DE

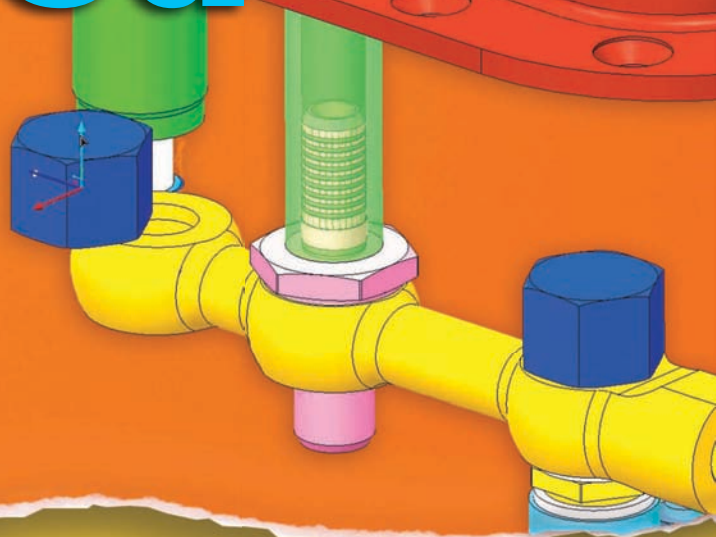## Desktop Engineering®

TECHNOLOGY FOR DESIGN ENGINEERING

A Robotics Revolution P.26

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Creo 1.0 Revealed

Tearing into the details of PTC's
new
Creo apps. P.14

REVIEWS:
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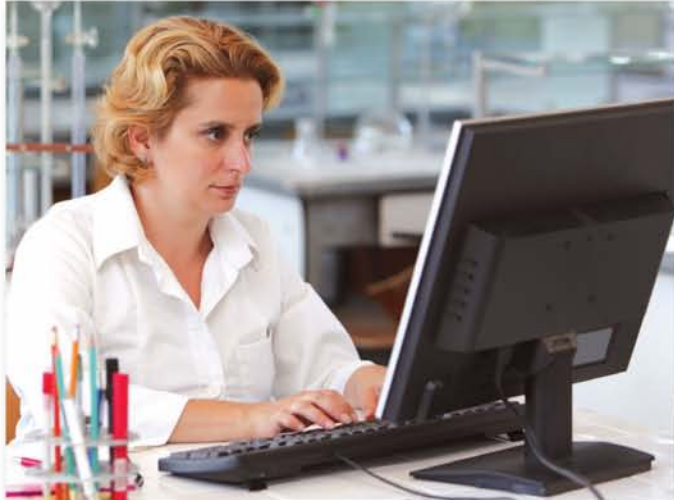See the future of CAD by finding an event near you at **ptc.com/go/creo-events**.

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Rapid 2011 Review

I have just returned from this year's SME Rapid event, which took place in Minneapolis. I have to say, the excitement level of this year's show was much higher than the last couple of years. The attendance was good and the attendees who stopped by to talk with us were excited about using rapid technologies to accomplish their goals.

I found it interesting that many of the engineers we talked with were just considering their first 3D printer after working with a rapid prototype service bureau.

Outsource vs. in House

During a conversation with Bruce Bradshaw of Objet Geometries, we discussed how one of Objet's clients, Trek Bicycle Corporation, had added rapid prototyping technology recently because its outsourced prototyping costs had hit the ceiling. After the new system had been online and running for a while, the design team found they could ex-

> **Being able to access 3D printing technology has proven to have unexpected benefits.**

periment and create new parts, then test them right away. This was a great advantage that helped them create better designs and build better bikes. If the engineers had to take their ideas to the weld shop and wait for an extended time for the parts to be returned, creativity takes a hit.

However, Trek hasn't stopped using prototyping service bureaus altogether. It is allowing its designers to access 3D printing technology in a way that brings products to market faster, giving the company a competitive advantage.

Rapid Initiative Comes Together

During Rapid 2011, I also attended a meeting of a startup initiative that looks like it's on the path to becoming an association. The Additive Manufacturing Branding Initiative (AMBI) is headed by Wilfried Vancraen, CEO of Materialize and Todd Grimm, an industry consultant who is acting as project manager. The 12 companies that initially provided funding for the project met at Euromold last December, and the AMBI has now grown to 18 companies.

At the Rapid 2011 AMBI meeting, Todd discussed the problem plaguing the additive manufacturing industry: A lot of design engineers are not aware of the how 3D printing could benefit their design processes and their companies' bottom lines. I have noticed this at every Rapid show I have attended. You see attendees who have just seen a stereolithography (SLA) or selective laser sintering (SLS) printer for the first time. They just stand there, looking in the machine's window, mesmerized. When I stop and talk with them, they almost always say, "I've read about this, but I just didn't get it!"

The AMBI wants to get the word out on the use of 3D printing by telling great stories about how additive manufacturing technology can make a difference in creating great designs. You will be hearing more on this from *DE* as the initiative moves forward in the near future.

Slicing up Micromolds

There were a lot of amazing technologies on display at Rapid. One cool new technology at the show was CGI's new Pearl-700, which cuts ultrathin slices from a micromolded parts to create a 3D point cloud of the part's shape.

This high-resolution measuring technology creates an accurate model of the molded part by encasing it in plastic resin and then milling it and scanning it. Each 2D scan is then processed into a representation of the 3D shape. It is then imported into the inspection software to be checked against the original molded parts design. When I first saw the molded electronic component in its bed of resin, I thought, "Wow, someone sure screwed up on this part." After the demo, I was impressed with the ability for inspection as well as reverse engineering of very small molded parts.

Overall, the use of rapid technologies is becoming more prevalent in the day-to-day activities of design engineering. Being able to access 3D printing technology in the workplace has proven to have benefits that often are not anticipated when the justification for the printer is presented to management.

DE has committed to conducting a rapid technologies survey in the near future and will share the results with our readers when it is finished. If you would like to share your experiences on how 3D printing and 3D scanning has enabled your designs, please send your stories to de-editors@deskeng.com. **DE**

Steve Robbins *is the CEO of Level 5 Communication and editorial director of* DE. *Send comments about this topic to de-editors@deskeng.com.*
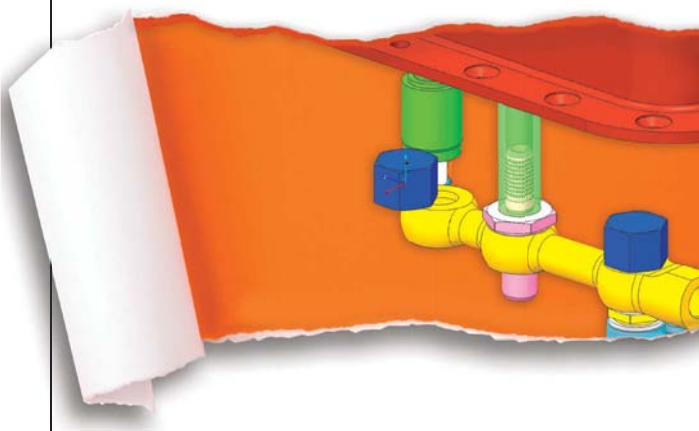
COVER STORY

PTC Creo Revealed

14 What started at the
announcement of Creo on
Oct. 28, 2010 as a company's
vision for the future of product
development has now become
the app-driven product line
claiming unparalleled direct
modeling capabilities and a
level of interoperability among
programs the like of which has
never been seen. The products
are out. The promise is being
delivered. Creo is here. Josh
Mings brings you all the details
of the apps available in Creo 1.0.

Correction: The July *DE* article "CFD in the Cloud" article
incorrectly stated that Intelligent Light's FieldView software
is priced to start at $25,000. The actual starting price of
$2,500. *DE* regrets the error.

ON THE COVER: PTC's first Creo apps were officially released
at this year's PlanetPTC Live. Images courtesy of PTC and
iStockphoto.

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Autodesk 123D: a Fusion-Spawn

The dam broke when Google unleashed SketchUp, a free software program that makes modeling as easy as pushing and pulling on faces. By its success, SketchUp forces CAD software giants—and many CAD users—to abandon the conventional wisdom that 3D modeling has to be difficult.

Following SketchUp's emergence, Dassault Systèmes released 3DVIA Shape, a 3D modeler that lets you create fairly detailed objects without a lot of effort. Aimed at attracting people with little or no experience in mechanical modeling or industrial design, the software is a dramatic departure from Dassault's professional products, like SolidWorks and CATIA.

More Simple 3D Modeling

In May, Autodesk launched its own easy 3D modeler, dubbed Autodesk 123D. The software, currently a free Beta download, is described as "a free solid modeling software program based on the same Autodesk technology used by millions of designers and engineers worldwide. Not an engineer? No problem: With Autodesk 123D, you can design precise and makeable objects using smart tools that let you start with simple shapes, and then edit and tweak them into more complex shapes."

The software looks and feels like a limited version of Autodesk Inventor Fusion. Current export/import options are limited to the software's native .123d, DWG, STEP and STL—not an extensive list, but enough to create something for a rapid prototyping machine or a service bureau. It offers the same push-pull geometry editing and face rotation that Autodesk introduced in Inventor Fusion.

The software comes with a Freeform command, which lets you pick a spline or an edge and reshape its profile by manipulating the control points.
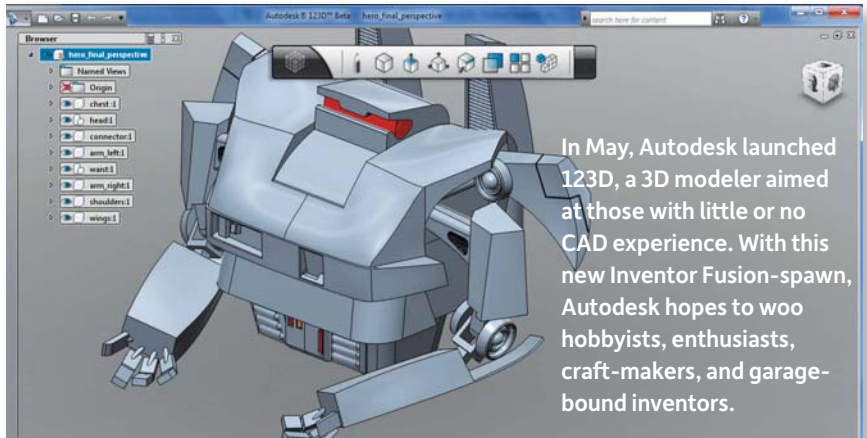
In May, Autodesk launched 123D, a 3D modeler aimed at those with little or no CAD experience. With this new Inventor Fusion-spawn, Autodesk hopes to woo hobbyists, enthusiasts, craft-makers, and garage-bound inventors.

The same command gives you Symmetry, which lets your geometry edits from one side reflect on the other side.

But there are a few peculiar interface behaviors, too. In creating solids using the Sweep command, for example, you'd have to select the profile, select the sweep path (so far, so good), then select the Boolean glyph and set it to New Component. Until you execute the two latter steps, you won't be able to see a preview of your sweep profile or complete the operation.

The current version is a Beta release, so we can expect Autodesk to refine 123D's interface in later versions. The new software is technically a history-free CAD program, so it may not be that easy for those unfamiliar with CAD protocols to figure out on their own (that is, compared to a package like SketchUp). That's where the vast collection of multimedia tutorials Autodesk has created will come in handy.

Content Sharing

Autodesk 123D's launch is accompanied by the debut of a new content-sharing portal, similar to Dassault's 3DVIA.com and 3DContentCentral.com. The searchable content database includes certain standard mechanical parts (such as fasteners, shafts, pipes and tubes) and popular objects (such as vehicles, electronic devices and spacecraft).

The 123D initiative also involves 3D Systems, a rapid-prototyping machine maker; TechShop, a series of member-accessible workshops; and Ponoko, a service bureau that helps you turn your digital model into a physical one for a fee. These partnerships advance 123D from a simple digital modeler to a physical part-making tool. It also brings Autodesk closer to a new market, comprised of amateurs, hobbyists, 3D enthusiasts, craft-fair participants, garage-bound tinkerers and homegrown inventors.

It's a market also courted by Solid-Works, a Dassault subsidiary, and Alibre Design, a Texas-based CAD developer with a $199 CAD option for personal use. Autodesk and SolidWorks both lobbied to place their software into the hands of TechShop members, through CAD classes offered at the workshop locations.

Though Autodesk and its major competitors currently cater to the professional market, they're evidently keeping an eye on the horizon beyond, where many younger consumers, nurtured by Google SketchUp, may be ready for their first taste of an introductory CAD program. **DE**

Oracles' AutoVue 20.1:
Viewing and Markup Integral to PLM

Before the product was known as Oracle AutoVue, it was Cimmetry AutoVue. It was a no-nonsense, no-frill application for viewing and marking up 3D CAD files.

After Cimmetry Systems was acquired by product lifecycle management (PLM) software supplier Agile, Agile itself was acquired by Oracle. This landed Cimmetry AutoVue in Oracle's lap. Under Oracle's stewardship, AutoVue returns as a viewer embedded within Oracle Agile, a suite of Oracle-branded PLM applications. AutoVue can still be deployed as a desktop application, but Oracle points out that you won't get its full value if you choose that option.

Released in May, Oracle AutoVue 20.1 reflects the product's origin as a simple, straightforward viewer. Basic zoom, pan, and rotate functions are consistent with how you'd expect them to work in CAD programs. Explode gives you a slider bar you can use to view, in animation, how different parts come together in your assembly. Transform gives you the option to rotate a part by its center or move it along a selected axis — a handy tool

to test out different placement options and potential clashes. The application also comes with a general Clash Detection command so you can run it to identify all contacts and clashes, then review the results one at a time to decide how to resolve them.

You may also use the Sectioning command in AutoVue to virtually slice through your part or assembly. Measurement tools in AutoVue let you pick specific components on features (vertices, faces, edges, centers, and so on) and obtain the distance between them. The same granular approach can be used for your comments and notes, so you can associate a certain comment to a vertice, face or feature. The annotation dialog box gives you the option to attach a file or insert a URL as well.

Well-Integrated Viewer

Perhaps the strength of AutoVue is how well it fits into the rest of Oracle's Agile PLM modules. With AutoVue as the de facto viewer, you can set up items in your BOM so that, whenever you double-click on a product thumbnail, it automatically launches AutoVue. If fully integrated with the PLM system, AutoVue-re-

lated actions—like adding comments and notes—automatically creates a trail in the PLM module, giving you a way to keep track of the changes requested and executed on your design.

In 2D drawings, such as electronic routing systems and piping diagrams, you may link each joint, connection, or intersection to meta data fields in an ERP, supply chain, or inventory system. This gives you the ability to quickly obtain critical data about your design (the last time a valve was examined by a crew, for example) right from AutoVue with a simple mouse click, without launching the enterprise system itself.

There's still a market for independent viewing and markup tools, because many engineers and designers still have to juggle numerous file formats. Oracle's approach—a viewer embedded inside an ERP or PLM system—turns the viewer into something else. Inside Agile, AutoVue is not just a desktop application to look at 3D models without a CAD program but a visual interface to manage design changes, keep track of assignments, and monitor associated activities from the rest of the supply chain. **DE**
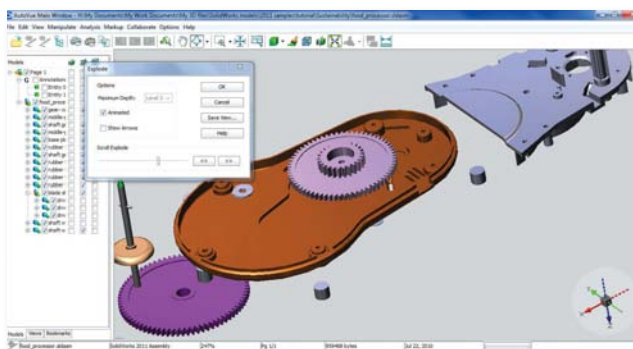
Oracle AutoVue 20.1 works not only as a lightweight CAD file viewer, but also as a PLM-integrated collaboration and workflow management tool.
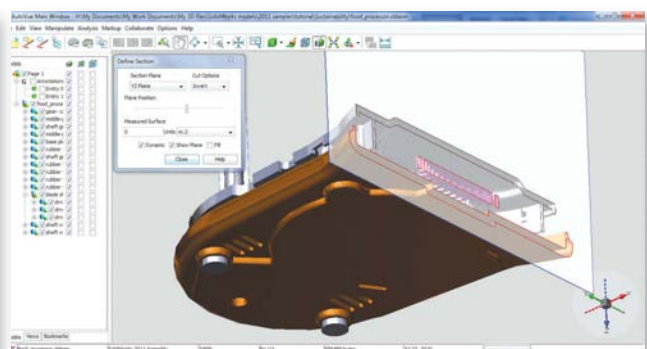
AutoVue 20.1 gives you a way to slice through your assembly for a cross-sectional view.

PLM Navigation with Windchill 10.0

Last month, as PTC rolled out a new version of its PLM software, Windchill 10.0, the company also resurrected a dying name from the browser history. Navigator, the moniker that once belonged to Netscape's browser, has been picked up by Windchill. The 10th release of PTC's Windchill comes with its own PLM Navigator.

As the name suggests, Windchill's Navigator looks—and behaves—a lot more like Windows Explorer and a standard browser than a PLM application. The search window and browse function are never far from your fingertips. Navigator also remembers your browsing history, just like your favorite web browser, so you can always trace your steps back to a certain part's requirements or a supplier's compliance history with a few clicks. You can save your search results, narrow them down with additional filters, or export them as Excel spreadsheets.

If your work happens to revolve around a certain project, you can make that your home page in Windchill. So you'll always be starting your PLM session with a full report on your outstanding change orders, files you've checked out, and files you've assigned to others. At the part level, most files you see in Windchill's Navigator give you access to tabs with critical attributes: change history, structure, related objects, where used, etc.

Desktop Integration

There's also a Windows integration plug-in, called Windows Desktop Integration. With this plug-in installed, you can access Windchill-indexed documents right from Windows Explorer. You may also check in or check out certain design-related documents right from Microsoft Office applications like Word or Excel.

Just as PTC's rival Siemens PLM Software and Autodesk have been experimenting with different ways to display product and project data in CAD models, PTC is incorporating similar display functions. In Windchill Cost, the PLM module for cost analysis, you'll have the option to display cost overruns and budget issues in the assembly model itself.

Lifecycle Assessment Available

Responding to rising demands for sustainable design development tools, PTC now offers Windchill LCA, a module for manufacturers who're interested in lifecycle assessment, sustainability and compliance. Windchill LCA ships with several material data sets, such as Carnegie Mellon Economic Input-Output Life Cycle Assessment database, and also interacts with the International Material Data System (IMDS), a standard in the automotive industry.

