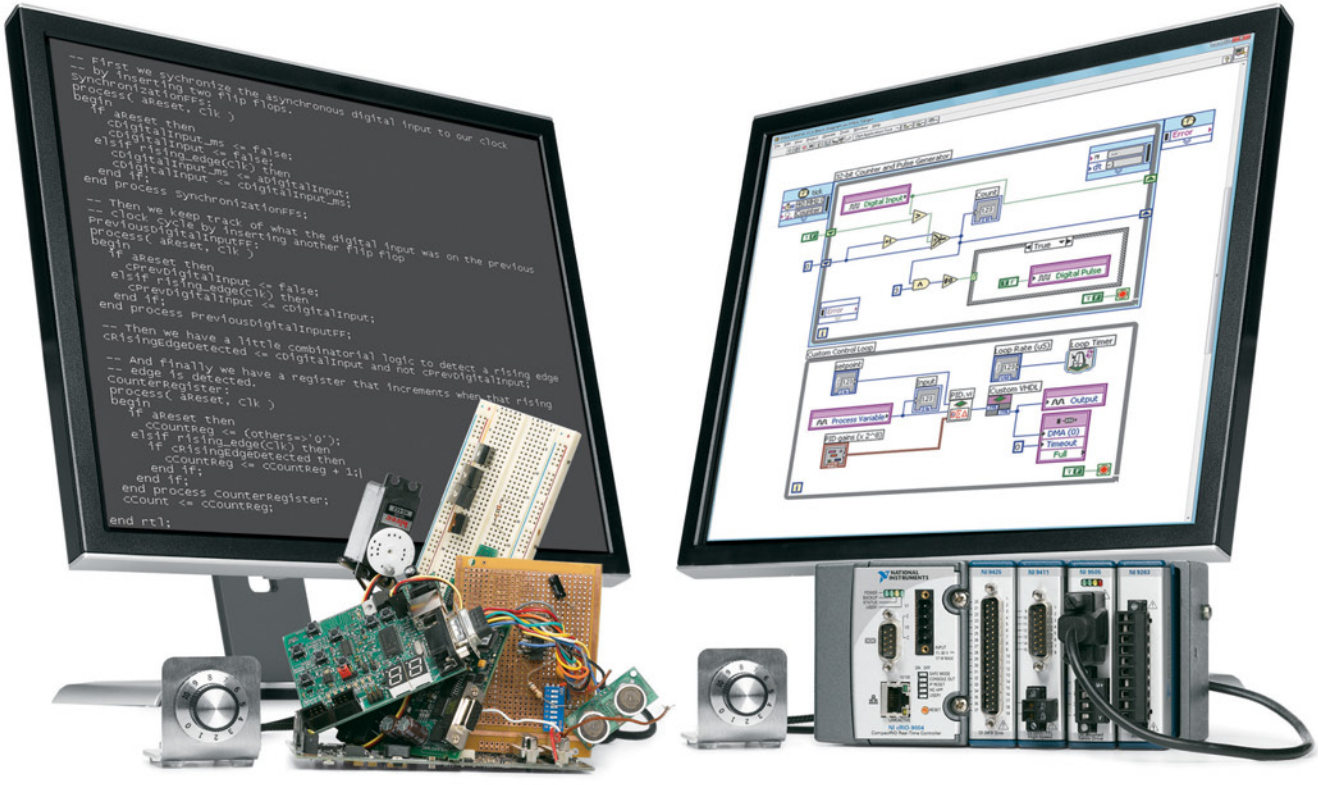
Here's what I'd like to see. A movie showing the results of FEA, CFD, stress tests, or any other kind of simulation. The more spectacular, the better. Essentially, I'm looking for exemplary or unorthodox use of computer-aided analysis. Show me twisted metal plates, collapsing vehicle frames, and airborne assemblies in colored contours and animation. Show me your most impressive displacements, shears, and Von Mises.

Please don't e-mail me those clips as attachments, by the way. My e-mail server simply won't be able to cope with that kind of traffic. You can upload them to DE Exchange, our new online community at deexchange.ning.com, then e-mail me the link with a subject line that reads, "DE story pitch." No explanation, no background, no preface, just the link to the movie and your contact info. As an alternative, you may also upload it to YouTube, then e-mail me the link in the same fashion. I'll pick one that piques my curiosity the most, then contact the sender to develop it into an article.

My inbox is now open (kennethwongsf@earthlink.net). I look forward to view your submissions.

–Continued on next page

Embedded Prototyping. Simplified.



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NATIONAL INSTRUMENTS

Echoes From COFES 2010

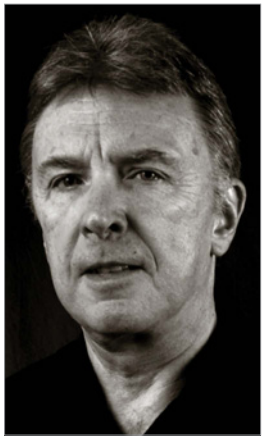
Every year, people who influence the future of engineering technologies—developers, innovators, and industry watchers—get together to discuss, argue, and debate the hot-button issues everyone is grappling with. The event is known as Congress on the Future of Engineering Software (COFES; cofes.com). This year, when it convened last month, the congress took up cloud computing and sustainability, among other topics.

The following excerpts are from interviews I conducted with Jon Peddie, self-professed pixel-chaser from Jon Peddie Research (JPR; jonpeddie.com), and Terry Swack, cofounder and CEO of Sustainable Minds (sustainableminds.com), both participants of COFES 2010.

Jon Peddie to Walk on Cloud

Can we come up with a working definition, or clarify what we mean when we say, "cloud computing"?

Peddie: Keep in mind, the cloud is just a synonym for the Internet. Think of the cloud as a source of computing power, as we think of utility companies as a source for electrical power. We don't have electrical generators in our backyards. Why do we have powerful computers? With the Internet being so ubiquitous, so fast—with high-speed Internet in the home, at work, via DSL, cable, etc.—we really can do [in the cloud] a lot of the things we would [previously only] do on local machines. You now have ultimate mobility…. You now have access to your documents wherever you are; you're not chained to your desk or your office with a big, expensive machine…. [We] always get tripped up on the definition. We could probably spend an hour with a whiteboard, coming up with what the definition of cloud is, but as soon as we show it to another person, we'd have to change it.



Jon Peddie from Jon Peddie Research discusses cloud computing at COFES 2010.

What would you say are the downsides associated with cloud computing?

Peddie: The first one that always comes up is, someone will say, "I don't trust cloud computing because I don't have confidence in [the provider's] security," or "I'm unwilling to allow my personal data or secret sauce or whatever that I value and think of as precious out of my immediate control." I find that a ridiculous argument. My response to that is: Where is your 401K? Where's your mortgage? You don't know where that is…. The point is, you already are exposing yourself to an enormous amount of cloud [computing] with no control, with large sums of dollars, and you feel comfortable doing that. How many times have you bought something online or entered your social security number? That goes into the cloud. If you're doing anything online—email, downloading videos from YouTube, paying bills, or buying items—you are using the cloud.

The idea that we have to buy bigger and bigger computers, that we have to [upgrade to] more powerful devices every year or we'll fall behind and our operating systems won't work anymore—I think that model is breaking apart.

Terry Swack on Sustainability

Is there a difference between designing something for compliance, and designing something to make it more environmentally friendly and sustainable?

Terry Swack from Sustainable Minds helped organize the Design and Sustainability Symposium at COFES 2010.

Swack: At the highest level, compliance is about executing something specifically for some type of legislation or guideline or label. In the green building industry, there's a phrase for designing to code. It's "barely legal." [Codes and regulations] are usually the result of a group of people coming to consensus, typically on the lowest common denominator. So it's the minimum threshold.... Designing something to be sustainable or to be environment-friendly is really an opportunity for product innovation, to look across the product lifecycle, to see where environmental performance could be improved, therefore to transform the product or system you're designing.

You've said there's no such thing as a green product, only greener products.

Swack: All products use materials and waste energies. There's no such thing as a green product. They all consume stuff. But things can be compared. And through that comparison, you can determine what makes a product greener.... We're very careful to not call something "a green product," because they just don't exist.

What are the topics that don't get discussed enough? What do you hope people will bring up at the Design and Sustainability Symposium [part of COFES]?

Swack: Green-washing has become a popular accusation. So the antidote to green-washing is metrics and transparency. The topic on everyone's plate right now is, how do you measure environmental performance, what should you be measuring, what are those metrics? Are we using consistent data sets in the engineering design tools developed that will allow comparability and comparison independent of the tool or application? So it goes to the fundamental building blocks—the input that goes into what we call system bill of materials.

Any advice for engineers/designers thinking about how to make products greener?

Swack: To design sustainable products, everyone has to be thinking the same way. We have to start designing systems, not just artifacts. We need to design whole product lifecycles, from raw material acquisition to end of life. So the starting point to designing greener products is to change the way you think about designing.

To listen to the podcasts in their entirety, please visit Virtual Desktop blog (deskeng.com/virtual_desktop/) and search for posts titled "Jon Peddie to Walk on Cloud" and "Terry Swack on Sustainability."

Uncertainty Surrounds SW on Mac

Hold your applause for SolidWorks on Mac! It may be premature. After previewing what looked like SolidWorks running inside Mac OS at SolidWorks World 2010 in February, the company revealed it

After making a splash at SolidWorks World 2010 by previewing what seems like SolidWorks running in Mac OS, the company reveals it has no definite timetable on when it'll be available.

can't commit to delivering a native Mac version of SolidWorks in the foreseeable future.

"Mac users will have better access to tools from Dassault Systemes SolidWorks in the future; however, we have no plans for our SolidWorks CAD product as it exists today to become available as a native Mac application," said Fielder Hiss, SolidWorks' VP of product management.

So what exactly did the presenters show the audience during the main stage presentation? According to Hiss, they demonstrated "[cloud-] hosted versions of prototype applets running on [a PC with] Windows 7, on a Wacom tablet, on an all-in-one Mac workstation, a netbook, and an iPhone."

This, however, contradicts SolidWorks CTO Austin O'Malley's explanation of the technologies shown at the conference. At SolidWorks blog, he wrote, "The iMac and Windows 7 devices were running native implementations of the software, while the netbook was accessing a hosted version of the software through a thin client interface." (see "More on the New Technology Shown at SolidWorks World 2010," Feb. 23, 2010, at blogs.solidworks.com.)

The point of demonstrating with multiple platforms, Hiss explained, was to show that "with cloud-based technology, platform is irrelevant. Essentially, it lets people use any device they feel comfortable using."

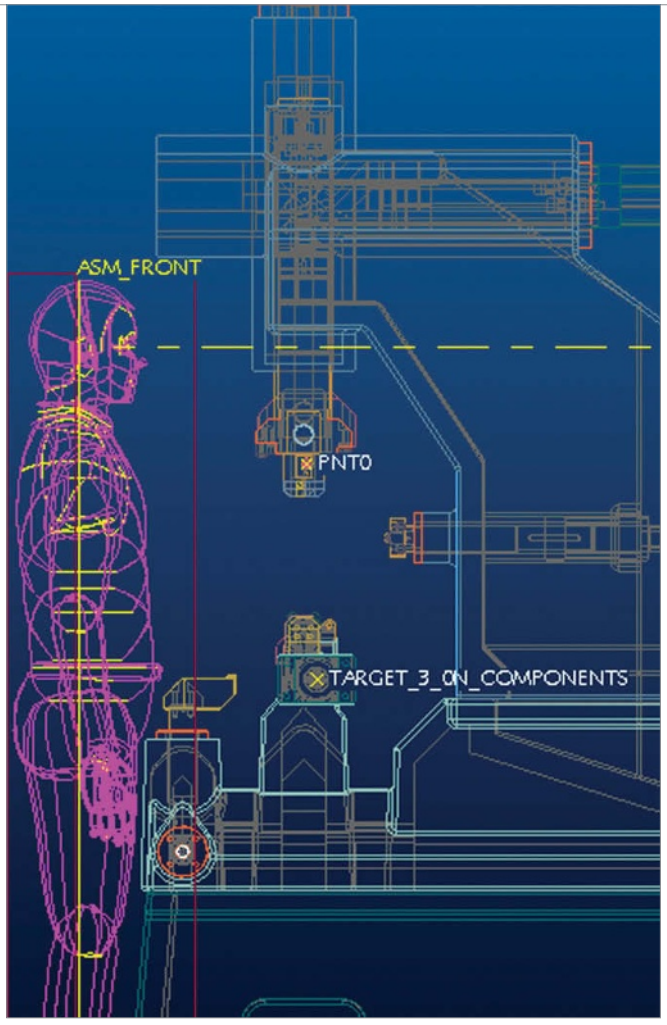
Browser-accessible, hosted software doesn't rely on the operating system of a user's machine to boot and run, so it's bound to be available to anyone logging in using a supported browser. But placating Mac fans with this approach is, at

best, a compromise, because it doesn't take full advantage of Mac hardware and OS.

"We developed [these preview codes] to be platform-independent," said Hiss, "but if we choose to—at any time—deliver them as native versions, we can deliver them as native Mac, Linux, Windows versions." The prototype code and applets demonstrated at the conference, he added, are all fully functional (in other words, not mock-ups representing concepts).

At SolidWorks World, one thing became abundantly clear to developers. "There are lots of people excited about Mac," acknowledged Hiss. "We continue to watch [the platform], prototype things [for it], but we just don't have a time line on exactly when we can deliver these as products." ■

Kenneth Wong *writes about technology, its innovative use, and its implications. One of DE's MCAD/PLM experts, he writes DE's Virtual Desktop blog at deskeng.com/virtual_desktop/. You can follow him on Twitter at KennethWongCAD, or send e-mail to DE-Editors@deskeng.com.*



Does the Pro/ENGINEER digital manikin look like a Bob or an Edi to you? If you were asked to name it, what would be your choice?

Pro/Mankin 2.0

By referring to the Pro/ENGINEER digital manikin as "Bob" in my review of the software ("Pro/ENGINEER Wildfire 5.0, a Dynamic Update," March 2010), I may have unwittingly started a naming ceremony. On PTC's Facebook page (Pro/ENGINEER - Did You Know?), the administrator asked, "What is your take on the name? Do you think Bob is a good name for our manikin? Any other suggestion?"

The community came up with quite a few. Vladimir recommended "Edi." PTC fan Bob (understandably) was partial to "Bob." Sandy Joung, PTC's senior director of product marketing, chimed in: "What about the girl manikin?" she asked. As a pair, the male and female manikins might be dubbed "Manuel Manikin and Mandy Manikin," replied someone. Another variation currently in the running was "Manie and Mandy Manikin." To put in your own two cents, search for Pro/ENGINEER – Did You Know? on Facebook.

Direct Part Production from AM

Additive manufacturing (AM) technology is having a profound impact on the way some companies manufacture products. These organizations—some very small—are successfully applying the technology to the production of finished goods. Wohlers Associates believes that this practice will grow to become the most significant application of the technology. In the future, many organizations will use AM to manufacture a wide range of custom and limited-edition products and replacement parts. Companies will use AM for short-run and series production in part quantities ranging from one to thousands.

Image courtesy of Stratasys

For the first time, a large and impressive number of consumer products from AM are available for purchase from multiple sources. For example, FigurePrints, a company founded by former Microsoft vice president Ed Fries, produced 1,700 custom products using AM for players of World of Warcraft in October 2008. This came only 10 months after the company launched the manufacturing service.

Metaltec Innovations, a division of ProMetal (an Ex One company), uses AM to produce custom pulls, knobs, and knockers for doors. The MGX division of Materialise of Belgium was launched in 2004. The group applies methods of additive manufacturing to the production of limited-edition lighting designs, furniture, and other home and office accessories. The complexity of most of the designs in the collection makes it impossible to produce them any other way. The MGX business was about $2 million in 2009, the majority coming from selling around 1,500 lamps.

Companies in the additive-manufacturing business are optimistic about the future growth of AM for part production applications. Organizations representing thousands of users and customers of AM technology from around the world responded to a survey on the subject. They believe that AM part production will represent 35.9 percent of their business in five years. *—Terry Wohlers*

FOR MORE INFO & REGISTRATION:

> Wohlers Associates

Quickparts Offers New Accura Bluestone Material

Quickparts has announced the availability of Bluestone, a stereolithography material for rapid prototyping.

According to the company, Bluestone is an accurate, strong, high-temperature material that can be used across many industries for digital manufacturing projects.

Accura Bluestone material is widely used for wind-tunnel testing for the aerospace and motorsports industries, and has proven to be successful for electric/electrical components, microwave applications, pump and valve parts, and marine and automotive manufacturers.

FOR MORE INFO:

> Quickparts

Objet Printer Tailors Iron Man's New Suit

This month, Robert Downey, Jr. will once again transform into the technologically advanced superhero Iron Man thanks to his character's engineering prowess. The plot line parallels the production of the film, also made possible by cutting-edge technology: the latest advances in rapid manufacturing.

Using an Objet Geometries 3D printer, the film's production company Legacy Effects created the iconic Iron Man suit, as well as the one worn by arch nemesis Whiplash. This body armor is in fact "print-to-wear"—comprised of pieces that came directly out of a 3D printer before being finished with paint. Plus it's specially designed to be durable and comfortable for the actors, who engage in grueling fight scenes while wearing the gear.

Jason Lopes, Legacy Effects

According to Jason Lopes, systems engineer at Legacy Effects, 3D printing is not yet common in movie-making but is likely to become so, especially as live action flicks make more of a come-back.

FOR MORE INFO:

> Objet Geometries

Lund Speeds Production with Z Corp 3D Scanner and Geomagic Studio Software

Lund International a Lawrenceville, GA, maker of aftermarket auto accessories, is using Z Corporation portable 3D laser scanning technology and Geomagic Studio software to develop new products.

Lund uses the ZScanner 700 handheld laser 3D scanner in the design of products for cars, pickups, SUVs, and heavy trucks, including Nifty floor mats, Belmor hood shields and Deflecta-Shield cargo liners. Lund designers scan vehicles, including interiors, to capture contours. Using Geomagic Studio software, they prepare the resulting scanning data for use in Dassault Systemes' CATIA.

Lund previously used fixed-position scanner but found it time-consuming and unable to operate in tight spaces. According to Z Corporation, the ZScanner allowed Lund to shorten the typical product development cycle by 40 percent.

According to Lund, Geomagic Studio and the ZScanner complement one another.Its polygon editing tools and automation help create CAD-ready data from a scanned polygon mesh. It smoothes surfaces, eliminates irregularities, and produces a standard IGES file that CATIA incorporates with a click.

