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OCTOBER 2009 • VOL. 15, ISSUE 2 • $9.00

TECHNOLOGY FOR DESIGN ENGINEERING

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elements of HPC
> Special Section

COMSOL MULTIPHYSICS DRIVES UNIQUE SPEAKER DESIGN

> MATLAB Moves into the Parallel Domain
> Voltaire Accelerates Mobility Lab
> Fiat Counts on LMS Test.Lab
> NewTek LightWave 3D 9.6
> ATI FirePro V Series Review
> Industrial Design Adds Value
> RE Becomes Standard Practice
> ENOVIA V6 Enables Market Agility
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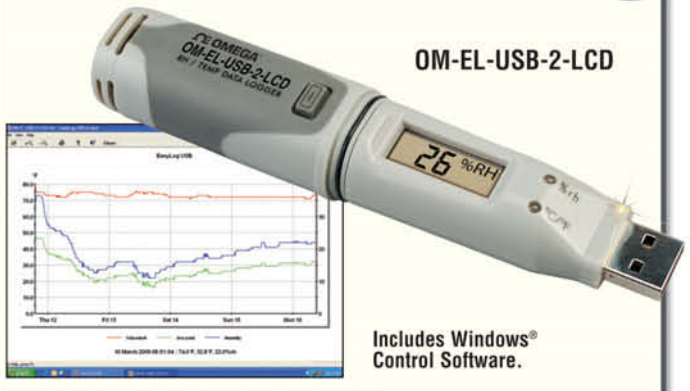

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I Got a Blackberry Mainly Because I was Curious

PETER VARHOL
pvarhol@deskeng.com

I recently got a Blackberry. It wasn't so much that I felt that I needed a smartphone; rather, it was curiosity that I might be missing out on something. Despite my role as a technologist and technology journalist, I rarely adopt the leading edge of new technologies. I've never considered that my use of any technology makes a statement about me, as so many of those with iPhones and now Android phones seem to do. Rather, I carefully consider if a technology is useful for the set of activities that is important and relevant to me, and if its cost delivers enough value to justify the expenditure. I bent that rule with the Blackberry. The cost was certainly an important factor, but I had ulterior motives. Just about everyone I know has a smartphone today, and I wanted to understand the appeal. Also, it seems more and more likely that this was the wave of the future; dumb phones are likely to be less and less common over time.

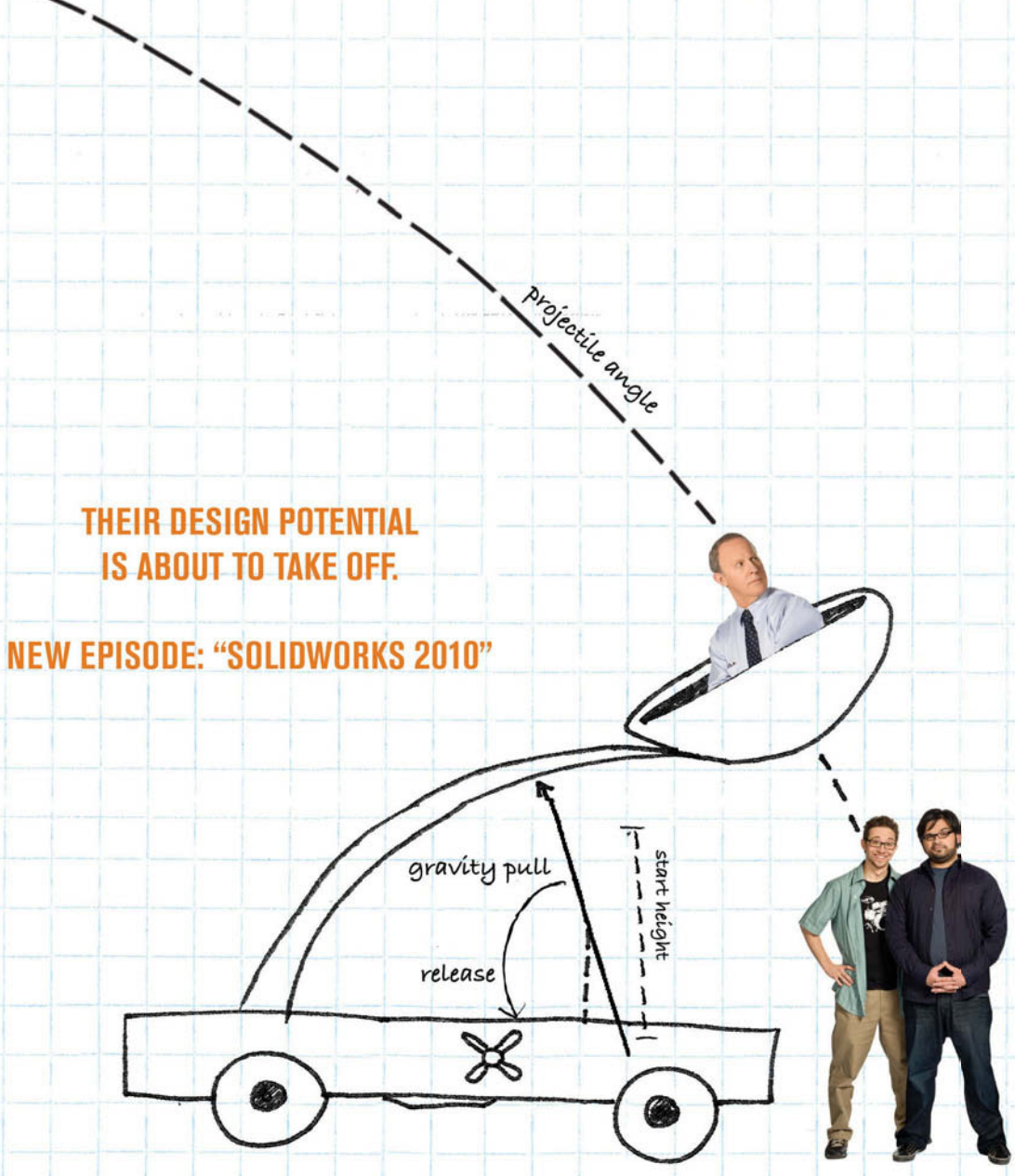
Cost is a bit more difficult to assess, as the cost is an ongoing voice and data subscription in addition to the base cost of the phone. The discounted price of the phone is much less relevant than the carrying

>The jury is still out on whether engineers can get their money's worth.

cost of those subscriptions. In my case, it was $50 a month for the minimum acceptable calling plan, plus an additional $30 for the minimum data plan. Along with the taxes, fees, and taxes on fees, that adds up to be just about $100 a month. Can it really be worth it?

A couple months later, that is still a relevant question. There is a certain amount of convenience in being able to see and respond to e-mail just about anywhere, but that's also a significant downside. Unless it is a matter of extreme importance for you to have e-mail all the time, you may find yourself wasting more time looking at your screen every time the phone buzzes. I suppose there's some external cachet to interrupting your life to glance at your e-mail, but I can do without it.

Still, there are some e-mails that are worthwhile receiving and acting



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SolidWorks

upon without finding a wireless hotspot and getting online. Can they wait? Probably, they always have in the past. But for time-critical tasks, it can make work both more efficient and less stressful.

The web browser is far more interesting; it's like having a dictionary, encyclopedia, newspaper, and reference manual attached to your hip. The screen isn't necessarily the easiest for reading websites, but when you want to know something fast, you can't beat a smartphone.

There are alternatives to the Blackberry, but most have their individual issues. To be sure, I never considered an iPhone, not because I'm not intrigued, but because I didn't care to switch wireless carriers to obtain one. I've been with my existing carrier for almost 15 years, and am very pleased with its plans and coverage. Apple deigns to promote exclusivity, but I'm not biting on that one. Some interesting things are going on with smartphone designs today, but until Apple decides to be egalitarian (don't hold your breath), it's not a choice for me.