PTC has also revamped the interface of Windchill SocialLink, the company's social media-inspired module for community management and collaboration. In the latest version, the desktop client gives you access to both communities and collaborators in a single pane, making it easier to interact with group members as well as groups. Over time, PTC may allow users to post questions and comments to SocialLink communities right
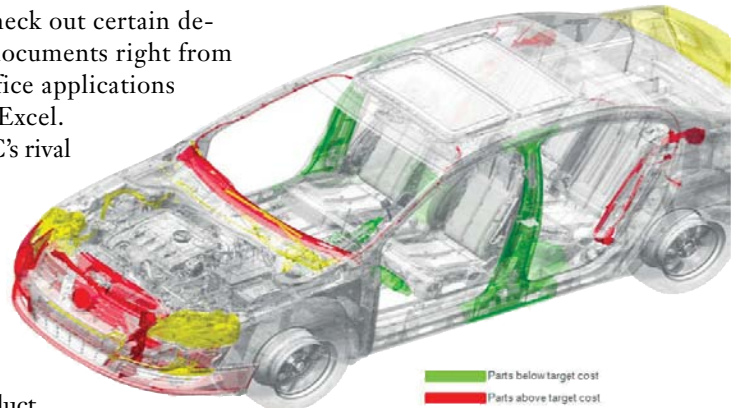
Windchill Cost, a module from PTC's Windchill 10.1 suite, gives you a way to visually display cost issues in your assembly.

from within their authoring environment, such as Creo Elements/Pro and Mathcad.

SocialLink is currently designed to deploy internally (within a company's firewall or enterprise IT network), but PTC may explore cloud-hosted deployment scenarios if its customers show interest. Currently, SocialLink is designed to facilitate communication with only internal sources (internal communities that focus on medical equipment or heavy machinery, for example), but the SocialLink R&D team is also looking to enable subscription to public, online communities that offer RSS feeds in the future.

With visual data display, Windows integration, and social media functions, PTC joins its rivals to dramatically overhaul product data management. Dassault Systèmes, PTC and Siemens PLM Software may disagree on what PLM should look like, but they do seem to agree that traditional data management interfaces just won't cut it anymore. **DE**

Siemens PLM Connection:
Clues to Active Workspace

During the PLM Connection 2011 Conference that took place in Las Vegas April 29-May 4, Siemens PLM Software was not quite ready to discuss a new offering called Active Workspace in depth. Nevertheless, the curtain had already been lifted—by none other than the company's president, Chuck Grindstaff.

During his keynote address on the first day of the conference, Grindstaff give attendees a brief glimpse of Active Workspace. He also shared a few details about the same thing at PLM Connection Europe in Linz, Austria, last October: "A single entry point into a variety of data sources, with an always-on search [feature], and the ability to collaborate," as he put it.

"What we're trying to do," said

Siemens PLM Software president, Chuck Grindstaff delivers the keynote.

Bruce Feldt, Siemens PLM Software's VP of Open Tools, "is to provide access to information, that complex PLM information, though a transcendent user interface."

Getting Visual

The end product, revealed Feldt, "is intended to be a new client [with which] PLM workers of all classes will start their workday. Active Workspace will know who the workers are, what's on their work list, what kind of things they're working on. It's all centered around the notion of improved decision-making … It is a search-based application. Do not consider it as a search engine.

"The user interface has to be very simple to use," he continued. "It's a highly visual environment. Going through lists of texts, product structures and information presented in hierarchical ways is useful, but we think if we present them in a more visual way, it would be more useful and easier to understand."

The search capability, Feldt said, would be "very high speed, very rapid return." It would also include "shape-based search." Distinctly different from Siemens PLM Software's CAD packages, Active Workspace is not meant to be an authoring application (but you may conveniently launch an authoring application from Active Workspace).

Navigating PLM

Active Workspace will also come with a new technology, currently in the works, dubbed "Network Navigator." It's meant for navigating through complex relationships in the PLM environment.

The only image of Active Workspace I've seen online was a snapshot taken by the quick-handed tech blogger and tweeter Rick Stavanja (@stavanja on Twitter), which shows what appears to be an NX model surrounded by floating instant messenger windows. Siemens has not released any images of Active Workspace to the press yet, as it's an R&D project with an uncertain launch date.

PLM Evolves

Search-based PLM application is also pursued by Siemens PLM Software's rival Dassault Systèmes, which owns the enterprise search engine Exalead. For more information, read "Dassault Plays Semantic with Exalead Acquisition," June 2010, Virtual Desktop blog.

Another rival, PTC, has been focusing its efforts on integrating social media-like functions into its Windchill PLM Software. In time, PLM software may become an integration of product data management tools (for CAD files, bills of materials, suppliers, compliance histories, etc.) and community management tools (social media-style collaboration tools), with robust text- and shape-based search. **DE**

Kenneth Wong writes about technology, its innovative use, and its implications. One of DE's MCAD/PLM experts, he has written for numerous technology magazines and writes DE's Virtual Desktop blog at deskeng.com/virtual_desktop. You can follow him on Twitter at KennethwongSF, or email him via de-editors@deskeng.com.

Avoid 100,000 Errors

BY JIM ROMEO

The wrong part. The wrong number. The wrong component. If these happen to you, the consequences can be devastating to an engineering business model. Avoiding 100,000 errors means using the right tools in the right place, in conjunction with engineering software.

But using engineering software in today's global marketplace demands many attributes of the underlying technology. Such software often relies on ancillary products—many of which are Web-based and can add value to engineering software, as well as to the job of the design engineer in general.

Peter Mooney is Thomas Industrial Network's product director for enterprise solutions, based in New York. His WebCAD Publishing Technology is one such product used by design engineers without a standalone product installed on their own servers. Recently, *DE* spoke with Mooney to understand his product and how it can benefit today's engineer.

Q. How does your WebCAD Publishing Technology work?
A. *Thomas Industrial Network's WebCAD Publishing Technology, built on our proprietary Navigator Platform to help industrial suppliers improve their websites, enables design engineers to find and download the exact parts they need from those suppliers who publish 2D and 3D CAD drawings online, insert them into their designs, and immediately assess their fit.*

Engineers go to the industrial destination ThomasNet.com, select the top CAD drawings tab to search among millions of available drawings, enter the keywords for the parts they need, and pull up a list of companies that offer them. From there, they can go into specific suppliers' sites, conduct parametric searches to find or configure products that will meet their detailed specifications, and even compare several parts side by side.

Once they have chosen or "built" a part that they are considering for purchase, they select their CAD system—AutoCAD, SolidWorks, Inventor, etc.—from a drop-down menu, and hit "go" to download and then insert a 3D model of the part directly into their design.

Q. What types of problems does this software help solve for design engineers and drawing developers?
A. *It improves design productivity and precision, reduces costs, increases efficiency, minimizes the risk of "100,000 errors," and speeds time to market.*

A design engineer may be working on an assembly that includes thousands of components, such as motors, actuators, gears and rods. In today's increasingly demanding market for improving productivity and reducing costs, finding specific parts within a few minutes makes engineers' jobs much easier, lets them work more efficiently and collaboratively with their suppliers, and enables them to complete designs and go to market faster.

In addition, engineers need to work with extreme accuracy—but traditional processes for sharing drawings have the potential for significant errors. As suppliers share drawings with design engineers, and then refine them at engineers' requests, unclear faxes and multiple iterations of drawings can lead to the wrong part being designed and purchased.

Another source of errors in the past was the potential for specifying the wrong part number. The WebCAD Publishing Technology also delivers the bill of materials for each inserted part, from the manufacturer's name to detailed specifications. This makes it easier to communicate with those in purchasing, and ensures that everyone involved is able to place the correct order.

PETER MOONEY

Q. What would you point to as the most important features of this product?
A. *Among the most important features is its compatibility with all 2D and 3D CAD systems. Much of the bill of material information is passed into the CAD system with the CAD drawing itself, and one-button-click direct enables insert of the drawings.*

Q. In your view, what are the key economic and functional benefits that your software provides as a solution to existing problems?
A. *The main benefits are tremendous time savings and accuracy. These are especially important as manufacturing and industrial companies continue growing, helping to lead the recovery from the recession. Our semi-annual Industry Market Barometer, tracking the growth of and outlook for this sector, shows that companies are expanding at a fast clip in comparison to other economic sectors. They're increasing hiring and making investments in areas such as technology and capital equipment. Tools such as the WebCAD Publishing Technology help them respond to growing demand for new products and services—and at the same time, work more productively, efficiently and with greater accuracy.* **DE**

Jim Romeo *is a freelance writer based in Chesapeake, VA.*

INFO ➜ Thomas Industrial Network: ThomasNet.com

Product Design is Getting Faster

It is rare that a perfect storm forms, but when they do, they can propel great energies.

BY PETER VARHOL

We may be in a perfect storm now — not a devastating storm, but a storm that helps companies accelerate their innovation cycle. There are two distinct trends occurring, and they both benefit the speed and efficiency of product design.

Traditional CAD vendors like Autodesk, SolidWorks, Siemens PLM and others are all adopting software product design suites. These suites integrate CAD and simulation, so users can now quickly and efficiently create, test and modify product ideas in a faster loop. With these advancements and integrations, digital prototyping or simulation-based design is no longer restricted to the domain of large companies and experts — it is available to all.

What is digital prototyping or simulation-based design? It is an approach to product development that helps your organization design, visualize, and simulate products rapidly and cost-effectively. It is a suite of solutions that is designed to help you grow your revenue, spur innovation, and deliver higher quality products faster than ever before. It can also help your organization to create and test more innovative concepts and verify that these new ideas are meeting the product requirements before you build a single physical model.

Today's workstation offered by vendors like BOXX, Dell, Fujitsu, HP and Lenovo support up to two Intel Xeon processors with a total of 12 computational cores and 24 threads. They also support immense amounts of I/O bandwidth that help to insure that data gets to where it needs to be, when it needs to be in order to change data into actionable information. Not too long ago we thought speed was governed by processor speed. Today it is governed by the rate at how fast you can move the data to a processing element. These technologies include important items like the size of last level cache, integrated memory controllers and quick path interconnect technologies that connect multiple processors and cores.

Get more value from your workstations and software

It is no secret that CAD applications are single threaded. Parts of them benefit from more cores and threads, but much of the time they remain single threaded. So why do you need more cores? You do not if you continue to do only CAD at your workstation.

However, many organizations — your peers and competitors — are looking at ways to accelerate how quickly and cost efficiently they can create, test, modify and bring new products to market. In a recent Aberdeen 2010 Manufacturing Survey, they found that top performing manufacturing companies are using simulation-based design concepts to build half the number of physical prototypes and get products to market faster with a 48% reduction in physical prototyping costs.

The workhorses of digital prototyping and simulation-based design are dual processor workstations. These dual processor Intel Xeon 5600 based workstations are changing the game, and as a result they help you get more results back in less time and increase the value of your software and engineering investments.

Let's assume you are doing simulation-based design and your model sizes are taxing your dual processor Intel Xeon 5600 series based workstation. Using four dual processor workstations from LENOVO, BOXX, Fujitsu, Dell or HP along with Parallels PWE software, Windows 7 and a single license Windows HPC server, you can quickly gang these workstations in a fashion to appear as small HPC cluster. Now you have a carpet cluster that combines up to 48 cores and 500GB of memory to employ on larger scale models.

Simulation-based design has never been so accessible. It can help organizations quickly and efficiently create, test and modify product ideas in a faster loop. Software providers like Autodesk, SolidWorks, Siemens PLM and others are all adopting software product design suites. Workstations from BOXX, Dell, Fujitsu, HP and LENOVO support up to two Intel Xeon processors and provide you the opportunity to extract greater value from your simulation-based design software suites. Clustered workstation give even small and medium business affordable access to HPC resources they need to be engineering leaders in their industries. **DE**

INFO ➜ **Intel Corp:** intel.com/go/workstation

PTC Creo Revealed

App-driven product line released, promising a multi-paradigm design platform.

BY JOSH MINGS

In 2010 PTC shook up the CAD industry with the announcement that its flagship product, Pro/ENGINEER, and its whole product line was changing: changing names, changing features, changing possibilities. It was a vision then, lacking any defined product or pricing. Now, PTC is ready to deliver what they've promised, Creo, and what it says is the industry's only true multi-paradigm design platform.

The dust has settled. What started at the announcement of Creo on Oct. 28, 2010 as a company's vision for the future of product development has now become the app-driven product line claiming unparalleled direct modeling capabilities and a level of interoperability among programs the like of which has never been seen. The products are out. The promise is being delivered. Creo is here.

The idea sprouted from the concept of a single program being able to do anything. Previously, the PTC family of design software was a divergent mix of modeling, viewing and drawing programs with little to no connectedness, pushing the user to decide between using one modeling process or the other. PTC knew it, and even more importantly, the users knew it. It was time for a change. With the vision for Creo firmly planted and Jim Heppelmann taking the reigns of CEO in early October of 2010, PTC was—in essence—a new company, rebranded with a new roadmap for a product line that would, at the very least, change its position in the CAD industry, and ultimately deliver a new model of how to cross-pollinate modeling methodologies within an interoperable set of products.

Releasing the Products

If you've wondered what products actually comprise the Creo name or where your existing PTC products will fit in, you're not alone. This has been one of the biggest questions
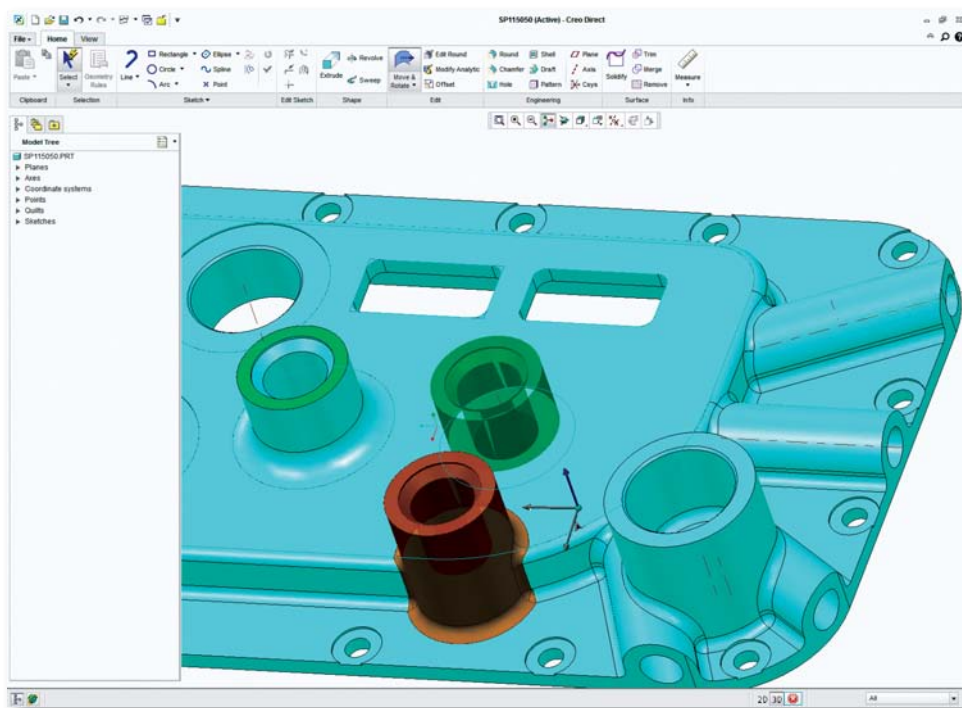
CREO Direct allows features to blend with the adjustments in geometry.

since the reformation was announced. At the annual PlanetPTC Live event in June, the company revealed the first batch of products that would be delivered under the Creo name, all of which are being referred to as 'apps.' Now, referring to a 3D modeling application as an app may be confusing, but PTC's reasoning lies in how it plans to present and deliver the products. There are nine apps slated to be launched in the Creo 1.0 timeframe, seven of which are currently available.

1. Creo Parametric for "history-based" parametric modeling. PTC says it will have "all the capabilities of Creo Elements/Pro, aka Pro/ENGINEER."

2. Creo Direct for "history-free" direct modeling. "When you want to interact directly with the 3D geometry."

3. Creo Simulate for structural and thermal simulation.

4. Creo Illustrate, a technical illustration app for communicating complex service information concepts graphically in 3D.

5. Creo Schematics, an app for creating 2D routed systems diagrams, like cabling and piping.

6. Creo View MCAD, which PTC says is a "lighter weight app for those who want to view, interrogate, and mark up MCAD geometry."

7. Creo View ECAD, a viewer tailored for electronics.

8. Creo Sketch, an industrial design app to capture design ideas in 2D (available July 2011).

9. Creo Layout, an app for early concept layout work in 2D, with the intention of ultimately evolving the design to 3D (available November 2011).

With Creo 2.0 launching March of 2012, you'll see two more (yet to be announced) apps and, more than likely, an iPad app. After this, the Creo apps will slip into an annual release schedule.

Features Explained

There are some important features being delivered with Creo Parametric that you'll want to know about. With this becoming what was Pro/ENGINEER, it will likely become the most common app used across the PTC customer base, so special attention has been given to bringing in legacy data

THE CREO Simulate app can be used for both structural and thermal simulations.
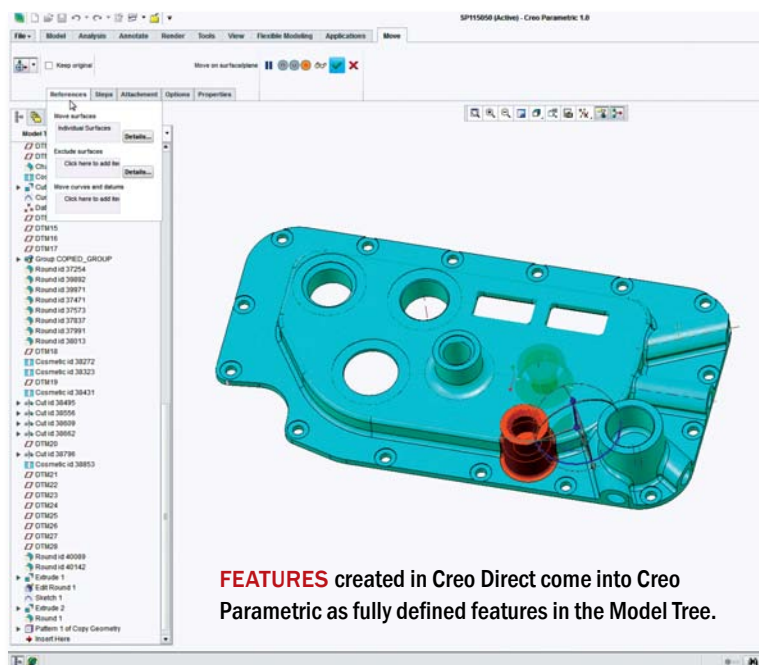
from any CAD system and providing the user more options for modeling.

With Creo Parametric, the Flexible Modeling Extension (FMX) is a plugin that will be available as a tab on the Creo Parametric UI. FMX allows a user to stay in the same environment and edit models as they would in Creo Direct. Any feature created with FMX in Parametric can also be edited in Creo Direct.

Another extension coming to Creo Parametric is the Legacy Migration Extension (LMX). This extension allows user to bring in legacy CAD data from other modeling programs and have the model, view, and annotations completely associated with each other. It identifies what models belong to which drawings, what views belong to which models and which dimensions belong to which views.