FOR MORE INFO:

> Lund International

Verisurf Unveils Master3DGage Rapid 3D Inspection Solution

Verisurf Software, Inc. and select Mastercam resellers have introduced Master3DGage, a portable rapid 3D inspection solution that enables machine shops to increase production and improve part quality. The complete hardware/software solution automates the 3D inspection process and verifies manufactured parts directly to 3D CAD models.

Master3DGage will be sold exclusively by select Mastercam resellers worldwide beginning March 31. It will be unveiled at the WESTEC Show in Los Angeles (Mastercam booth 2169) from March 23-25.

"For the first time, machine shops will have a precise 3D model-based Inspection system that can quickly verify parts directly on a CNC machine or anywhere else in the manufacturing process," says Tom Shelar, president of CAD/CAM Consulting, a Mastercam reseller. "Implementing portable inspection into the manufacturing process identifies issues quicker, reduces scrap, and significantly improves productivity."

Master3DGage integrates a Hexagon Metrology six-axis Portable CMM with Verisurf's 3D model-based inspection software. This complete solution delivers a fully automated digital process to inspect directly to CAD models anywhere on the shop floor. First article inspections are completed in minutes, according to the companies.

The Master3DGage rapid inspection process is designed to improve manufacturing productivity by eliminating dependence on 2D drawings, eliminating the need to route products to fixed inspection areas, and complete a fully digital workflow.

FOR MORE INFO:

> Master3DGage

Rapidform XOR3 RE Solution Produces Editable Native CAD Models

INUS Technology Inc. has announced that Rapidform XOR3 is directly compatible with five CAD software applications. Rapidform features direct interfaces to CAD, enabling users to scan objects and generate parametric, feature-based models in Rapidform, then transfer the complete model to their CAD software. Rapidform XOR makes solid models that are editable.

With the release of Rapidform XOR3, users can open reverse engineered models as native geometry in SolidWorks 2007-2010, Siemens NX4 to NX7, Pro/ENGINEER Wildfire 3.0 to 5.0, AutoCAD 2008 to 2010, and CATIA V4.

Rapidform calls its approach to direct 3D scan-to-CAD compatibility liveTransfer. With liveTransfer, Rapidform XOR communicates directly with compatible CAD products.

FOR MORE INFO:

> INSUS Technology

Laser Design Installs Scanning System at Carley Foundry

Carley Foundry recently installed a Laser Design Inc. scanning system using the FaroArm in its Blaine, MN, facility. Carley Foundry, in business since 1955, specializes in aluminum castings for the aerospace and automotive industries. The Laser Design system will be used for verifying aluminum mold tooling prior to production runs.

"Carley Foundry is the kind of well-respected small business that has built their reputation on casting short-run, complex-shaped, high-accuracy parts," says C. Martin Schuster, president and CEO of Laser Design. "Our portable FaroArm system will add to their array of quality assurance equipment, adding both speed and precision. The system can be moved around to all of the production areas to provide timely verification and inspection to the parts being cast at any time. The system's versatility also allows them to reverse engineer legacy parts for which no CAD models exist."

The portable FaroArm arm is teamed up with the Laser Design SLP-500 laser-line scanning probe. The non-contact 3D laser probe captures up to 144,000 points per second, according to the company. The SLP probe line features digital (ASCII) coordinate output, a visible beam, a Class II rating, and a long standoff to prevent crashes during part scanning. Dual CMOS receptors featuring simultaneous scanning assist with steep sidewall and recessed geometry capture.

FOR MORE INFO:

> Laser Design, Inc.

RapManPRO 3000 Multi-color 3D Printer Released

Technology Education Concepts (TEC) has announced the BFB RapManPRO 3000, developed by Bits From Bytes. The $3,395 3D printer is similar to the BFB RapManUSA 3D printer kit. However, unlike the RapManUSA, which must be built from a kit, the BFB RapManPRO is assembled in a housing of brushed aluminum and stainless steel.

With the new NetFab Professional for RapMan process-software and its ability to carry three extruder-heads, the BFB RapmanPRO allows more complex build-parts with support, at a faster speed, and, the ability to build multiple models at the same time, using multiple colors. The BFB RapmanPRO is designed for schools, colleges, and other organizations.

FOR MORE INFO:

> Technology Education Concepts

Inventor 2011 Helps Speed Workflow

Inventor 2011 promises to speed common design tasks by up to 40 percent, says Autodesk, Inc., upon introducing its new 2D and 3D design and engineering software lineup for manufacturers. The integration of Autodesk Inventor 2011 software with the Autodesk Digital Prototyping software portfolio helps enable designers and engineers do more work in house.

"Over the last several years, Digital Prototyping workflows have torn down historic barriers to innovation—time, money, distance, language—and helped foster manufacturing teams in which designers, engineers, marketers, and end customers collaborate continuously from concept to production," says Robert "Buzz" Kross, senior vice president, Manufacturing Industry Group at Autodesk. "Autodesk's 2011 product lineup makes huge strides in technology integration and productivity, extending the benefits of digital prototyping to even more small and large manufacturers seeking to make better products."

Autodesk has enhanced its specialized tools for product development professionals focused on conceptual design, design visualization, engineering, and manufacturing disciplines. It has also embedded functionality from these tools within its core Autodesk Inventor 3D mechanical design and engineering software. According to the company, new direct manipulation capabilities in Inventor 2011 helps accelerate design times compared with Inventor 2010 software by approximately 40 percent on common tasks such as assembly modeling. Inventor 2011 software also incorporates Autodesk's design visualization capabilities within the CAD application. New shading, lighting, and material properties give users a photo-realistic representation of their designs, with Inventor software rendering designs as the user works.

Other highlights of Inventor 2011 include:

>**Simulation:** With added frame analysis, users can test responses of frame models to gravity and other loads and record animations of displacement and stress results. The software guides users through the steps required to define the best testing scenario.

>**Tooling:** Inventor Tooling 2011 improves performance for a number of key operations, supports dynamic simulation of mold assemblies, and helps enable users to automatically generate the mold core and cavity for a broader range of plastic parts, whether using native Inventor or imported files.

>**Design Automation:** Inventor iLogic technology is now fully integrated into Inventor 2011. The new iCopy feature enables customization

of commonly used assemblies by automating the process of copying and positioning similar components.

>**Freeform Shape Modeling:** Autodesk Alias Design for Inventor 2011 is a new product that integrates freeform shape-modeling capabilities in the Inventor parametric modeling environment.

Along with Inventor software, new applications within the Autodesk solution for digital prototyping offer capabilities spanning conceptual design, engineering, and manufacturing workflows. The latest releases of Autodesk software have been enhanced with new features for 3D design and visualization. A consistent user experience across the flagship products will also facilitate working with and moving between multiple Autodesk products.

Key 2011 Autodesk products, including the AutoCAD software products, Autodesk Inventor software for Digital Prototyping, Autodesk Revit software for Building Information Modeling (BIM) and Autodesk 3ds Max software, have been enhanced with a consistent user interface that features new tools for interacting with 3D models directly in the design canvas, reducing the number of menus.

FOR MORE INFO:

> Autodesk

HP Expands Z Workstation Series

HP's new workstation offerings include a small form factor workstation, multicore processor updates to its Z Workstation series, and a mobile workstation with DreamColor display technology.

The HP Z200 SFF Workstation is a small form factor workstation designed for space-constrained environments including the health care, engineering, education, financial, and original equipment manufacturer markets. U.S. pricing starts at $739.

New six-core, 32nm Intel Xeon 5600 series processors are now available on HP Z800, Z600 and Z400 workstations, which deliver greater parallel processing performance. U.S. pricing starts at $929 (HP Z400), $1,579 (HP Z600), and $1,799 (HP Z800).

Dressed in a gun metal anodized-aluminum finish, the HP EliteBook 8740w Mobile Workstation is HP's most powerful mobile workstation to date. Pricing starts at $1,999.

FOR MORE INFO:

> HP

Alliance and Bricsys Cooperate On ODA Platform

Bricsys and the Open Design Alliance have announced the synchronization of the ODA platform with improvements and enhancements made by Bricsys with more on the way.

Development teams from both companies are working together to incorporate modifications made to the ODA platform code by Bricsys back to the ODA, with modifications to be included in the base code delivered by the ODA to its member companies. The first phase of the joint development efforts are expected to take three months to complete.

ODA and Bricsys have agreed to collaborate and work closely on additional contributions.

FOR MORE INFO:

> Bricsys

Cray Cx1 Deskside Available with Intel Xeon 5600

Cray Inc.'s CX1 line of deskside supercomputers will now ship with the Intel Xeon processor 5600 Series. Intel's next generation of intelligent server processors accelerates performance and saves energy.

With the addition of the new Intel Xeon processors series, the Cray CX1 line of deskside supercomputers now feature an Intel Core microarchitecture built on the company's latest 32nm process technology. The new microarchitecture features two more compute cores per socket (from four core to six core) while maintaining the same thermal footprint. Compared to the Intel Xeon processor 5550 series released last year, these new Intel Xeon processors add 50 percent more compute power—but keep power and energy consumption levels flat.

FOR MORE INFO: > Cray Inc.

Abaqus FEA and SolidWorks Speed Medical device innovation by Innerpulse

InnerPulse, a medical device company pioneering technology for patients with cardiac rhythm disorders, has selected Abaqus finite element analysis (FEA) software from Dassault Systemes' SIMULIA brand to assist in the development of its technology, designed in SolidWorks CAD software.

Sudden cardiac death (SCD) remains a major threat, despite advances in medication and other treatments. According to the Sudden Cardiac Arrest Association, approximately one American life is lost every two minutes. It has been estimated that SCD claims more than 7 million lives per year worldwide, and the overwhelming majority of those deaths are attributed to ventricular fibrillation, or rapid, uncoordinated contractions.

InnerPulse has developed a percutaneous implantable defibrillator (PICD), which enables physicians to implant the life-saving defibrillators within a patient's vasculature using a catheter procedure—making the procedure both minimally invasive and less expensive. Leveraging SolidWorks for design and the realistic simulation capabilities in Abaqus FEA software, the design engineers at InnerPulse are able to perform accurate analysis for concurrent device and tool design.

"It was important for us to be able to model the way Nitinol material in our PICD anchoring technology will behave throughout the complete manufacturing process," stated Cinnamon Larson, Ph.D., the senior mechanical engineer at InnerPulse, Inc. "The powerful, non-linear material capabilities in Abaqus allowed us to meet those requirements ... throughout the development process."

FOR MORE INFO:

> InnerPulse, Inc.
> SIMULIA
> SolidWorks

LEDAS Releases RhinoDirect Beta Plug-in

LEDAS Ltd. has released beta 0.2 of its RhinoDirect plug-in module for Rhinoceros 3D modeling software from Robert McNeel and Associates. RhinoDirect allows Rhinoceros users to modify 3D geometric shapes parametrically using geometric constraints and driving dimensions.

Version 0.2 adds several features to RhinoDirect. Geometric constraints and driving dimensions are now stored when users perform commands such as copy-and-paste and importing models from other 3DM files. Constraints and dimensions are no longer deleted when users modify geometry with Rhino commands, such as for holes, fillets, and Boolean operations. The plug-in now correctly supports Rhino's built-in history. And in another enhancement, the plug-in can now parametrize arbitrary solid bodies composed of planar and cylindrical faces independently of their orientation with each other.

FOR MORE INFO:

> LEDAS Ltd.

Wireless Smart Sensor Report Released

Research and Markets, Ltd. has released "Major Trends in Developing Wireless Smart Sensors Communications: Technologies and Markets." This report analyzes Wireless Sensors Networks (WSNs) marketing and technological characteristics.

The report emphasizes the following trends in these networks developments:

>**Evolution to wireless smart sensors.** Technologies allow building multi-purpose, miniaturized devices with various radios. Smart sensors have enough computing power to process data; and they consume very little energy. The report concentrates on the standardization work, technological advances, and WSN marketing characteristics. A survey of the industry is also included.

>**Mesh configuration.** The mesh topology becomes a prevailing topology in the WSN environment. Networks use the benefits of meshing, such as self-organization and self-healing. The report details marketing and technological characteristics of meshed WSN, standardization efforts and provides an industry survey.

>**IP-based WSN.** Benefiting from the IEEE, IETF, ITU, and other standard organizations work, WSN is evolving toward the IP environment. The report analyzes such protocols as 6LoWPAN and ROLL, and shows that designers now have a choice to incorporate IP advances in WSN. The report also addresses Ubiquitous Sensor Network properties and benefits.

>**Maintenance-free WSN.** A WSN may reside in the harsh environment, and though its deployment as any wireless infrastructure does not need any cabling, it still requires maintenance. This can be a difficult and expensive task mainly due to the necessity to periodically replace batteries in every sensor and/or radio. The report addresses features of power harvesting industry, which makes progress toward the design and implementation of self-powered WSN nodes. The survey of these industry vendors is included, and various power harvesting technologies are addressed.

FOR MORE INFO:

> Research and Markets, Ltd.

EDITOR'S PICK OF THE WEEK

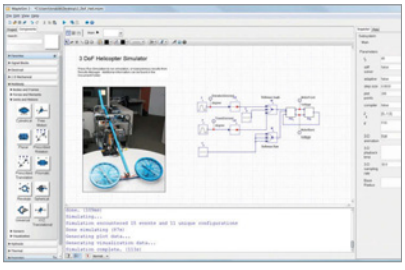
FROM THE DESK OF **ANTHONY J. LOCKWOOD**, EDITOR AT LARGE, *DESKTOP ENGINEERING*

WOULD YOU TRUST THIS GUY? Well that question has already been answered by thousands of readers who have indicated they already do, implicitly. So here are Lockwood's most recent musings about the products that have really grabbed his attention, and deserve yours.

Maplesoft Extends Connectivity to NI Tools

>MapleSim Connector for LabVIEW and NI VeriStand helps manage models.

Remember that scene is the movie "Jerry Maguire" when the guy in the elevator tells his girlfriend that she completes him? Today's Pick of the Week will be like that for many of you. Maplesoft's new MapleSim Connector for LabVIEW and NI VeriStand does just that. It completes the loop, hardware-in-the-loop (HIL) that is. In a nutshell, what the MapleSim Connector does is make HIL testing and simulation faster and more accessible.



Now, what the MapleSim Connector does is let you integrate MapleSim's multi-domain modeling and simulation environment into NI's widely deployed LabVIEW graphical programming environment for developing test, measurement, and control applications and the NI VeriStand environment for configuring real-time testing applications such as HIL test systems.

READ MY COMPLETE REVIEW:

>MapleSim

Energy-Efficient Wide-Format Plotter Saves Space

> Océ PlotWave 300 multi-function system offers economical document printing.

I've done time at outfits large and small and played a disruptive part in workgroups large and small. I much prefer being a multi-hatted member of a dinky workgroup that's part of a tiny, entrepreneurial outfit. With one exception: Le tools of duh trade. Small outfits wring every last dime and breath out of their tools by necessity. You know, like that shared multifunction plotter you've beat on since 1998? The one that's big as a Hummer, takes 45 minutes to warm up just to spit out three monochrome pages, and that exacts a chunk of finger whenever you change paper? Well, Océ has nifty solution for you called the PlotWave 300.

The deal with the Océ PlotWave 300 multifunction system is that it is a compact, all-in-one large-format system that enables small engineering and manufacturing workgroups to print, copy, and scan low volumes of technical documents quickly and efficiently. OK, so far so good. But what does it mean for you?

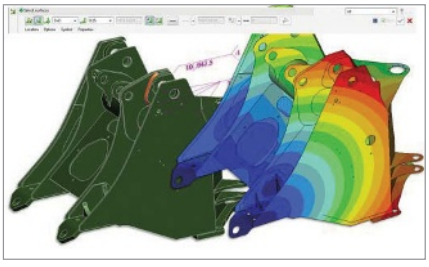
READ MY COMPLETE REVIEW:

>Océ

Pro/E Wildfire 5.0 Focuses on Productivity, Efficiency

> PTC's flagship CAD/CAM/CAE system strives to make engineers barriers to productive go away.

When PTC announced Pro/ENGINEER Wildfire 5.0, the buzzwords were "Design Without Barriers." This was a nod toward its new real-time dynamic editing capability and faster performance. It was also a wink toward its communications abilities. I can't get around dynamic editing being big news from the company that gave us parametric modeling. But my guess is that history may also record that social design engineering was the real news in version 5.0.



By social design engineering, I'm not yapping about multi-cultural guest seating arrangements by committee. Nor am I saying that version 5.0 is CAD by Facebook and Twitter—though the idea that a model might notify you that a co-worker is a fan of toolpaths strikes my fancy. Rather, what Pro/Engineer Wildfire 5.0 represents is the beginning of the integration of instant messaging, Wikis, and—yep—Facebook-like functionality into the design engineering workflow. This is fascinating.

The social engineering part of Pro/ENGINEER Wildfire 5.0 comes in the form of Windchill ProductPoint.

READ MY COMPLETE REVIEW:

>PTC

ZWCAD 2010 Released

> ZWSOFT says the newest version is its fastest ZWCAD ever.

You've probably been hearing more and more about ZWCAD from ZWSOFT as of late. Kind of hard not to, actually. ZWCAD is a lower-cost CAD package based on IntelliCAD technologies, which means it offers a native DWG format. The company just came out with its 2010 version, and says this is the fastest ZWCAD ever. This might be the time for you to learn more about this AutoCAD competitor that is gaining notice all over the place. And we have gathered the resources for you to make up your own mind about it.

The 50-cent tour is that ZWCAD 2010 is an AutoCAD-compatible 2D and 3D application. It offers efficient and easy-to-use drafting, drawing, and plotting features as well as a set of APIs to customize the program as you are wont. Version 2010 has been optimized with new compressed processing and new algorithms that are said to improve the efficiency of commonly used commands and boost speed all around, but particularly when you are working with large drawings.

Drawing features include a newly developed In-Place MTEXT Editor and additional enhancements that make your workflow simpler and easier.