Most organizations still believe that their engineering staf needs moderate-performance computers, design and analysis software, and very little else. I won't argue that a smartphone is an essential tool for an engineering professional, because it really depends on the circumstances. However, if an engineer is out of the office a fair amount and his or her expertise must be shared among others on the team, a smartphone will be a valuable tool. Otherwise, it may just be an expensive toy. ■

Contributing Editor ***Peter Varhol*** *has been involved with software development and systems management for many years. Send comments about this column to DE-Editors@deskeng.com.*

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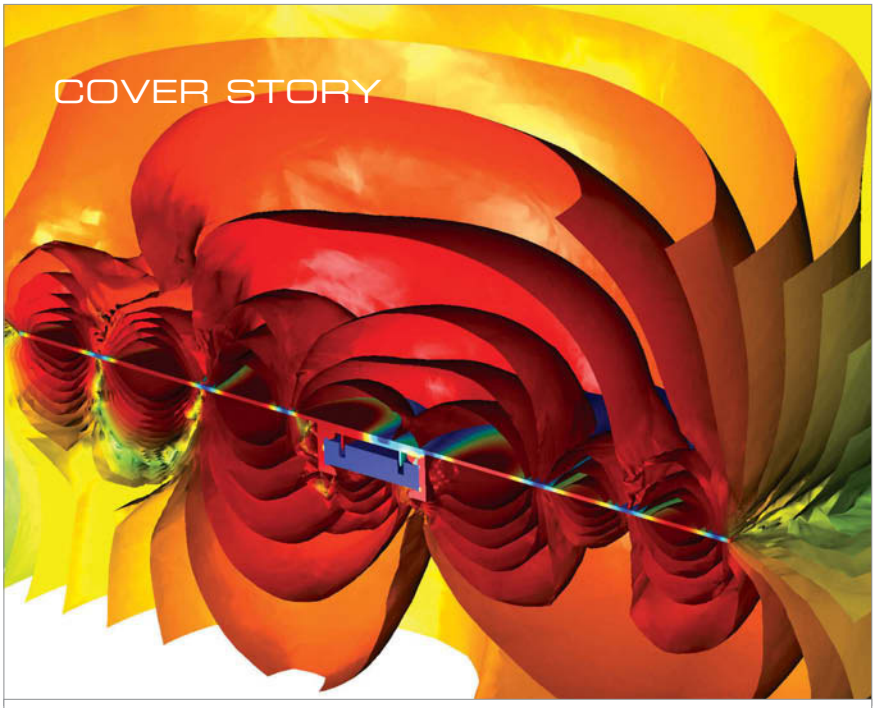
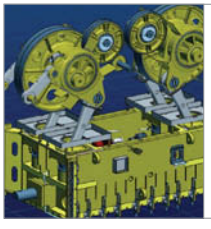
"In all large corporations, there is a pervasive fear that someone, somewhere is having fun with a computer on company time. Networks help alleviate that fear."

> John C. Dvorak





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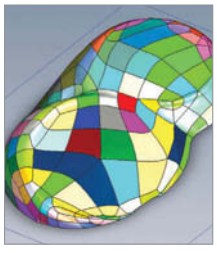

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PRODUCT OF THE MONTH

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Kenneth Wong > Virtual Desktop Hardware, software, and publications. Live links connect to suppliers

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> *Newslink; Editor's Pick of the Week; Check It Out (Videos, White Papers and Webinars); Virtual Desktop; Elements of Analysis and Simulation; Elements of Engineering IT & Computing; Elements of MCAD; and Elements of Rapid Technologies.*

ON THE COVER > An isosurface plot generated with COMSOL Multiphysics illustrates the sound-pressure levels that emit from a typical panel surface when driven with the Gel Audio transducer. Here the results are shown for one frequency (1092 Hz). To read Rod Habeshaw's article, turn to page 46.

The smallest details
create the real design

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Future Forward CAD

The CAD industry reflects the general economy with startling immediacy. Nevertheless, the worldwide slide of CAD came as a surprise. Even when the real estate crisis and problems in the automotive industry made it clear that CAD in the U.S. and Europe was in for a rough period, the growth in India and China promised to offset the losses in the west. However, the world markets are inextricably interrelated and the credit crunch had its effect worldwide.

What's probably most accurate to say is that the scope of the collapse of world economies came as a surprise, but once that happened it was clear the CAD industry would be facing some of the most serious challenges it has faced since the manufacturing sector globally restructured itself in the 1990s.

Europe is recovering in some quarters but overall its recovery is expected to lag slightly behind that of the U.S. and Canada.

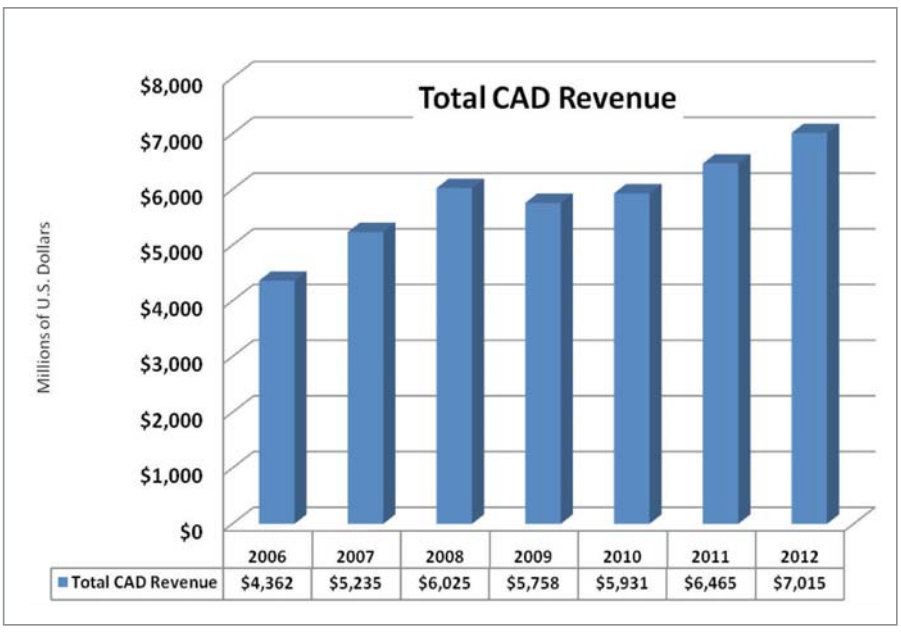
The CAD companies are still experiencing decreased revenues for 2009, but are feeling like the worst is over. Both Autodesk and PTC reported that their summer quarters were not as poor as expected.

At the beginning of 2009 it was hoped that stimulus projects would help offset declines in the CAD industry. Cash, however, has been slow to flow.

The same trend is playing out worldwide. Infrastructure work is desperately needed in many countries and the newspapers in the United Kingdom are reporting much the same economic news as those in the U.S., expressing disappointment in stimulus money that has not helped as much as hoped and in infrastructure that has not received as much as needed. We at Jon Peddie Research believe that much of this is a matter of timing. Infrastructure projects take time to complete and benefits may be slow to materialize. On the plus side, the benefits are long lasting and substantial.

CAD's dominant manufacturing segments of automotive and aeronautic have both slowed in 2008 and 2009. Customers are not showing much enthusiasm for consumer goods either, but we feel that the CAD market has growth potential as companies adopt advanced 3D CAD design and visualization techniques.

Finally, rendering and visualization is shaping up to become a new growth area for companies working in the CAD fields. New hardware and program-



ming tools promise to put fast rendering in the hands of just about anyone who wants it.

At Siggraph 2009 in New Orleans, several rendering companies were vying for attention and had their elbows out as they staked positions relative to the market and to each other. Companies were demonstrating products to enable designers and engineers to render and sell their designs earlier in the process. We believe this capability will help small and medium businesses compete with larger companies, especially those SMBs with 3D design practices. Their success will in turn help propel the transition to 3D—a source of growth for all the major CAD companies.

Until the engines start humming again, the CAD industry is going to suffer as customers hold off on buying or hiring. As 2009 fades there is hope that 2010 will be a better year for many companies. By mid-2011 we not only expect to see growth resume in most segments but we expect to see the development of new markets.

— Kathleen Maher, Jon Peddie Research

FOR MORE INFO:

> Jon Peddie Research

Dimension Announces Sixth Annual "Extreme Redesign" Global Design Contest

Dimension 3D Printing, a brand of Stratasys Inc., announced the launch of its sixth annual "Extreme Redesign: The Ultimate 3D Printing Challenge" with an additional "Green Bonus." The contest challenges computer-aided-design (CAD) students worldwide to submit their most creative, useful and innovative Extreme Redesigns.

The new Green Bonus award will recognize one student across all categories whose design best displays innovation in areas such as energy efficiency and environmental sustainability. The Green Bonus winner will receive a $250 gift card.

In addition to the Green Bonus, Dimension will again award nine student winners either $2,500 or $1,000 scholarships in the High School Engineering, College Engineering, and Art & Architecture categories. Designs will be evaluated based on creativity, usefulness, part integrity, and aesthetics. Instructors of the three first-place student winners will receive a laptop computer for use in the classroom.

Students must identify an existing product and redesign it, making the original design better by adding new functionality or aesthetic qualities.

Final submissions must be postmarked by February 1, 2010. Complete contest rules and submission information is currently available online at dimensionprinting.com/education/extremeredesign.shtml.