The newest and most anticipated feature for some is the inclusion of Sub-Division (subD) modeling within Creo Parametric. PTC is also introducing what they call Freestyle, a fluid modeling tool to shape the geometry as you wish. This comes included as a part of the Creo Parametric package.

To provide some technical details for context, it should be explained that all the apps together rest upon the backbone of a "Common Data Model." Instead of a single modeling kernel, you can think of this Common Data Model as a book of kernels, which allows interoperability between each of the Creo apps. The idea here is that each user (or company) has a suite of "purpose built" apps that support the data between each app and delivers that data to consistent user interfaces within each program. Currently the apps are separate executables, different interfaces with their own file formats, but similar in look, feel and functionality. This is then able to bridge with Windchill process management software to put a streamlined set of interoperable apps into the hands of the user who can use the data created in each. However, it is important to note that Creo does not re-

FEATURES created in Creo Direct come into Creo Parametric as fully defined features in the Model Tree.

quire a Windchill implementation to function. Windchill will simply add bill of material (BOM) driven assemblies slated for Creo 2.0.

Now, if you're wondering where your existing product falls into this arrangement, here's how it lines up. Creo Parametric would be Creo Elements/Pro or Pro/ENGINEER. Creo Direct would be Creo Elements/Direct or CoCreate. Creo Simulate would be Mechanica. Creo Illustrate would be along the lines of Arbortext. Schematic would be the Routed System Designer. Creo View MCAD and Creo View ECAD would be Creo Elements/View or ProductView. The correlation between each is simply for ease of transition. The Creo product line is very much a new set of programs with more functionality that you'll see in the previous product lines. For example, Creo Direct is not Creo Elements/Direct (CoCreate) with a new interface. Creo Direct is a separately developed product, and where the former and the new product have similar functionality, over time you will see these converge to the point where Creo is the only offering. For the time being, Creo Elements/Direct will continue to be developed and available
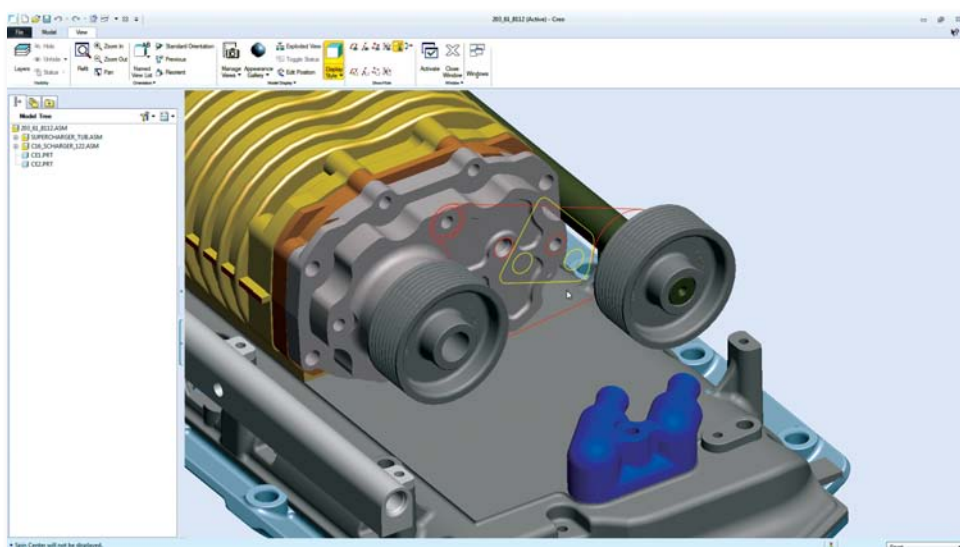
COMMUNICATING complex service information concepts with other departments and partners can be accomplished graphically in 3D.

Behind the Names

Consolidating a product line behind the name Creo is certainly interesting, but where discussion has focused for many in the CAD community is around the product names Creo Parametric and Creo Direct.

Creo Parametric creates and maintains a feature-dependent history. Creo Direct has solid bodies that are related, but independent of each other. Where the rub comes in, is how parametric modeling and direct modeling can happen in both history-based and history-free programs. For Creo, it's just as true. You'll find parametric relations in both Creo Parametric and Creo Direct. The names simply imply that the process behind each program.

Creo Parametric is used to create parametric features, whereas Creo Direct is used to interact with those features. Models can float back and forth between the programs with no loss of history on the Parametric side and no need for history on the Direct side.

for updates. All of this works together as to how the apps are being licensed and delivered.

Delivering Creo

Since the announcement of Creo, PTC has been promising a smooth transition for all users of PTC products. The company's strategy all along is not to make people buy what they already own. Ideally, the transition is seamless with no regression, no data loss and all data and configuration detail upwardly compatible to Creo. For those on maintenance, the same support and version updates remain as they have previously. Above all, no extra cost will be incurred for moving to Creo. For a concurrent use license, a similar licensing structure is available for each individual app. For network license use, FlexLM will be used as it has been in the past.

Packages or suites of apps have yet to be announced, but will become available, the first of which being Creo Engineer Pack 1, set to retail for $6,000. Each separate app will be priced according to its capability, tailored for the features needed and scalable for the functionality between each. This is PTC's way of saying, "We can provide exactly what you need."
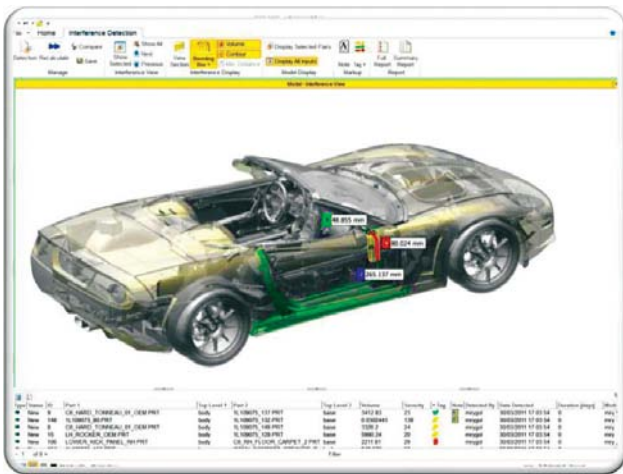
As the company develops more products in the Creo line, you'll see packages in the $10,000+ range as well as some apps available for free and still others that will be delivered online. With that said, there's no talk of a web-based version of Creo Direct or Parametric being developed. iPad apps, yes. Cloud apps, no. They're not interested in it … at least on the surface. To PTC, modeling on the cloud is a solution looking for a problem to solve. The company says it already has a problem to solve with model data and how it's used in the design process. That's

THE CREO VIEW MCAD app can be used by departments that need to view, interrogate and mark up MCAD geometry, but don't need full modeling.
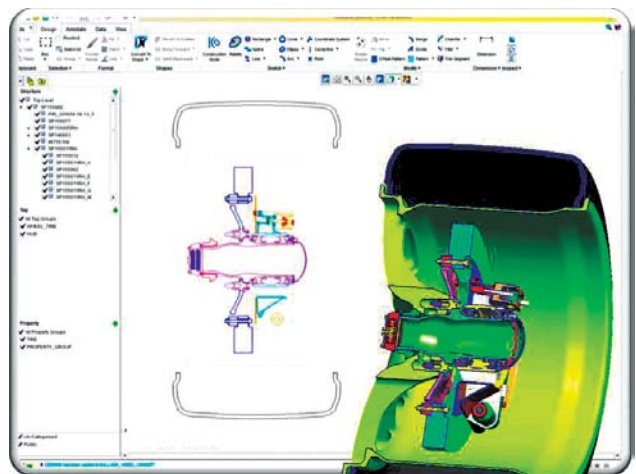
PTC plans to release Creo Layout in November. The app can be used for early concept layout work in 2D before taking the design to 3D.

what each part of Creo is aimed at doing. So, (for now) you won't hear much about delivering Creo over the web or harnessing off-site computing power from PTC.

If you're wondering about Mac OS X support that is down the line in PTC plans as part of Creo 2.0. The first app you'll see here is Creo Sketch, an industrial design tool for 2D and 3D sketching that will be the first of the apps seen on the Mac and iOS devices.

Bold Move

It's something nearly unfathomable: A company with an established product name that changes it, rebrands it, consolidates it and now has a new set of products to deliver. All of this within the past eight months. PTC has obviously put a lot of thought (and money) into developing a strategy and a product to address its customer base and the trend toward solid modeling software bringing in a more fluid design workflow.

The company has focused on a core group of problems and have applied a core group of technologies against them, namely specific roles having options for modeling modes with the flip of a switch of an app. There's a simplicity in all that, which makes the design process seem cleaner. That's good, really good for PTC whose command-to-click ratio had, in the past, been a process to fear. The interface now is cleaner, simpler with just the right amount of similarity needed between apps that had been missing.

The strategy is particularly evident within Creo Parametric and Creo Direct. PTC has brought over the best bits from CoCreate and made it easier to use. It has added features to Creo Parametric that will make Pro/ENGINEER seem archaic. And within both, the company is showing how a feature can live in a history-based and a history-free environment, retaining the parametric relation to features

within each if intended.

When Creo was simply a vision, no one thought users would want to leave their beloved Pro/ENGINEER. Now, with what PTC is delivering, users may very well want to dump that legacy in the drawer and enjoy all that Creo is beginning to offer. **DE**

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INFO ➜ PTC: ptc.com

Pricing:

One of the questions surrounding the move to Creo is whether the same functionality design engineers had with pre-Creo software would be available for a comparable price. As of *DE's* June 16 printer deadline, the following prices had been announced:

• Creo Direct - $4,995 US (Entry)

• Creo Parametric - $3,500 US

• Creo Sketch (July 2011) - Free

According to the Creo website, "There is a no cost upgrade for existing maintenance customers to each target Creo app, extension, or package. There are no increases in annual maintenance fees when the customer selects the no cost upgrade."

"PTC is no longer automatically shipping CDs for new product releases to maintenance customers," according to a Creo 1.0 FAQ document. Active maintenance cstomers can download Creo 1.0 or order a free CD from the PTC support site. If you're not a maintenance customer, stay tuned to deskeng.com for updates.

Something for **Everyone**

AutoCAD 2012 provides a wealth of improvements.

BY DAVID COHN

Autodesk recently began shipping AutoCAD 2012, the 26th major release of the world's most popular CAD program. For more than a dozen years now, AutoCAD has had a three-year development cycle. Every three years, Autodesk makes changes to its DWG drawing file format, which then supports the next round of additions to its venerable flagship product. The file format changed last with the release of AutoCAD 2010. If the cycle continues, AutoCAD 2012 marks the last version to use the 2010 file format.

In the past, that might have meant a release relatively light on new features, much as AutoCAD 2009 offered few surprises beyond the now-familiar ribbon interface. But while really big enhancements may have to wait until next year, AutoCAD 2012 provides a wealth of welcome changes.

Borrowing from the Mac

Last fall, Autodesk quelled rumors when it released the first native Macintosh version of AutoCAD in nearly 20 years (see deskeng.com/articles/aabamx.htm). In addition to a totally Mac interface, AutoCAD 2011 for the Mac featured new in-canvas viewport controls. These same tools have now been added to AutoCAD 2012, enabling users to change viewport settings, views and visual styles by using tools that always appear in the upper-left corner of each viewport.

In-canvas control is further exploited in AutoCAD 2012 by the addition of new user coordinate system (UCS) icon functions. The UCS icon can now be selected and manipulated by using grips to quickly align the UCS with existing objects, including curved surfaces and solids. You can also right-click on the UCS icon to access additional UCS controls from a new shortcut menu, making it much easier to manipulate the coordinate system—particularly when working in three-dimensional space.

There are actually all sorts of subtle 3D changes. For example, a new Offset Edge tool lets you create an offset curve from a planar 3D face or surface. You can then use the Presspull tool to quickly add or remove the bounded area from a solid, and Presspull now repeats until you exit the command. In addition, when creating or modifying surfaces or solids, the software displays a preview of the resulting model, and how it will change before you commit to the change. So now, when you select a profile to create a lofted solid or surface, for example, an updated preview of the resulting object is displayed with each selection.

The new preview also works when filleting, chamfering,
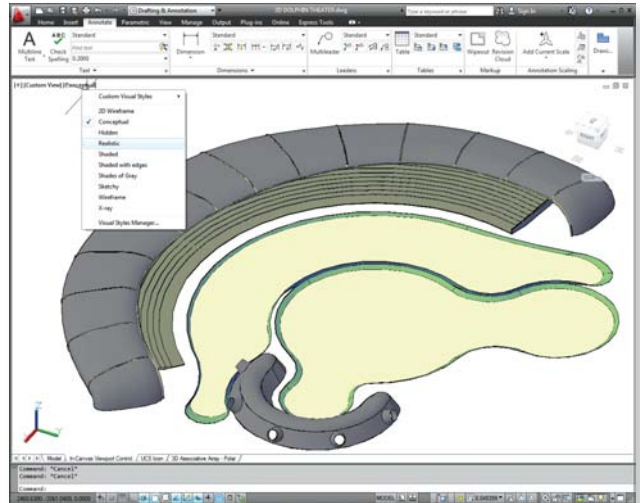
The in-canvas viewport controls that originally appeared in the Macintosh version of AutoCAD 2011 have been added to AutoCAD 2012.

blending or patching surfaces and solids, and there are new chain and loop selection options when modifying 3D models. The preview works when creating 2D fillets and chamfers, as well.

Another interface change is the new auto-complete function. In spite of improvements to its ribbon interface, many longtime AutoCAD users simply type to start commands. But as the software has evolved over more than 25 years, the number of commands and system variables has grown, making it difficult to remember them all. With auto-complete, as you type at the program's command prompt or dynamic input field, AutoCAD 2012 displays a list of commands matching what you've typed thus far. You can then quickly select the command or system variable from the list.

Creating Associative Arrays

One particular addition to AutoCAD 2012 stands out as one of the biggest productivity improvement in years: AutoCAD can now create associative arrays.

Rather than simply making duplicate copies of selected objects, arranged in a rectangular or circular pattern, the old Array tool in AutoCAD has been replaced by three new commands for creating rectangular arrays, polar arrays or evenly distributing objects along a path formed by objects such as lines, arcs,
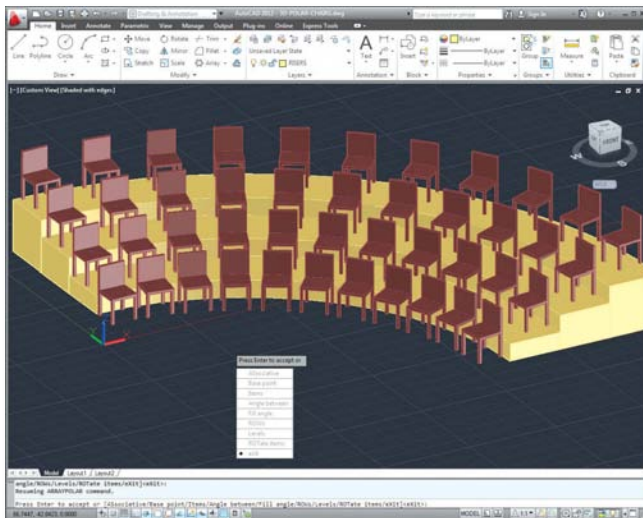
You can now create associative rectangular, polar or path arrays in 2D or 3D, change the number of objects or array relationships, and even replace arrayed objects.

The new drawing views capability lets you quickly create orthographic and projected views of 3D models, and control their view style and scale.

polylines or helixes. Once the objects are positioned, you can modify them by changing the array relationships, such as increasing the number of rows or columns, changing the distance or angle between the copies, or modifying the individual items in the array. You can even change the source object and apply the changes to the rest of the items in the array.

The new array functionality isn't limited to 2D, however. All three types of arrays can include multiple levels, and path arrays can follow 3D paths. Nor are associative arrays the only big 2D improvement. Multi-functional grips have been extended to more AutoCAD objects, such as lines, arcs and dimensions, as well as 3D faces, edges and vertices. When you hover the cursor over a grip, you now see a list of available options—and with dynamic input enabled, you can enter dimensional values.

AutoCAD 2012 also includes improved tangent and perpendicular object snap functionality. When grip editing, AutoCAD now finds osnap points to make objects tangent or perpendicular, and if AutoCAD's inferred constraint function is toggled on, a corresponding geometric constraint is automatically applied.

There's also a new array option when using the Copy tool to make multiple separate copies of objects at once, and AutoCAD can now create a fillet between splines. In fact, there are a number of enhancements to splines. For example, a new Blend tool creates a spline object between lines, arcs, polylines, splines and helixes, and includes an option to control the continuity between the two curves—very important if the resulting curve will be used as the basis for a 3D surface.

Manipulating 3D Models
AutoCAD 2012 represents some significant changes in the way users interact with three-dimensional models. In past releases, AutoCAD remembered the operations performed on
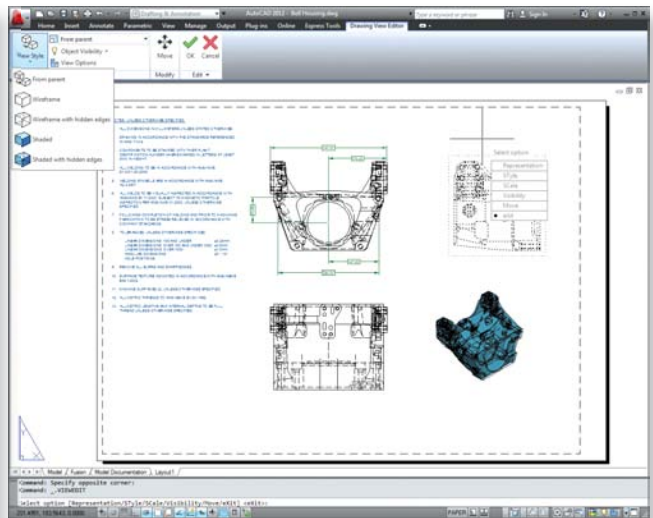
solid objects. But in AutoCAD 2012, Solid History is toggled off by default. That means that users can no longer press the CTRL key to select and modify the properties of sub-objects that had been combined to form more complex solids. While users can certainly turn Solid History back on before creating 3D models, Autodesk's intention is to move customers toward direct manipulation of non-history-based solids.

To accomplish that, AutoCAD 2012 automatically installs Autodesk Inventor Fusion, a plug-in that lets you edit 3D models using intuitive direct manipulation. When working on a 3D model, a single click opens the current drawing in Fusion. There's no need to save and export the file. Once in Fusion, you can edit faces, edges and vertices, modify sub-objects, and add new features. After making the desired changes, a single click returns the updated model directly to AutoCAD—again without having to first save any files.

AutoCAD 2012 also includes the ability to import 3D models in a wide variety of formats, including CATIA, NX, Parasolid, Creo Elements/Pro, Rhino and SolidWorks. Depending on the size and complexity of the model, this can take quite some time. An Import icon displays on the status bar tray, and a notification bubble appears once the import is complete so that you can place the 3D model into your AutoCAD drawing.

The imported data is translated into native AutoCAD geometry, and inserted into the drawing as a block. Parts and assemblies in the original model are preserved and replicated as nested blocks. After importing, the model can be modified using standard AutoCAD tools.