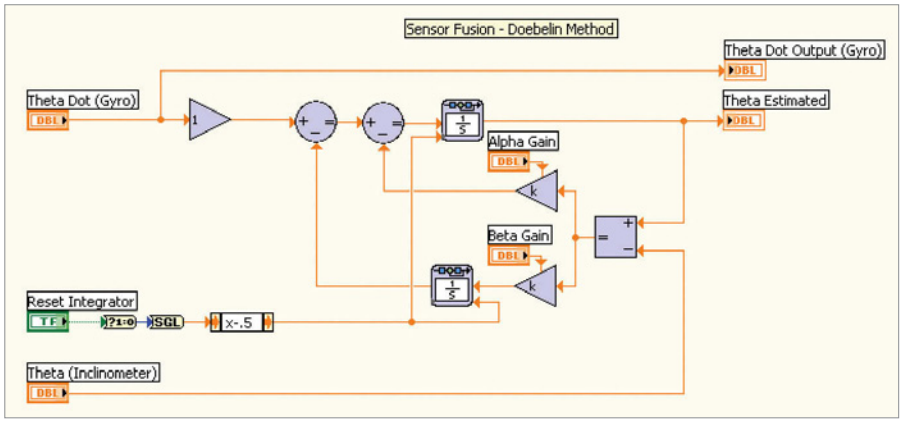
READ MY COMPLETE REVIEW:

>ZWSOFT

Designing New-Age Electronics

> Here's one view of how the realities of human nature, market forces, emerging technologies, and new design practices will transform mobile electronic devices.

BY TOM KEVAN



Key components of sensor fusion are the algorithms that process the disparate data streams into actionable information. This block diagram shows how a sensor fusion algorithm was implemented in LabVIEW by a design team at Rensselear Polytechnic Institute. The approach used complementary filtering to fuse inclinometer and MEMS gyroscope signals.

Everyone wants to know what the future holds in store, and I'm no different. In a recent conversation, I asked Dave Blakely, director of Technology Strategy for IDEO, a leading global design consultancy, about the future of electronics and the design practices that build them. By picking apart the technologies and components of today's smartphones, he was able to sketch a vision of the future and outline some best practices for design engineers. The roots of the predictions and suggested practices are changes in attitude, developments in technology, and evolving expectations.

Multitasking Mobiles

Start by considering today's smartphones. Mobile is in great demand. The new generation of users doesn't think of mobile phones as dedicated devices. Instead, they see them as flexible systems that can be customized with accessories and software downloads to perform a growing range of new functions. As these phones have gotten "smarter," they have displaced traditional stand-alone products. For example, people don't travel with portable alarm clocks anymore. They use their cell phone.

But as popular as mobile has become, there is a limit to the number of devices people are willing to carry. In short, they want a wide range of features on as few devices as possible.

What does this mean to the design engineer? Instead of seeing the smartphone as one type of

SENSOR OFFERINGS

MPU-3000 Triple Axis Gyroscope

InvenSense's MPU-3000 family of motion processing units (invensense.com) features a 3-axis gyroscope, with an embedded Digital Motion Processor (DMP) hardware accelerator engine. The MPU-3000 provides complete motion processing in smart phones, including a wide range of motions, from 250° to more than 2000° per second, built-in 16-bit ADCs, programmable digital filters, factory calibration to 1% sensitivity, built-in 6-axis sensor fusion, and 13 mW power consumption.

The MPU-3000 family integrates a secondary I^2C interface to link an external accelerometer to the DMP. This enables the DMP to perform 6-axis sensor fusion by integrating output from the gyroscope and accelerometer and report quaternion output to the handset application processor, offloading the host from sensor timing synchronization and sensor fusion computation.

Features:

- DMP engine supports 3D motion-processing and gesture-recognition algorithms
- Programmable digital high-pass and low-pass filters for motion processing applications
- Motion Processing Library for Android, Linux, Windows, and Windows Mobile platforms
- Programmable interrupt support features, including gesture recognition, panning, zooming, scrolling, zero-motion detection, tap detection, and shake detection
- Digital-output temperature sensor.

MEMS Multi-Sensor Inertial Measurement Unit

STMicroelectronics' STEVAL-MKI062V2 (st.com) is the second generation of the iNEMO family of multi-sensor Inertial Measurement Unit (IMU) devices. It combines a 2-axis roll-and-pitch gyroscope, 1-axis yaw gyroscope, 6-axis geomagnetic module, pressure sensor, and temperature sensor to provide 3-axis sensing of linear, angular, and magnetic motion, complemented with temperature and barometer/altitude readings. The inertial system can be used several applications.

Features:

- Two power supply options: power connector, USB connector
- STM32F103RE: high-density performance line ARM-based 32-bit MCU, with 256 to 512 KB Flash, USB, CAN, 11 timers, 3 ADCs, and 13 interfaces
- Extended connector for wireless connectivity.

Programmable System-on-Chip Design Environment

Cypress Semiconductor's PSoC Creator Integrated Development Environment (IDE) surports the company's new PSoC 3 and PSoC 5 programmable system-on-chip (PSoC) families (cypress.com). Creator combines a software development IDE with a graphical design editor to create hardware/software co-design environment.

Features:

- Library of pre-configured analog and digital peripherals that can be dropped into the schematic design canvas
- Automatic routing of all on-chip signals and I/O to the optimum pins
- Ability to save designs and their associated APIs in a library for future reuse.

mobile electronic device, engineers need to see it as an example of a possible platform to host diverse new functionality. After all, smartphones already have the necessary building blocks, such as powerful processors, internal memory, power sources, and a growing variety of input devices, such as GPS and sensors. In many cases, designers don't have to re-invent the wheel. Early in the design process, they should seriously consider leveraging existing mobile platforms rather than create dedicated devices.

"Our attitudes as designers should be: Let's be humble and leverage existing platforms rather than reflexively designing our own custom platform," says Blakely. "If you don't do that, you should be extraordinarily sure that the custom platform you are thinking of has an amazing value proposition that can't possibly be addressed by a versatile tool such as a smartphone."

Sensor Fusion

Another development gaining momentum in smartphones is sensor fusion—the combining of multiple sensor outputs to perform complex applications. By using sensory data from disparate sources, you get more comprehensive information, which in itself is more accurate than the results derived from the same sensors individually.

For example, if you have a GPS component in your smartphone, you know where you are. When you combine that with a fluxgate magnetometer, which is a solid-state compass, and a solid-state tilt sensor, not only do you know where you are, but you also know how the device is oriented. The fusion of data from these three sensors, for example, enables services such as Yelp Monocle.

Yelp Monocle ranks establishments, mostly restaurants. You get reviews and a ranking from a user base. But Yelp Monocle is also an example of augmented reality. You hold your smartphone up and point it at the establishment, and as you look through the phone, you see an image of the restaurant, with the rating overlaid on the image.

Sensor fusion increases demands on both the design engineer and the smartphone. The engineer must modify the design process, and the smartphone may well have to take advantage of emerging technology.

The implementation of sensor fusion means more work for the designer. "With almost any sensor, you have to deal with amplification and complex filtering," says Blakely. "You may also have sensors that are sensitive to things like temperature and humidity, which you must compensate for. So the integration of a new analog sensor into a cell phone can lead to some exciting new value propositions, but it's not something to be taken lightly. You have to make sure you factor in analysis, test, and validation. You are going to go through a couple of iterations of these three before you get it right."

Sensor fusion is also going to require more processing, and there is a limit to what can be done efficiently on a smartphone. "But we are entering and era of cloud-computing support for mobile-based devices, where you will have these giant backend engines crunching data for you," says Blakely. "You can have relatively thin clients receiving the information from these high-powered servers. Typical maintenance activities, such as turning down the power on certain elements or modules to save

battery power will continue to be done locally. But I see algorithms that are going to bring all kinds of activities to life going out to the cloud."

For example, Google is pursuing real-time translation (you speak French on your phone, and someone on the other end hears English). "That sort of processing-intensive application is likely to live in the cloud," says Blakely.

The Vision

Make no mistake. This isn't a discussion just about smartphones. It's a look at trends that are reshaping electronic devices and the design practices that create them. Integration has been a driving force for years. Add to it the changing perceptions of users, and it becomes the way of the future. Sensor fusion acknowledges the rising tide of sensing capabilities and applications. Both integration and the growing role of sensors are just indications that new perspectives are called for. ■

*Contributing Editor **Tom Kevan** is based in New Hampshire and is DE's mechatronics, PLM, and systems expert. Send your comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> IDEO
> National Instruments
> Yelp

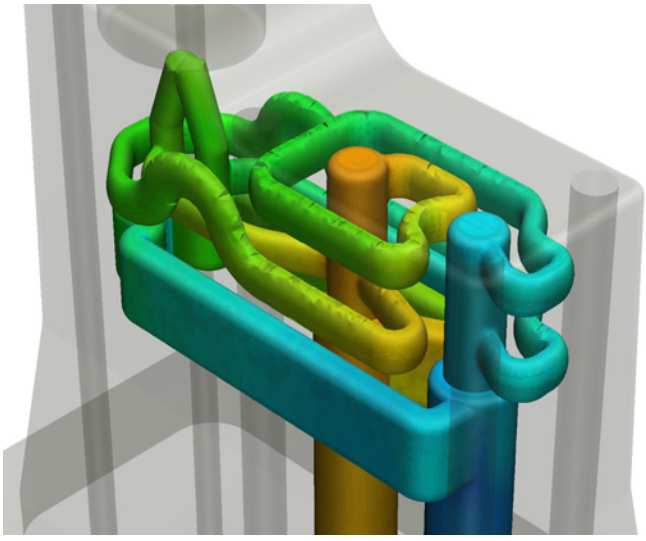
CFdesign Leads to a Radical New Mold

> NyproMold explores cooling advances with CFdesign computational fluid dynamics and laser metal-fusing technology.

BY BOB CRAMBLITT

Radical is not a word one expects to hear from a plastic injection molding company. Yet, it pops up more than once in conversation with Paul Mailloux, the CAD/CAM application engineer for NyproMold of Clinton, MA.

NyproMold designs and builds high-precision molds used for products such as cell phones, electronic equipment, consumer, and medical devices. At NyproMold, radical is most often used to describe mold cooling breakthroughs made possible by upfront CFD using CFdesign software and the latest in laser sintering technology from CONCEPT Laser of Lichtenfels, Germany.



A CFdesign image shows the pressure within a cooling system – blue is the lowest pressure.

Removing the Guesswork

CFD, FEA, and injection-molding simulation software has always been part of the NyproMold design and engineering process, helping the company make decisions and predictions prior to actual manufacturing. But with CFdesign software from Blue Ridge Numerics, CFD is factored in at the early product-development stages, where it is most valuable in determining the feasibility of design options.

Integration between CFdesign and Pro/ENGINEER software from PTC enables NyproMold to conduct iterative design studies without any translation, conversion, or data loss. Volumes, void-filling, boundary conditions, and material properties are assigned automatically in CFdesign. Associativity of all geometry is maintained as the assembly moves between CAD and CFD iterations. This close relationship between CAD and upfront CFD is enabling NyproMold to replace conjecture with confirmation.

"NyproMold brings many, many years of cooling expertise to the table and can often predict

what is needed for good cooling circuits," says Mailloux. "CFdesign can confirm and/or correct the original predictions. It has replaced guesswork with accurate, concise data that gives us the confidence we need to design and build molds right the first time. This is extremely important to us as there is never enough time or capital to do the same job twice."

Manufacturing for Radical Cooling

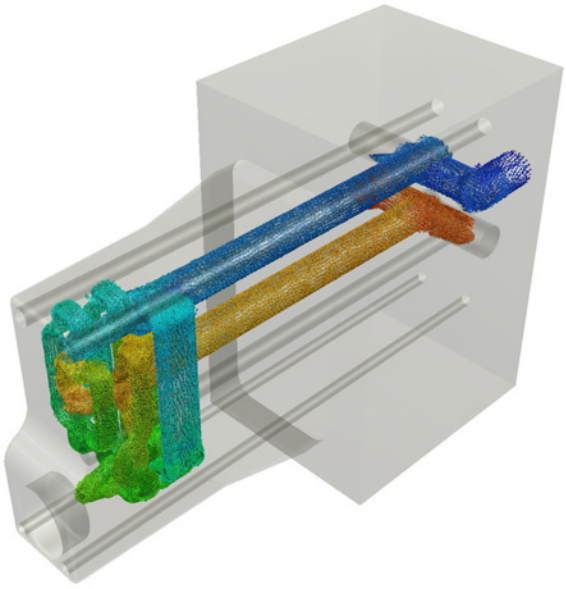
While CFdesign provides the ability to explore new designs on the front end, laser sintering enables NyproMold to fully realize those designs in the physical world.

Laser sintering is a fusion process that uses 3D CAD data to produce large-volume components layer-by-layer. Complex component geometries can be manufactured without tools, and optimally cooled mold inserts allow parts to be produced without distortion. Parts produced with laser sintering are comparable to traditionally machined parts in terms of steel density and hardness, according to Mailloux.

"Laser sintering technology allows us to create parts and inserts that contain complex conformal cooling circuits that are otherwise impossible to create with conventional manufacturing techniques," says Mailloux. Conformal cooling is a methodology that uniformly cools complex cores and shapes in molds, offering large savings in cycle times and increased part quality.

Reducing Cycle Times

Mailloux cites a before-and-after contrast for a high-cavitation tool as an example of the big dividends from combining upfront CFD and laser sintering.

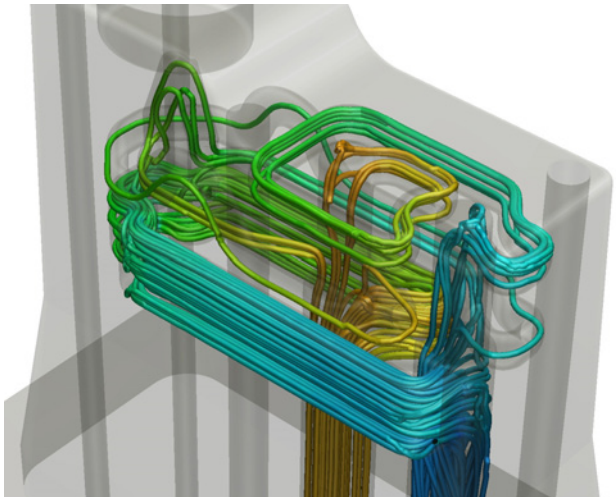


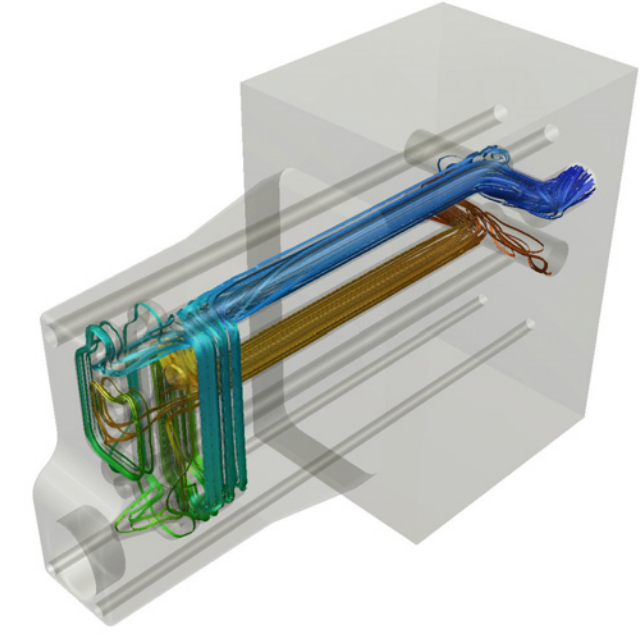
A CFdesign image shows the pressure drop throughout the cooling system; vectors indicate the flow direction.

The tool was initially designed with traditional circuits before NyproMold implemented CFdesign software and the laser sintering system. The second time the tool was designed, a new cooling circuit was developed after using CFdesign to experiment with several conformal cooling scenarios.

"The ability to overlay and compare various iterations of cooling circuits within CFdesign to determine the best cooling concept was extremely valuable to us," says Mailloux. "Then, there were the fast processing and quick results: Even during the computations, dynamic results were available for review and interaction. This enabled early decision-making prior to actually finalizing the computations."

Using the CFdesign simulations, NyproMold confirmed the best cooling concepts and per-





CFdesign images show the fluid flow path in the cooling system. Trace-1 is a zoomed-in view with the trace style set to lines and colored by pressure. Trace-2 shows the entire system, with ribbons as the trace style and pressure distinguished by colors.

fected the cooling circuits prior to manufacturing. "We basically removed all guesswork and rework upfront, and were able to then take full advantage of laser sintering at the back end," says Mailloux.

The improved cooling of the final high-cavitation tool reduced cycle time by more than 40 percent, from 23 to 16 seconds.

"In terms of injection molding, this is a radical improvement amounting in tremendous annual savings to our customer," says Mailloux. "Only CFdesign could have led us down this decision-making course to reach such a successful result."

Impact on Customer Satisfaction

Although customers rarely see upfront CFD analyses, Mailloux says they have a major impact on customer satisfaction.

"We have a far greater confidence that timelines will be met and first-off parts will be acceptable," he says. "We are able to provide the best cooling scenarios and therefore improved cycle time, part quality, and process windows that would otherwise be unachievable with mere guesswork."

With the combined capabilities of upfront CFD and laser sintering, NyproMold is adding an unexpected new meaning to "radical," making it synonymous with "rest assured." ■

Bob Cramblitt *is principal of Cramblitt & Company in Cary, NC. He writes about technologies that dramatically impact the way products are designed, engineered, and manufactured. Comments should be sent to DE-Editors@deskeng.com.*

FOR MORE INFO:

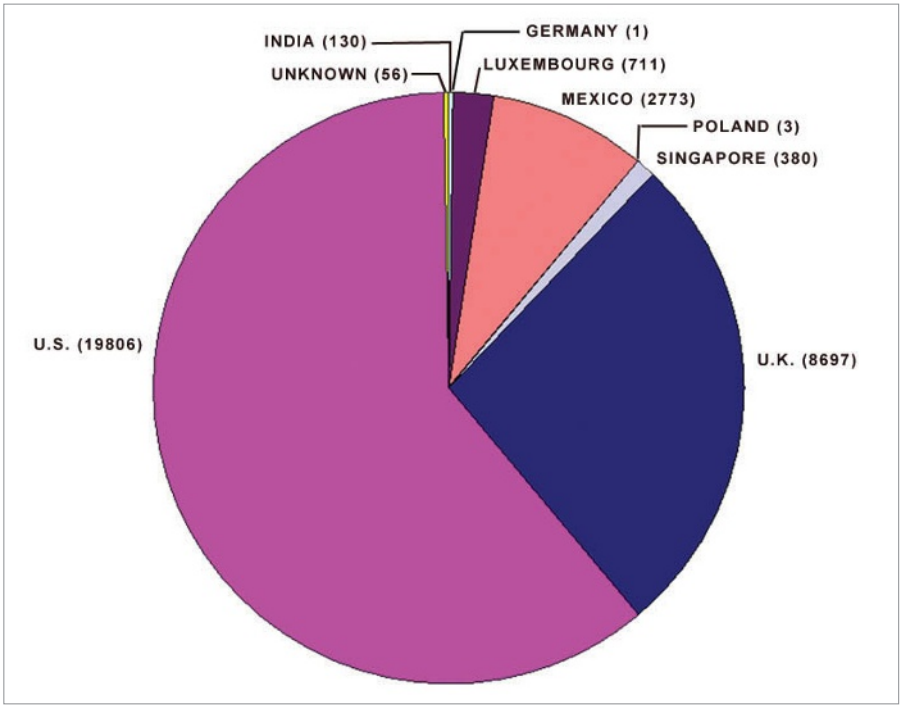
> Blue Ridge Numerics
> CONCEPT Laser GmbH
> NyproMold
> PTC

ANSYS Focuses Upfront Simulation at Delphi

> A corporate initiative at Delphi Electronics aims to bring benefits of early product simulation to sites around the world.