FOR MORE INFO:

> Dimension 3D Printing

Siemens PLM Software Announces Version 5.0 of Teamcenter Express CPDM

Siemens PLM Software announced Version 5.0 of Teamcenter Express software. Teamcenter Express is the collaborative product data management (cPDM) component of the Velocity Series portfolio, Siemens PLM Software's family of modular, yet integrated solutions addressing the PLM mid-market. This latest release provides key enhancements designed to improve the productivity of small and medium size businesses (SMBs), thus reducing the time needed for completing design-through-manufacturing projects.

Teamcenter Express Version 5 delivers an updated user interface with new Lifecycle Viewer and Structure Manager modules that consolidate and simplify visualization and product structure management tasks. New cost-analysis tools are also available for both products and projects, enabling costs to be calculated from the initial concept design through release to manufacturing, resulting in improved cost control and profitability.

Version 5 also delivers an improved user interface and expanded capabilities for integration with Microsoft Office 2007. While working in Word, Excel, PowerPoint, or Outlook, users can browse and search the Teamcenter Express database, add new documents to this single source, and review and approve cPDM workf ow tasks that have been assigned to them. More users working from a single source of data results in fewer errors and more consistent completion of everyday tasks.

Several enhancements to the optional project scheduling module are also delivered with Version 5. This includes the ability to view multiple project schedules in a single window.

Teamcenter Express Version 5.0 is built on Teamcenter 8 and delivers scalability to the unified architecture of this latest release of Teamcenter. Version 5.0 is also now available on Microsoft SQL Server 2008.

FOR MORE INFO:

> Siemens PLM Software

Dassault Systemes Launches SolidWorks 2010 Product Line

Dassault Systèmes (DS) SolidWorks Corp. has released the SolidWorks 2010 product line, a new set of software products designed to optimize core product design functions. The new SolidWorks product line also includes hundreds of new enhancements requested by customers.

The line includes SolidWorks Premium CAD, SolidWorks Simulation Premium, SolidWorks Enterprise PDM, 3DVIA Composer, and SolidWorks Sustainability software to help users determine the carbon footprint, energy consumption, and air/water impacts in a product design's raw material sourcing, manufacture, use, and disposal.

FOR MORE INFO:

> SolidWorks

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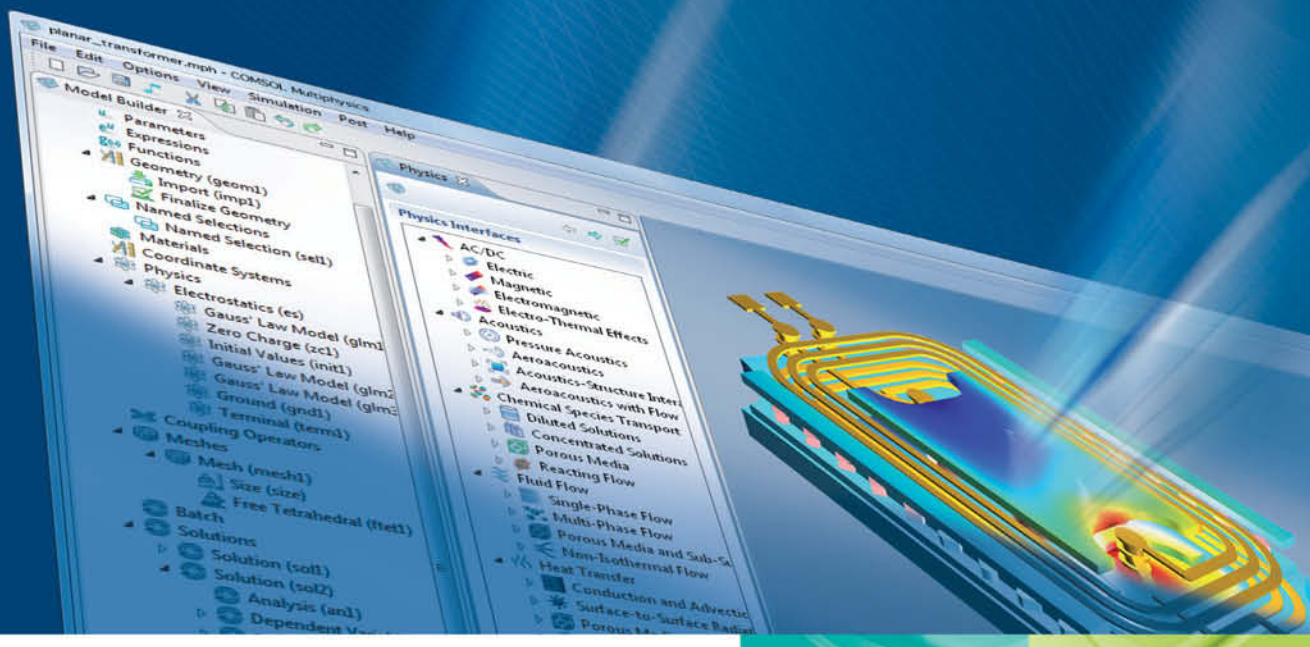
80% of product ideas never make it to market. Let multiphysics simulation bring your designs to life.



With COMSOL Multiphysics® you are empowered to build the simulations that accurately replicate the important characteristics of your designs. The key is the ability to include all physical effects that exist in the real world. This multiphysics approach delivers results—tangible results that save precious development time and spark innovation.

View Multiphysics applications at:
comsol.com/multiphysics

COMSOL

Stratasys Makes Four More Materials Compatible with the Fortus 900mc

Stratasys has made four more build materials and one more support material compatible with its Fortus 900mc 3D Production System. The materials include ULTEM 9085, PC-ABS, PC-ISO, and ABS-M30i.

These options more than double the number of materials compatible with the Fortus 900mc, and they provide an array of mechanical properties to chose from, such as FST (flame, smoke, toxicity) compliance, heat resistance, medical-sterilization capability, strength, and flexibility for prototyping and production. Stratasys materials previously compatible with the 900mc are ABS-M30, PC, and PPSF/PPSU (polyphenylsulfone).

SABIC's ULTEM 9085 is a thermoplastic widely used in aircraft interiors and other transportation applications. PC-ABS is one of the most widely used industrial thermoplastic blends and is commonly used in automotive, electronics, and telecommunications applications. The addition of PC-ISO provides users with a tough polycarbonate material that can be sterilized for medical device or surgical jig and fixture production or prototyping. Like PC-ISO, ABS-M30i is a biocompatible material suited for direct digital manufacturing applications in the medical, food, and pharmaceutical equipment industries with ISO 10993 or ethylene oxide (EtO) sterilization requirements.

Like other additive fabrication methods, the Stratasys FDM process requires a disposable material to support features such as overhangs.

FOR MORE INFO:

> Stratasys, Inc.

Blue Ridge Numerics Launches CFdesign 2010

Blue Ridge Numerics, Inc. has announced the availability of CFdesign 2010, a CFD application that provides a CAD-driven design study environment that enables engineers to achieve pass-fail and what-if engineering scenarios as part of a workflow.

CFdesign 2010 provides an environment to create and manage flow and thermal design studies containing single or multiple scenarios, and a new process for assessing performance comparatively against competing designs, as well as specified critical values.

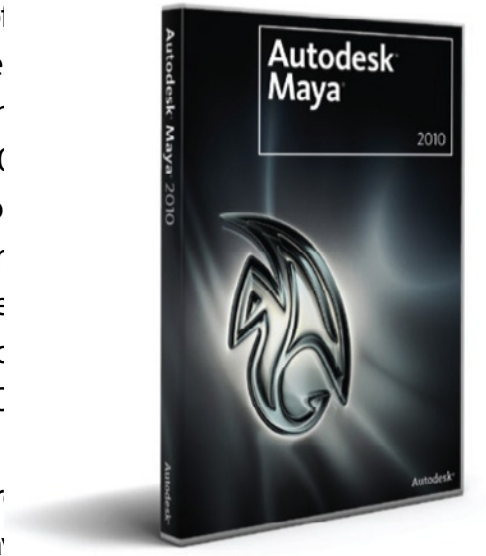
CFdesign 2010 automatically uses up to four cores. Additional cores can be used with the CFdesign HPC Module. CFdesign 2010 is available as an integrated, associative solution for numerous CAD programs.

FOR MORE INFO:

> Blue Ridge Numerics

Autodesk Maya 2010 Software Gets a Makeover

Autodesk's Maya 2010 soft ware unifies the Autode Maya Complete 2009 ar Autodesk Maya Unlimited 20(feature sets with matchmo ing, compositing, and renderir capabilities into a single offe ing. Maya 2010 is available c Windows, Linux, and Mac C operating systems.