Documenting Models with Drawing Views
In spite of its advances in 3D, AutoCAD is still used most often to produce 2D documentation. But those 2D drawings

AutoCAD LT 2012

With each new release of its flagship, Autodesk also adds new features to AutoCAD LT, the lower-cost 2D alternative to AutoCAD. Once again, AutoCAD LT 2012 benefits from new features in AutoCAD 2012—and also gains some functionality once reserved exclusively to AutoCAD.

For example, AutoCAD LT 2012 shares the same Autodesk Exchange interface for help and what's new, improved performance, and migration tools. AutoCAD LT 2012 also benefits from the same new auto-complete functionality and the new associative rectangular, polar and path arrays. Users can even create three-dimensional arrays by including multiple levels—in spite of the fact that AutoCAD LT still lacks tools like the ViewCube for easily viewing 3D models. The only practical way to reorient a 3D model in AutoCAD LT is by typing the Viewpoint command.

AutoCAD LT 2012 also gains the new Blend command, the ability to nudge objects, the improved multi-functional grip capabilities, and the double-click Properties palette functions added to AutoCAD 2012. The same new Groups panel also appears in AutoCAD LT's improved ribbon, and LT 2012 incorporates similar fillet and chamfer previews and improvements to multi-leaders, splines and layers.

Perhaps the biggest function to finally migrate from AutoCAD to AutoCAD LT is the Sheet Set Manager. AutoCAD users have long been able to create sheet sets to help organize sets of drawings, create layout views, and reduce the steps needed to publish documents. That capability has finally made its way into AutoCAD LT 2012, making it a more equal partner in the development of 2D documentation.

There also remains one other subtle difference between AutoCAD and AutoCAD LT: While AutoCAD still includes the MLine command, which creates largely disfavored multi-line objects that require their own editing tools, AutoCAD LT has a DLine command, which simply creates parallel line objects that can then be edited using standard commands.

With its two-dimensional functionality now nearly equal to AutoCAD itself, AutoCAD LT 2012 should meet the needs of anyone looking to add adjacent seats, or as a low-cost 2D-only alternative to AutoCAD. It's no wonder AutoCAD LT remains the top-selling 2D drafting application.
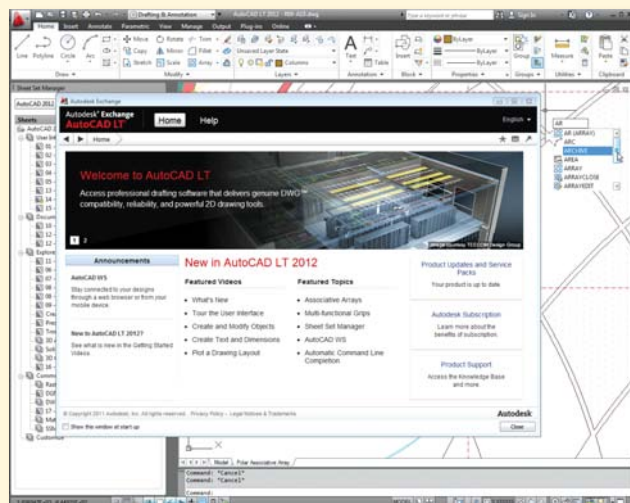
AutoCAD LT 2012 now includes the Sheet Set Manager, formerly only available in AutoCAD itself. The new release of LT also includes the same auto-complete functionality, an Autodesk Exchange portal, and the Content Explorer plug-in.

are frequently derived directly from 3D models by creating views of the model in separate paper space viewports. Dimensions and annotations would be created in model space on specific layers that were only visible in the appropriate viewport. If the model changed, everything would update, but users had to manage the individual viewports and layers, and set appropriate sizes for annotation objects.

AutoCAD 2012 introduces a totally new set of tools for documenting 3D models. If a drawing file contains a 3D model, users can switch to paper space and quickly create a base 2D drawing view of the 3D model. Once a base view has been placed, you can then create projected orthogonal and isometric views—and adjust the scale and appearance of those views. And if you make any changes to the original 3D model, AutoCAD displays a balloon notification: Clicking a link immediately updates the drawing views to reflect those changes.

Although drawing views can only be created in a paper space layout, they are not viewports but rather, a new Drawing View object. As a result, when you're ready to add dimensions and notes, you do so in paper space rather than in model space, eliminating the hassle of creating viewports, controlling layers, and so on. But dimensioning model space objects in paper space can have unintended consequences. For example, if you've dimensioned drawing views and then update the 3D model, the dimensions will lose their associativity. You would then need to manually re-associate each dimension. In complex models, this could become quite tedious.

Some New Tools May Need Some Work

There are several other new tools that may have more limited appeal. For example, when you first start AutoCAD, rather than the traditional "What's New" screen, the software displays the Autodesk Exchange portal. Here you'll find similar content, describing features in the new release. Autodesk Exchange is
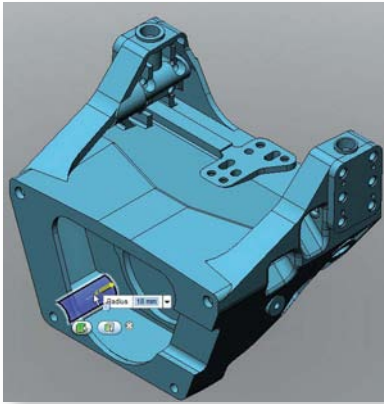
Users can open 3D models in Inventor Fusion, edit models by directly manipulating faces, edges, vertices and features, and return the modified model back to AutoCAD with a single click.

also where the program now displays Help whenever you press the F1 key. Autodesk Exchange is only available if you have a live Internet connection, although local help content can be displayed in a web browser when a web connection is unavailable.

By default, Autodesk Exchange appears whenever you start AutoCAD, although you can turn this off. In that case, you can still access Autodesk Exchange by clicking an Exchange button. In the future, Exchange may also host an online resource for add-ons, similar to the iTunes App Store, but this feature was not yet active at press time.

Autodesk Content Explorer is another new component that receives mixed reviews. This new AutoCAD plug-in appears to be a successor to DesignCenter, although both co-exist in this release. The first time you use Content Explorer, the software generates a Google-like index of DWG files so that you can locate and reuse blocks, layers, linetypes, styles, etc. Once the index has been created, you can easily find and filter content, then drag and drop results into the current drawing or open drawings by simply double-clicking. Users can add specific watch folders and also search for content on Autodesk Seek. You can also use Content Explorer to search across a local area network, but to do so, you must install the Content Service on the networked machines—something that may require the help of IT support staff.

Other Subtle Changes

As we've come to expect, the third release in a DWG series also includes a host of small improvements, what Autodesk often refers to as "fit and finish." For example, there are small improvements to the ribbon that make it easier to define and insert blocks. AutoCAD 2012 also starts up faster and responds more quickly when switching between ribbon tabs.

You can now select an object and nudge it a few pixels in orthogonal directions by pressing the CTRL key and the appropriate arrow key. In the past, the Quick Properties palette, if enabled, would appear when you selected an object, so many users turned this off. Now, you can turn Quick Properties off and still display this useful palette whenever you double-click on most objects.

AutoCAD's group functionality was another feature that users

tended to ignore because it could be tedious. Groups are now streamlined and have their own simplified panel on the ribbon.

When selecting objects, many users forget that there are selection modes other than window and crossing window. Now, when you pick an empty spot in a drawing, AutoCAD 2012 reminds you that you can also use a window polygon, a crossing polygon or a fence. And when AutoCAD's snap mode is enabled, the cursor no longer jumps to snap points when you're simply selecting objects.

AutoCAD 2012 includes a layer enhancement that lets you freeze specified layers in all viewports except the current viewport, improvements to multi-leaders, and the inclusion of a Delete Duplicate command as a core function rather than relying on an Express Tool. Other enhancements include:
- improved raster and DGN file support;
- improvements to AutoCAD's installation process;
- improvements to the tools used to migrate customizations made to an older version to the new release; and
- improvements to AutoCAD's point cloud capabilities.

We've got to hand it to Autodesk. Rather than simply being a grab bag of functions that somehow didn't make it into previous releases, AutoCAD 2012 offers a lot of truly useful new features. By combining these with improved performance, AutoCAD 2012 is another must-have release. **DE**

David Cohn *has been using AutoCAD for more than 25 years and is the author of more than a dozen books on AutoCAD. He's the technical publishing manager at 4D Technologies, a contributing editor to* Desktop Engineering, *and also does consulting and technical writing from his home in Bellingham, WA. You can contact him at david@dscohn.com or visit DSCohn.com.*

A New Point of Origin

Help with drawing conclusions from seemingly insurmountable volumes of data.

BY VINCE ADAMS

I n the data-driven worlds of research and engineering, more truly is better. OriginPro 8.5.1, released in April, "provides tools for serious data analysis, such as Peak Fitting, Surface Fitting, Statistics, Signal Processing, and Image Handling," says Joe Przechocki, business development manager of OriginLab Corp., Northampton, MA.

Origin began in the early 1990s as a utility for processing data from microcalorimeters from MicroCal Corp. (now part of GE Healthcare). Its beginnings focused the product on publication-quality graphing and easy-to-use curve-fitting for Windows users. MicroCal quickly recognized its value and flexibility early on, and a new company called MicroCal Software was developed for the sole purpose of developing Origin for wider applications. In 2000, the company changed its name to be more in line with its popular product name. OriginLab Corp. was born.

In a nutshell, Origin, the base version, and OriginPro, with extended functionality, provide point-and-click control over every element of a plot. Additionally, users can create multiple types of richly formatted plots, perform data analysis and then embed both graphs and results into dynamically updated report templates for efficient re-use of effort.

"At a conference, you can tell right away who's using a graphics program like OriginPro and who's not," notes Jeff Thompson, a research scientist at the Energy & Environmental Research Center in Fargo, ND. He frequently acquires data in relatively short-duration projects that needs to be analyzed, then published or presented. The "polish" and personalization he can add to a report drew him to Origin Pro, he says.

All data, plot types and settings are saved in a single project file (called an OPJ file), so organizing, archiving and sharing is practically painless. Furthermore, Origin-Lab offers a free Origin Project Reader so that any colleague—or customer—can access OriginPro data without a copy of the software installed. This can be downloaded from OriginLab.com.

The User Interface

As shown in Figure 1, OriginPro is toolbar-driven with two primary sections: the Project Explorer, on the left, and the working or active window. The Project Explorer has a familiar-looking folder structure. Because the project is

stored in a single file, each user-created folder represents a section of the data to make access more logical and organized. The list below the folder tree reflects the contents of
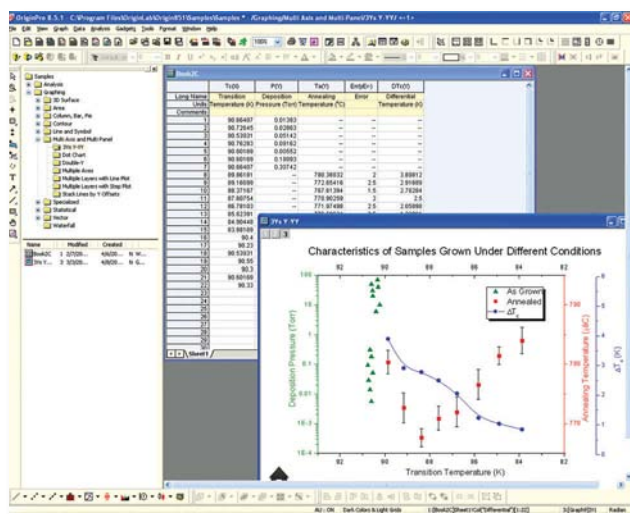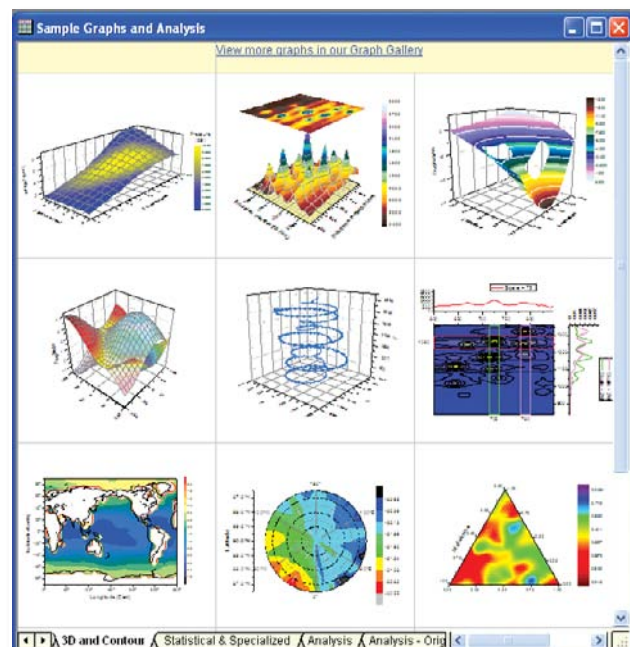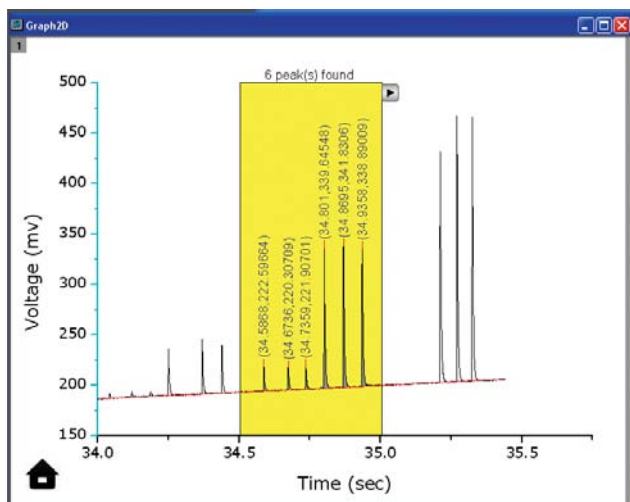

FIGURE 1: The OriginPro User Interface.

FIGURE 2: The OriginPro Graph Gallery.

FIGURE 3: The return on investment selections in the Quick Peaks Gadget.

FIGURE 4: The Faxed Stress-Strain curve is digitized.

FIGURE 5: Standard color palettes in OriginPro 8.5.1.

the selected folder, including data tables and plots.

To make changes in a graph, a user navigates to the folder containing the graph, then double-clicks on any part of the graph to get a dialog box. This is where the years of product refinement show: Almost any conceivable change to the graph is possible with the dialog boxes provided—no special coding or programming knowledge is required.

As with many full-featured software products, the number of options and controls can be daunting. To reduce the learning curve, both after extended periods away or when venturing into new graph or report types, OriginPro offers a number of aids, both in the software and on its website.

The Help and Tutorials walk users through all the steps and options. The sample project gallery within the software offers prepared workbooks in a number of styles and formats, which users can replicate or swap data into to create their own graphs (see Figure 2).

Additionally, there is a Graph Gallery on OriginLab.com with industry-specific examples and case studies that are updated regularly to provide the most up-to-date samples.

Once a graph has been developed with exactly the right settings for a particular type of project or dataset, users can either create Graph Templates for the creation of similar graphs, or Graph Themes to update the style and format of existing graphs to match a consistent look. Both tools help produce professional-grade reports and publications.

While OriginPro 8.5 was targeted and labeled a major release from OriginLab, OriginPro 8.5.1 contains enough new functionality to be considered a major release unto itself.

New Gadgets
Gadgets in OriginPro are tools that perform quick analyses on Regions of Interest (ROI) within a graph, shown by the yellow rectangle in Figure 3. Gadgets, introduced in OriginPro 8.5, are transient selections, using a rectangle, circle or ellipse on an existing graph, that report back information. The results calculated within a Gadget are updated dynamically as the ROI is dragged within a graph. Version 8.5.1 added four additional Gadgets:
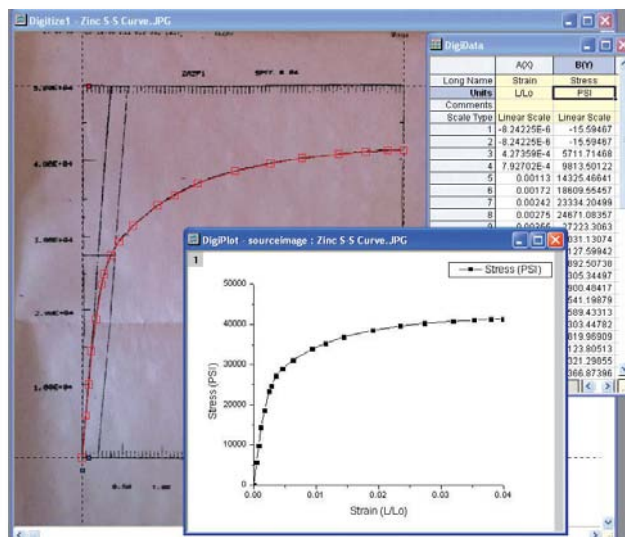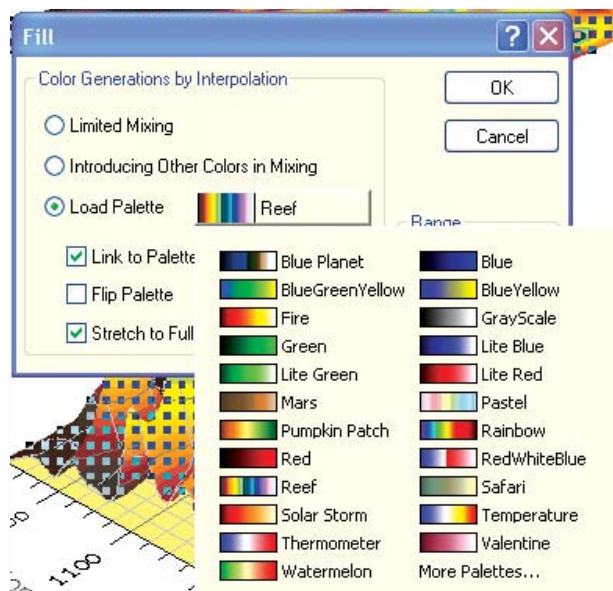
- The Quick Peaks Gadget can identify both positive and negative peaks within a given plot. Quantities such as a Peak Area, Peak Height, Peak Center and full width at half maximum (FWHM) are reported. Peaks can be tagged and multiple peaks can be fitted, while baseline data can be identified and subtracted.
- The Cluster Manipulation Gadget performs basic statis-

CASE IN POINT

Jeffrey Hurlbut is a research Fellow at Solutia, Inc., a developer of specialty products such as the material used to prevent shattering on most automobile windshields. He has been using OriginPro for about 10 years, and says he was drawn to it as much for the data analysis tools as the data formatting capabilities.

"Regular tasks, such as finding the area under a curve, are much easier than in common spreadsheet applications," he says. "The Gadgets introduced in 8.5.1 are fantastic. I can quickly drag a selection around a curve with immediate feedback on the region of interest. I'm able to examine data and trends that I might otherwise have overlooked with more complicated methods."