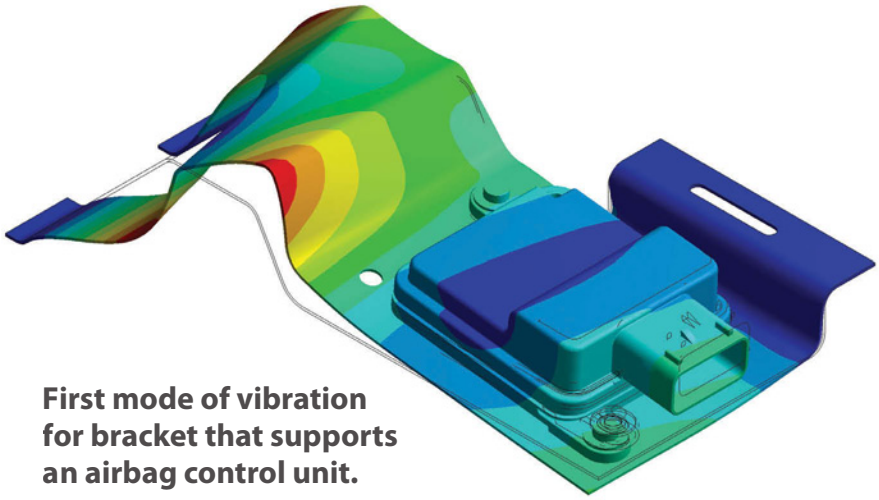
BY FEREYDOON DADKHAH

Most high-technology companies now realize the potential benefits of simulating the performance of their products using tools such as finite element analysis (FEA). They also clearly know that performing analysis early in the design cycle has the potential to identify and solve design problems much more efficiently and cost effectively than later.



This chart shows the hours of ANSYS DesignSpace use at various Delphi sites internationally.

One company using upfront analysis throughout the product engineering organization is Delphi Electronics and Safety Systems—a division of Delphi Corporation specializing in mobile electronics and transportation systems for the automotive and consumer product industries. Beginning in the late 1990s, Delphi Electronics and Safety embarked on a program to take full advantage of FEA in the product development process. Along with other companies, Delphi Electronics and Safety had been using FEA in a more limited way as a troubleshooting tool often late in a project's development. The new initiative intended to use FEA as an integral part of the product development process—especially focusing on the use of simulation upfront in the design cycle. To achieve this goal, Delphi started training design engineers in the use of FEA in the early stages of the design process. This program



First mode of vibration for bracket that supports an airbag control unit.

began by classifying engineers according to their skill levels in the use of FEA and in their ability to interpret analysis results. Gradually, the program incorporated use of FEA into the Delphi Electronics and Safety product development plan.

Safeguards such as peer reviews, engineering fundamentals training, and mentoring were implemented to ensure proper use of FEA. Furthermore, Delphi Electronics and Safety has restricted use of this technology to engineers and scientists with a minimum of a bachelor's degree. Training in the use of the structural mechanics simulation software—in this case, ANSYS DesignSpace on the ANSYS Workbench platform—is a prerequisite at Delphi Electronics and Safety.

Steady-State Thermal Analysis

The most common use of the ANSYS Workbench tool at Delphi is by design engineers engaged in product development. Analysis types include steady-state thermal, free vibration, and linear static stress analysis. More advanced types of analysis, including those involving material or geometric nonlinearity, transient loading, fluid flow, and multiphysics, are performed by full-time analysts.

Delphi produces a number of products including those for use in the automotive and consumer product sectors that must meet stringent thermal requirements. A steady-state thermal analysis is, in many cases, the first step in ensuring that the final product will meet the thermal requirements of the customer. Based on usage data collected annually, the ANSYS DesignSpace tool is widely used to perform this type of analysis.

For example, an integrated circuit package used in a transmission controller unit developed by Delphi might undergo a steady-state thermal analysis. Once the steady-state performance is established, transient and system-level analyses are performed to completely characterize the system.

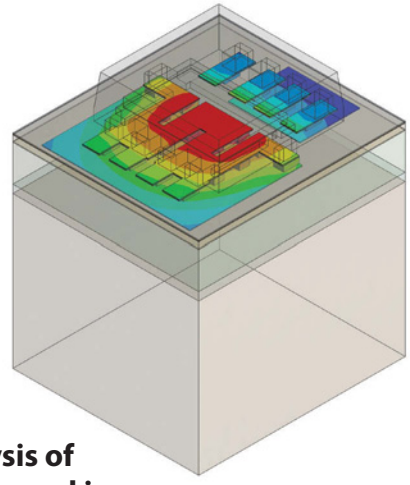
In another example, ANSYS DesignSpace software is often used for determination of the natural modes of vibration of a system. When Delphi develops an automotive part, the first step is to ensure that the first few modes of vibration of the product are beyond the minimum values that can be excited by the vehicle's operation. The image above (left) illustrates a study for the first mode of vibration for a bracket used to support an airbag control unit. Using the ANSYS DesignSpace tool to perform modal analysis, product engineers are able to determine if any changes to the initial design are needed to improve the vibration characteristics of the system. The design then proceeds to the next stage, in which harmonic and power spectral

density analyses are performed and any required changes are made.

Upfront Simulation Required

Today, the company has incorporated the use of structural mechanics simulation into the Delphi Product Development Process (PDP) as a requirement. The PDP begins with the concept stage and proceeds to the validation stage when prototypes are built and tested, and finally the program is handed off to manufacturing. This has led to developing much more robust and reliable products as well as greatly reducing or eliminating validation failures. This process is enforced by a Design Failure Modes and Effects Analysis (DFMEA) plan represented by a spreadsheet of possible failure modes for a product and indicating the required analyses to show that the product is immune to specific failures. A large number of engineers in the global Delphi organization use these tools, including the full suite of software in the ANSYS Workbench interface, to perform thermal, stress, vibration, and other general analysis in the course of product development. In 2007, the number of ANSYS DesignSpace users at Delphi exceeded 200, and approximately 30 percent were Delphi Electronics and Safety engineers. Delphi Electronics and Safety users globally logged 11,151 hours on the software, or 34 percent of the total for all sites internationally.

By adopting a comprehensive approach for implementing FEA across the worldwide organization, Delphi has effectively incorporated an extremely powerful technology into the product development process. The initiative to focus on upfront analysis in particular has resulted in outstanding business value for Delphi in terms of improved designs developed very efficiently. The use of the ANSYS Workbench platform has certainly facilitated this process by providing the ability to perform a variety of analysis types of different complexities in the same familiar environment. Perhaps the best indicator of the effectiveness of this software in a business context is management support for its widespread use by such large numbers of Delphi engineers around the world. ■



Steady-state thermal analysis of an IC package used in a transmission controller unit.

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FOR MORE INFO:

> ANSYS, Inc.

> Delphi Electronics & Safety Systems

Keeping MIME at Forefront of Design

> > Designing for minimum impact and maximum effect is as practical and cost-efficient as it is the environmentally responsible way to go.

BY MIKE HUDSPETH

Efficiency and simplicity are keys to successful design. I remind myself of that by adhering to the MIME principle—that's design that results in minimum impact for maximum effect. MIME is a way of getting the most bang for your buck while at the same time keeping your influence as low-key as possible. It's about doing more with less.

Simulation allows you to build and test your designs without wasting anything but time and hard disk real estate. PTC even has a digital Manikin to test the ergonomics of large assemblies.

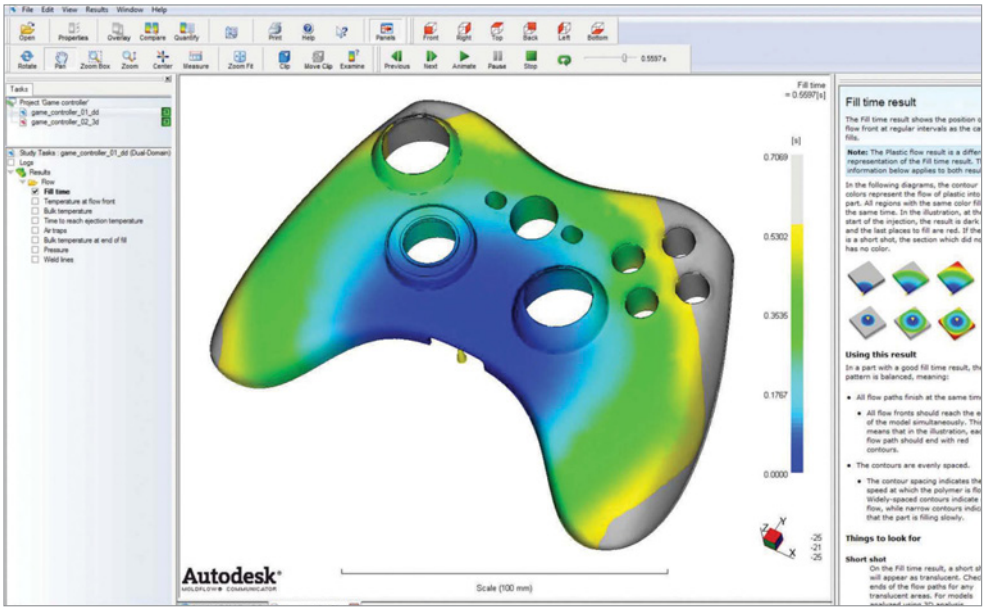
Minimal Impact and Responsibility

Regardless of where you stand on the global warming debate, there's no denying that everything we do has an impact on our surroundings. Yet MIME is more a practical approach to responsible design than an attempt to simply go green. The ultimate goal of MIME is to decrease expenses and increase profits by conserving resources and energy while at the same time minimizing any impacts on the natural environment.

The fact that green products sell is a supplemental gain to MIME design. "Going green" means finding a way to get the most out of what you have on hand without depleting supplies and making it necessary to go look somewhere else for more. It means using more sustainable products and materials that can be reused or re-grown. It means being more self-sufficient.

MIME Methods

Say you are asked to design a tube. You've heard the old saw that when you have a hammer everything looks like a nail. Well, if you are used to designing injection-molded parts, you might be tempted to just apply that process to the tube. Yes, you could get hundreds of great parts. But you'd have to design a new tool and it would cost you. And your lead-time would be measured in weeks, perhaps months. In contrast, an extrusion die is a tiny fraction of the cost of an injection mold. And lead times for extrusion dies can be as brief as days.



With mold analysis you can see how your material will flow within your injection mold. You can find out the flow front temperature, how your parts will cool, even where your knit lines and gates will be well before you cut any tool metal.

Aside from the tool there are raw materials to consider. For an injection mold you would most likely need to add in runners and sprues, both of which involve material waste and thus a higher per-piece expense. Machining is almost always going to give you more accurate parts, but the time and effort it takes to get them is costly. With an injection-molded part you get a more robust product because of their internal flow lines and counts in the hundreds of thousands—and fast.

Don't forget packaging. Will a folded cardboard box make more sense than vacuum-formed foam? McDonald's took a lot of grief for their Styrofoam containers years ago. They switched over to cardboard and their image improved. It certainly made marketing sense. MIME would tell us that we must know more about the available processes to select the one that offers the greatest ROI.

Implementation and Tools

There are two good ways to implement MIME for any project you are working on. Both are part of designing for manufacturability (DFM). That means designing things that are easy to make. Acquire and read everything you can about designing for assembly (DFA) and designing for disassembly (DFD). With these you can minimize the materials it takes to create your parts, the man-hours to put them together, and the energy to recycle them. These are some of the best things you can do for your products and your company. And they are 100 percent MIME.

Chances are you're already using the tools that

Tips for Applying MIME to Your Projects

Think about the environmental impact of producing your product. Production byproducts can have an impact long after their useful life.

- Don't use materials that are rare or hazardous unless there is no other choice.
- Pick a process with less impact. Learn about other processes and when they might be appropriate.
- Design for assembly. Fewer steps in manufacturing mean less energy and materials used (and lower costs).
- Think of how your customers will use your products. Design the product so it will be used properly.
- Think disposal of your product. Products can have an impact long after their useful life.
- Design for recycling. Some might refer to this as designing for disassembly.
- Don't design products that will end life as waste in a landfill. Try to use materials that will degrade quickly.
- Slow down; haste makes waste. Take time to think through what the impact of the project will be.
- Use recycled and recyclable or sustainable materials whenever possible. —*MH*

will help with your MIME implementation. Most state-of-the-art 3D MCAD programs offer different kinds of analysis packages. This is a very MIME thing. FEA—even the stripped-down versions that come free with most software—can help you design stronger and more reliable parts. That's good for business. With fewer fragile or broken parts going out, there is less material waste and happier customers. (Planned obsolescence is not an aspect of MIME.)

With injection molding you can produce huge numbers of parts very quickly. But be very careful not to create too much scrap in the form of sprues and runners.

We now have enough computing power on our desktops to enable us to see how our designs will work in the real world. We can test them in many ways: forces applied, parts assembled, maintenance performed, etc. There are even software packages that can simulate whether a worker can reach a tool up on a shelf.

Mold-analysis software is another product that falls into the good MIME camp. One of the most popular is MoldFlow from Autodesk. MoldFlow will help you find the optimum molding characteristics for your parts. You can simulate where knit lines will be (any time you have a through hole you're going to have one), where you are likely to get trapped gases (and thus where you need vents), even where you can expect short shots. All you have to do is build your model, establish where your gate is (and perhaps how many) and the program takes care of the rest.

Computer aided machining (CAM) software is another MIME-friendly product. It reduces scrap costs by basing the toolpaths directly on your 3D model. There is generally no human error (like misreading a blueprint or even typos actually ON the blueprint). And repeatability is all but ensured.

Last but certainly not least are rapid prototyping (RP) tools. Yes, there are costs involved with any kind of prototype, and RP technology keeps them under control. You get your parts sometimes within hours, and there is no tooling scrap (depending on the process you use).

Earth's a Closed System

I know that most of us don't make the decisions about which projects we work on. Management and marketing make decisions that designers have to deal with. But we each can design and act as responsibly as we choose. And in that way, we can effect change and make a difference in our world one decision at a time. Ultimately MIME is about designing sustainably so we don't use up all the planet's resources.

Earth is a closed system. There may come a time when we have exhausted its resources. MIME helps us push that time off as much as possible. ■

Mike Hudspeth, *IDSA, is an industrial designer, illustrator, and author who has been using a wide range of CAD and design products for more than 20 years. He is DE's expert in ID, design, rapid prototyping, and surfacing and solid modeling. Send him an e-mail about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Autodesk

> PTC

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PTC's Pro/Engineer Speeds Development of Denmark's First Supercar

> Zenvo Automotive was founded with only one goal in mind—to produce a unique hand-built supercar. The research and development for the prototype started in 2004. With the final prototype and performance testing now completed, the Zenvo ST1 is being introduced at selected venues worldwide.

Supercars are the fastest and most expensive cars in the world. Zenvo wanted to build a supercar that delivered power and speed, yet could be driven on a regular street by an untrained driver.

Zenvo was able to tap the power of the PTC 3D product design software solution Pro/ENGINEER to hand build the frame and body of the supercar and ensure that all of the car's parts work together flawlessly. The carmaker chose the software because of its broad array of functionality, user-friendly interface, ease of use, and extensive technical support.

> More info

Continuum Blue Uses COMSOL Multiphysics to Streamline Mixing of Polymers and the Manufacture of Implants

> Continuum Blue Ltd. (UK) is in the business of developing soft tissue implants made of hyper-elastic elastomers that dissolve in the body, eliminating the need for surgical removal.

During the development of novel new ligament implants, the company determined that the implants required anisotropic material properties. The problem was that a single elastomeric material could not meet requirements. To address this, Continuum Blue supported the development of a unique method of injecting two slow-curing polymers into a mold to create a one-piece implant with the desired anisotropic hyper-elastic properties.

With a COMSOL Multiphysics model, the company's engineers were able to evaluate how to best mix the necessary polymers and manufacture the 3D implantable device in a single production process. With this newfound knowledge, Continuum Blue significantly reduced development time and costs.

> More info

Altair's OptiStruct Helps Boeing Optimize Rotorcraft Design

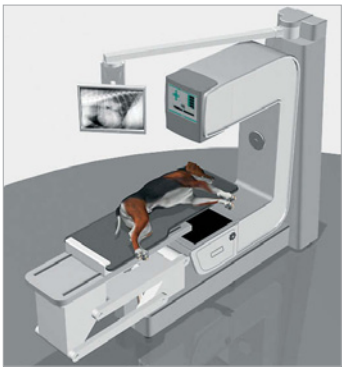
> In the late nineties, Boeing began manufacturing rotorcraft airframes by machining a single block of aluminum rather than constructing them of formed and riveted sheet metal. The new process has significant benefits, but when designed using traditional engineering tools and methods, the airframe structures are heavier than before. This challenge provided Boeing with the opportunity to take a fresh look at the design process.

As part of this effort, Boeing engineers identified the ramp on the Chinook CH-47 for a weight-savings pilot study to examine the benefits of topology-optimization technology to accelerate new product development and improve upon legacy designs.

Using Altair's OptiStruct, the engineers produced a "radical" new open-truss structure for the ramp. The software tool designs and optimizes the performance of mechanical structures by defining the best material distribution for a given design space, target mass, and method of manufacture.

> More info

Labview and CompactRIO Help Veterinary Supplier Develop 3-in-1 Imaging



> Animage, which delivers advanced imaging products to vets, decided to create a three-in-one imaging system called Fidex, including digital radiography, 3D CT, and fluoroscopy.

Engineers began by developing a benchtop prototype to control the X-ray source, detector, and motion system. Using LabVIEW, they focused on the key algorithms for the product and created the timing code to synchronize the X-ray source generation with the sensor data acquisition, integrated the mechanical prototype with the rack-mounted generation and acquisition system, and added motion control to demonstrate mechanics.