Maya 2010 offers all the featur of Maya Unlimited 2009 and Ma Complete 2009, including the advanced simulation tools: the Maya Nucleus Unified Simulation Framework, Maya nCloth, Maya nParticles, Maya Fluid Effects, Maya Hair, and Maya Fur; in addition to its modeling, texturing, and animation tools, it includes brush-based 3D technology, an integrated stereoscopic workf ow, Toon Shading, rendering, an extensive Maya application programming interface/software development kit, and Python and MEL scripting capabilities.

New features in Maya 2010 are Maya Composite, a dynamic compositing system based on Autodesk Toxik software, which is no longer available as a standalone solution; Autodesk MatchMover 3D tracking and matchmoving system; five mental ray Batch render nodes, and the Autodesk Backburner network render queue manager.

The Autodesk suggested retail price (SRP) of a license of Maya 2010 will be $3,495. Upgrades to Maya 2010 from Maya Complete and Maya Unlimited 2009 will be $895. All Maya Complete and Maya Unlimited customers with current Autodesk Subscription will be entitled to the Maya 2010 release. International pricing may vary.

FOR MORE INFO:

> Autodesk

Cray Inc. Wins DOE Contracts at NERSC and Oak Ridge National Laboratory

Cray Inc. has won the contract to install a next-generation supercomputer at the Department of Energy's (DOE) National Energy Research Scientific Computing Center (NERSC) located at the Lawrence Berkeley National Laboratory. The multi-year supercomputing contract includes delivery of a Cray XT5 massively parallel processor supercomputer, which will be upgraded to a future-generation Cray supercomputer. When completed, the new Cray will deliver a peak performance of more than one petaf ops (quadrillion mathematical calculations per second).

Consisting of products and services, the multi-year contract is valued at more than $50 million. The full system is expected to go into production in late 2010.

FOR MORE INFO:

> Cray, Inc.

HP Adds NVIDIA Quadro Plug-in for Adobe Creative Suite 4 Users

HP will make Elemental Accelerator available for NVIDIA Quadro plug-in for Adobe Creative Suite 4 users as an option on the company's family of workstations.

Now available on the full line of HP workstations—including HP Z Workstations—the NVIDIA CUDA-based Elemental Accelerator 2.0 plug-in software for NVIDIA Quadro GPUs delivers further performance benefits when working with Adobe Premiere Pro CS4.

By leveraging the CUDA parallel computing architecture, the new plug-in software of oads H.264 video encoding to the Quadro GPU, enabling Adobe Premiere Pro CS4 users to experience a performance increase of up to 11 times when compared to CPU-only encoders.

With a Quadro GPU-equipped HP workstation, CS4 users can leverage its GPU-accelerated functionality and get optimal performance with the CS4 family of applications, including Adobe Premiere Pro, After Effects, Flash and Photoshop.

Elemental Accelerator 2.0 plug-in software works with NVIDIA Quadro FX 1800, 3800, 4800, and 5800 GPUs. It is available on the HP Z800, Z600, Z400, xw4600, and xw9400.

FOR MORE INFO:

> HP

3D Systems Gets Desktop Factory Assets

3D Systems has acquired certain assets of Desktop Factory, Inc., an Idealab company that developed a sub-$5,000 3D Printer. The Desktop Factory 3-D Printer, which is currently in an advanced development stage, produces plastic parts at a build speed comparable to existing 3D printing technologies.

3D Systems plans to continue to develop Desktop Factory's technology within its previously announced annual research and development expenditure range and integrate this technology into its expanding family of desktop and professional 3D printers.

FOR MORE INFO:

> 3D Systems Corp.

COFES 2010 Set for April 15-18

Cyon Research has set the dates of the Congress for the Future of Engineering Software (COFES). The three-day annual forum for CAD pros will take place April 15-18, 2010, at the Scottsdale Plaza Resort in Arizona.

"After a decade of COFES, it is amazing to see how the event has adapted as our industry has evolved," says Cyon CEO Brad Holtz. "The open and collaborative format ... has led to some great ideas and great friendships over the years." Organizers are seeking referrals to the invitation-only event.

FOR MORE INFO:

> COFES

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What does that mean for your final design? It's up to your standards. And for you? Standards that just got a whole lot higher.

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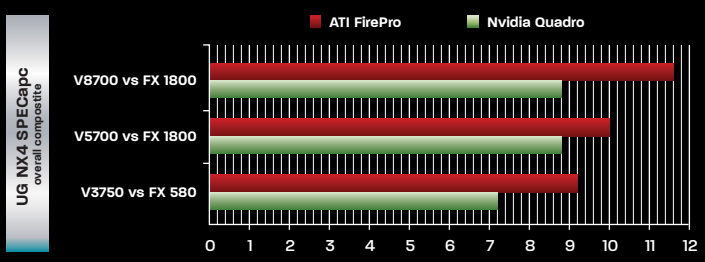


Learn more at www.ati.amd.com/FirePro

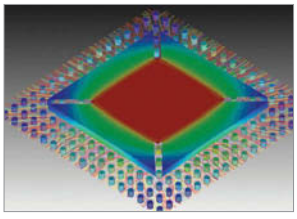
EDITOR'S PICK OF THE WEEK

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

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

ANSYS Releases Icepak 12.0 Fluid Simulation Software

> New simulation advancements in electronics thermal management reduce engineering time.



I usually try not to have back-to-back Picks of the Week from the same developer, but ANSYS Icepak 12.0 CFD (computational fluid dynamics) software for electronics thermal management demanded a hard look.

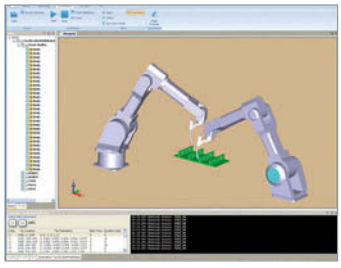
Icepak is hot stuff for electronics cooling management. It's based on the ANSYS FLUENT CFD solver, which long ago became one of the leading high-end applications for solving flow, turbulence, heat transfer, reaction, and similar problems. Icepak enables design engineers to leverage FLUENT power through a streamlined user interface that, in ANSYS's words, speaks their language. The short of what that means for you is that Icepak helps you model and predict the fluid flow and heat transfer performance of complex electronic assemblies at the component, board, or system level quickly. For the boss, this means fewer prototypes, tighter development cycles, and faster time to market.

READ MY COMPLETE REVIEW:

>ANSYS

Accelerate 3D Application Development

> New Rapid Application Development Framework provides functions to save programming efforts



Big changes have a knack of happening under the radar, and only in retrospect do you realize that a big news event went down and you missed it. Spatial made one of those quiet yet big announcements a few weeks ago, and it slipped right by me. Spatial's announcement was about RADF, which stands for Rapid Application Development Framework not some royal defence force. RADF will, however, provide defense against wasted time and effort for the hundreds of CAD/CAM, CAE, and other developers that leverage Spatial's geometry kernel and translation and visualization components, such as ACIS, 3D InterOp, and HOOPS.

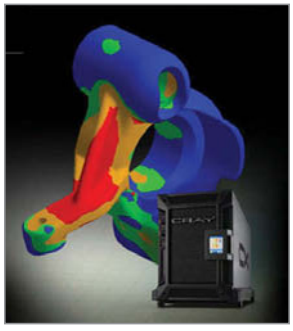
Developers will use RADF functionality as a framework to create their applications. RADF comes with all sorts of core 3D functions and capabilities that end users have come to expect or really want in their applications.

READ MY COMPLETE REVIEW:

>Accelerate 3D

Base Pricing for Entry-Level Supercomputer Starts at Less Than $12k

> Cray expands its HPC offerings for more engineers with a lower-cost supercomputer.



In a message the other day I wrote about how I like the fact that Cray has made HPC (high-performance computing) and cluster computing affordable with its CX1 deskside supercomputer. Now, they've gone one better with their Cray CX1-LC deskside supercomputer.

LC means Light Configuration, but this is not a light anything. Think of the CX1-LC as beginning at the price point where high-end workstations max out, only it has more power from the get-go. Consequently, the CX1-LC gives the chance to have an ultra very high-end workstation and a small cluster in a single unit next to your desk starting at about $12,000 or so.

Cray has a build it for your needs approach to HPC and cluster computing like everybody else ... except they put it together, which is startlingly different than many cluster setups. They do, of course, have suggested, customizable units. This all means you can select your own compute nodes, processors, storage options, visualization power, RAM, monitor, and so forth to fit your needs and budget like you would do for your home PC.