Hurlbut also points to OriginLab's strong support network: "OriginLab has even written custom applications for Solutia, and provided live update training for the 10 or so users at our facility."
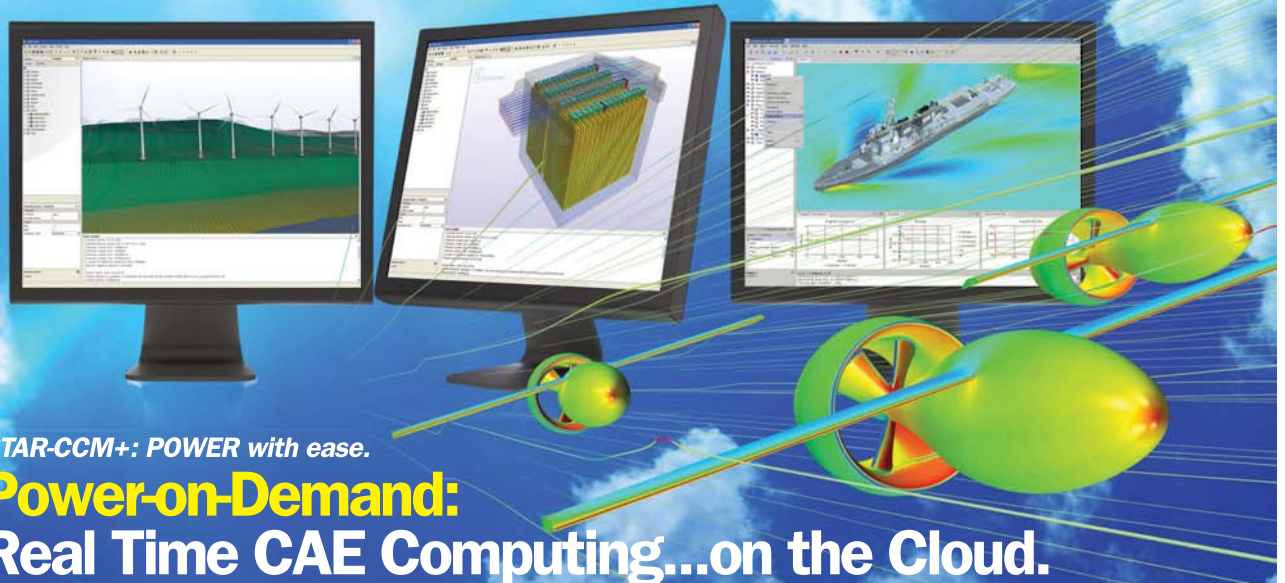
tical calculations on a cluster of data or on the points outside the selected ROI. Data points can be edited, deleted or temporarily masked. Data includes number of points, sum, mean, median, standard deviation and min/max.

- The Statistics Gadget provides an added level of statistical output on the selected ROI.
- The Digitize Image Gadget allows users to import scanned graphs from books, journals or faxes and convert them into digitized tabular and graphical output. The process has an intuitive, but manual graphical user interface (GUI) for axis definition and point selection—but with the graphical feedback and subsequent data analysis, the value of this work is readily apparent. The images in Figure 4 show the key elements of this process. A faxed stress-strain curve was photographed with a cell phone camera and digitized. OriginPro 8.5.1 allowed the image to be rotated with reasonable precision and the axes were defined. In this step, the strain axis was automatically converted from "percent strain" to actual strain, so that slope calculations would have the proper units.

Users can zoom in on the image while selecting points to improve precision. The overlay plot is visible upon point selection, which can help users can determine whether more points are required to capture curvature. OriginPro orders points as selected, so if a user backtracks to add

points, he or she must simply re-sort the data based on x-value. The plot updates automatically.

Multiple traces can be added to a single graph with corresponding, independent columns. Once complete, the tabular data can be exported to a text file or Microsoft Excel for use in other calculations, such as finite element analysis (FEA) material definition.

Additional New Features

OriginPro's non-linear curve fitter has been updated in version 8.5.1 to fit multiple 3D peaks in a dataset. Surface fitting techniques are used in many scientific fields, such as spectroscopy, mathematics, electrical engineering and earth sciences. Nineteen different surface fitting models are available, including Gauss2D, DoseReponse2D, Exponential2D and Polynomial2D. These calculations can be automatically updated if the underlying data changes, or the settings can be saved as an Analysis Theme to use later with similar data.

One differentiator of OriginPro is the complete control a user has over the format of data for publication. Most researchers and engineers understand that while presentation can't replace compelling data, it can open up opportunities for more widespread and detailed review, with a favorable attitude toward conclusions.

To that end, OriginPro provides access to the seemingly small details that can really make a difference. In OriginPro 8.5.1, a number of enhancements have been made, including improvements to the plot color palette.

OriginPro has many built-in coordinated color palettes that can be added to, modified and saved. Figure 5 shows some of the color palettes that can be applied to different types of graphs.

The vast majority of improvements to OriginPro are driven by customer input collected by the manufacturer's technical support team, according to the company. Users receive 90 days' free support with each purchase and on-going maintenance plans are available. Current maintenance customers also receive upgrades during their maintenance period. **DE**

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

INFO ➡ **OriginLab Corp.:** OriginLab.com

➡ **Solutia, Inc.:** Solutia.com

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

Mobilizing Toward a Robotics Revolution

Sensor developments are facilitating progress toward autonomous mobile robotics, but what's holding us back?

BY BARBARA G. GOODE

FIGURE 1: Just days after Microsoft released Kinect, the sensor was hacked by code developers wanting to enable control through a PC rather than just the Xbox.

The most exciting development in sensing for autonomous service robots—which is arguably the most exciting frontier in robotics—is a sensor that has only begun to be used in robotics and, in fact, was developed for a completely unrelated application. It is Microsoft's Kinect for Xbox 360, which the computer giant describes as a "controller-free" interface for its video game platform (see Figure 1).

The Kinect enables control of the Xbox through "natural interaction"—a term trademarked by PrimeSense (Tel Aviv, Israel), which developed Kinect's underlying optical sensing and recognition technology that translates body motion into control commands. As Microsoft explains, "the Kinect sensor has a 3D camera and a built-in microphone that tracks your full-body movements and responds to your voice." What makes the sensor captivating is its price tag: $149.99.

"It's the most exciting sensor to be released in a very long time," says Bill Kennedy, co-founder of Amherst, NH-based MobileRobots, Inc., the maker of autonomous robot cores, bases and accessories that was acquired in 2010 by industrial automation and robotics multinational Adept Technology, Pleasanton, CA.

Fred Nikgohar, CEO of RoboDynamics, Santa Monica, CA, agrees.

"Kinect is a great example of what is possible now with sensors and embedded systems," he says. "It's not that we couldn't do 10 years ago what Kinect does, but at $150 it is a radical game changer."

That's certainly true for service robots, defined by the International Federation of Robotics as those that operate semi- or fully autonomously to perform services useful to humans and equipment, excluding manufacturing. It is also likely true for other fields, as well.

Getting 'Kinect-ed'

Industry watchers were surprised that Microsoft was seemingly unaware of the potential of Kinect for robotics applications—potential evidenced by the fact that days after Kinect's release, it was hacked by code developers wanting to enable control of the sensor through a PC rather than just the Xbox. In response, Microsoft announced plans for a software development kit (SDK) that will allow exploration of Kinect for other applications. A non-commercial starter kit for Windows, which should be available by the time you read this, promises:
• Robust, high-performance capabilities for skeletal tracking of one or two persons moving within the Kinect field of view.
• Advanced audio capabilities provided by a four-element microphone array, with sophisticated noise and echo cancellation, beam formation to identify a sound source; and integration with the Windows speech recognition application programming interface (SAPI) also included.
• Access to a standard color camera stream, as well as depth data to indicate distance of an object from the Kinect camera, to enable development of novel interfaces.

At an unspecified date, Microsoft also plans to release a commercial version of the SDK that will include support and confer any intellectual property rights—which the non-commercial version will not. Microsoft is releasing no further details at this time.

Meanwhile, however, a number of others are working on Kinect-like products, says Conard Holton, editor-in-chief of Vision Systems Design. Among them is the Interface Ecology Lab at Texas A&M University, whose ZeroTouch sensor was covered recently by *Time*, among other publications.
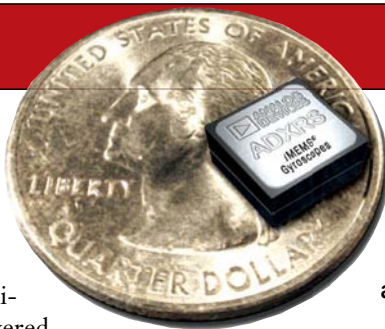
Complex and Evolving

Robots employ a number of sensor types, including GPS navigation, radar, sonar and inertial guidance. However, "the majority of service robots require some sort of vision system," says the Vision for Service Robots Report. According to the report, these range from simple 2D CMOS sensors to complex subsystems capable of 3D imaging and pattern recognition. The vision sensor technologies most often used in service robots are structured light and two-camera stereo systems, time-of-flight sensors, LIDAR, and single-lens camera systems.

While some of those options still run in the multiple thousands of dollars, MobileRobots' Kennedy says on the whole, vision sensor pricing has dropped dramatically—and sensors themselves can be relatively easy to put together. However, that doesn't make mobile autonomous movement a simple endeavor.

"The vision software needed to understand these images and provide robotic feedback is complex and evolving rapidly," notes the Vision for Service Robots Report. Kennedy explains that most of today's autonomous mobile robots operate under constrained conditions. For instance, those that ferry supplies in a factory typically follow lines installed in the floor, and will stop if their paths become blocked. The lighting must be just right, too: Shadows will throw the robots off, as will overly bright light.
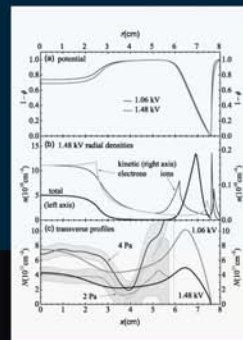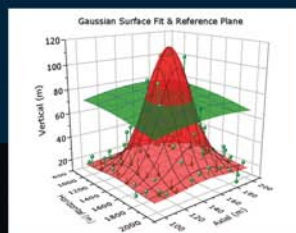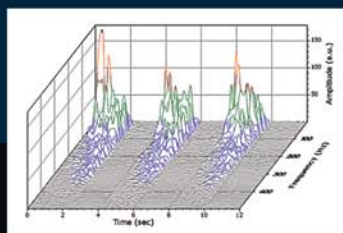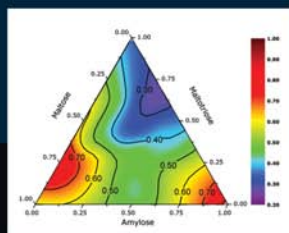
Gating Factors

"Designing navigation and stability systems requires extensive hardware and software knowledge," maintains Howard Wisniowski, marketing manager for MEMS/Sensors Technology Group, Analog Devices (ADI), Norwood, MA. Today's inertial measurement units (IMUs) are sophisticated enough to cover many bases. They may include a multi-axis (X, Y, Z) accelerometer, a multi-axis (X, Y, Z) gyroscope, and a multi-axis magnetometer (compass). See Figure 2. And yet, dealing simultaneously with multiple axes as well as angular (pitch, roll and yaw) and linear (up, down, sideways) motions while determining position, velocity, and heading in free space, "is

Platform Approaches

RoboDynamics CEO Fred Nikgohar points to what he sees as three fundamental problems that hamper the robotics industry:

1. Fragmentation. Nikgohar says that every company works independently, lacking standards, unification or collaboration. This prevents the development of economies of scale.

2. A dearth of affordable, useful platforms. This severely limits market incentives required for innovation and, by extension, to create a diverse ecosystem of adopters and innovators.

3. Lack of designs that will engage people emotionally.

On May 11, 2011, RoboDynamics made a move intended to overcome those limitations: The company's new Luna is a sleek, 5-ft., 2-in. open-standard hardware platform (with an 8-in. touchscreen LCD for a face) designed to enable robotics innovation (see Figure 3).

"We've made the proper tradeoffs to get it to a consumer-level price," explains Nikgohar, adding that 1,000 limited-edition Luna robots will begin shipping during the fourth quarter of 2011 for $3,000 each. Luna will feature a native App Store, standard PC architecture, an open Linux-based operating system, touchscreen display, Wi-Fi and multiple USB ports for expandability.

"Our objective is to aggressively remove cost and complexity, thereby facilitating widespread consumer adoption while simultaneously providing a unique ground-floor opportunity for the developer community to bring innovative ideas to a financially viable robotics ecosystem," says Nikgohar.

Other developers—including Willow Garage, based in Menlo Park, CA, and MIT's Bilibot Project—are also providing affordable, open-source robotics platforms to encourage innovation. In fact, the MIT team is currently offering a competition with a rebate of up to $350 on the purchase of a Bilibot (which, by the way, is built on Kinect) for creating and sharing an open-source application.

If you've been thinking about trying your hand at robotics, this might provide just the incentive to start. Starting now is probably necessary if Nikgohar is to achieve his goal of "A robot in every home in 10 years."

FIGURE 3: RoboDynamics' new Luna (shown here with company CEO Fred Nikgohar) is a 5 ft., 2 in. open-standard hardware platform featuring feature a native App Store, standard PC architecture, an open Linux-based operating system, touchscreen display, Wi-Fi and multiple USB ports for expandability.

complex and has many constantly changing variables that need to be interpreted correctly," in the context of other variables that need to be understood, such as temperature compensation, offset and hermeticity, says Wisniowski.

Kennedy says, "even the simplest of tasks, like driving from one place to another in a cluttered, dynamic, human-occupied environment, requires a lot of robotic sophistication—lots of sensors and lots of processing for the very sophisticated fast-acting software. Only when the price of all that hardware comes way, way down will robots become more ubiquitously deployed around people."

The Kinect is a step in the right direction, though the field has a long way to go, and Kennedy points out a major stumbling block: liability. Just as commercial airplanes have to be far safer than cars, the safety issue implies a cost that is "much more than people are willing to pay to have a robot in their midst."

Help Wanted

Wisniowski explains that while design tools such as evaluation boards and software development platforms are available through component suppliers and third-party specialists, they are not simple to use—and developing the algorithms that the microprocessor can use and that fit the application is another

challenge. Indeed, practical algorithms for interpreting sensor measurements/readings is a major factor holding back the growth of robotics, says Teddy Yap, Jr. of Washington State University, whose doctoral dissertation was titled "Mobile Robot Navigation with Low-Cost Sensors."

In addition to less expensive, more sophisticated sensors and processors, Kennedy's list of things necessary for design engineers need to take consumer robotics from a niche to mainstream includes better tools for non-programmers and training. He notes that MobileRobots offers training, but the demand is limited.

Training is provided via downloadable PDFs on Freescale's website to support its new 9-in.-tall bipedal sensor robot and development kit that the company launched in May for $199. The walking robot has four degrees of freedom, a 32-bit "brain," and a three-axis accelerometer for balance, and it offers a choice of easy-to-use scripting languages. **DE**

Barbara G. Goode *served as editor-in-chief for* Sensors *magazine for nine years, and currently holds the same position at* BioOptics World, *which covers optics and photonics for life science applications. Contact her via de-editors@deskeng.com..*

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INFO ➡ Adept Technology: Adept.com

➡ **Analog Devices, Inc.:** Analog.com

➡ **Freescale:** Freescale.com/MechBot

➡ **International Federation of Robotics:** IFR.org

➡ **Microsoft:** Xbox.com/en-US/kinect

➡ **MIT's Bilibot Project:** Bilibot.com

➡ **MobileRobots, Inc.:** MobileRobots.com

➡ **PrimeSense:** PrimeSense.com

➡ **RoboDynamics:** RoboDynamics.com

➡ **Texas A&M University's Interface Ecology Lab:** EcologyLab.net/research/zerotouch/index.html

➡ **SICK USA:** Sick.com

➡ **Vision Systems Design:** Vision-Systems.com/research-reports.html

➡ **Willow Garage:** WillowGarage.com/turtlebot

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NVIDIA **Raises** the Bar

Reviewing the latest workstation-class Quadro professional graphics accelerators.

BY DAVID COHN

The entry-level NVIDIA Quadro 600.

The mid-range NVIDIA Quadro 2000.

The high-end NVIDIA Quadro 4000.

The ultra-high-end NVIDIA Quadro 5000.

The last time we looked at workstation-class graphics accelerators from NVIDIA (see *DE* November 2010), we reviewed one of the new Quadro boards based on the company's Fermi architecture. That card, the ultra-high-end Quadro 5000, was announced at last year's Siggraph trade show along with the high-end Quadro 4000 and flagship, ultra-high-end Quadro 6000. According to NVIDIA, the new boards are as much as five times faster than previous cards when running 3D applications and up to eight times faster for computational simulation. What's more, the graphics processing units (GPUs) in the two new ultra-high-end Quadro boards were also the first professional graphics solutions with error correction codes (ECC) memory.

We ran the Quadro 5000 through its paces back in November, along with three older NVIDIA Quadro FX boards. The Quadro 5000 was also included in recent workstations we've reviewed from BOXX Technologies and Dell. Since then, NVIDIA has expanded its Fermi-based Quadro lineup with the introduction of the mid-range Quadro 2000 and the entry-level Quadro 600. For our latest roundup, we look at these two new boards as well as the Quadro 4000.

All four boards use a PCI Express 2.0 x16 bus interface and support DirectX 11 and Shader Model 5.0 as well as OpenGL 4. They also all feature a full 30-bit display pipeline, enabling more color values than 24-bit boards, as well as full-scene anti-aliasing, hardware 3D window clipping, and HDMI support via an HDMI adaptor. The NVIDIA GigaThread Engine provides up to 10X faster context switching compared to the company's previous generation architectures, while the Quadro Scalable Geometry Engine improves performance across a range of applications. And the NVIDIA Parallel DataCache supports a true cache hierarchy combined with on-chip shared memory to accelerate real-time ray tracing, physics processing, and texture filtering.

At the high and ultra-high-end, the Quadro 4000, 5000, and 6000 also incorporate Dual Copy Engines, which allow simultaneous transfer of data between the GPU and the host computer, further accelerating operations such as ray tracing and physical simulations, and enabling high performance computing thanks to double-precision floating point performance. All the new boards support NVIDIA's Application Configuration Engine (ACE), which automatically adjusts graphics settings for optimized application performance. All four also feature NVIDIA Mosaic Technology, which enables any application to use one or more Quadro boards to scale across up to eight high-resolution displays.

Of course, the biggest differences from the previous generation of Quadro boards are the amount of memory and computa-

tional power in each card's GPU. NVIDIA calls its parallel computing architecture CUDA (Compute Unified Device Architecture), and even the new entry-level Quadro 600 provides 96 such processors compared to just 32 in the previous entry-level board.
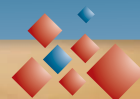
The New NVIDIA Quadro Family

At the entry-level, the NVIDIA Quadro 600 provides a full gigabyte of DDR3 memory, compared to 512MB of GDDR3 memory in the older NVIDIA FX 580 board it succeeds in the lineup. As mentioned, the new GPU in the Quadro 600 offers three times the number of CUDA processors as the previous generation board. In our tests, however, the two boards performed about the same, with the older FX 580 even scoring a bit higher on some tests. The new Quadro 600 carries a slightly higher price tag than its predecessor and also compromises a bit, providing one DisplayPort connection as well as a dual-link DVI port, whereas the FX 580 has two DisplayPorts. Still, with a street price around $161, the NVIDIA Quadro 600 is an excellent entry-level board.