Next Animage developed a preproduction imaging system, using NI CompactRIO hardware to control a prototype scanner. The company's engineers then migrated the prototype to the final deployment technology by developing hazard-mitigation code and a user interface, and moved to a single-board computer designed for embedded machine development.

> More info

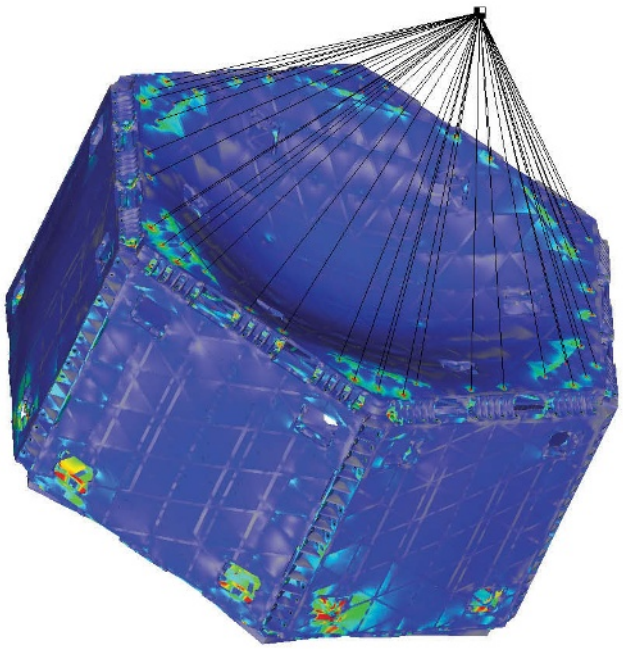
Femap Plays Key Role in Modular Satellite

> SpaceWorks Engineering, Inc. uses Femap with NX Nastran to develop a revolutionary modular design to build satellites in days, instead of years.

BY RUSSELL SHUBA

SpaceWorks Engineering provides unique and advanced satellite solutions for a range of customers. One of the company's current projects involves the development of the next-generation satellite structure for the U.S. Air Force Research Laboratory (AFRL). The system, appropriately named "Plug-and-Play Satellite" (PnPSat), features a modular framework of panels that use a shared electrical and communication bus that can be quickly assembled into a fully functional and ready-to-launch satellite in a matter of days.

Depending upon the mission of the satellite, any number of "off-the-shelf" spacecraft component modules can be plugged into the panels, making the satellite ready for immediate launch.

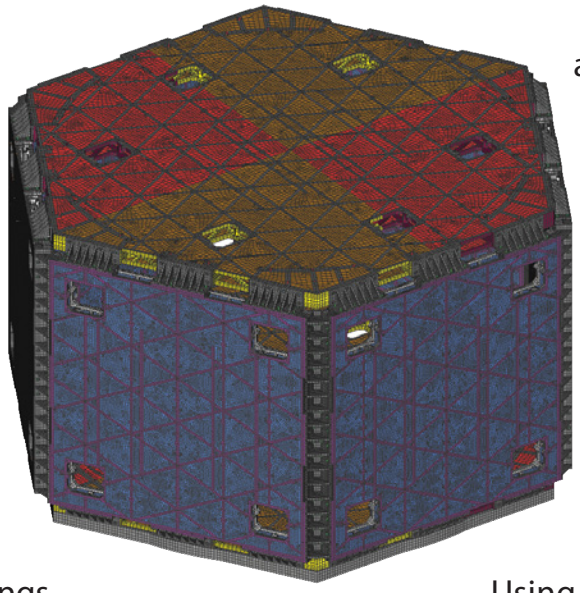


Each panel of the satellite is composed of an outer skin of plate elements meshed over a framework of 8-node brick elements. This efficient FE construction technique limited the model size to approximately 800,000 nodes. Meshing the geometry with 10-node tetrahedrals would have resulted in an FE model in the range of tens of millions of nodes.

A Revolutionary Leap

The approach represents a revolutionary leap forward. Typically, months and usually years are required to create a dedicated satellite. Conversely, the PnPSat system provides a turnaround time of just days for the right missions.

A key factor in the utility of the PnP satellite is its lightweight and rigid structural framework that facilitates the easy placement of spacecraft component modules (e.g., batteries and telescopic imagers). To allow commonality of usage, the framework was designed to launch the lightest combination of modules in any desired grouping. Determining the appropriate combination was not an easy process and required the extensive use of



Dynamic analysis of the PnPSat-2 satellite showed remarkable agreement with experimental results with normal mode predictions in the 5 percent range. Although the model was quite large (>800,000 nodes), run times were in minutes using Femap from Siemens PLM Software.

engineering optimization using finite element analysis (FEA).

To tackle the FEA end of things, SpaceWorks hired Predictive Engineering as its FEA specialist. "We chose Predictive Engineering due to the company's unique blend of high-end analysis resources and ability to easily work within our engineering team in meeting our schedules and budget," says Jeff Preble, president of SpaceWorks. Using Femap with NX Nastran technology from Siemens PLM Software, Predictive Engineering built a series of elegant but complex FE models that allowed SpaceWorks to quickly gain insights into the structural performance of this novel spacecraft structure. Within weeks, SpaceWorks verified its new design and won accolades from AFRL.

Leveraging Advanced Analysis

The PnP satellite structure is composed of eight panels that are bolted together. Each panel consists of two symmetric halves. The panel has thick ribs to provide structural reinforcement with a thin outer skin. Meshing the geometry with 10-node tetrahedrals would have resulted in an FE model in the range of tens of millions of nodes and would have proven essentially unsolvable. A different design approach was necessary.

Predictive Engineering determined that the only practical approach was to mesh the thin skin using plate elements and the thicker ribs with 8-node bricks. Using the advanced meshing techniques in Femap, a completely mapped mesh (bricks and plates) of the PnPSat structure with a node count of approximately 800,000 was produced. Although large by most analysis standards, the FEA results for the structure's normal modes were found to be within 5 percent of experimental results.

"We knew we were pushing the technology of both Femap and NX Nastran with this model and such tight correlation just confirmed to us that we were on the right track," says George Laird, principal mechanical engineer for Predictive Engineering. "To see such a good correlation on a very complex system model was impressive."

In addition, solution times were in the range of minutes using a standard 64-bit PC computational platform. Without the advanced meshing tools within Femap—creating matched grids of 8-node bricks and 4-node quads—it would have been impossible to achieve the simulation accuracy required by SpaceWorks. "We knew that we had the right engineering analysis team on board when we saw that not only the model was

accurate but we could generate optimization runs in minutes," says Preble.

Strong Competitive Position

SpaceWorks' development of the PnPSat structural system demonstrates its ability to rapidly respond with innovative solutions to highly complex engineering requirements. Preble points out, "Creating advanced models that are both accurate and fast definitely gives us a competitive edge and has become a critically important contribution on these fast-paced, technically challenging spacecraft projects." ■

Russell Shuba *is a freelance writer who lives outside Madison, WI. When he's not tracking down the details of his latest assignment, he can be found plying the north country's lakes in a homemade kayak or skiing in the backcountry. To comment on this article, send us an e-mail addressed to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Predictive Engineering
> Siemens PLM Software
> SpaceWorks Engineering, Inc.

ThinkStation D20: Lenovo's New Dual Quad-Core Powerhouse

> This new dual-socket workstation proves to be a heavyweight contender and an optimum choice for running any CAD or analysis application.

BY DAVID COHN

The ThinkStation D20 bears a striking resemblance to the S20, housed in a similar black case, but is noticeably larger. It's powerful, too; perfectly suited for any CAD, DCC, or analysis application.

For several years now, Lenovo has impressed us with a series of ThinkStation workstations aimed at midrange CAD applications (See November 2009 DE). But those systems were all equipped with single CPUs. Recently, Lenovo sent us its latest powerhouse, the ThinkStation D20, equipped with a pair of Intel X5550 "Gainestown" processors, derived from the "Nehalem" architecture. Like other recent Intel CPUs, the X5500 series provide support for tri-channel DDR3 memory as well as Intel Turbo Boost and Hyper-Threading technology.

The ThinkStation D20 bears a striking resemblance to the S20 we reviewed last year, but is noticeably larger. It comes housed in a similar black case, but this time the case measures 8.25 in. x 23.62 in. x 17 in. (WxDxH), with a removable handle that adds two more inches to its height. As noted in past reviews, we like the handle, which makes it much easier to move the 52-lb. computer. The top portion of the front panel provides three

A handle adds two inches to its height, but aids in moving the machine around.

5.25-in. drive bays, one of which contained a 16X DVD+/-RW dual-layer optical drive. Below these is a smaller bay containing a 20-in-1 media card reader as well as a panel with the power button, two USB ports, and headphone and microphone jacks. Icons above these ports light up, making them easier to find in low-light conditions. There's also a spot for a FireWire (1394) port, a $29 option that was included on our system.

The rear panel provides eight more USB ports as well as a 9-pin serial port, two RJ45 LAN ports, six audio jacks, S/PDIF input and output connections, a second 1394 port, and an eSATA connection. Pressing a small lever on the tool-less chassis is all it takes to remove the side panel to access the well-organized interior.

Inside, the two CPU sockets were fitted with a pair of 2.67GHz Intel X5550 CPUs hidden beneath large heat sinks and cooling fans. Each of these quad-core CPUs has 8MB of smart cache and is rated at 95 watts of thermal design power (TDP). Lenovo offers the ThinkStation D20 with CPUs ranging from the 1.86GHz Xeon E5502 up to the 3.2GHz Xeon W5580. The Lenovo extended ATX form factor motherboard has capability for 12 DIMM sockets. Our evaluation unit came with 8GB installed as four 2GB DDR3 PC3-1060 1333MHz memory modules. The D20 will be able to accommodate up to 192GB of RAM once 16GB DIMMs become available.

The motherboard provides a total of six expansion slots: two PCIe x16 slots, a PCIe x4 slot, a PCIe x1 slot, and a pair of standard PCI adapter card slots. One of the x16 slots on our evaluation unit was filled with an NVIDIA Quadro FX4800 graphics accelerator equipped with 1.5GB of memory. This large, ultra high-end board covered one of the PCI slots and was so wide that we questioned whether it would be possible to install a second FX4800, although Lenovo does offer that option. With two large graphics adapters installed, the only slots left accessible would be the PCIe x1 and one of the PCI card slots. Lenovo also offers less-powerful graphics boards, including the entry-level NVIDIA Quadro NVS290 as well as ATI boards including the Fire Pro V7750.

The internal drive cage provides five 3.5-in. drive bays with quick-release acoustic-damping rails. Our evaluation unit came equipped with a pair of 500GB Western Digital Caviar 7,200rpm SATA drives configured in a RAID 0 array; they appeared as a single 1TB drive. While that provided lots of storage space and can boost performance, it's not the safest configuration: if either drive fails all data will be lost. The BIOS also supports RAID 1, RAID 5, and RAID 10 and the motherboard includes five SATA connectors. Other SATA as well as SAS drives are also available.

The 1060W power supply provides more than enough energy and enough additional power connectors to handle any expansion option. In

ThinkStation D20 Workstation Benchmark

		Lenovo D20 workstation (two 2.66GHz Intel Xeon X5550 quad core CPUs, NVIDIA Quadro FX 4800, 8GB RAM)		**Dell Precision T3500** workstation (one 2.27GHz Intel Xeon E5520 quad core CPU NVIDIA Quadro FX 3800,4GB RAM		**Lenovo S20** workstation (one 2.93GHz Intel Xeon W3540 quad core CPU, NVIDIA Quadro FX 4800, 4GB RAM)		**HP Z800** workstation (two 3.2GHz Intel Xeon X5580 quad core CPUs, NVIDIA Quadro FX 4800, 12GB RAM)		**HP xw8600** workstation (two 3.4GHz Intel Xeon X5492 quad core CPUs, NVIDIA Quadro FX 4800, 4GB RAM)		**Lenovo Thinkstation S10** workstation (2.66GHz Intel Core 2 Q6700 quad core CPU, NVIDIA Quadro FX 4600, 2 GB RAM)
Price as tested		$5,943		$2,544		$3,885		$10,604		$9,307		$2,589
Date tested		1/11/10		7/30/09		7/29/09		4/24/09		12/22/08		6/30/08
Operating System		Windows XP	Windows Vista	Windows XP	Windows Vista	Windows XP	Windows Vista	Windows XP 64	Windows Vista 64	Windows XP	Windows Vista	Windows XP
SPECviewperf	higher											
3dsmax-04		50.38	51.21	39.91	42.75	48.43	52.59	50.55	51.51	52.24	**54.61**	**37.88**
catia-02		61.79	62.01	51.85	53.33	60.40	60.61	62.10	61.66	**63.17**	62.48	**48.25**
ensight-03		55.26	53.51	47.26	47.84	51.74	**55.33**	53.99	53.62	54.44	50.82	**43.33**
maya-02		**250.41**	223.73	220.79	199.04	232.92	207.87	213.80	209.74	234.50	193.15	**191.10**
proe-04		**64.83**	63.66	55.67	55.54	61.56	64.49	63.59	61.48	52.73	57.15	**48.86**
SW-01		144.17	**145.19**	123.28	120.57	136.81	139.54	135.24	128.08	109.91	119.29	**90.90**
tcvis-01		**40.55**	39.51	28.71	28.07	29.17	38.76	28.93	28.29	29.84	27.58	**24.46**
ugnx-01		**34.93**	34.52	33.40	32.27	33.41	33.19	33.34	32.38	34.17	31.14	**27.04**
SPECapc SolidWorks	lower											
Score	seconds	141.59	n/a	178.39	n/a	**140.42**	n/a	145.17	n/a	164.71	n/a	**188.01**
Graphics	seconds	41.48	n/a	**62.99**	n/a	47.33	n/a	**41.31**	n/a	54.18	n/a	60.13
CPU	seconds	33.00	n/a	36.68	n/a	**31.01**	n/a	32.68	n/a	**44.36**	n/a	41.48
I/O	seconds	67.73	n/a	83.35	n/a	**65.86**	n/a	71.94	n/a	69.96	n/a	**90.18**
SPECapc SolidWorks	higher											
Score	ratio	6.28	n/a	4.66	n/a	5.91	n/a	**6.38**	n/a	4.84	n/a	**4.56**
Graphics	ratio	4.68	n/a	**2.92**	n/a	3.92	n/a	**4.85**	n/a	3.55	n/a	3.15
CPU	ratio	9.78	n/a	8.80	n/a	**10.41**	n/a	9.87	n/a	**7.27**	n/a	7.72
I/O	ratio	4.67	n/a	3.80	n/a	**4.81**	n/a	4.40	n/a	4.52	n/a	**3.51**
Autodesk Render Test	lower											
Time	seconds	64.00	63.60	118.20	125.00	99.00	117.60	59.00	**52.00**	64.40	67.60	**153.20**

Numbers in **blue** indicate best recorded results. Numbers in **red** indicate worst recorded results. Results are shown separately for portable and desktop workstations.

spite of lots of fans, including those on the CPUs, rear panel, power supply, graphics card, and behind the hard drive bay, the ThinkStation D20 was virtually silent after its initial startup.

Cutting edge performance

Lenovo pre-installed the 64-bit version of Windows Vista and also sent us a pair of drives that we could swap out, so we could repeat all of our benchmark tests using Windows XP 64-bit Edition. Once again, Lenovo proved that its engineers know how to combine and configure first-class components to deliver cutting-edge performance. The ThinkStation D20 equipped with the NVIDIA Quadro FX4800 graphics board turned in some of the fastest SPEC viewperf scores we've ever recorded on a number of the datasets, with the top SolidWorks dataset numbers coming while running Vista.

When we turned our attention to the SPECapc SolidWorks benchmark, however, which is more of a real-world test (and breaks out graphics, CPU, and I/O performance separately from the overall score), the numbers showed the D20 actually lagging slightly behind the Lenovo ThinkStation S20. While this was initially a bit of a surprise, it's more the fault of the benchmark test itself rather than the computer. Managing the second CPU adds just enough system overhead to cause this apparent decrease in recorded performance. When you compare the actual scores, the differences between the S20 and D20 as well as the HP Z800 are negligible.

Inside, two CPU sockets were fitted with a pair of 2.67GHz Intel X5550 CPUs hidden beneath heat sinks and cooling fans. Each of these quad-core CPUs has 8MB of smart cache and is rated at 95 watts of TDP. The D20 will accommodate up to 192GB of RAM once 16GB DIMMs are available.

And when we turned our attention to the AutoCAD rendering test, the true performance numbers and the advantage of all those extra CPU cores becomes readily apparent. With hyper-threading enabled, the pair of quad-core CPUs made it appear to the operating system as if the D20 had 16 processors. Since AutoCAD's Mental Ray rendering engine is multi-threaded, the ThinkStation D20 completed our test rendering in 64 seconds, just 12 seconds behind the HP Z800, whose premium-priced CPUs were running more than 500MHz faster.

Lenovo rounded out our evaluation unit with its Preferred Pro USB Fingerprint keyboard, a full-size 104-key keyboard with an integrated fingerprint

sensor and accompanying software so you can swipe a finger across the sensor rather than type passwords. A Lenovo-branded Primax optical wheel mouse was also included.

In addition to the 64-bit versions of Windows XP and Vista that we received, you have the option of having other operating systems, including Windows 7 or Red Hat Linux 5 pre-installed, as well as ordering a system with no installed operating system. Several versions of Microsoft Office as well as other application software are also available at the time of purchase. Lenovo backs the system with a three-year limited onsite warranty. The D20 uses 27 percent post-consumer and 23 percent post industrial plastic content, meets Entergy Star 5.0, EPEAT Gold, RoHS, and 80 PLUS Bronze criteria, and is GREENGUARD certified.