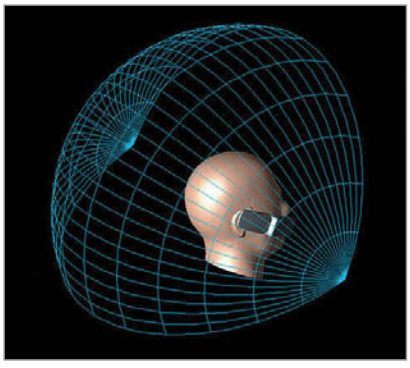
READ MY COMPLETE REVIEW:

>Cray

Big Speed Boost for Electromagnetic Simulations

> Remcom updates XStream GPU acceleration. Bundles it free with XFdtd 7.0.

Computational-intensive applications and I have a lot in common: We're both tough to process, sometimes requiring more time to solve than you wish to spend on the job. Applications like 3D electromagnetic simulation are difficult to process even on modern 64-bit workstations. But not so much any more. Remcom, long-time developer of electromagnetic simulation software, has introduced a new version of its XStream GPU acceleration technology for its XFdtd 3D electromagnetic simulation (EM) tool that can reduce solution times from hours to minutes. Coupled with XFdtd's ability to preview meshes before you hit go and dynamically display results as data changes, you could knock months off your development cycle.



XStream's power comes from its ability to leverage NVIDIA CUDA architecture. In simplified terms, XStream offloads the heavy numerical processing jobs from your main CPU onto the NVIDIA GPU (graphical processing unit) on your graphics accelerator card. This frees the main processor to do other, less-intensive jobs. In effect, this turns your workstation into a massively parallel computer.

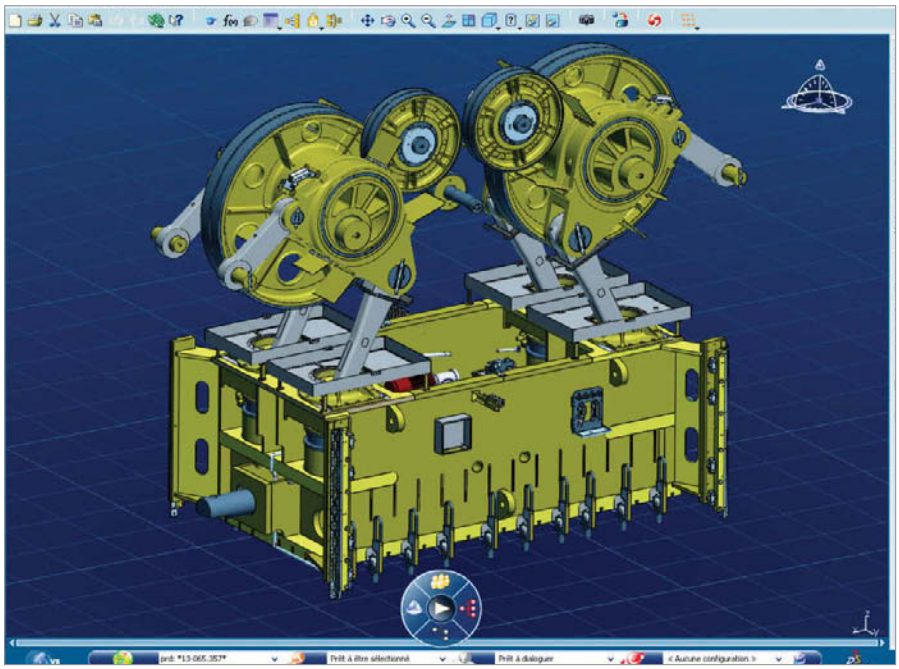
READ MY COMPLETE REVIEW:

>Remcom

DS ENOVIA V6 PLM Enables Market Agility

> A world-wide manufacturer of press systems and metalforming

BY RUSSELL SHUBA



CATIA V6 allows for kinematic simulation of large assemblies, as shown here.

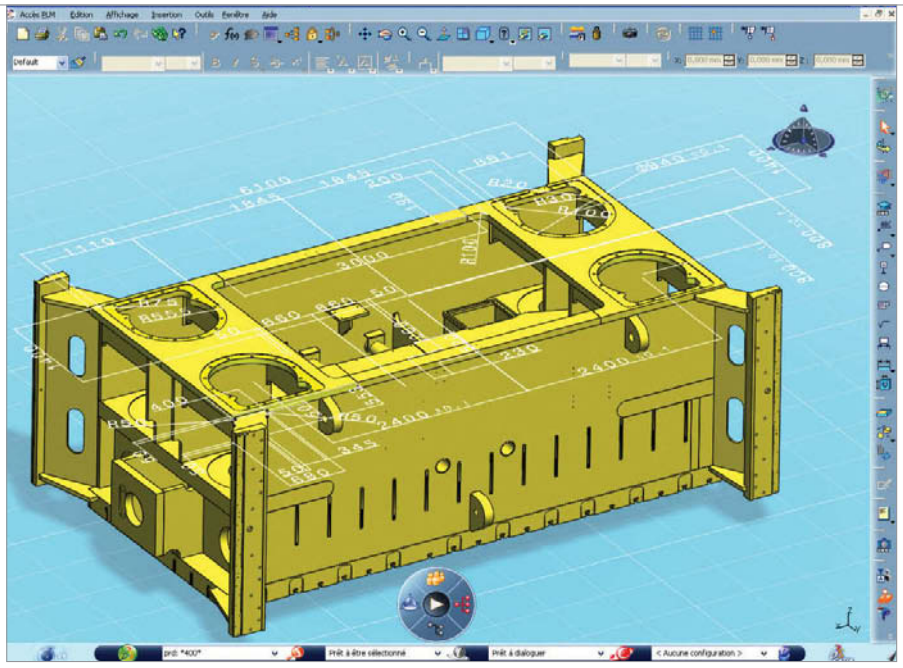
Since its founding in 1839 as a metal fitter's shop, Germany's Schuler AG has become a global manufacturer of mechanical and hydraulic metalforming products, systems, and services, with annual sales of more than $1 billion and a workforce of 5,710. At the forefront of developing transfer and servo presses widely used across the automotive industry, Schuler pioneered hydro-forming technology for contouring tubes in the 1990s. Its presses are also used in minting and solid forming. Schuler has ten forming system sites in Germany as well as sites in Brazil and China, with advanced technology sites in Germany and the U.S.

To maintain its reputation as a leader in the metal-forming sector, Schuler must constantly demonstrate its commitment to innovation, product quality, and customer service. This means reacting quickly to new market opportunities and delivering the quality products its customers expect.

"Schuler's number one business challenge is to satisfy the changing requirements of our customers such as automotive manufacturers," says Joachim Beyer, a member of Schuler's board of directors.

Each of Schuler's manufacturing sites is responsible for different product parts and processes. The presses themselves are huge, tailored to customer needs, and often comprise more than 30,000 parts with a lifetime of up to 30 years. Each

press, let alone the coordination of building a line of them, presents enormous data management and coordination challenges. This complexity requires real-time data sharing and decision making among geographically dispersed engineers, suppliers, and customers. To address these development challenges, Schuler began using Dassault Systèmes' ENOVIA version 4 product lifecycle management (PLM) solution in 1996 before migrating to V5 in 2003.



There are full annotation capabilities available in CATIA V6.

Single PLM Platform for IP

Schuler needed a solution that would help it make the most of its intellectual property, enabling all its stakeholders to work together and run with their ideas, according to Walter Knoblauch, PLM manager for Schuler.

As its projects became more complex, Schuler wanted to manage all of its product-centric IP from idea- to product-experience on its single PLM platform. This includes all product-related information or knowledge necessary to design, manufacture, and deliver products to market, as well as modeling applications for engineering disciplines and collaborative business processes that span the entire product lifecycle.

"PLM could help us to manage our process and product data more efficiently by grouping all this IP in a single environment," says Dieter Laube, Schuler's PLM administrator. "For me, the system will be easier to manage because everyone at Schuler will have the same information at the same time."

Online Collaboration & Authoring

Now, Schuler stakeholders can create and collaborate in real-time from remote locations via a basic Web connection. For example, engineering teams can display, manipulate, or design parts concurrently in Germany and Brazil.

"Online remote collaboration reduces the problem of bandwidth and latency time," says PLM Manager Knoblauch. "Our engineers can connect and work together simultaneously on the same product and actually model in real-time 3D. Distance is no longer a problem."

The ability to create and collaborate remotely enables design teams to be more flexible and responsive. It enables engineering managers like Martin Schmeink, who works in Schuler's automotive business unit to allocate work to sites around the world where resources or expertise is available. "We also use outside contractors for

designing in order to meet demand," says Schmeink. "This application helps us to simplify the process of connecting these small offices and is a great way to adjust to our workload."