The mid-range proved to be the sweet spot. Although decidedly more expensive than entry-level boards, professional graphics boards aimed at this segment of the market typically deliver significantly better performance at a reasonable price point. The new NVIDIA Quadro 2000 comes with 1GB of GDDR5 memory compared to 768MB of GDDR3 memory in the older

Quadro FX 1800. Its GPU also provides 192 CUDA cores, compared to just 64 in its predecessor. Although the memory interface drops from 192-bit to 128-bit, NVIDIA engineers have increased the memory bandwidth in the Quadro 2000 to 41.6GB/second. As a result, the new board delivers better performance on most, but not all, of the datasets in the SPEC Viewperf benchmark. The new board also supports NVIDIA SLI technology, a feature not present in its predecessor. Like the older FX 1800 board, the Quadro 2000 requires a single PCIe x16 slot. Although at 62 watts it consumes a bit more power, it does not require an auxiliary power connection. Its manufacturer's suggested retail price is a full $100 less than the board it replaces, but its current street price is actually a bit more expensive than the Quadro FX 1800.

At the high end, NVIDIA has eclipsed the FX 3800 with the new Quadro 4000. Although its suggested price of $1,199 is identical to the older board, its average street price is around $780, a bit less than the FX 3800. This board comes with 2GB of GDDR5 memory—double that of the older board—while retaining the same 256-bit memory interface. It also provides 256 CUDA cores—64 more than its predecessor—yielding an 89.6GB/second memory bandwidth. As a result, the new Quadro 4000 easily outperforms the older board, often by a wide margin. In addition to its two DisplayPorts and dual-link DVI connector, this board also supports stereoscopic 3D output (with an optional 3-pin Mini-DIN bracket) as well as SLI. In spite of all this power,

SPECviewperf Benchmark Results for Current NVIDIA Quadro and Quadro FX Series Graphic Cards Reviewed

	NVIDIA Quadro FX 5000	NVIDIA Quadro FX 4800	NVIDIA Quadro 4000	NVIDIA Quadro FX 3800	NVIDIA Quadro 2000	NVIDIA Quadro FX 1800	NVIDIA Quadro 600	NVIDIA Quadro FX 580
	NEW!		NEW!		NEW!		NEW!	
Manufacturer's price	$2,249	$1,999	$1,199	$1,199	$599	$699	$199	$170
Average street price	$1,765	$1,620	$780	$818	$450	$405	$161	$150
SPECviewperf 11.0 (Boxx 8550 XTREME)								
catia-03	48.85	24.70	41.17	24.30	30.81	22.12	16.96	15.41
ensight-04	42.54	15.03	30.62	15.04	20.15	11.45	10.50	9.00
lightwave-01	69.48	66.17	69.61	65.36	65.85	58.92	41.99	42.56
maya-03	100.73	51.81	83.43	20.90	21.38	36.54	13.44	24.32
proe-05	11.37	10.79	11.36	10.72	11.33	10.72	10.02	10.09
sw-02	66.16	45.94	57.28	45.40	46.47	40.58	31.36	28.81
tcvis-02	42.36	17.91	35.41	17.59	24.87	15.80	15.45	10.62
snx-01	44.02	17.69	32.15	17.24	21.91	15.90	12.73	11.39
SPECviewperf 10.0 (HP xw6600)								
3dsmax-04	62.46	62.89	62.43	62.74	62.69	52.29	62.63	59.74
catia-02	77.93	70.09	77.86	69.91	73.67	68.33	51.41	62.56
ensight-03	112.82	59.45	91.50	56.82	66.97	54.37	44.40	45.38
maya-02	409.21	239.61	352.45	234.88	266.74	221.39	165.60	180.35
proe-04	56.95	55.22	57.00	54.91	56.69	55.75	53.59	53.48
sw-01	102.34	105.48	102.49	105.43	102.45	105.48	88.75	87.16
tcvis-01	80.27	40.47	75.86	40.04	56.73	35.61	34.81	23.71
ugnx-01	89.29	37.91	66.32	37.59	43.80	34.63	29.35	23.23
SPECIFCATIONS								
Bus architecture	PCI Express X16	PCI Express X16	PCI Express X16	PCI Express X16	PCI Express X16	PCI Express X16	PCI Express X16	PCI Express X16
Extra power req'd	Yes	Yes	Yes	Yes	No	No	No	No
Form factor	4.38"x9.75"	4.38"x10.5"	4.38"x9.5"	4.38"x9.0"	4.38"x7.0"	4.38"x7.8"	2.73"x6.6"	4.38"x6.75"
Slots used	2	2	1	1	1	1	1	1
Max Power (watts)	152W	150W	142W	108W	62W	59W	40W	40W
PCIe version	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Length	3/4-length	3/4-length	3/4-length	2/3-length	2/3-length	2/3-length	1/2-length	1/2-length
Processors	352	192	256	192	192	64	96	32
Memory configuration	2.5GB (GDDR5)	1.5GB (GDDR3)	2GB (GDDR5)	1GB (GDDR3)	1GB (GDDR5)	768MB (GDDR3)	1GB (DDR3)	512MB (GDDR3)
Memory interface	320-bit	384-bit	256-bit	256-bit	128-bit	192-bit	128-bit	128-bit
Memory bandwith	120 GB/sec	76.8 GB/sec	89.6 GB/sec	51.2 GB/sec	41.6GB/sec	38.4 GB/sec	25.6 GB GB/sec	25.6GB/sec
Number of Dual-Link DVI Outputs	1	1	1	1	1	1	1	1
Number of Display Port Outputs	2	2	2	2	2	2	1	2
Stereo 3D Connector (3-pin)	Yes	Yes	Yes (1)	Yes (1)	No	No	No	No
SDI-enabled	Yes	Yes	Yes	Yes	No	No	No	No
Framelock/Genlock	Yes (2)	Yes (2)	No	No	No	No	No	No
SLI	Yes	Yes	Yes	Yes	Yes	No	No	No
OpenGL version	4.0	3.0	4.1	3.1	4.0	3.0	4.0	3.0
DirectX/Shader Model	11/5.0	10.0/4.0	11/5.0	10.0/4.0	11/5.0	10.0/4.0	11/5.0	10.0/4.0
Maximum Resolution Support (@ 60 Hz)	2560x1600	2560x1600	2560x1600	2560x1600	2560x1600	2560x1600	2560x1600	2560x1600

Notes: 1. Requires optional 3-pin Mini-DIN bracket. **2.** Requires optional G-Sync option card.

the Quadro 4000 requires just a single PCIe x16 slot, but since it consumes 142 watts it does require an auxiliary connection to the system power supply.

Benchmarking the Boards

We tested the three new NVIDIA Quadro boards using the same system we've used for several years now for evaluating graphics cards, an HP xw6600 workstation equipped with a pair of 3.0GHz quad-core Xeon E5450 processors. While that system is certainly showing its age, using the same computer enables us to continue to compare our results to those of older boards from both AMD and NVIDIA, making it easy to see just how much these graphics accelerators have improved over the years. However, since NVIDIA updated its driver software for the newest boards, we also retested the previous generation of NVIDIA graphics cards using the updated driver, so that we could determine how much things improved simply because of improvements in the driver software.

But, recognizing that many readers are likely using newer systems, we also did something a bit different this year, running an additional set of tests using the BOXX 3DBOXX 8550XTREME workstation we recently reviewed. The BOXX workstation was equipped with a pair of 3.33GHz Intel Xeon X5680 six-core CPUs over-clocked to 4.2GHz. We tested all of the boards using two different versions of the SPEC Viewperf

benchmark (spec.org): version 10 on the older HP workstation running Windows XP 32-bit at 1280x1024 resolution and the newer version 11 on the system from BOXX running the 64-bit version of Windows 7 at 1680x1050.

Based on our results, with the exception of the entry-level Quadro 600, the new generation of NVIDIA Quadro boards surpasses the performance of the older boards. In fact, at the mid-range, high, and ultra-high-end, the newer boards at the lower price point once again beat the performance of previous generation graphics cards one step higher on the food chain.

All of the new NVIDIA Quadro boards are fully certified with most CAD and DCC applications and all of the boards in the Quadro line, including earlier Quadro FX boards, use the same unified video driver. Drivers are available for most 32- and 64-bit operating systems, including Windows 7, Vista, XP, and Linux. **DE**

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

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INFO ➡ NVIDIA Corp.: NVIDIA.com

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

modo® 501 image by SeventhStreet – SeventhStreetStudio.com

Ready for adventure
Luxology®

A Force to Reckon with
in the 3D World

Luxology's modo polygon and subdivision surface modeler, continues to grow by leaps and bounds.

BY MARK CLARKSON

I reviewed modo 401 back in 2010 (deskeng.com/articles/aaaynw.htm). I liked what I saw then, and I like the new release even more.

The first thing I noticed upon firing up modo 501 was RayGL, modo's new real-time render preview. Previous modo versions have had a dedicated preview window, but RayGL is better, faster and available in any window. With a few weird exceptions, RayGL gave me a fast, accurate preview of the finished render. This technology is becoming de rigueur in 3D applications, so it's not surprising to see it here, but it's still extremely welcome.

Luxology claims to have greatly improved the rendering speed with version 501, and wow, have they ever. The first scene I tested—a 22 million polygon collection of espresso machines—rendered 2.25 times faster (189 seconds vs. 83 seconds).

Testing old scenes and new, I found 501 to consistently be much faster than 401, often two to three times faster. The results were often visibly superior, and typically used less memory than the same scene rendered in 401.

modo's renderer is Intel single instruction, multiple data (SIMD) accelerated, so computers with modern cores (which, sadly, doesn't include mine) will see an even bigger improvement in overall speed.

modo's renderer offers better depth of field—complete with Bokeh effects, if you so desire. New bump map and displacement map engines provide better results with less memory.

The RayGL option, available in any modeling window, provides a fast, accurate preview of the finished render.

Calling Catmull and Clark

I use modo's subdivision surfaces all the time. They turn boxy, low-resolution objects into smooth, high-resolution objects with a press of the tab button. While great for organic shapes, they're a bit of a pain when it comes to hard-surface modeling. By their nature, sub-d surfaces smooth things out. So when it comes time to create some hard edges, you're always fighting against them. You end up adding more geometry than you'd really prefer. To get a sharp corner, you typically have to slice the object up, adding new edges—and new rows of polygons—just to force the sub-d's into a tighter bend. Tweaking the weights of your edges helps somewhat, but it also distorts your textures.

Enter Pixar subdivision surfaces—or more properly, Catmull-Clark subdivision surfaces. Pixar sub-d's are very similar to modo's native sub-d surfaces. In fact, at first the difference between them might not be at all apparent. The big benefit comes from the Pixar sub-d's more useful brand of edge-weighting: You can get a nice, crisp edge by simply turning up that edge's weight. (Pixar sub-d's are also less prone to the distortion of UV textures, as they have less of a tendency to stretch and compress the underlying geometry around the edges.)
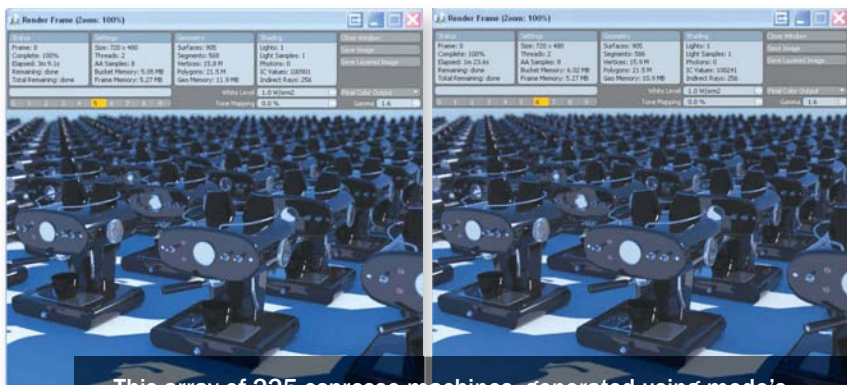
This array of 225 espresso machines, generated using modo's Replicator feature, renders 2.25 times faster in modo 501, while using less memory.

Pixar sub-d's also enable modo's new multi-resolution mesh sculpting. This allows you to sculpt details at ever-higher levels of resolution without destroying the previous resolution.

Pixar sub-d's are more computationally complex, and they do generate a higher density mesh (read: more polys) at any given subdivision level, so your computer works harder while you work less.

Schematics View

modo's animation system, in addition to doing both forward and inverse kinematics, lets you hook up nearly anything to nearly anything else via constraints, linkages and relationships. You scale an object's texture when that object is scaled, for example. But you can also change an object's color when it's scaled. Most applications are more prosaic: having windows open together, or one gear driving another.

On an animation I did of a submarine, for example, the screws are driven by a simple relationship with the sub's position: for every X meters the sub moves forward, the screws revolves once on their axes. (As they are counter-rotating screws, one of them multiplies the sub's position by -1.)

This works really well, but anything more complex becomes progressively more difficult to visualize and maintain. And modo is capable of

nightmarishly complex assemblies—entire internal combustion engines, industrial robots, etc.

modo 501's new schematic view takes a giant leap in the right direction. Now you can lay your relationships out in a very visual way, and a normal human being has a much better chance of being able to create, edit and use complex assemblies.

To recreate my submarine rig, I drag the submarine's Z position—and each propeller's Z rotation—onto the stage, where they appear as labeled boxes. I hook the boxes up by dragging from any box's output to any other box's input. Where math is needed, I drag a math operator onto the stage and hook it up. The results are easy to read, and easy to modify.
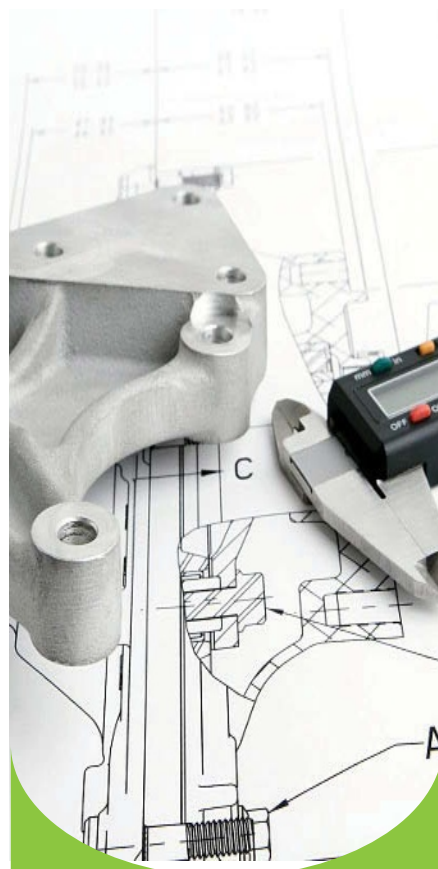
Even better, you can package these schematics up into assemblies. Assemblies not only keep things nice and neat, but also allow you to reuse your animation rigs, texture drivers and what-have-you by applying them to different objects.

It's the Little Things

There are little improvements all around. You can now define the default snap, axis, brush and snap state for your tools. Sculpt tools work in the UV mapping workspace. modo's fur—with new frizz and kink settings—is also easier to comb. modo reads RGB-alpha images directly, giv-
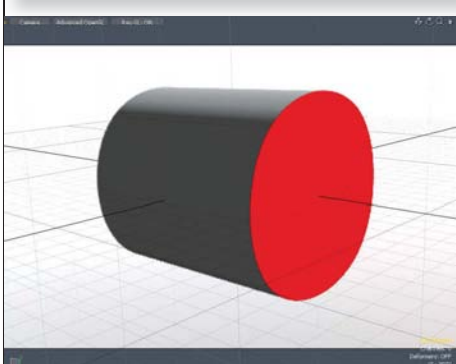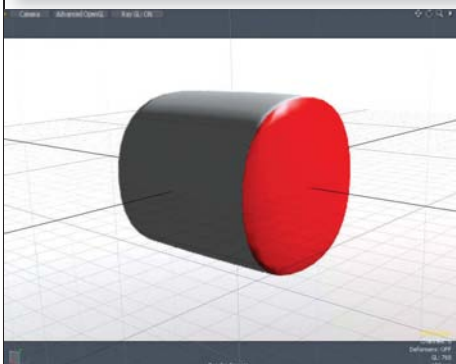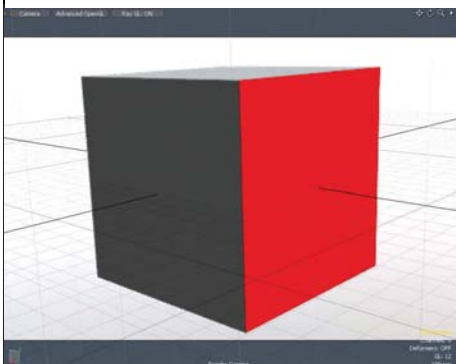
modo's schematic view makes setting up animated relationships easier than before. This setup uses the submarine's position along with two math operators, to drive the rotation of the two screws.
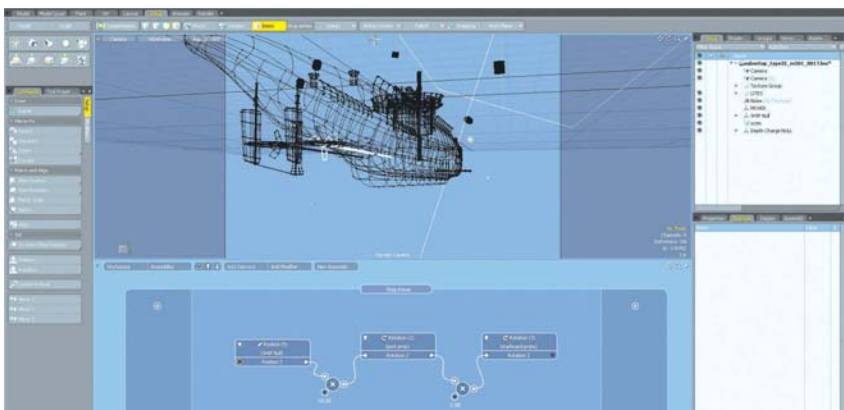

A simple 6-poly cube (top), converted to a tube with modo subdivision surfaces (middle) and the new Pixar subdivision surfaces (bottom). Pixar subdivision surfaces give crisper corners, with less distortion.

ing you alpha and color channel in one file. You can also work with really huge image maps.

modo 501 comes with a whole new set of procedural textures, with everything from dripping water to spaceship panels to the extremely useful occlusion shader. The occlusion shader lets you isolate low or high areas of your geometry—areas that would be shadowed or would be exposed to the light—and build procedural textures based on them. It's great for adding rust and dirt (admittedly, not something designers do that often) but also for building complex organic textures, or ceramic glazes with a hand-applied look.