Base systems start at $1,269. As configured, our evaluation unit priced out online at $5,943. You could certainly reduce that price significantly by opting for a single hard drive and lesser graphics board, and still end up with an extremely powerful system. Once again, Lenovo has impressed us. The ThinkStation D20 is clearly a top-of-the-line workstation. ■

*Contributing Editor **David Cohn** is DE's MCAD and workstation expert. A computer consultant and technical writer based in Bellingham, WA, he has been benchmarking PCs since 1984. He's the former editor-in-chief of Engineering Automation Report and CADCAMNet, and the author of more than a dozen books. Please send comments about this article to DE-Editors@deskeng.com. You can also contact David at david@dscohn.com.*

Lenovo

Lenovo ThinkStation D20

> **Price:** $5,943 as tested ($1,269 base price)
> **Size:** 8.25 in. x 23.62 in. x 17.0 in. (WxDxH) tower
> **Weight:** 52 pounds
> **CPU:** two Intel Xeon (Quad Core) X5550 2.67GHz
> **Memory:** 8GB DDR3 SDRAM at 1333MHz
> **Graphics:** NVIDIA Quadro FX 4800
> **Hard Disk:** two Western Digital 500GB Caviar SATA 7,200 rpm drives in a RAID 0 array
> **Floppy:** none
> **Optical:** 16X DVD+/-RW Dual-Layer
> **Audio:** onboard integrated SoundMAX 7.1 audio (microphone, headphone, line-in, front speaker, rear speaker, center/subwoofer, and S/PDIF in and out)
> **Network:** integrated 10/100/1000 LAN (two ports)
> **Modem:** none
> **Other:** One 9-pin serial, ten USB 2.0, 1394 (FireWire), 20-in-1 media card reader
> **Keyboard:** 104-key Lenovo Preferred USB Fingerprint keyboard
> **Pointing device:** USB optical roller wheel mouse

FOR MORE INFO:

> Lenovo

Analysis Driven Design – Not Just For the Expert Anymore

> Design engineers can use increasing workstation power to build better products.

BY PETER VARHOL

Most design engineers haven't had an opportunity to fully exercise their skills and creativity in designing new products. Because of the need to do finite element analysis and simulation on large clusters or supercomputers, designing on the desktop was largely hit or miss. It wasn't possible to create a design, run the analysis, and incorporate the results back in order to fine-tune the design. You needed an expert and access to an expensive and often complicated high-end cluster or supercomputer to analyze a design and employ the results to improve the design. Unless the analysis indicated an inadequate design, the engineer took the results of a single analysis and made final adjustments to a design. While it met the defined design criteria it may not have been the optimal design.

That approach is changing, thanks to the affordable power of engineering workstations and work group high performance clusters. With these tools, engineers can complete virtually all of the initial design work on the desktop, rather than taking a design as far as it can go on the desktop, then sending it to a supercomputer or cluster to perform a structural or dynamic analysis. Now, analysis and simulation can be done by all design engineers as a part of the design process. Any design engineer can be an expert in analysis and simulation, performed on the desktop workstation.

Today, it's possible to create a design, perform multiple analyses and even a simulation of the design, make adjustments based on the results, and run the analysis again to ensure its correctness. It's also possible to test different designs altogether to determine the most appropriate one.

Technologies That Are Changing The Game

What is driving this new approach to design engineering? Two technology breakthroughs; first, users now have access to inexpensive workstations and workgroup clusters based on the new 64-bit Intel® Xeon® processor 5600 series. These

workstations and work group clusters deliver the compute capacity of high performance computers that were in a glass room just a few years ago. Second, the transformation from discrete software tools into organized and democratized software suites from companies like ANSYS, SolidWorks and others are easier to use by more than just the expert simulation engineer.

The result is analysis driven design is no longer a luxury, it is a mandate to delivering newer, more innovative products to market faster than ever before. Today's new workstations are now capable of computing finite element analysis, multiphysics analysis, fluid dynamics, and other sophisticated processes at your desk.

And with technologies from Intel like Intel® Turbo Boost and Intel® Hyper-threading technologies performance of CAD and CAE tools is getting faster than ever.

It's Time For Analysis Driven Design

With the advent of new hardware and software technologies it is now time to re-evaluate how you design and develop products. It is time to change the workflow and optimize it to leverage new tools.

Desktop engineering workstations take analyses that used to require hours and can now be accomplished in a matter of minutes. If a larger analysis is required, engineering teams can implement a highly effective and affordable workgroup high-performance cluster. These clusters, available from companies like SGI, Appro and others, take advantage of the Intel® Cluster Ready specification. The specification is designed to minimize traditional support, installation, and deployment issues. Organizations will see entirely new systems with amazingly simple deployments utilizing Intel® Cluster Ready certified hardware and software components. Intel Cluster Ready simplifies the HPC solution requirements for large and small organizations.

These hardware and software technologies should cause a paradigm shift in how we approach product development. Engineers need be given tools that give them an opportunity to design the optimal product and not simply an adequate product.

As engineering teams consider technology upgrades, they should evaluate the economic and product development benefits of analysis driven design workflows and contrast that benefit to the small incremental investment in dual processor workstation technology and work group focused HPC clusters. They may find these investments can save time and produce better products that not only boost a business's competitiveness but also result in faster time to market. Last, it saves the most valuable commodity – the engineer's time and skill, which can better be put to use on improved designs or more design projects. ■

FOR MORE INFO:

> Intel Corp – Workstation
> Intel Corp – HPC
> Intel Corp – Cluster

DE MARKETPLACE

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This laser-sintered mold is used for producing plastic injection molded drinking cups.

Image courtesy EOS

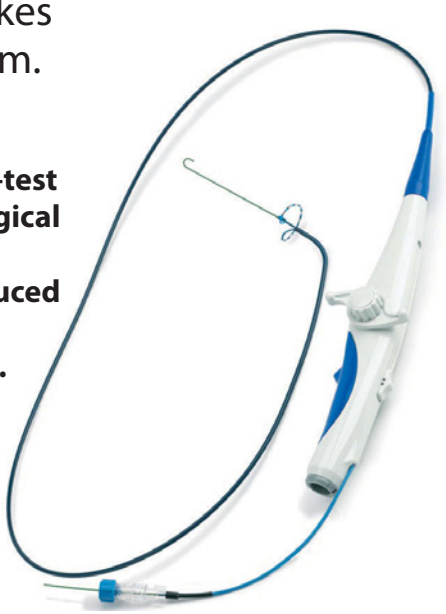
By Pamela J. Waterman

Rapid Tech Aids Medical/Dental Fields

> Daily production of tens of thousands of parts takes these applications far beyond the prototyping realm.

In the past year, if you or someone you know has had a dental crown installation, hearing aid fitted, or electrotherapy treatment, the procedure likely involved an additive manufacturing (AM) process. Jay Leno may get the spotlight for building one-off car parts, but the real news in rapid technology (RT) comes from the sheer numbers and variety of medically related pieces now in daily production.

Companies such as 3D Systems, Arcam, EOS, Envisiontec, ExOne, Objet Geometries, Solidscape, Stratasys, and Z Corporation are producing plastic and metal products that are either fully qualified as a tool in a medical or dental procedure, or become a final part for the application itself. DE looks at the latest of these accomplishments, which show no signs of slowing down.



Working beta-test version of surgical ablation tool; housing produced on Stratasys Fortus system. *Image courtesy Stratasys*

Tools of the Trade, RT Style

With necessity, or possibly frustration, being the mother of invention, it's no surprise that many medical devices first see light of day as a design by an independent doctor. Taking that rough concept from napkin drawing to initial production generally involves working with a product development company that creates a first article for design and material evaluation. If the prototype seems acceptable, production tooling is ordered, easily starting at $50,000. But what happens three months later when field-testing uncovers design flaws in 2,000 injection-molded parts?

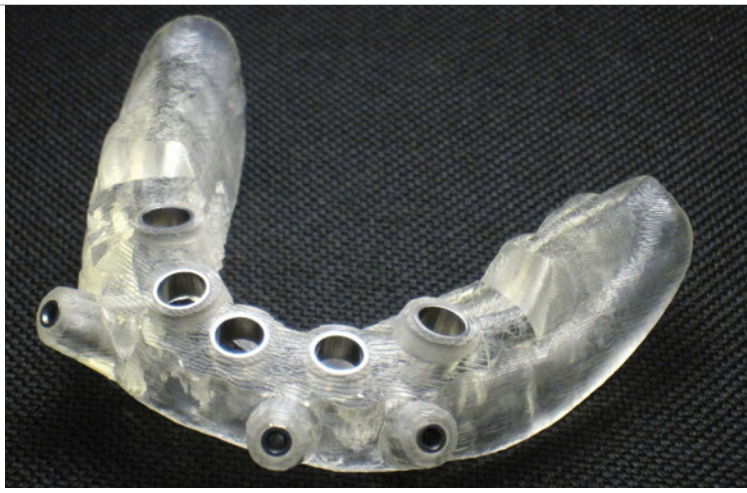
Stratasys is helping minimize the risk of both time and money by offering a step-by-step AM-based path for product development. The company's Fortus 3D production systems can build parts from a range of production-grade thermoplastics,

including polycarbonate (PC)-ISO and ABS-M30I versions for direct medical applications.

PC-ISO met the material needs for Ablation Frontiers (now part of Medtronic) to provide early adopters with a real, autoclave-safe defibrillator tool for use in open-heart surgery. Working with Stratasys' RedEye service bureau in a parallel effort of user evaluation and design refinement, the medical group was able to incorporate seven design changes during beta testing of 10 to 20 parts at a time. The tool has now gone into clinical trials.

The ability to combine an AM strategy with an ISO-10993 certified material offers a crucial advantage. Stratasys product manager Tim Thelin says, "When a product development company does a material search, that's when the door opens (to using our systems)." A second product in development with the help of RedEye is a suture device made from high strength ABS-M30I. This biocompatible material can be sterilized with gamma- or ethylene-oxide processes, necessary in cases where high-temperature steam is not permitted (e.g., instruments with wiring). The device customer is currently shipping surgically qualified products, generating interest and income that will support larger-scale injection-molded manufacturing.

3D Systems' large family of AM products includes high-end metal-based selective laser sintering (SLS) and plastic-based stereolithography apparatus (SLA) systems. Historically, the company has seen SLA used for surgical planning models. Now, an emerging market for both technologies is that of single-use surgical guides, akin to those used as dental drilling guides, in applications such as orthopedic surgery.



A custom plastic dental drilling guide made on a 3D Systems SLA machine. This aids dentists in drilling holes for inserting tooth implants.
Image courtesy 3D Systems

"Our 8000 IPro series has taken accuracy to a whole new level," says Kevin McAlea, 3D Systems' general manager and vice president for large-frame systems. "Customization of (these) products lends itself to a high throughput machine. We're talking about hundreds of thousands per year." Along with the accuracy, having materials that can be sterilized and meet U.S.P Class 6 tests for various aspects of toxicity has been key to customer interest.

Other medical application areas under study on 3D Systems SLS equipment include metal bone-replacement materials built as porous parts and bone-scaffolding pieces built from high-temperature plastics.

Metal bone-replacements, such as hip and spine implants, have long been a specialty of Arcam, developers of electron beam melting (EBM) systems. EBM parts made of titanium or cobalt-chrome are well-suited to osseointegration, since they can be optimized in terms of pore geometry, pore size, relative density, and roughness. Using Arcam equipment, a growing number of medical technology companies have developed standard

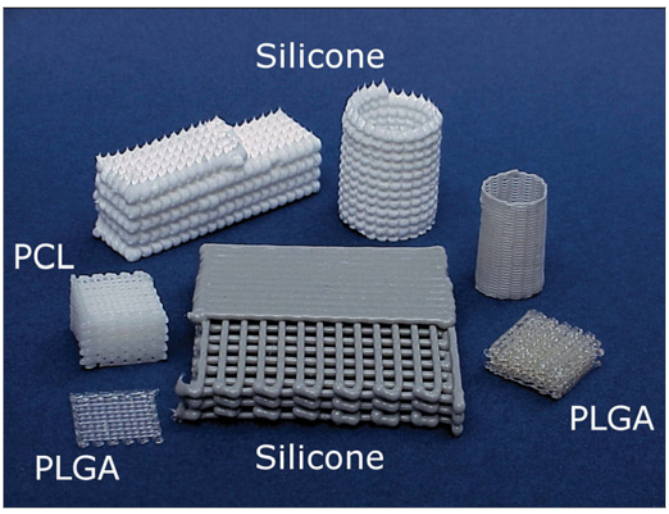
and patient-specific products that are CE-certified for surgical implant.

Reducing Timelines

Companies that work with Objet Geometries are completely changing the way they do business because of the speed, accuracy, and smooth finish derived from Polyjet Polymer Jetting technology. One medical customer, Ivivi Health Sciences, develops noninvasive electrotherapy devices, some of which stimulate a patient's antiinflammatory responses, reducing pain and swelling; other products treat cardiac, neurological, and orthopedic conditions.

Andre A. DiMino, Ivivi vice president of engineering, manufacturing, and regulatory, says that Objet's Eden350 system has given Ivivi the ability to create working medical devices overnight that are ready for clinical trials.

Another Objet customer, Orchid Design, a division of Orchid Orthopedic Solutions, works with medical professionals to design, prototype, and test new orthopedic solutions. Since development time is critical during the FDA approval process, Orchid was pleased to find that in-house use of Objet's Alaris30 Desktop 3D printer let it build prototypes 10 to 20 times faster than before; timelines are now reduced by 20 percent.



Sample biocompatible scaffold structures built on an Envisiontec 3D-Bioplotter.
Image courtesy Envisiontec

Growing Business

The introduction of Z Corporation's water-curable zp150 plastic material has given a boost to device developers as well as doctors planning complex surgeries. As the company's strongest, whitest, highest resolution material yet for any of its 3D printing systems, the material produces surgical models that look more like bone when compared to parts made from zp131 powder.

Z Corporation Vice President of Business Development Scott Harmon notes the benefits of using this material and process: Surgical customers can visually differentiate various tissues involved and "wrap" bone-density maps on the model's surface, while device developers appreciate the brilliant colors that come from working on a bright-white substrate.

Dental applications form a major share of business for Envisiontec, whose AM systems are primarily based on Texas Instruments' DLP technology. Operating with a choice of materials suitable for the dental and hearing-aid industries, several thousand Envisiontec systems are in use worldwide. The company's Digital Dental Printer (DDP) creates investment castings for crowns with WIC300, a material that literally melts out (leaving no ash) and also produces dental drill guides with its biocom-

Is the U.S. on par with Europe for medical implant adoption?

Additive manufacturing industry consultant Terry Wohlers, doing research for his annual Wohlers Report on the state of the AM industry, points out that the U.S. acceptance of AM technology for medical applications lags that of Europe. He notes, "The part that's most frustrating is the lack of adoption of metal orthopedic implants. I'm unaware of a single company here in the U.S. that is using AM to manufacture metal implants. A minimum of nine European companies are using AM for this application and six are in production at some level. Europe has granted CE certification for the production of hip implant products, but here in the U.S., the FDA has not yet done so."

Wohlers explains that surgeons are using custom implants from AM on a one-off basis. "If you want to introduce a mainstream product, the FDA must get involved, and that hasn't happened in the U.S." By contrast, one of Arcam's European customers has CE certification for an implant product and uses six EBM machines to manufacture more than 25,000 products per year at one location. "There's nothing remotely close to this here in the U.S.," Wohlers observes (wohlersassociates.com). — *PJW*

patible e-Shell 300 material. For crown wax-ups made on a DDP, the average part cost is $0.20.

Envisiontec also plays a role in the world of computer-aided tissue engineering. Its 3D-Bioplotter fabricates scaffolds from a truly impressive range of materials, from tricalcium phosphate for bone regeneration to the FDA-approved copolymer polylactic-co-glycolic acid (PLGA) as a drug-release mechanism, and from agar to chitosan for soft tissue printing.

Metals and Plastics Go Bionic

It's difficult to name an application area where EOS systems don't play a prominent role, particularly in medicine. This company continues to expand the material offerings for both its plastic and metal precision laser sintering machines, and so the variety of applications grows too. Specialty instrumentation, knee replacements, and dental implants are just three of the many products now created in ongoing product lines.

EOS' vision has always been to use its technology to tailor patient-specific products; two relatively new applications are moving that plan forward. Andy Snow, EOS regional sales manager for North America, says, "Some of our customers are utilizing our plastic technology for patient-specific hip and knee cutting guides, in preparation for surgery, with the use of our PA2200 nylon (Class 6 biocompatible) material."

He adds that another EOS plastic—high-temperature PEEK HP3, originally developed for aerospace applications—has attracted interest in the medical arena. Its outstanding tensile strength (up to 94MPa) makes it a candidate to replace stainless steel and titanium in spinal implants. Titanium use continues to gain in the dental world, particularly for dental implant screws, and cobalt-chrome alloys make an excellent base for porcelain restorations.

Solidscape, a pioneer in fine-detail wax-up parts

for casting, continues to market its preXacto line of inkjet droplet systems to the dental industry. More sources are emerging for AM cost-savings in the dental field. 3D Systems has expanded its product line and material offerings to compete strongly in this arena with its dedicated Top to Bottom Dental business. Their crown jewel (no pun intended) is the role their SLA machines play in creating the molds for Invisalign removable orthodontic appliances.

Hearing aid manufacturing (in thousands per day) forms the next largest market, but interest from the general dentistry segment is increasing. Lee Dockstader, vice president of 3D Systems dental segment, explains that many factors are coming together to make this an excellent time to use AM. "The manual way of taking impressions has many variables; intra-oral scanners remove the variables. There's new software, there's impression scanners, and the big players use stereolithography to produce the models (for building a crown, etc.) When they take a crown off the model, it fits every time."

This level of automation allows dental labs to keep their work from going overseas, saving the mailing time previously required, and the dentist time in fitting the crown to the patient. Other 3D Systems options include its selective laser melting systems for metal copings and implants, as well as the new ProJet MP3000 for $65K.

For more than ten years ExOne and its various divisions, from ProMetal to Imagen, have been involved in printing precious metals, particularly for dental applications. While Imagen is currently undergoing a business reorganization, ProMetal engineers have been busy supporting ADA Technologies' prosthetics R&D division, PhysioNetics.

Skull model for surgical preplanning, produced in bright white plastic on ZCorp 3D printer *Image courtesy ZCorp.*

AM: Medical Business as Usual?

Just as the dental and hearing-aid worlds now use AM as a regular way of doing business, more medical apps are evolving. Product development companies continue to make the connection between a great new idea and this great way to build it, and more manufacturing companies are treating it as a standard mode of operation. As 3D Systems' McAlea says, "Seeing some of these applications emerge is truly remarkable—what we can get from an accuracy point of view, I didn't really think was possible five years ago. It's really gratifying." ■

*Contributing Editor **Pamela J. 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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By Susan Smith

New Sintering & Small Printers Lead The Way

> Rapid manufacturing and prototyping hardware reflects new efficiencies, a move to recycle, and the economic downturn.

Bringing 3D printing to the desktop is a great idea. And it's gotten there due to technology that has shrunk the hardware's footprint and made processes safe for office environments by preventing dust from escaping machines. Other pluses are improved efficiency and recycle consumables left over from the process.