Global Collaboration Enabled

Schuler engineers, suppliers, and customers can now collaborate and innovate on a large scale via the Web, and harness the collective intelligence and creativity among these online communities to design complex products concurrently in real-time at any level of detail. Likewise, business users can collaborate across common business processes, or leverage engineering information.

"One of the significant benefits is that this application can handle large-scale projects," says Laube. "More disciplines can collaborate on projects, regardless of the factors of size and the complexity of assemblies."

Because PLM provides interoperability with virtually any other enterprise application, it enables Schuler to access and leverage diverse data sources.

"Having engineering and manufacturing practices integrated with business processes better connects my designers to the rest of the company and our suppliers," says Schmeink. "For example, my engineers can instantly access sourcing and compliance information, giving them a better chance of getting their design right the first time—we save time and money."

According to Andreas Schäffer, the company's CAD manager for hydraulic presses, the V6 interface gives him the ability to instantly and easily find information. "It's easier to work with geometry on the screen than with words that you find in a traditional interface," says Schäffer.

Schuler teams can conceptualize, develop, and deliver products in a shared environment over the Web, or access search, navigation, and collaboration capabilities for a real-time snapshot of a product's status throughout its lifecycle. Better communication results in better products, according to the company.

Breakthrough ROI

With a single platform on one server for all IP modeling and collaborative business process applications, Schuler is reaping a substantial increase in return on investment by reducing the cost of adoption and reducing the time necessary to deploy a full PLM solution.

"With V6, there is only one server for the entire system," says Laube. "This means only one server to install, customize, administer, and maintain, which reduces our IT costs overall. We also deploy faster because integrating new sites is now easier."

The V6 solution enables Schuler to further leverage worker knowledge and skills, and provide its global development teams with the right tools for concurrent engineering. ■

Russell Shuba *is a freelance writer with credentials in PLM, interoperability, and simulation processes. To comment on this article, send e-mail addressed to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Dassault Systemes

> Schuler AG

NewTek LightWave 3D 9.6

> Introducing LightWave, a render and animation engine also useful for initial sketching.

BY MARK CLARKSON

A prototype MP3 player rendered with LightWave's new Car Paint shader, and Sigma fisheye lens.

LightWave is in the class of "art and media" applications that includes 3ds Max and Maya. Like those programs, it is used heavily in the production of games, motion pictures, television, and print ads. Unlike those programs, LightWave is one of the few remaining major players in non-CAD 3D space not owned by the Autodesk juggernaut.

LightWave isn't a CAD program. There is no real 2D component, no BOM and no construction history. An engineer will probably find LightWave most useful for creating beautiful renders and animations of designs created in other applications, or as a less structured environment for "sketching" out initial designs.

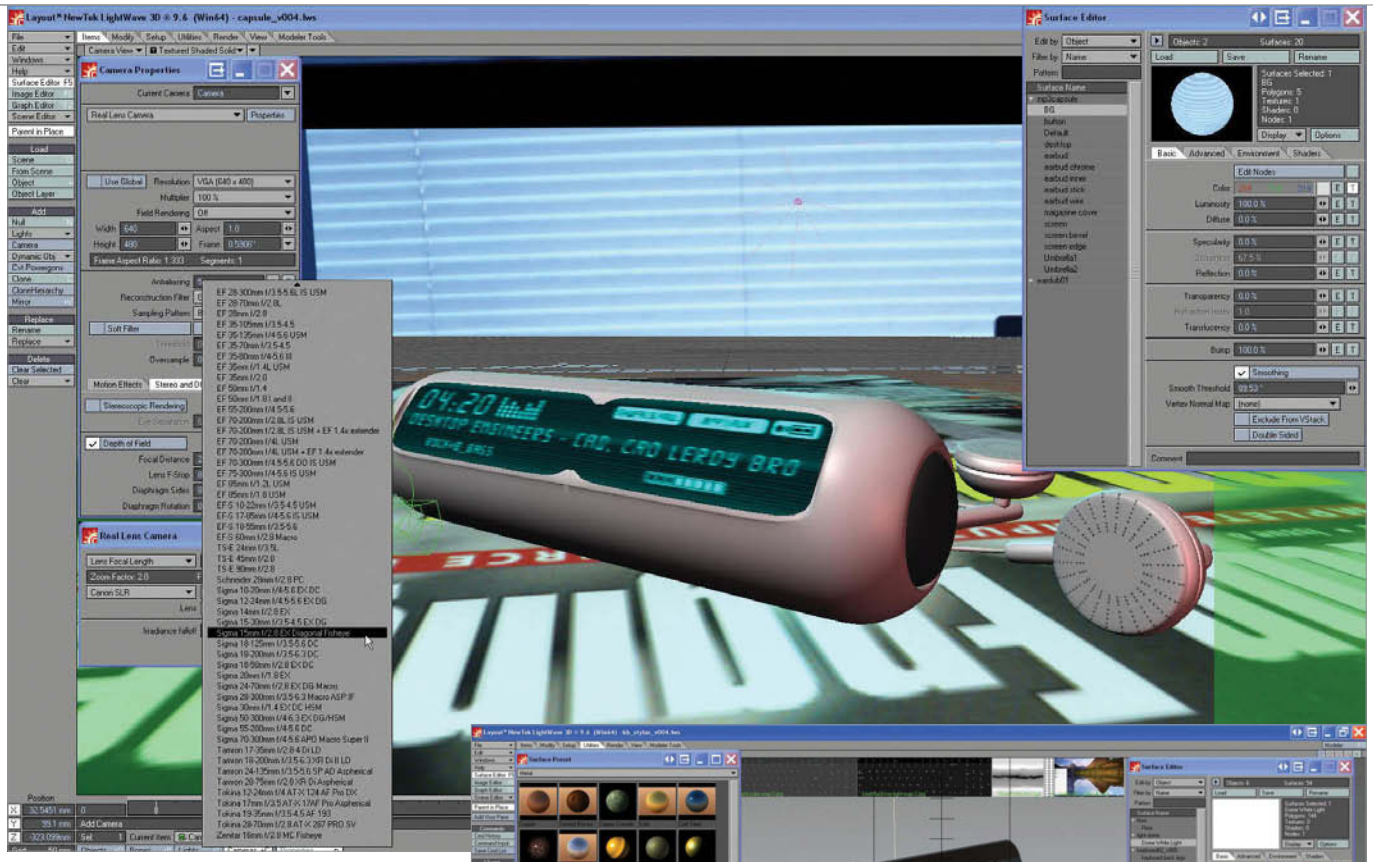
Two Apps in One

LightWave is really two separate applications: Modeler for modeling, and Layout for rendering and animation. It's not nearly as bad as it sounds, though; the two applications are tied together. It's functionally similar to the way most CAD programs let you pop in and out of different environments for models, drawings, and assemblies. You can select an object in Layout, press a key, and open that object up in Modeler. Likewise, changes made in Modeler are automatically reflected in Layout. LightWave Hub, a mini-application, sits in your task bar and facilitates the interaction.

I've actually come to prefer it over the everything-all-the-time approach of similar applications; editing individual objects within the context of a complex scene can become quite cumbersome.

Modeler

LightWave is a polygon and surface modeler. All



LightWave's Layout application is where you render and animate your creations.

LightWave allows you to easily select for a wide range of real-world cameras and lenses.

objects, by default, are polygon meshes. You create objects from primitives (i.e., cubes or spheres), by extruding or lofting curves along paths, or by linking 2D curves together to define curved 3D surfaces.

For organic surfaces, turning a poly mesh into a curved subdivision surface (SDS) is as easy as hitting the Tab key. The mesh becomes a cage on which the curved surface is hung; you modify the surface geometry by manipulating the components—polygons, edges, points—of the underlying cage. Another touch of the Tab key converts the object back to polygon mode.

You can model in polygons, SDSs, or a combination. You can freeze curve surfaces as polygonal meshes, or retain them as is for rendering and animation.

Modeler provides ten layers, accessed by the number keys. Different layers can hold curves, construction surfaces, models or parts of models. I often use layers as an easy way to keep iterative versions of my objects. LightWave's layer functionality is limited, but it's super fast and easy to pop back and forth the between layers, combine

layers, place different layers in the foreground or background, and so on.

In fact, LightWave's Modeler is fast and easy to use, in general.

Rendering Texturing

LightWave's rendering has always been top-notch, and continues to get better. In 9.6, global illumination calculations are much faster, and rendering feedback is greatly improved.