Unlike previous versions, the 64-bit version of 501 now opens SolidWorks parts and assemblies natively. Appearances and decals now come through. Luxology has recently announced its SolidWorks Kit ($299), a module that promises to smooth still further the processes of moving your work between SolidWorks and modo.

Documentation

If I have a pet peeve—and believe me, I do—it's bad documentation. Documentation is so often overlooked and under-loved that it's commonly the low point of my product reviews. It's generally easier and more effective to use Google than inline help.

I'm happy to report that modo's help has gotten much, much better with this release. modo has always had a lot of good information, examples and videos available, but up to now it's been kind of scattershot. In 501, it's much better organized, with a search feature that actually returned me helpful results more often than not. Pushing F1 and then clicking on an element on the screen— the Push tool, for example—opens the help file at the page covering that tool.

Users can even rate help sections and add their own comments and additions, leveraging the community to improve the documentation over time.

Worth the Cost

At $995—$100 more than the previous version—modo remains a relative bargain. A trial version is available at Luxology.com/trymodo.

While modo still can't compete with more complete packages like 3ds Max or Lightwave, especially in terms of animation and dynamics, it's a very powerful package with a great modeler and renderer. Luxology is clearly laying the groundwork for something big. I'll be watching for it. **DE**

Contributing Editor **Mark Clarkson** *is* DE's *expert in visualization, computer animation, and graphics. His newest book is "Photoshop Elements by Example." Visit him on the web at markclarkson. com or send e-mail about this article to de-editors@deskeng.com.*

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

Learn the Two-Step

Two-step optimization for product design takes manufacturing variability into account.

BY JERRY FIREMAN

It's not all that difficult to design an idealized product that will perform well when each one is built exactly to nominal conditions. But variation is inevitable in everything. It's much harder to design a real-world product that can be built in a real-world process in such a way that every unit will perform exactly like its predecessor. Will a particular combination of design parameter values cause a performance problem—or worse yet, a safety problem?

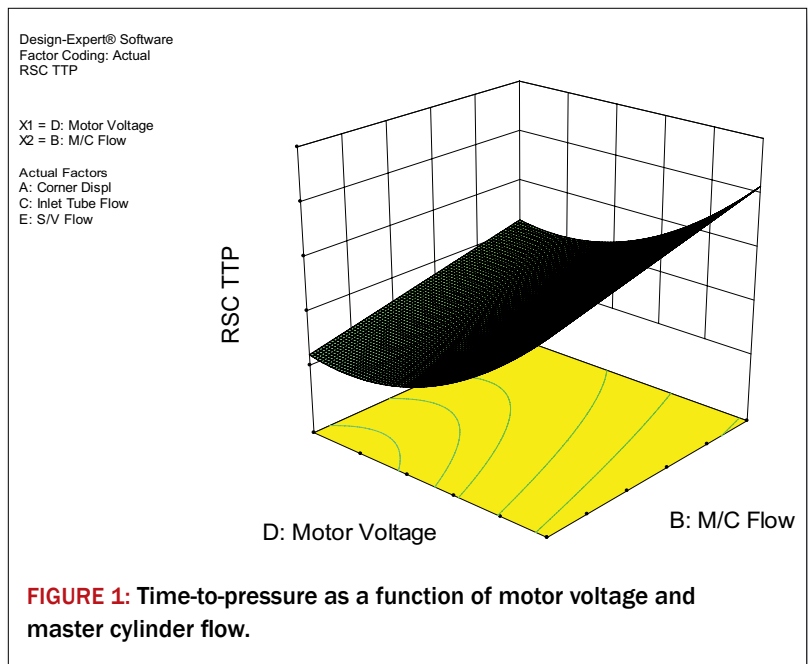It typically costs money, often lots of money, to reduce manufacturing variability. So which design parameters should we target for reductions in variation? And how can we optimize both the nominal value and the variability of each design parameter to achieve the highest performance over the entire production volume at the lowest cost?

Design engineers have had many tools available to evaluate variation-free part performance for worst-case or nominal conditions. But they've had few options to evaluate the potentially infinite possibilities for how the finished products may actually turn out in mass production. Chad Johnson at TRW Automotive has been working on this problem. He has applied methods for optimizing the performance robustness and cost of designs with variation taken into account, a combination of objectives coined by Dr. Genichi Taguchi as two-step optimization.

The process begins with establishing a polynomial y=f(x) relationship to model, the relationship between the inputs and the response. The model can be acquired through a response surface methodology (RSM) design of experiments (DOE) analysis. A Monte Carlo simulation leverages that model to simulate building thousands of products. The results indicate which factors are having the greatest effect on performance variation and which are affecting the mean. The user can then change the nominal values or variability of any factor (within cost or performance constraints), and measure the impact on the performance of the entire population of products.

Design-Expert® Software
Factor Coding: Actual
RSC TTP

X1 = D: Motor Voltage
X2 = B: M/C Flow

Actual Factors
A: Corner Displ
C: Inlet Tube Flow
E: S/V Flow

RSC TTP

D: Motor Voltage

B: M/C Flow

FIGURE 1: Time-to-pressure as a function of motor voltage and master cylinder flow.

Under Pressure, So to Speak

For example, Johnson offers, the TRW team recently focused on a braking system where one of the objectives was to quickly generate pressure when demanded by the vehicle stability control system. The team selected the following factors as those with the greatest potential to influence the critical time-to-pressure performance variable:

- Corner displacement—the amount of fluid that needs to be moved between the pump and the brake, measured in cubic centimeters (cc).
- Master cylinder (M/C) flow rate, in cc/second.
- Inlet tube flow—the flow rate in the inlet orifice in the hydraulic line, in cc/second.
- Motor voltage, in volts.
- Solenoid valve (S/V) flow—flow rate of the solenoid valve that controls the master cylinder, in cc/second.

The first question to answer regarded the impact of these variables on the time-to-pressure. The traditional approach

of building a few prototypes and measuring their performance only helps to understand a tiny fraction of the design space. One-factor-at-a-time (OFAT) experiments go further by systematically varying one factor, while holding the others constant, and recording the impact on performance. But the time required for each run makes it practical to cover only a small fraction of the design space. This approach also fails to account for multiple-factor interactions.

Applying RSM DOE

Johnson addressed these challenges by using RSM DOE to map out the complete design space while running only a relatively small number of experiments. The model was validated by measuring several vehicles under controlled conditions. DOE requires far fewer experimental iterations than the traditional OFAT approach, and makes it possible to identify the most robust combination of factors for the product. RSM provides a solid estimate for the value of responses for every possible combination of the factors by varying the values of all factors in parallel. In other words, it allows one to comprehend a multi-dimensional surface with non-linear shapes.

Johnson reaches for Stat-Ease's Design-Expert software from his Six Sigma Master Black Belt toolbox.

"It offers a powerful, easy-to-use and statistically sound set of DOE tools behind an interface that is designed for use by an engineer, rather than a statistical expert," he says. "Further, the Stat-Ease staffers are all excellent people, always willing to assist in any way they can."

For the braking system project, Johnson selected a 64-run central composite design (CCD) response surface method (RSM) because it enables the user to visualize both the response values and their sensitivity to change in the factors.

Johnson's team completed the experiment and entered the results into the software. The software then performed statistical analysis that mapped out the complete time-to-pressure design space as a function of the five factors plus second order (squared terms) and multiple interaction effects. The software fitted the following predictive model (actual coefficients omitted for proprietary reasons):

$$
\begin{aligned}
\text{Time to Pressure } = \\
&+ \beta_0 \\
&+ \beta_1 \; * \text{ Corner Displacement} \\
&+ \beta_2 \; * \text{ M/C Flow} \\
&- \beta_3 \; * \text{ Inlet Tube Flow} \\
&- \beta_4 \; * \text{ Motor Voltage} \\
&- \beta_5 \; * \text{ S/V Flow} \\
&- \beta_{12} * \text{ Corner Displacement} * \text{ M/C Flow} \\
&- \beta_{34} * \text{ Inlet Tube Flow} * \text{ Motor Voltage} \\
&+ \beta_{33} * \text{ Inlet Tube Flow}^2 \\
&+ \beta_{44} * \text{ Motor Voltage}^2
\end{aligned}
$$

DOE Maps Design Space

The statistical results enabled Johnson to graphically explore the design space by producing response surface maps that offer better understanding of individual factor combination effects on the response. Figure 1 maps time-to-pressure as a function of motor voltage and master cylinder flow. The map shape also indicates the non-linear effects of these two factors.

The response surface map provides all of the information needed to evaluate the performance of the design, based on any given set of values for the design parameters. It provides the ideal tool for optimizing the design parameters, as well as determining the robustness of any particular set of nominal values. But the team needed to go one step further, and simulate the performance of a large number of products built under real-world manufacturing conditions.

The Monte Carlo Simulation

Johnson used Monte Carlo simulation to accomplish this task. He defined a probability distribution for each input. Then he applied Monte Carlo techniques using the Apogee tool created by Statistical Design Institute to simulate a large production population. The technique works by randomly selecting a value for each input factor (from the earlier described polynomial) based on the assigned probability distributions. The polynomial formula calculated by Design-Expert is then leveraged to calculate the time-to-pressure (response) for each virtual product built during the simulation.

One of the most powerful aspects of the Monte Carlo simulation is the insight it provides on understanding the impact of each factor on the variability of the dependent variable.

"The combination of DOE and Monte Carlo analysis helps us understand how much impact the variation of each factor has on the overall performance of the product, while simultaneously taking into account the variation of all other involved parameters," Johnson explains. "We can make much smarter design decisions than would be possible with either worst-case or root-sum-squares tolerancing methods. Furthermore, we can leverage the same model to optimize the design by evaluating alternatives to determine where to set the combination of parameter mean and variation to optimize the performance of every unit we make." **DE**

Jerry Fireman, *is president of Structured Information, Needham Heights, MA.*

Finding the Speed for Multiple Designs

How to simulate multiple design scenarios in high-performance computing environments.
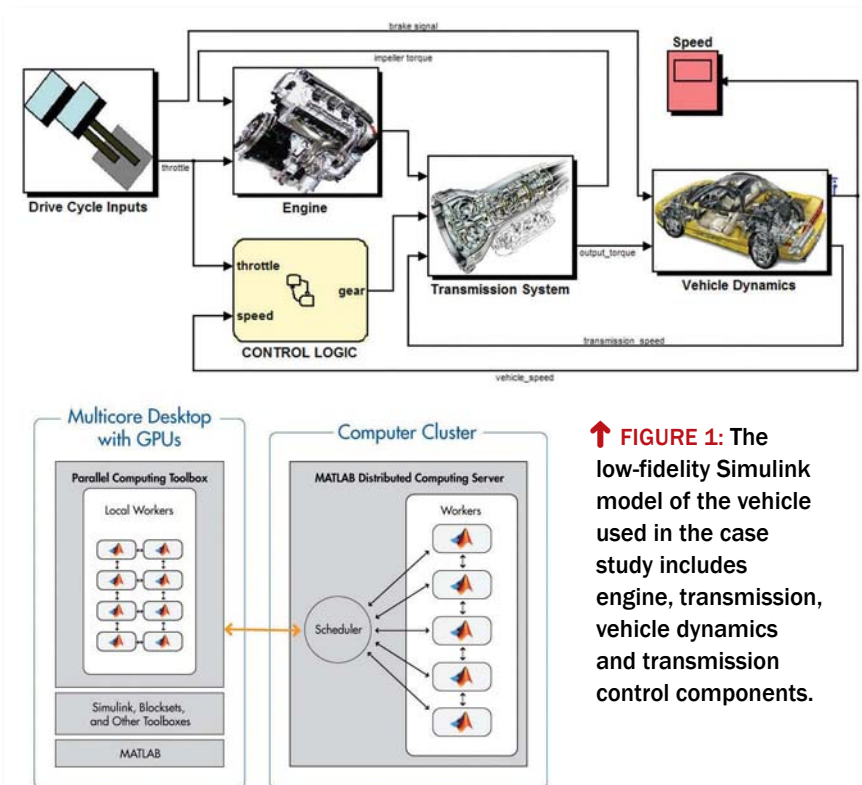
BY JASON GHIDELLA

Simulation is a core enabling technology for successful organizations using model-based design. By simulating software models for multiple scenarios, engineers can explore innovative designs and gain deeper insight into system behavior early in the development process—and before physical prototypes of the system are available. This approach enables engineers to develop complex embedded systems efficiently and cost-effectively. The ability to run multiple simulations also helps organizations meet quality and robustness goals with techniques such as design optimization, design exploration, robustness studies, Monte Carlo studies, parameter sweeps and bit error rate (BER) calculations.

Depending upon the complexity of the model, the number of simulations to be completed, and the frequency of the task, simulation time can become a critical bottleneck in the development process. An approach that leverages the computing power readily available in today's multi-core desktops and general-purpose, commercial off-the-shelf (COTS) clusters can overcome this limiting factor.

↑ FIGURE 1: The low-fidelity Simulink model of the vehicle used in the case study includes engine, transmission, vehicle dynamics and transmission control components.

↑ FIGURE 2: The Parallel Computing Toolbox enables simulations to use up to eight local workers on a multi-core or multi-processor computer. When used with MathWorks' MATLAB Distributed Computing Server, application simulation can be run using any number of workers on computer clusters or grid and cloud computing services.

Case in Point

Aerodynamic drag forces can significantly reduce the fuel efficiency of a vehicle. Typically, vehicle body design is an iterative process, in which trade-offs between performance and body style considerations are made. The iterative nature of the development process affects engineers across all phases of development.

In the initial phases, for example, powertrain controls engineers will not have exact knowledge of the vehicle's aerodynamic parameters. To overcome this uncertainty, they can use the executable specification of the control system and model of the vehicle to conduct a simulation study on a range of parameter values. This enables them to assess the robustness of their design for multiple body geometry variations. The results of such studies are invaluable for management, as they make critical decisions on the vehicle style while balancing performance and fuel economy needs.

Figure 1 shows a low-fidelity automotive vehicle model built in MathWorks' Simulink and chosen specifically for the illus-

trative purposes of this article. Across a fixed drive cycle, the vehicle speed will be simulated and studied for a set of drag coefficients that varies from 0.2, which is typical of a sleek electric car concept vehicle, to 0.6, which is typical of a large truck.

Intuitively, one might approach this parameter sweep by simulating drag coefficients at 0.2, 0.3, and so on. However, this would risk missing potential design candidates, as even a 2% change in aerodynamic drag can affect fuel economy by as much as a 1%. In addition, engineers will also want to evaluate performance robustness across parameter variations.

To address these issues, the study was conducted with much finer granularity. Specifically, the aerodynamic drag was increased in steps of 0.4% from 0.2 to 0.6, resulting in 512 design scenarios and providing a dataset large enough to ensure confidence in the resulting vehicle design.

Because a low-fidelity model was used, a drive cycle spanning 1,000 seconds took, on average, less than 2 seconds to simulate on a single core machine. However, because 512 simulations were required for this study, the total time needed to complete all simulations serially on the same machine was approximately 730 seconds, or more than 12 minutes. For a more realistic, higher-fidelity model in which each simulation takes 10 to 15 minutes to run, the study would require four days to complete.

Because the simulation scenarios are independent of one another, they can be executed concurrently on multiple pro-cessing cores. Parallel Computing Toolbox provides a scalable solution to solve computationally and data-intensive problems by distributing them on multi-core and multi-processor computers, as shown in Figure 2.

Using the PARFOR command, an intuitive high-level construct that parallelizes FOR loops in conjunction with functions from the Simulink application programming interface (API), engineers can construct a MATLAB script to automate the process. Engineers save time because they can program this within MATLAB, instead of with complex cluster software.

This case study was conducted using a computer cluster comprising 16 quad-core computers, for a total of 64 processing cores. The number of available cores was varied to evaluate its effect on the overall simulation time. For a two-core setup, the simulation was completed in approximately 380 seconds. The resulting 1.9-fold speedup is close to the best possible outcome of a two-fold speedup.

A plot of the vehicle speeds for the standard drive-cycle at different aerodynamic drag values is shown in Figure 3. The graph shows some interesting properties for the automatic transmission controller used in this design. The highest decline in vehicle speed performance because of drag was about 10 mph during the cruise phase (shown on the right of Figure 3). Drag did not have as much influence during the acceleration phases, and the braking phase actually benefited from the additional drag. These

sors increased, the overhead involved in distributing data and work across them limited the performance improvement to a less-than-perfect linear speedup. For example, with 64 cores, the speedup was approximately 42-fold, not 64-fold.

Explore Better Designs with HPC

In this case study, robustness of various designs was demonstrated by simulating multiple design scenarios. High-fidelity models and large parameter sets can create bottlenecks in the development process when using this approach. By taking advantage of a high-performance computing (HPC) environment, the simulation time was shortened by a factor of 40 as the number of processing cores was increased to 64.

To give some context to this speedup, a simulation that would have taken four days on a single processor can be completed in 2.5 hours on the cluster. These techniques can be applied with minimal engineering effort to eliminate the bottlenecks associated with running multiple simulations for design optimization, design exploration, robustness studies, Monte Carlo studies, parameter sweeps, and BER calculations. DE

FIGURE 3: Vehicle speed profiles for the given drive-cycle for aerodynamic drag coefficients varying from 0.2 (blue) to 0.6 (green) show that the largest effect of drag occurs during the cruise phase.

results indicate that the controller design is robust to changes in aerodynamic drag, as the speed profile varies smoothly.

Simulation times for 4, 8, 12, 16, 24, 32, 40, 48, 56 and 64 cores are shown in Figure 4, where the overall time to complete the 512 simulations is on the left axis, and the resulting speedup in comparison to the baseline serial run is shown on the right axis.

The trend shows that the speedup improvement scaled almost linearly with the number of processors used from the cluster. Conversely, simulation time had an inverse relationship with the number of processors. As the number of proces-

Jason Ghidella *is technical marketing manager at MathWorks, Natick, MA.*

INFO ➜ MathWorks: MathWorks.com

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Fast Apps
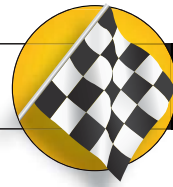
'Clear'-ing the Way

An axle manufacturer sees its way to a better design, thanks to some help from 3-Dimensional Services.

BY ED SZYKULA

Though typically a casting, this clear plastic transfer case prototype produced by 3-Dimensional Services allows the customer to clearly view the vital flow of oil within it.

Automotive companies today are constantly seeking to improve vehicle operating efficiency and thus improve fuel efficiency, especially in light of the ongoing upward climb in gas prices. Improving efficiency, however, is no longer easy because the low-hanging fruit has already been picked. So, in pursuit of this goal, automakers and major auto suppliers are increasingly turning to tech-savvy partners to help them turn innovative ideas into reality.

This was the situation when an axle manufacturer partnered with 3-Dimensional Services, Rochester Hills, MI, on a new testing device.

3-Dimensional Services is a firm that specializes in the design, engineering and analysis, in-house tool construction, and complete build of prototype first-off parts and low- to medium-volume production runs. Prototype parts are typically provided faster than conventionally equipped prototype shops are able to offer—sometimes as much as 70% faster, according to the company.