DE took a look at the year's offerings in printers and scanners and offers the following compendium.

The Mcor Technologies Matrix 300 uses paper and a water-based adhesive to create 3D parts.

Z Corp. ZPrinter 350

The ZPrinter 350 monochrome 3D printer ($25,900) is touted as a fully functional automated 3D printing solution. The printer has much of the automation of the earlier 450 and 650 models, including snap-in cartridge loading, automated material loading, intuitive control panel, automated recycling of used build material, and self-monitoring.

Joe Titlow, Z Corp. product manager, said that 80 percent of the functionality of the higher-end systems has been ported to this entry level product. The build speed is approximately the same, at about .8 vertical in. per hour, "which means that you can create a model several inches tall in just a few hours."Why a monochrome 3D printer? Because monochrome is a less-expensive process than color and simpler to use.

The build size is 8 in. x 10 in. x 8 in. As with the ZPrinter 450, the 350 has 300 x 400 dpi resolution, which has proven capable of producing detailed features. The ZPrinter 350 also features office-safe build materials, dust control, noise control, and no liquid waste—making it a true office solution.

The Dimension uPrint Plus.

The materials use non-toxic powders and binders. "All unused powder is completely recycled and used in the system," said Titlow. This is in clear contrast, according to Titlow, to systems that build supports that are cut away and discarded after printing. Such support material can comprise 50-70 percent of the volume of the part.

"We have a new water cure finishing process," said Titlow. "When the parts come off our machine they're simply blown off to remove all that loose powder that acts as support and then it can just be misted with a water solution," Titlow said.

Dimension Printing uPrint Plus

Another desktop machine is the new uPrint Plus from Dimension Printing, a division of Stratasys. The uPrint Plus ($19,900) is an enhancement of the uPrint ($14,900), has a larger build envelope at 8 in. x 8 in. x 6 in. (33 percent more build volume) and the ability to print models in eight ABSplus material colors—red, blue, olive, black, dark gray, nectarine, fluorescent yellow, and ivory. It still has the small footprint of 25 in. x 26 in.

The new colors should interest engineers looking to differentiate components and intrigue clients with a concept design that looks more like the end product. It also offers two resolution settings of 0.010 in (0.254 mm) and 0.013 in (0.330 mm).

The company says two support-material enhancements will reduce material consumption and modeling time. The first, Smart Supports, cuts material use by 40 percent, while the second, SR-30, is an improved soluble support material that dissolves 69 percent faster, to speed the modeling process. Smart Supports are available for both uPrint and uPrint Plus.

The two machines do not generate any powders or dust. The material is a solid filament wound on a spool that is liquefied before being extruded into thin layers.

3D Systems V-Flash Modeler

The V-Flash Desktop Modeler from 3D Systems (priced at less than $10,000) has a footprint of 26 x 27 in. (660 x 685 mm) and weighs 66 kg (146 lbs). Like the previous printers, it too fits easily in the home or business workplace.

The V-Flash process is described as "instant" prototyping by the company and the build volume of 9 in. x 6.75 in. x 8 in. (230 x 170 x 200 mm) makes it possible for users to create a broad range of part sizes. According to 3D Systems, the V-Flash is easy to install, so that first-time users can start making models in minutes.

Parts are attached to the build pad "using small, strategically spaced break-off supports that use a minimum amount of material" so that less material is used, translating to less cost overall. Building material can be replenished during the printing process. V-Flash has patented and proprietary Film Transfer Imaging (FTI) technology that eliminates wear parts in the printer, instead transferring them to the returnable and recyclable single-use material cartridge.

Solido SD300 Pro 3D

When 3D printing company Solido struck a deal with CAD software and service provider SolidVision, the two took a giant step in a new direction for the world of 3D printing. The agreement meant that Solido's 3D desktop prototype printer, the SD300 Pro 3D printer ($9,950), could be brought to SolidVision's broad base of CAD users. By using their CAD data to directly build in-house designs, users could use those specifications to cut, glue, and layer engineered plastic sheets from a spool, a process known as laminated object manufacturing (LOM).

While previous attempts at LOM had met with criticism because it wasn't capable of producing high detail and resulted in hazardous waste, the SD300 Pro changes that. The SD300 produces detailed, functional parts within 0.1mm accuracy and cuts down on waste. Customers send Solido their empty containers and waste material in pre-paid pouches, and earn "green points" to use toward credit on their next order. In addition, the material is non-toxic and can be peeled away from parts with forceps supplied with the machine.

The V-Flash Desktop Modeler from 3D Systems

With minimal training, users can drill, finish, and assemble parts to create larger models without having to outsource. And the process enables nesting multiple parts to run builds simultaneously.

Mcor Technologies Matrix 300

The Matrix 300 ($20,000) is unusual in that it uses paper and a water-based adhesive to create 3D parts. A tungsten carbide blade cuts the profiles. "We don't use a laser, try to keep the costs down and try to keep the machine as robust as possible," said Conor Mac Cormack, Ph.D., CEO of Mcor Technologies, which manufactures the printer.

Mac Cormack says that because it uses paper and a water-based adhesive instead of a polymer material, it is eco-friendly. Finished printed parts can be thrown into the paper-recycling bin when no longer needed. Users can also use scrap paper from a regular photocopier or printer in this machine.

The Matrix 300 has an aluminum chassis con-

A1 Technologies RapManPro 3D Printer

The RapMan Pro 3D Printer (starting at about $3,000) from A1 Technologies is based on the company's earlier RapMan 3D Printer in kit form.

Designed by Bits From Bytes, and supplied by A1 Technologies, the RapMan Pro, recently renamed the BfB 3D, has been developed using open source technology. The open source technology means that anyone can contribute to the design, and everybody owns the design. It is said to be similar to the fused deposition modeling (FDM) technology from Stratasys in that it uses a filament off a spool, heats the filament with an extrusion tip, and lays down the plastic layer by layer. That's where the similarity ends, however, as the BfB 3D is a very inexpensive product compared with the higher-end FDM machines from Stratasys.

Improvements in the BfB 3D include an anodized aluminium chassis for more rigidity. The Z axis now uses lead screws, which has enhanced Z-axis performance, accuracy and repeatability.

The RapMan kit runs with two key materials: ABS and PLA. Both of these materials are supplied to the machine on spools and 100 percent is used. The only waste that results comes from any support structure. However, it should be noted that the volume of waste from support materials can be cut by a well designed part and part orientation on the machine.

ABS is a common plastic material that can be shredded and then recycled, although A1 does not yet offer this service. PLA (poly-lactic acid) is a biopolymer and is therefore biodegradable and environmentally friendly. It is capable of building large parts, but with the crucial benefit that the lifecycle of the part itself has zero carbon impact on the environment.

struction with a device similar to a paper-feed mechanism in a large photocopier. The size of models are in the range of 8.5 in. x 11 in. x 6 in. Multiple parts can be manufactured and joined together afterward using the same adhesive within the machine so there is good uniformity and bonding along the joints.

Objet Connex 350

Objet Geometries launched the Connex350 ($200,000), a 3D printer that enables the simultaneous printing of multiple materials with different mechanical and physical properties. Modeled after Objet's Connex500 ($250,000), the first to offer printing multiple, diverse materials, the Connex350 is a smaller machine with a smaller build tray size (13.78 in. x 13.78 in. x 7.9 in.) for economy-minded organizations.

Both the Connex500 and Connex350 use Objet's patented PolyJet Matrix technology that makes it possible to produce multi-material models such as a rigid cell phone housing with soft buttons that also possess great detail and accuracy. The prototypes, made of a combination of flexible and rigid materials, closely resemble the feel, look, and function of final products.

The system can jet two different Objet FullCure photopolymer materials in pre-set combinations to create 16-micron, high-resolution layers. Once cured, the material can be recycled with any plastic

recycling program and Objet will accept used resin cartridges at its U.S. headquarters for reclaiming.

Laser Sintering Systems

On the other end of the spectrum from 3D printers are the new plastic laser-sintering systems, EOSINT P 395 and EOSINT P 760 from EOS, the new additions in the P3 and P7 series.

Unlike the products made from most 3D printing processes, the products derived from these machines and direct metal laser-sintering (DMLS) can include manufactured, fully functional parts. EOS has developed peripheral equipment, special materials and software products to address the e-manufacturing process chain and has introduced new products for powder handling and preparation called integrated process chain management (IPCM).

Both the EOSINT P 395 and EOSINT P 760 are modular systems to expand purchase options, and can be upgraded with part property profiles (PPP). The quality of vertical surfaces has been improved by the addition of a completely re-engineered laser optics module (surface module).

The EOSINT P 760 can be fitted with the OnlineLaserPowerControl (OLPC) to monitor and control the laser's power during the building process, and a FlashRecoating module that increases productivity when using the "TopSpeed" and "Speed" parameter sets by accelerating the recoating speed up to 400mmps. With the appropriate packing density, users can reach build-up rates of up to 700cm^{3}ph.

Powder materials can now be reused via IPCM; it is sieved quickly under defined conditions before its reuse. The powder is prepared outside the machine via powder homogenization, and ensures high quality and flexibility.

EOS direct metal laser-sintering (DMLS) can produce fully functional parts like this nickel fan.

Artec3D Scanner

Exact Metrology, Inc. has added the new MH 3D Scanner from Artec to its line of measurement and scanning devices. The lightweight, ergonomic design of this handheld 3D scanner allows the user to scan target objects from any angle. The MH 3D Scanners require no mounts or markers, just like other hand-held Artec3D Scanners.

The scanners work like video cameras, but instead of a 2D image, the result is a 3D image captured at speeds of up to 15 fps or 0.5 million points per second while providing up to 0.2 mm resolution at 0.02 mm accuracy. The scanners are equipped with wide-field-of-view 3D and mega-pixel 2D

sensors. The technology enables the capture of both shape and surface texture of objects in a snapshot or video mode. They are suitable for a variety of applications including computer graphics and animation, medical imaging, archiving, and prototyping.

System weight ranges from 3 to 5 pounds, depending upon the model. Exact Metrology Artec3D Scanner systems, including hardware, software, and training, start at about $15,000.

3D3 Solutions FlexScan3D

The 3D3 Solutions FlexScan3D Development Kit ($11,999) includes hardware, 3D scanning software, and technical support for creating your own 3D scanner. The FlexScan3D software ($2,499) enables users to choose their entire hardware lineup.

Regardless of the option chosen, the kit connects with a variety of off-the-shelf digital cameras and a presentation projector. The projector puts a reference pattern onto the scan target to aid accurate digitalization. FlexScan3D's triangulation engine takes the images from the cameras to acquire data needed to create 3D models.

ZScanner 700 PX and ZScanner 700 CX

Z Corporation's handheld ZScanner 700 PX and 700 CX capture large quantities of 3D geometry and color data. Extending the company's 700 platform, which digitizes 3D surfaces in real time, the ZScanner 700 PX ($84,900) is a handheld laser scanner designed for large-scale scanning of products like aircraft and automobiles.

The ZScanner 700 CX ($49,900) can capture surface information in full 24-bit color, and can render the complete picture of an object, not just the geometry. Greater realistic 3D visualization and concept models can be achieved with color 3D data, making the 700 CX suitable for more than product design and engineering. The company says it can also be used for art, anthropology, entertainment, and web applications, and provides accurate, automatic texture mapping that can be saved separately from the point cloud. ■

*Contributing Editor **Susan Smith** is DE's expert in rapid technologies and has been immersed in the tech industry for more than 17 years. Send e-mail about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

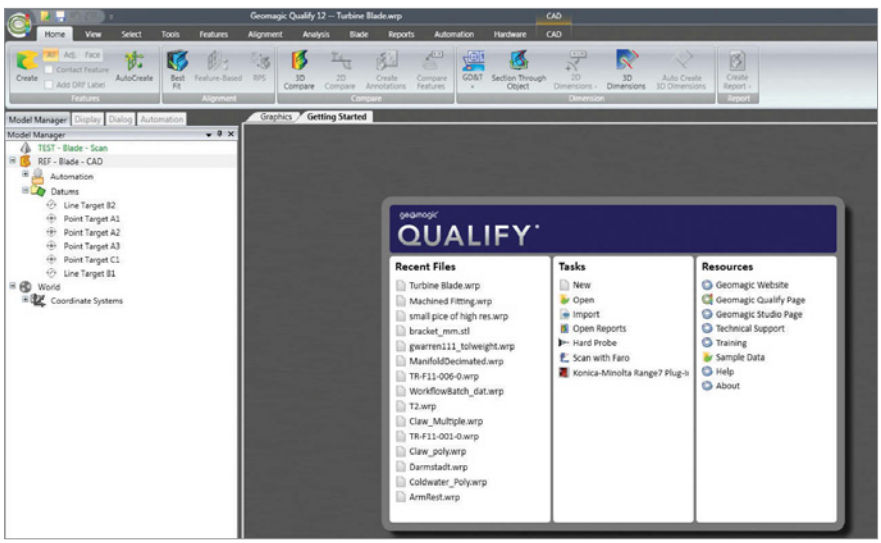
- > 3D Systems
- > 3D3 Solutions
- > A1 Technologies Ltd
- > Arcam
- > Dimension Printing
- > EnvisionTEC GmbH
- > EOS GmbH
- > Exact Metrology, Inc.
- > ExOne
- > Mcor Technologies
- > Objet Geometries, Ltd.
- > Solido
- > Solidscape
- > SolidVision
- > Stratasys
- > Z Corporation

By Al Dean

Geomagic Qualify 12: A Solid Quality Release

> Straightforward enhancements to this inspection and metrology program are reflected in a better user interface and its ease of use.

Geomagic has built its reputation on providing a set of tools for working with scanned data in a wide range of processes. Whether you're looking to capture the form of a physical concept, create digital data for parts where there are none, or inspect physical parts to find deviations from the nominal CAD data, Geomagic has a solution.

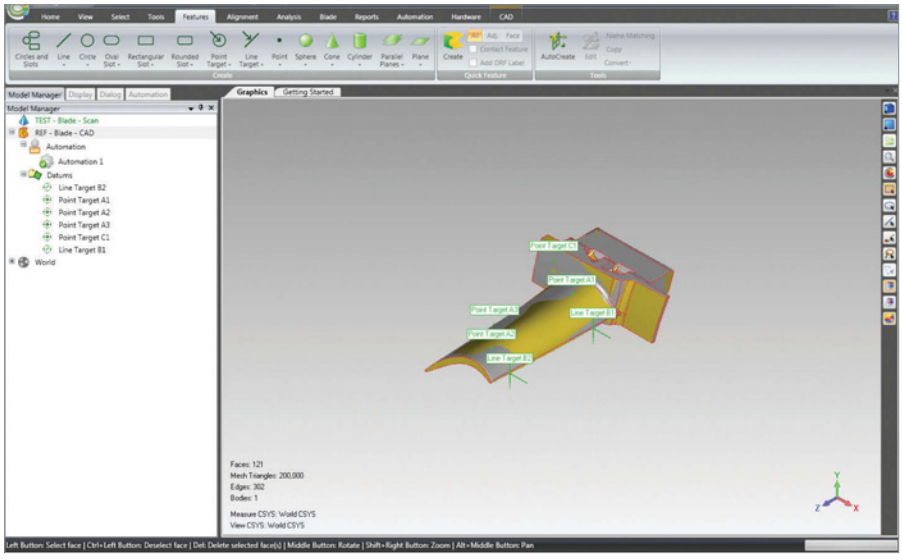


The new Geomagic Qualify 12 user interface as seen when first starting up the application. Common tasks, help, and documentation and recent used files are all presented for quick access.

This release cycle of Geomagic's suite of tools—Geomagic Studio for reverse engineering and Geomagic Qualify for inspection and metrology—is perhaps one of the most fundamental in quite a few years. Not for the usual reasons of technology advancement and additional functionality, but rather for marking a new era of ease of use. Geomagic has adopted the now seemingly ubiquitous ribbon-based user interface found in not only Microsoft products but all across the software world. While the ribbon has been met with a mixed reaction since its introduction, when it comes to highly linear yet complex software, such as Geomagic Qualify 12, it makes perfect sense.

Upon starting up Qualify 12, a user of an older version will notice quite a change. Gone are the complex toolbars, and the user interface is now

clean and well organized. To assist with getting started, the welcome screen now gives you quick access to "what's new" guides, tutorials, and help. It also provides quick shortcuts to recent files, to load or import data, or to connect to specific hardware for which you have the appropriate plug-ins, whether that's a Faro or Perceptron arm, Konica Minolta scanner, Creaform Handyscan, or many of the other measurement devices covered by a plug-in.



The new Ribbon toolbar allows the break out of previously hidden operations and makes them more discoverable—such as creating features.

But the real update is the ribbon bar. You'll now find all of Qualify's tools available in segmented panels, each containing commands, inputs, and variables that make the system work in clearly defined sections. The process of conducting a scan, working through the inspect set-up process, and then repeating that process with subsequent parts is, as we've said, highly linear and in this instance, the ribbon is perfectly suited.

Reads Multiple CAD Programs

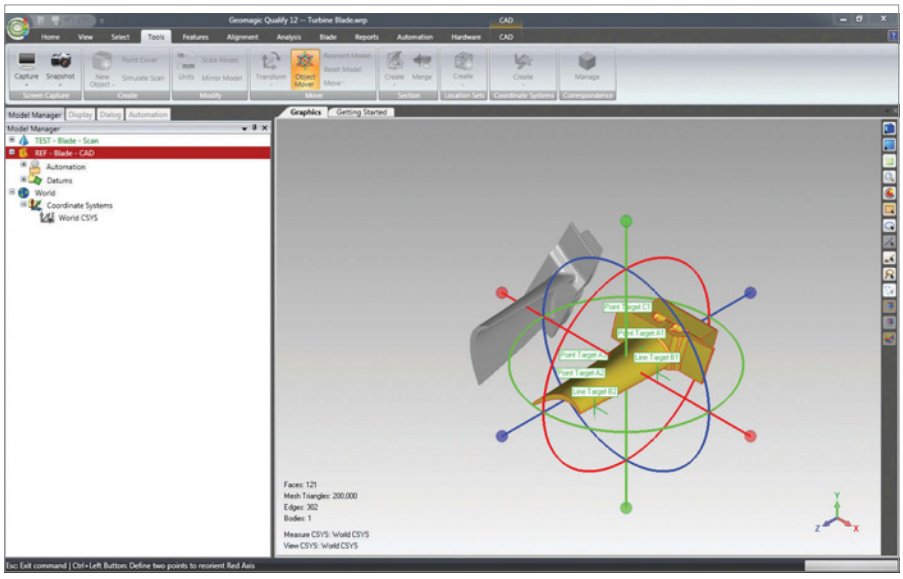
The process begins by loading the nominal CAD data from a variety of formats, either native or standards based. The initial scan is then conducted. Here, the holistic nature of laser-scanning methods gives you benefits over more sparse, explicit hard probing methods. With a more complete scan, a better understanding can be achieved of how your manufactured part differs from the nominal CAD geometry. As you're working in an inspection environment (as opposed to reverse engineering), there isn't a requirement to use Geomagic's scan clean-up tools, so you're ready to begin the inspection process. Initially, this can be done by comparing the scan to the geometry and finding areas of deviation and error.