LightWave's texturing has taken a big leap forward with the addition of nodal shading. You can build up fantastically complex texture networks using nodes for 2D and 3D textures, gradients, math functions, and materials. One heralded example is the new Carpaint shader that realistically simulates auto paint, complete with clear coat and metal flake.

You can also build nodal networks to control volumetric lighting and object displacement maps.

Lights, Camera

To help you better match reality, LightWave now has IES (Illuminating Engineering Society) profile lights and a greatly expanded selection of cameras, including perspective, orthographic, shift, and real-world cameras, as well as a configurable advanced camera.

You can create virtually any imaginable camera/lens combination. You want to replicate a Canon SLR with a Sigma 15mm f/2.8 fisheye lens? No problem; the real-world camera has those options. Want to create a custom tilt-shift lens? You can do that too. This is a big help to users trying to match camera/lens combinations when, for example, compositing a render into an existing scene.

LightWave will do complex character animation; grow fibers, fur and hair; and render dynamics such as sparks, smoke, explosions, and fairy dust blowing in the wind.

Unfortunately, the layout window doesn't always accurately reflect the appearance of the final render; the distortion of fish eye lenses, for example, doesn't show up. This makes camera setup a bit difficult.

Quibbles

One barrier to integrating LightWave into the engineering pipeline is its somewhat limited import and export capabilities. It hasn't got nearly the range of, say, Rhino. You won't find STL or IGES; OBJ and 3DS are your best bets. LightWave 9.6 has added support for the increasingly popular open standard COLLADA format. LightWave is one of the few programs still shipping with printed manuals, but it also has Web-based help. Sadly, there are holes.

Take Visor for example—a new image-viewing feature within Layout. I only know about it because I stumbled upon a discussion on the Web. I couldn't find it in a menu or on a button. It doesn't appear in the printed manual, and searching for it in the online help gets you no results. The feature doesn't seem to come pre-installed, either. You have to know it exists, know its name, manually add the plug-in to LightWave, and then manually add it to a menu somewhere. That's a lot of work for a new feature.

LightWave isn't alone in having surprising omissions in its help; I seem to ding every application I review for the same thing. C'mon, guys!

In Summation

Quibbles aside, LightWave has a lot going for it. It is one of the most widely used 3D modeling and rendering solutions, and for good reason. It is comparatively easy to learn and use, filled with great features, and capable of motion-picture quality photo-real renders and animations.

LightWave goes way beyond static renders and simple turntable animations. It will do complex character animation; grow fibers, fur and hair; and render dynamics such as sparks, smoke, explosions, and fairy dust blowing in the wind.

And, with an MSRP of $895, LightWave represents an astounding value. ■

*Contributing Editor **Mark Clarkson**, a.k.a. The Wichita By-Lineman, has been writing about all manner of computer stuff for years. An expert in 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 c/o DE-Editors@deskeng.com.*

FOR MORE INFO:

> NewTek

Form and Function

> Industrial design takes all aspects of manufacturing and combines them to add value to the bottom line.

BY MIKE HUDSPETH

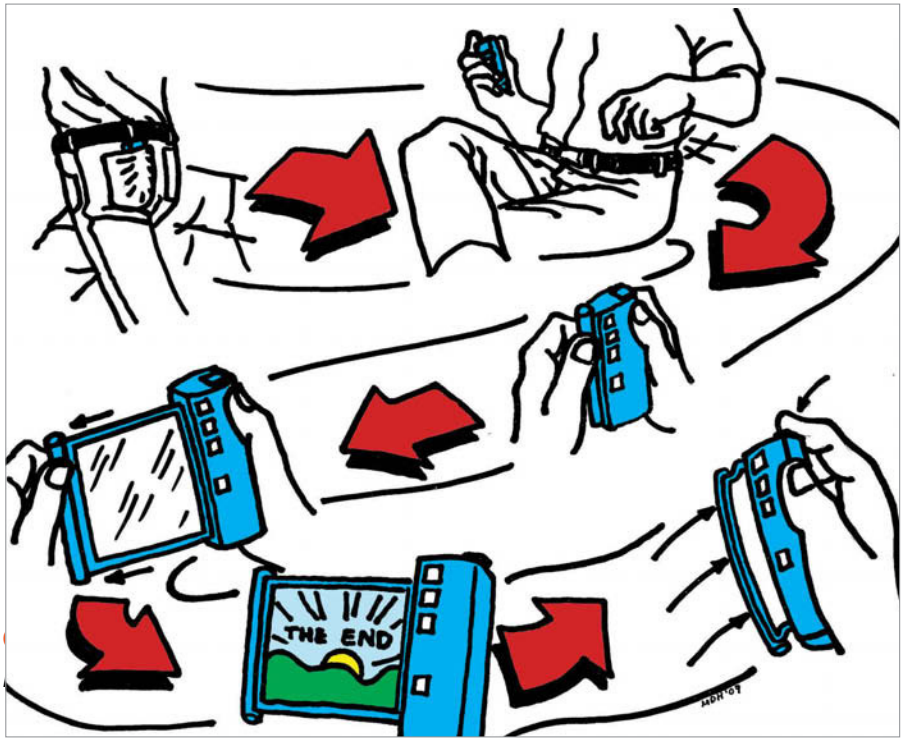


Figure 1: By laying out every part of your user experience you not only have a better idea of how your product will be used, but you might see problems you might not have seen otherwise.

We've all heard the mantra, "form follows function." In a nutshell it means that *what* something does will dictate *how* it looks. And while many of you are nodding in full agreement that the functional requirements of a device will often shape what it looks like, that's not the only way to look at things.

In a perfectly engineered world everything would be either right or wrong—it would make sense or it wouldn't. But we live in a world where there are as many points of view as there are people, and that makes things somewhat more complicated—especially when designing the "next great thing." So while engineers are trained to design things that work, engineering school usually skips the bit about designing things that people want. It's not an objective, numbers-based exercise. Instead, it involves emotion and personal taste and ventures into that overlooked corner of industrial design.

That creative spark

There are many ways to quantify a winning design. From measuring the profits it brings a company to determining how it fulfills customer expectations and from generating repeat business to fitting a sustainable and responsible mission, perhaps a winning design is one that does all these things, and more. All it has to do is be all things to all customers.

To be sure, industrial design (ID) is about styling, but it goes further than that. An industrial designer's job encompasses a wide range of important functions—all of which add value to the enterprise. Industrial design is also about taking the best of each discipline involved in the development of a product—from manufacturing to marketing—and combining them in a way that best meets the product's needs. To say industrial design is all about art is to put the profession into a very small box. Of course, to say engineering is all about the numbers does the same thing. But when we are under so much pressure to think outside of that box, we must cultivate innovation just to survive and industrial design is ultimately about innovation.

The Methodology Of Industrial Design

When I saw *The Empire Strikes Back* for the first time, I honestly thought Yoda told Luke, "always emotion is the future." I was later corrected that he actually said "in motion," but the damage was done and I've since believed that emotion rules mankind. Look back through history. Wars have been fought because of it. Grand epics have been written to stir it. Great acts have been accomplished in the pursuit of it.

People like things for intangible reasons, emotional beings that we are. We need and desire. We look at the world through emotional eyes. So to sell to humans you have to understand them—and their emotions. What is it about a product that will elicit emotion? It can be different in each culture, yet a designer must know what each design feature will say to a customer and so designs for emotion.

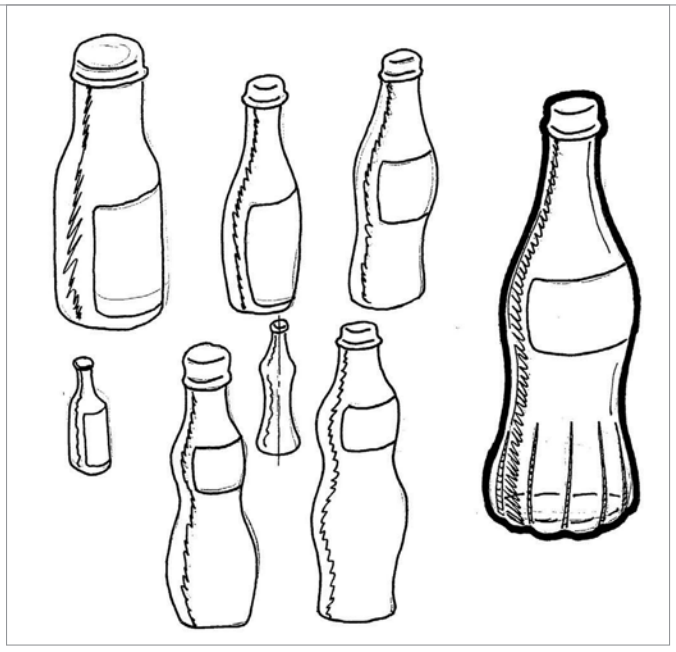


Figure 2: Imagine what the world would be like if we hadn't been gifted with the gene for exploring. By drawing out and looking at a variety of designs you can explore the shape or function of your product. When the time comes to make a choice about which way to go, having choices makes all the difference.