In this instance, 3-Dimensional was asked to focus its various areas of expertise on a transfer case oil flow testing system for a new axle design for cars and light trucks.

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Testing Seals with Prototyped Parts

Here's how one company created an inexpensive way to work out the kinks of their latest design.
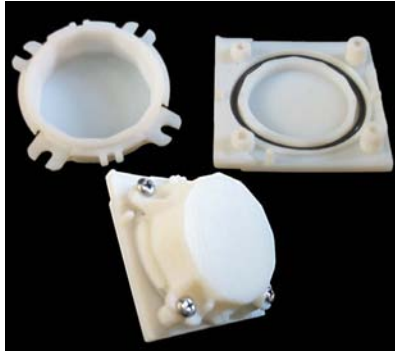
The seal test for the enclosure pieces needed for the functional testing of a newly designed handheld device.

Eric Schneider is a design engineer who took on the job of producing a generation of handheld devices for a new client. He works for Key Tech, Inc., a Baltimore consulting firm known for its designs of medical devices, instruments and consumer electronics. They've worked on everything from climate-controlled pet carriers to spa circuit boards to devices that measure red blood cells.

Schneider's latest project was a challenge because the handheld needed to be waterproof, operating in up to a meter of water. After researching materials and costs, he selected several seals with various cross sections that he thought would do the job. But he still needed to test them to be sure they'd hold up. If the test proved unsuccessful, he'd have to either redesign the enclosure or go for more expensive seals, which could push the project outside its cost estimate.

In the past, Schneider would have to design the enclosure and outsource it to a model shop. This could take several weeks, and costs could go way over budget fast. If he had to redesign the enclosure and go through the same process again, things could get even worse. Then Schneider had another idea.

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Back on Track

Plasma-Therm completes a successful management buyout, with help from Adept's engineering document management.
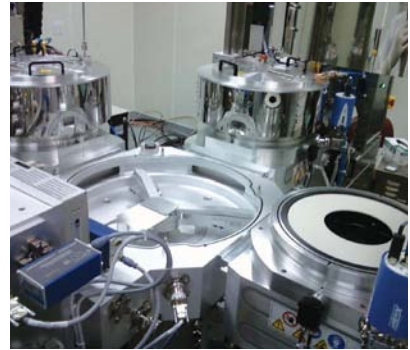
An Adept engineering document management facilitates Plasma-Therm's ISO 9001 audit.

Plasma-Therm LLC is a supplier of advanced plasma process equipment to various specialty markets. Incorporated in March 1975, Plasma-Therm, Inc. was sold in 2000 to Oerlikon, a large Swiss industrial conglomerate. In January 2009, four Plasma-Therm managers pooled their resources and bought controlling interest back. This executive management team now owns the company.

At the time of the buyout, Plasma-Therm was in a vulnerable position. "When the company changed ownership," explains Kenneth Pizzo, product engineering manager at Plasma-Therm, "we were in the midst of designing several customer specials, required to fill orders that were already accepted."

During that period, Pizzo had to organize an entire engineering department, and replace the document management solution from the former owner's product lifecycle management (PLM) system as quickly and seamlessly as possible.

"We knew we needed to purchase some sort of product data management (PDM) system, due to the complexity of our product and the dynamic nature of our business," says Pizzo.

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Editor's Picks

by Anthony J. Lockwood

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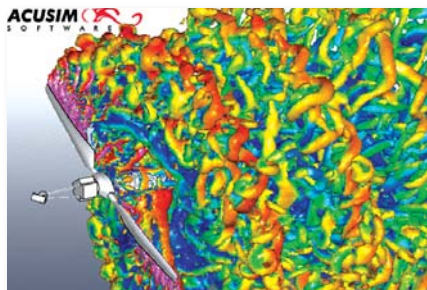
Altair Engineering Acquires ACUSIM Software

Acquisition strengthens Altair's position in CFD and multiphysics simulation.

Altair has quietly built itself up into a powerhouse engineering software, services, and technology development company. It offers everything from MCAD and industrial design in the form of its solidThinking subsidiary to world-class CAE in its HyperWorks platform. It has on-demand cloud computing technologies, business analytics solutions, and a product development consulting division.

Still, what Altair really did not offer was CFD technology that competed toe-to-toe with that offered by other top-level developers. With ACUSIM in its quiver, Altair can scratch that off the to-do list.

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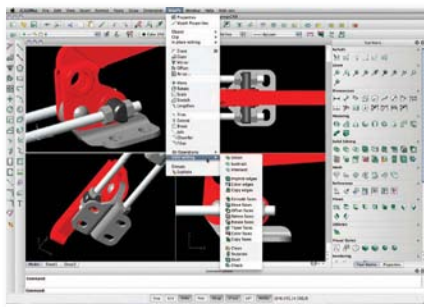
AutoCAD Alternative for Mac OS X

Developer says iCADMac exports DWG files to Apple's hand-held devices as well.

I was at a relative's house and on a counter was a beautiful, big-screen iMac. The guy's self-employed, so I asked him if he used it for working from home. "Naaa," he lamented. "I love it, but the software I need for my business only runs on PCs." Such has been the complaint of many an engineering Mac maven for years now, but life changes. And the recent announcement of iCADMac from progeCAD serves as another example of the rapid speed of your changing desktop.

iCADMac uses a native format that's DWG-compatible, and it can handle 2D/3D DWG/DXF files formats from AutoCAD version 2.5 through 2011.

**MORE** ➡ deskeng.com/articles/aabacs.htm

Scanner a 3D Virtuoso with Macs and PCs

Non-contact laser scanner reportedly scans objects in most any light.

Have I mentioned lately that I think it's exciting that developers are embracing the Mac more with each passing day? A lot of the "we do Mac and PCs" trend has to do with the Unix roots of Mac OS X, but it's also a nod from the developers that the Mac has serious applicability in — and a growing presence throughout — the desktop engineering community. So, it was with great interest that I came to learn of the Mac- and PC-compatible Virtuoso 3D scanner. You industrial designers at the forefront of engineering on the Mac will be especially interested in this portable unit.

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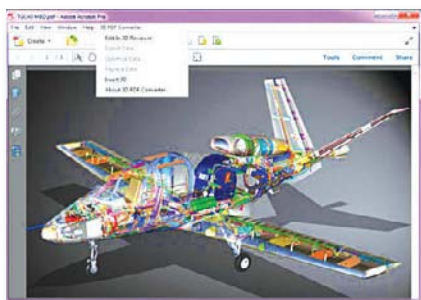
Convert CAD Data into Interactive 3D PDFs

Tetra 4D's 3D PDF Converter leverages Adobe Acrobat X Pro user interface and features.

When 3DF first hit the market, it was greeted with much fanfare. But design and manufacturing engineers soon cooled because it seemed difficult to create PDFs of CAD files with the flare to blow away clients or make your documents idiot proof for downstream users. A cottage industry sprang up offering that sort of manufacturing pizazz, and recently I came across news of an intriguing CAD-optimized 3D PDF application from a company I did not know too much about. I think this will interest all of you tasked with documenting manufacturing data for clients, downstream users, and even web marketing.

MORE ➡ deskeng.com/articles/aabafz.htm

The World as Your Workstation

BY BERTRAND SICOT

Sam, a sales engineer, lingers over lunch with a customer, looking at a tablet computer displaying a 3D solid model of a product on which two other engineers are working. The customer tells Sam that he is interested in the product, but he needs a variation on the original design.

Sam modifies the product to his specifications during lunch. He's also able to reassure the customer that the modification won't affect the product's performance, that the parts to meet the customer's requirements are available, and that his company's production line can accommodate them without any inconvenience. With the knowledge that his company can produce the customer's variation without extraordinary costs, Sam sends the specifications to the product development team—and signs a deal with the customer on the spot.

The concept sounds simple: Put engineering data, knowledge and processing power where business occurs, which could be on sales calls, the shop floor, or someplace on the road. But while business has been mobile for years now, product development has been tethered to desktops since the computer-aided design era began. Processing requirements and the cost of applications for designing, testing and manufacturing products meant that only a fraction of product design could be performed in the field. The serious tasks—such as major modifications, simulations and performance optimization—had to wait for engineers and designers to return to their desks, where they had access to

> **Engineering and product design will happen everywhere you want to be.**

wired networks and enough computing power to operate the full range of software they needed to complete their work. Being out in the field, on a shop floor or on a customer site meant being cut off from the computing assets needed to perform every facet of your job.

The lack of processing power and application functionality are obvious drawbacks to being away from the office, but they're not the only ones. Engineers and designers working with customers or partners in the field are also largely cut off from one another—or, more specifically, one another's data. They can communicate through email and cell phones, but they don't have direct access to all of the data for a given product. Design engineers onsite with a customer are unable to determine the

effect a late-stage design change has on tooling, machine layout or production costs. And the product manager on the road cannot approve those changes without accessing the corporate network or product lifecycle management (PLM) system.

The State of the Art

New mobile computing paradigms make portable devices a gateway to a new collaborative model, where everyone connected to product development can access all of the latest data on a project. From calling up the most current design iteration for a sales meeting to modifying the design in real time, emerging "cloud computing" infrastructures will eliminate boundaries to fully mobile product design. Applications are moving from the desktop to the Internet, making it possible—in theory, at least—to design in 3D on any device with an Internet connection.

Over the next few years, purpose-built applications and viewers will bring product designs to all of the platforms that your employees, partners, and customers use—including desktops, mobile devices and browsers, with experiences appropriate to the platform. New delivery models will provide on-demand access to software, processing capacity and data storage, ensuring that mobile designers and engineers always have the right tools for the job, regardless of where they are. The result will be increased creativity, greater productivity and livelier, more interactive collaboration.

Engineers and product designers' careers are built around knocking down barriers through the design of new and improved products—products that perform better and more efficiently, at lower production costs, and with minimal impact on the environment. Yet, they've had to accept limitations on their creativity and collaboration because their primary tools kept them in the office, even though much of what they do occurs somewhere else.

Desktop CAD software freed product design from high-powered workstations by putting essential design tools on everyday PCs. Mobile engineering goes the next step, putting those tools where products go from design to reality. **DE**

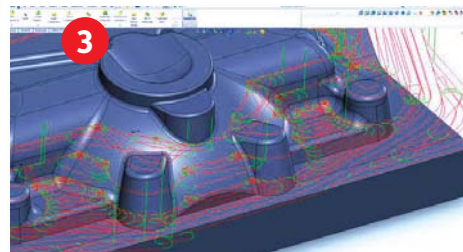**Bertrand Sicot** *is CEO of Concord, MA-based Dassault Systèmes SolidWorks Corp.*

INFO ➜ **Dassault Systèmes SolidWorks Corp.:** SolidWorks.com

For more information on this topic, visit deskeng.com

New Products for Engineers

1 Collier Research Releases HyperSizer v6

Collier Research Corporation (hypersizer.com) has announced the release of HyperSizer v6 structural sizing and analysis software designed for reducing weight, maintaining strength, and improving the manufacturability of complex composite and metallic designs. HyperSizer integrates with FEA solvers in a continuous, automated iterative loop, conducting trade studies and examining millions of potential design candidates down to the ply and element level. The software helps ensure structural integrity through a suite of failure analysis predictions that are validated to test data. The tool also helps enhance manufacturability by minimizing ply drops, identifying and controlling laminate transition drop/add boundaries, and defining best ply shapes and patterns.

Corel Releases CorelCAD

Corel (corel.com) has expanded its graphics and technical illustration portfolio with the introduction of CorelCAD, which delivers native DWG support, and the ability to navigate between 2D and 3D environments. Optimized for the Mac and Windows platforms, CorelCAD enables engineers, designers and architects to customize their work environments. Priced at $699 for new customers and $499 for registered users of CorelDRAW Graphics Suite X4 and Corel DESIGNER Technical Suite X4 or higher, CorelCAD offers small- to medium-sized businesses and larger enterprises an affordable option for site-wide deployments, according to the company.

Canfield Connector Releases Reed and Electronic Sensors

Canfield Connector's (canfieldconnector.com) Series 9Q is a magnetic proximity switch specifically engineered to fit "T" slot extruded actuators. The 9Q's small size is applicable for most space requirements, according to the company. Its design enables installation anywhere along the slot and assembly without removing the actuator end cap. The sensors are offered as a flying lead or 8mm quick connect.

2 Omega Releases RTD-to-Wireless Connector/Converter

Omega Engineering's (omega.com) new UWRTD transmits process temperature, ambient temperature, signal strength and battery status in real time, wirelessly to a user's computer or the Internet. Users can interface up to 12 different wireless connectors with one receiver. Low power operation and sleep mode allows for long battery life. The CE-compliant UWRTD is compatible with the UWTC-REC family of wireless receivers, which can accept signals from up to 48 wireless transmitters and display them on a PC. Prices start at $135.

Dassault Systèmes SIMULIA Announces Isight 5.5

Dassault Systèmes SIMULIA (simulia.com) has announced the latest enhancements for modeling and simulation of integrated systems within Isight 5.5, an open desktop solution for simulation process automation and design optimization. Isight provides designers, engineers, and researchers with an open system for integrating design and simulation models—created with various CAD, CAE and other software applications—to automate the execution of hundreds or even thousands of simulations.

Advantech Releases Embedded Automation Computers

The Industrial Automation Group of Advantech (advantech.com) has upgraded three of their fanless Embedded Automation Computers: the UNO-2050G, UNO-2053GL, and the UNO-2059GL. The UNO-2050G has an onboard AMD Geode LX800 500MHz CPU with dual LAN and 8-channel isolated digital input and 8-channel isolated digital output with timer and counter. The UNO-2053GL has an onboard AMD Geode LX800 500MHz CPU with dual LAN and two 10/100Base-T RJ-45 ports and two USB 2.0 ports. The UNO-2059GL has an onboard AMD Geode GX533 LX800 500MHz CPU with one 10/100Base-T RJ-45 port and two USB 2.0 ports.

3 SolidCAM Launches iMachining CAM Software

SolidCAM (solidcam.com) has launched its iMachining CAM software as part of its latest SolidCAM2011 release. The company says iMachining reduces cutting times by up to 70% by optimizing tool engagement and cutting feed through the entire tool-path. iMachining is driven by a Technology Wizard, which considers the machine being used, the material being cut and the entire geometry and material of the cutting tool. This helps ensure the tool load is constant, which in turn increases tool life and makes it possible to machine with the full length of the cutter.

Altair's PBS Professional Added to Dell's HPC Portfolio

Altair Engineering Inc. (altair.com) has announced that PBS Professional, the commercial-grade high-performance computing (HPC) workload management solution and job scheduler, is now available directly through Dell's (dell.com) ordering system for its high-performance computing customers. PBS Works is a solution for optimizing workload scheduling and management of complex jobs in the HPC environment to help ensure that technologies are being used to their greatest efficiency. It enables organizations to maximize efficient use of their computing resources and to initiate HPC jobs rapidly, thereby improving their overall productivity and return on investment.

4 SolidWorks Releases 3DVIA Composer V6R2011x

Dassault Systèmes Solid-Works' (solidworks.com) 3DVIA Composer technical

communication software helps design teams overcome language and knowledge barriers while reducing costs and production time, according to the company. The newest version of 3DVIA Composer, V6R2011x, transforms 3D CAD data into images or animated visual assets for use in product communication deliverables.

Mentor Graphics Announces FloEFD for Siemens NX

Mentor Graphics Corporation (mentor.com) has announced the new FloEFD for Siemens NX (plm.automation.siemens.com) product for concurrent computational fluid dynamics (CFD) simulation, seamlessly integrated with the Siemens

NX product lifecycle management (PLM) software. The FloEFD for Siemens NX software from Mentor Graphics works directly with native NX geometry using Finite Volume mathematical techniques, while supporting a range of applications. The FloEFD for Siemens NX product uses a hexahedral immersed boundary meshing approach that the company says is for more accurate and computationally efficient simulations compared to tetrahedral and prismatic elements found in other tools. As a result, the FloEFD software can support a range of physical simulation capabilities: highly turbulent flow fields, compressible flows, combustion and cavity modelling.

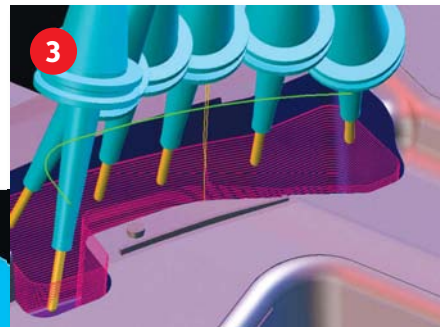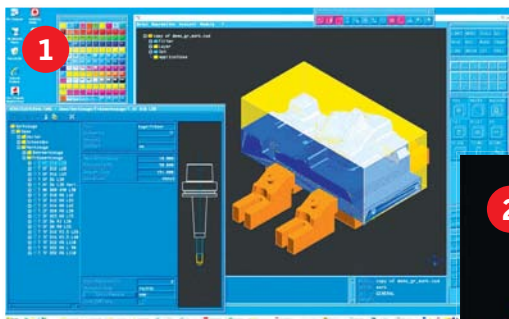## 5 EOS Debuts M 280 Laser Sintering System

EOS says its (eos.info) EO-SINT M 280, a direct metal laser sintering (DMLS) system, has process and control features that complete the evolution of DMLS systems into full-fledged production tools for the economical, batch-size, optimized manufacture of parts at all stages—from prototyping through finished product. It features either a 200- or a 400-watt solid-state laser, laser power monitoring (LPM) to control the build process, and the ability to use either nitrogen or argon protective atmospheres. **DE**

Updated User Interface

1 The user interface provides more room by moving dialogs off the work space. The work environment can be adapted based on individual preferences. It also features easier handling of the libraries, more transparency—thanks to hierarchically structured layers— and new analysis functions for component comparison, costing, and bore analysis.

Faster Speeds

2 According to the company, Tebis Version 3.5 offers a number of speed advantages, such as when loading model files, graphics performance, and in areas of NC programming. Roughing and re-roughing in particular are up to three times faster for large components, according to Tebis. The job manager is also designed for speed, helping to simplify the tasks of the NC programmers.

5-axis Simultaneous Milling

3 Tebis Version 3.5 allows users to control the tool direction with plumb curves for the tool center, for example, in order to avoid a potential collision. New analysis functions help find the optimal tilt direction vectors between which the tool direction interpolates. Expanded options for axis clamping and new spiral-shaped stepover in surface machining are also included.

Surface and BREP Design

4 New and expanded CAD functions of Tebis Verison 3.5 include faster unlinking of topologies and more accurate silhouette curves. It also features globally rounding of curves. Boundary representation (BREP) design is now integrated in the standard application, with BREP models as standard elements. Kink edges are supported throughout.

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

FYI

Tebis Version 3.5

Tebis software is developed by Tebis Technische Informationssysteme AG of Germany. The company has its U.S. offices in Troy, MI.

A number of modules are available for Tebis, including modules for virtual CNC machining, electrodes, and 2.5D milling and drilling.

In version 3.5, the job manager is the central control element for all machining steps.

For more information, visit tebis.com.

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