While this is useful, as with many areas of manufacture, there are specific points of interest where form accuracy is key. To accomplish this, Qualify includes a complete set of datum, feature (both 2D and 3D) definition tools that can be used either with a scan device or hard probe (hard-probe support was added in version 10). Again, while previous versions collected these together into complex dialog boxes, the ribbon-based UI has enabled the team to split them out and give them space to breathe. In turn, this means that you can find and create the features you need without having to dig through the UI. Alongside this, there appears to have been a concerted effort to remove dialogs from operations, shifting the focus to the model. An excellent example is the Quick

Feature command; you select the command icon, select the geometry, done.

New Tools

While the UI is clearly the major concentration for this release, that isn't to say work hasn't been done on functionality. There are a couple of new alignment methods, the most interesting being the Weighted RPS alignment option. While standard RPS alignment allows you to quickly fit the scan to your geometry, you can get odd results that don't match your requirements. The new Weighted option allows you to specify levels of clearance and priority between point and feature pairs, allowing a close match where needed. This is particularly key in casting applications where there are critical interfacing features and faces for post machining. Whether you're inspecting expensive parts like turbine blades or multiples of the same part, the ability to add more control and intelligence to the alignment process will save time by avoiding manual adjustment of data.

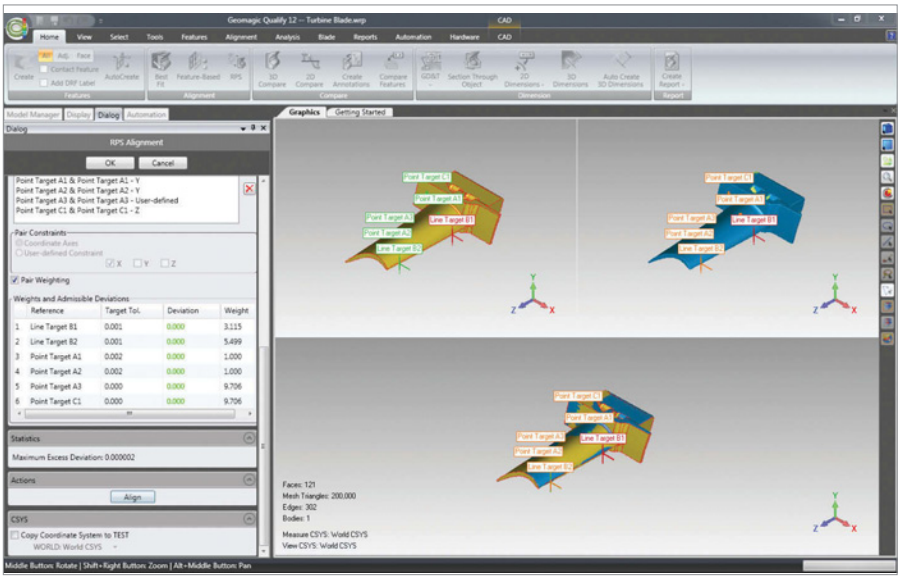


The new Object Mover makes manipulating both scan data and geometry much more dynamic than previously.

Elsewhere the Object Mover has been brought across from Geomagic Studio. This enables the dynamic translation and rotation of both geometry and scan data using drag handles rather than solely relying on numeric inputs. There's also a new measurement tool for calculating volume and area at the request of users working in the turbo-machinery field in particular.

The final area of Qualify 12 that ought to be covered is the creation of reports. While all manner of solutions have automated reporting tools, they're often generic and rather difficult to customize. As a result, most of us simply use them as a means of creating quick content, which is then repurposed for more formal reports. With regard to inspection, however, the whole point behind computer-assisted inspection is to quickly get to an inspection report for each part. As a result, report generation is absolutely essential in any metrology software. According to Geomagic, users were requesting even greater control over form and content of reports, hence the push to provide such tools.

Reporting now has its own Ribbon, which brings together a key number of commands that allow you to create report templates exactly how you want them. It includes a WYSIWYG (what you see is what you get) report designer that offers granular control over what's placed where, what



The new Weighted RPS Alignment tools allow you to add priority to faces, features, and such to ensure that critical alignments are factored into the automatic alignment process.

information is fed into the reports, and how it looks. These can, of course, be saved out, shared, and reused as you need them. Qualify 12 now also includes support for 3D PDF. This allows you to create digital PDF files that contain report data as well as a full 3D representation via a simple click. It can be zoomed, panned, and rotated. Metrology data can be inspected and used, giving you richer information than static images in a word document. To enable your 3D PDF reports, it requires a simple toggle.

Quality Qualify

Geomagic has done an excellent job with the user interface and interaction work for the 12th major release of its products. While we've concentrated on Qualify and the inspection process for this review, similar work has been done in the Studio area for reverse engineering and shape capture. It shows that the ribbon-based UI is gaining major traction and while many vendors are adopting it, often the implementation leaves something to be desired. In the case of Qualify, this is far from the truth. Here, with a linear workflow as its core, the new UI makes perfect sense.

Additionally, the way that previously obfuscated commands and options are now exposed, making the system easier to use (as you can find the command you want, more quickly) as well as inherently more discoverable without additional training and without a need to read the documentation. Alongside the user interface, the updates made to functionality mean that existing users will also benefit with more sophisticated tools to assist with their working practices. A good release, well executed. ■

Al Dean *is the editor at DEVELOP3D, a UK product development and manufacturing technology journal (develop3d.com). He divides his time between day dreaming about owning a 5-axis NC machine and having nightmares explaining its purchase to his family. Send comments to DE-Editors@deskeng.com.*

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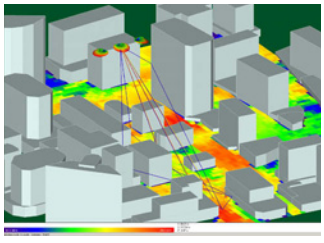

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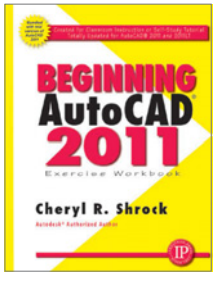

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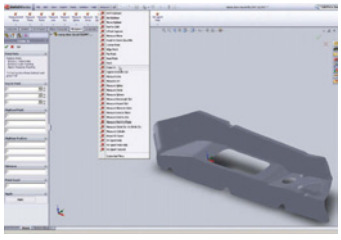

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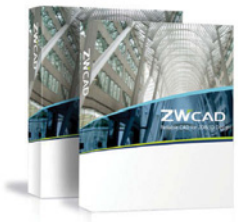

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nPower Software Releases Power Translators Plug-in

> **nPower Software**, a division of IntegrityWare, has announced Power Translators Universal, a plug-in product for Autodesk 3ds Max/Autodesk 3ds Design. Power Translators Universal was designed to provide native translation of Pro/Engineer, Catia, SolidWorks, SolidEdge, Unigraphics, Rhino, JT, Parasolid, STEP, IGES, and SAT files directly into Autodesk 3ds Max/Autodesk 3ds Design.

Power Translators Universal is an extension of the Power Translators plug-in for Autodesk 3ds Max. With Power Translators Universal, CAD designers can import their models directly into Autodesk 3ds Max/Autodesk 3ds Design without intermediate formats, and without loss of precision, according to the company.

Power Translators Universal is designed to handle the large data sets typical of CAD models. Power Translators Universal contains tools to cleanup, prepare, and render Pro/E models.

Power Translators includes native translation of Catia, Unigraphics, SolidWorks, SolidEdge, ProEngineer, and Rhino models; import of STEP, IGES, SAT formats; and more.

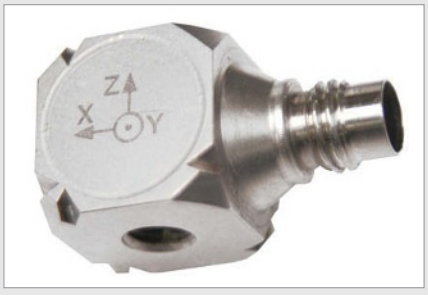
Pointwise Releases Latest Solid Meshing

> **Pointwise, Inc.** has announced the latest release of its Pointwise computational fluid dynamics (CFD) meshing software featuring tools for addressing problems associated with computer aided design (CAD) geometry data. Pointwise's Solid Meshing feature suite can automatically create watertight geometry models without the gaps and overlaps that can cripple the mesh generation process, according to the company.

Solid Meshing comprises solid models and quilts. Models are watertight collections of surfaces. Quilts are subregions of the geometry that

Kistler Debuts Type 8688A IEPE Triaxial TEDS Accelerometer

> **Kistler Instrument Corporation** has released the Type 8688A series of IEPE triaxial accelerometers, with optional TEDS, designed to simultaneously measure vibration in three orthogonal axes. Available in ranges of ±5g, ±10g and ±50g, with choice of 100, 500 or 1000 mV/g sensitivities, the Type 8688A IEPE triaxial range incorporates Kistler PiezoBeam technology, with an integral ceramic cantilevered beam,



enclosed within a lightweight titanium housing. Sensing elements are designed to provide amplitude and phase response over a wide frequency range.

Type 8688A sensors feature an integral low-noise charge amplifier that converts the charge signal to a proportional high-level voltage signal, at an output impedance of less than 500 ohms.

Autodesk Launches Inventor 2011

> **Autodesk, Inc.** has introduced its new 2D and 3D design and engineering software lineup for manufacturers. The integration of Autodesk Inventor 2011 software with the Autodesk Digital Prototyping software portfolio helps enable designers and engineers do more work in house.

Autodesk has enhanced its specialized tools for product development professionals focused on conceptual design, design visualization, engineering, and manufacturing disciplines. It has also embedded functionality from these tools within its core Autodesk Inventor 3D mechanical design and engineering software. According to the company, new direct manipulation capabilities in Inventor 2011 helps accelerate design times compared with Inventor 2010 software by approximately 40 percent on common tasks such as assembly modeling. Inventor 2011 software also incorporates Autodesk's design visualization capabilities within the CAD application. New shading, lighting, and material properties give users a photo-realistic representation of their designs, with Inventor software rendering designs as the user works.

Autodesk Inventor 2011 received the most visitors in the month of March.

capture engineering intent, simplify the topology, and are meshed as a single unit.

The new release of Pointwise, Version 16.03 includes support for 3D mice, user-customizable export to CFD solvers, and support for 64-bit versions of Microsoft Windows.

Corsair Launches Force Series Solid-State Drives

> **Corsair** has announced the Force Series of SSDs, providing SATA II performance based on SSD Processor technology from SandForce.

By using the SandForce SF-1200 SSD processor combined with MLC flash memory, the Corsair Force Series of solid-state drives deliver performance figures of up to 280MB/sec read and 260MB/sec write, according to the company.

"The Force Series are the fastest SSDs that Corsair has launched to date," says Kevin Conley, vice president of Engineering at Corsair. "We have been very impressed with the SandForce SSD Processor innovations...."

The Force Series of SSDs are available in capacities of 100GB and 200GB and support the TRIM command in Windows 7, which helps to maintain performance over the drive's lifetime.

LMS International Releases Noise & Vibration Solution LMS Test.Lab Rev 10

> **LMS International** has released the latest version of LMS Test.Lab, its integrated solution for noise and vibration testing and engineering. LMS Test.Lab Rev 10A introduces new applications, such as Time Domain Transfer Path Analysis (TPA) and MIMO FRF testing, and acoustic testing.

The new LMS Test.Lab Time Domain TPA application complements frequency domain TPA for the analysis of transient phenomena. The new LMS Test.Lab MIMO FRF Testing extends the modal testing techniques in LMS Test.Lab. It allows users to specify their specific excitation signals, define

a shaped amplitude spectrum, and extend the application to multi-sine excitation.

LMS Test.Lab Rev 10A integrates new acoustic testing capabilities and scalable solutions for sound testing and analysis. The LMS Test.Lab Rev 10A Sound Quality solution has been extended with new psycho-acoustic metrics used in the automotive, aerospace, and white goods sectors. The LMS Test.Lab Sound Intensity's geometry module has been extended with a 3D acoustic mesh generator. The new intensity data sheet presents an overview of all measured and processed data, quality indicators, and related components.

The LMS Test.Lab Rev 10A High Definition Acoustic Camera supports both real-time far field and real-time near field sound source localization. For interior sound source localization, the new LMS Test. Lab 3D Acoustic Camera has a laser that automatically scans the geometry without operator intervention. During the scanning, pictures are taken to obtain a 3D, photorealistic image of the vehicle.

Omega Introduces Handheld Rotating Vane Hygro-thermo Anemometer

> **Omega's** new rotating vane hygro-thermometer anemometer provides humidity, air velocity, and temperature measurements in harsh environments.

The HHF144 measures from 5.0 to 95% RH and

measures airflow in environments from -20 to 100 degrees Celsius (-4 to 212 degrees Fahrenheit). The product features a temperature sensor in the humidity probe standard, along with a minimum and maximum air speed feature and humidity measurements.

Applications include manufacturing, lab, computer rooms, environmental control, flow hood monitoring, and other applications where precise air flow measurement is required. Prices start at $945.

Advantech Launches a New 19-inch Flat Panel Monitor

> **The Industrial Automation Group of Advantech** has introduced its new FPM-5191G Flat Panel Industrial Monitor.

The FPM-5191G features an XGA TFT LCD, NEMA4/IP65 compliant flat-sealed front panel, direct VGA and DVI-D video inputs, front-accessible USB port, and an optional resistive touch screen version.

With multiple standard power inputs, including an attached 12VDC adapter and 10 ~ 30VDC input with Phoenix power-in connector, the FPM-5191G provides 110 ~ 220VAC input, but a range of VDC input, suitable for a variety of applications. The FPM-5191G supports panel, wall, or VESA mounting.

Measurement Computing Releases MCC DAQ Software CD Version 6.0

> **Measurement Computing Corporation** (MCC;) has released MCC DAQ Software CD version 6.0 with 64-bit drivers and universal library extensions (ULx) for National Instruments (ni.com) LabVIEW.

LabVIEW programmers using Measurement Computing data acquisition devices will benefit from a new library of virtual instruments (VIs) and example programs for application development. The new ULx for LabVIEW supports LabVIEW versions 8.2.1 and later.

Measurement Computing provides complimentary installation, configuration, and

measurement software. The MCC DAQ Software CD includes an installation, calibration, and test utility; UL programming libraries and components for developing 32-bit applications using Windows programming languages; TracerDAQ; and ULx for LabVIEW, a library of virtual instruments (VIs) and example programs for use with National Instruments LabVIEW Version 8.2.1 and later. UL for LabVIEW is available for LabVIEW Version 6.0 through 8.2

GibbsCAM Plunge Roughing Unveiled at WESTEC 2010

> **Gibbs and Associates**, developer of GibbsCAM software for programming CNC machine tools, has released the latest version of its enhanced Plunge Rough feature.

The new Plunge Rough feature within GibbsCAM 2010 accommodates the latest, inserted plunge milling tools developed for this type of material removal, and allows users to specify machining patterns and multiple variables to control tools and motion.

GibbsCAM Advanced 3D users will see Plunge Rough as a custom process tile appearing in their machining palette, with several new options and parameters. ■

A Prototype is a Prototype is a Prototype – Not!

BRUCE BRADSHAW
Objet Geometries

When you hear words like Kleenex, Q-Tip, and Xerox, do the actual branded products pop into your head or do you picture any facial tissue, cotton swab, or photocopy? Now let me ask the same question about your 3D prototype model. When someone asks for an SLA part do they expect to receive the part that came off a stereolithography system or do they actually expect a part that best simulates the end product they are designing? My guess is they would expect and want the part that resembles the finished part.

In many circles today, SLA has become the generic term for 3D physical prototypes. Many engineers and designers have fallen prey to this trap by not being as specific as they should be when requesting their prototype. As a result, they end up with a sub-par prototype for their design and get something that might not match the end product as designed.

3D printing technologies and material choices available from

> Prototyping with the right solution can help you achieve high standards.

manufacturers these days offer so much more versatility than SLA parts. The choices currently available facilitate greater design creativity and freedom, and settling for an SLA part can limit and—in some cases—inhibit the design of a given product.

Clearly there are many factors to consider when selecting the best materials for your design prototype. Whether the goal is to test the fit, form, and function of a design or to gain feedback from a focus group to better understand market acceptance, an SLA prototyped part might not meet your needs.

If, for example, a prototype must simulate an over-molded design or would require varying elastomeric properties, an SLA part would require some additional postprocessing. This would add significant cost and time and is unlikely to result in a part that actually matches the end product. In another example, the end product might include a living hinge so the designer would expect a prototype that includes both a rigid section as well as the flexible hinge. An SLA prototype will not include the flexible hinge and it will have to be simulated with a clumsy workaround.

There are other solutions on the market. For example, the Connex or Eden machines from Objet offer designers and engineers the opportunity to create realistic prototypes. The Connex can print as many as 11 different material properties in the same part at the same time. Additional technologies are also available from other 3D printer suppliers and additive-manufacturing vendors that can also add unique characteristics to a given prototype.

Don't get me wrong, a part produced with an SLA machine is very reliable and has served the prototyping world well for many years. However, it's now time to reset our boundaries and embrace all of the other prototyping options on the market. Simply labeling every prototype part as an SLA part is underestimating the versatility and value of a good prototype produced with other processes and materials.

Organizations should demand the optimal part to ensure they get the most realistic 3D rendering of their designs and have the opportunity to identify those critical design flaws early on. Ultimately these organizations will realize these benefits and bring better products to market faster.

Additive manufacturing is a very effective tool that has given many organizations the competitive edge to meet their business goals and, more importantly, satisfy their customers' requirements. Prototyping with the right solution can help you achieve the high standards your company is striving for. ■

Organizations should demand the optimal part to ensure they get the most realistic 3D rendering of their designs and have the opportunity to identify those critical design flaws early on.

Bruce Bradshaw *is the director of marketing at Objet Geometries. Send feedback about this commentary to DE-Editors@deskeng.com.*

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