The next thing an industrial designer must do is model the experience. From an ID perspective, you don't just create a thing—you design an experience. The product will be used and a designer must think through each step in that experience and consider what the user is going to see. A storyboard is very useful for this. This collection of fast sketches depicting each part of the user experience (*see Figure 1*) looks at the range of motion, the dents and dings, and the conditions the product will likely be subjected to. The more steps you can get into the storyboard, the more accurate your design will be.

Sketch, Sketch, Sketch!

If variety is the spice of life, then iteration is the life blood of good design (see Figure 2). Draw your product. Document each and every thought or

Psychology of Color

COLORS HAVE EMOTIONAL and psychological meaning. The same color can mean many things—even in the same culture. Color can elicit a strong emotional response—either good or bad. Below are a short collection of colors and their more common meanings:

Red is an aggressive color. It screams danger! It also promises excitement. Think of a little red sports car or that slinky red dress.

Yellow is a cautionary color. Certain shades are bright and sunny. All capture attention. Though black and white are technically the highest contrasting colors, the human eye is drawn more to yellow and black. Go figure.

White can mean many things. It most often symbolizes purity and cleanliness.

Black is rugged and sporty. It is also the color of choice for high-class formality.

Silver is a high-tech color. It can, however, scream artificial or cheap.

Pink is usually a more feminine color.

Blue is more masculine. It is also a cool color. It can be refreshing or chilling (temperature-wise) depending on its application.

Green is natural. It is life. It calms. That's why you used to see it used in so many hallways at hospitals. Green means safe.

Pastel colors generally beg trust. They're reassuring.

Muted colors are very classy. Think hunter green as opposed to bright Kelly green. They are rich yet understated—dignified.

Bright colors are anything but dignified. They denote fun and youth. That's why you see such colorful toys. They are very easy to see and are generally seen as happy.

direction you can. You don't have to be Leonardo DaVinci, just get the concept down. No one can consider an option they haven't seen. It's usually good to place a time limit on this. Once you've got all your sketches finished, go through them and select several that strike your fancy—say, six. Then you present those to the rest of the team. The team will narrow them to three that can be mocked up and presented to the customer.

While the traditional way to sketch a concept is with pencil and paper, there are many newer tools that can be used to great effect. Try a digitizer tablet or tablet PC. Wacom has its Cintiq line of touchscreen monitors that are fun to work with. There are many good software programs as well. A few that come to mind are Alias (the defacto standard for industrial design) and Sketchbook Pro from Autodesk, Corel Painter, CorelDRAW!, Adobe Illustrator, and Adobe's Photoshop. All of these products will help. Of course, once you've sketched your concepts and selected which ones to develop, you're going to need to model them using Alias, SolidWorks, Rhinoceros from McNeel North America, NX from Siemens PLM, Think3, solidThinking, or one of many others. Which tools you use really depends on your budget, your comfort level and expertise with the tools, and what your customer wants. (Many manufacturers will require results in a specific program.)

Along with *what* a product looks like, the industrial designer must also consider *how* it functions and

how a user might interact with it.

That interaction takes into account the product's ergonomics—a much-thrown-about term these days. People generally think of ergonomics the same way they do styling, but it's much more. Ergs are a measure of energy use. And economics is a study of resource use. Therefore ergonomics is literally about how much energy a product or system takes to use. *How* something operates is every bit as important as *whether* it operates. It's an ease-of-use issue as well as a fit issue. If a product takes too much effort to operate, people won't want to use it. Likewise, if one product choice has sharp edges that hurt, people will almost always buy the one that is soft or rounded.

Beyond the user, however, a good industrial designer will also keep the manufacturer in mind. Industrial designers must be familiar with all of the processes by which their designs will be produced. And since ease of manufacture and assembly can affect the final price of the product, it's important for an industrial designer to keep price as a consideration. If you design in a lot of manual operations, the manufacturer will have to pay someone to complete them and pass that cost on to the customer.

Color is another very important aspect of a design. A product's color palette can say a lot about the product. Color is not merely a function of the frequency of light that is reflected off a surface, but can excite an emotional response (*see Figure 4*). For example, why is red the color on the STOP sign? Consider that all creatures capable of seeing in color know red is the color of blood. Therefore, when they see something red, there is an emotional response that signals DANGER! In some cultures, black is the color of death, but in others it would be white (*see "Psychology of Color"*). The colors you use will elicit certain responses and convey specific feelings about your product and your company so approach color choice carefully.

The Many Facets of ID

There are many other facets of industrial design. Texture, shape, and a product's impact on the environment throughout its lifecycle are just a few. A good industrial designer will consider how the product is made, used, and disposed of.

Industrial designers take all of these things into account when they create a concept. Despite what some seem to think, industrial design is not just about seeing how artsy a product can be made. Industrial design is about meeting the needs of the product in the most economical and responsible way. Industrial designers aren't cheap, but they add significant value to the bottom line. ■

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

FOR MORE INFO:

- > Adobe
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- > Corel Corporation
- > Industrial Design Society
- > McNeel North America
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- > SolidWorks
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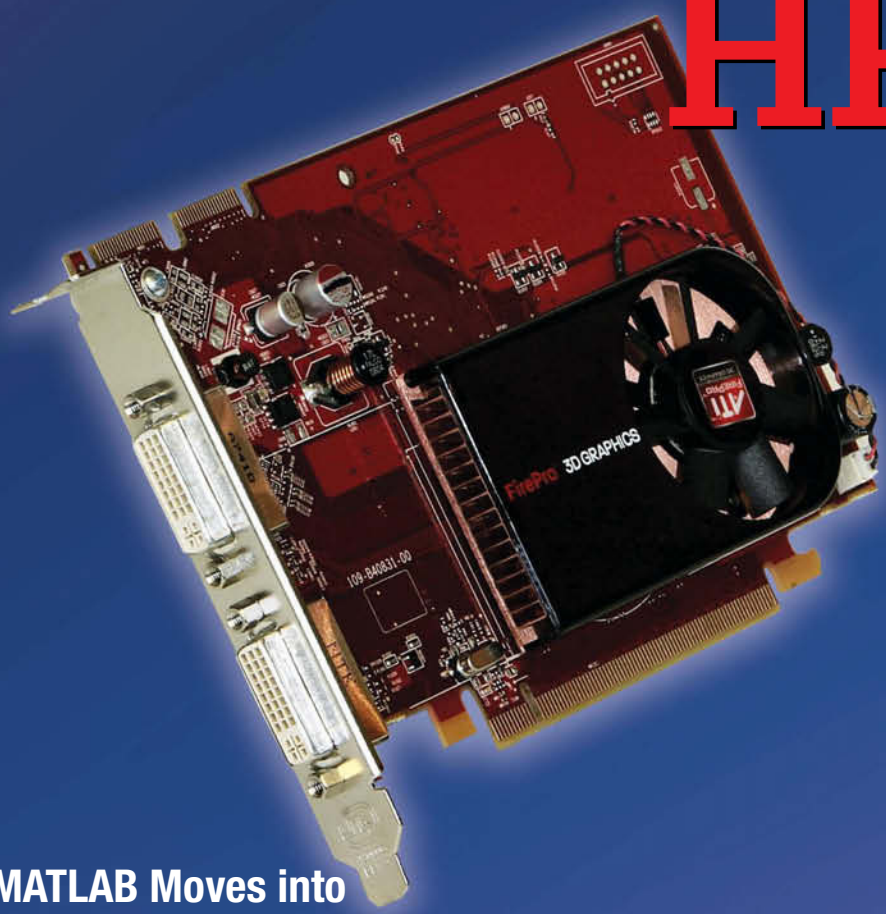


By Jos Martin

MATLAB Moves into the Parallel Domain

> Today's increasingly complex problems require multicore machines and clusters and a real need for robust parallel languages.

Today's engineers are being faced with computational modeling and simulation problems that are growing increasingly larger and it is common for these problems to take weeks or months to solve on a single computer. Recent examples of such large-scale problems include modeling the control systems for the proposed International Linear Collider to be used in high-energy particle physics research, reconstructing protein structure from electron tomography data, and running Monte Carlo simulations of analytic copula models of financials.

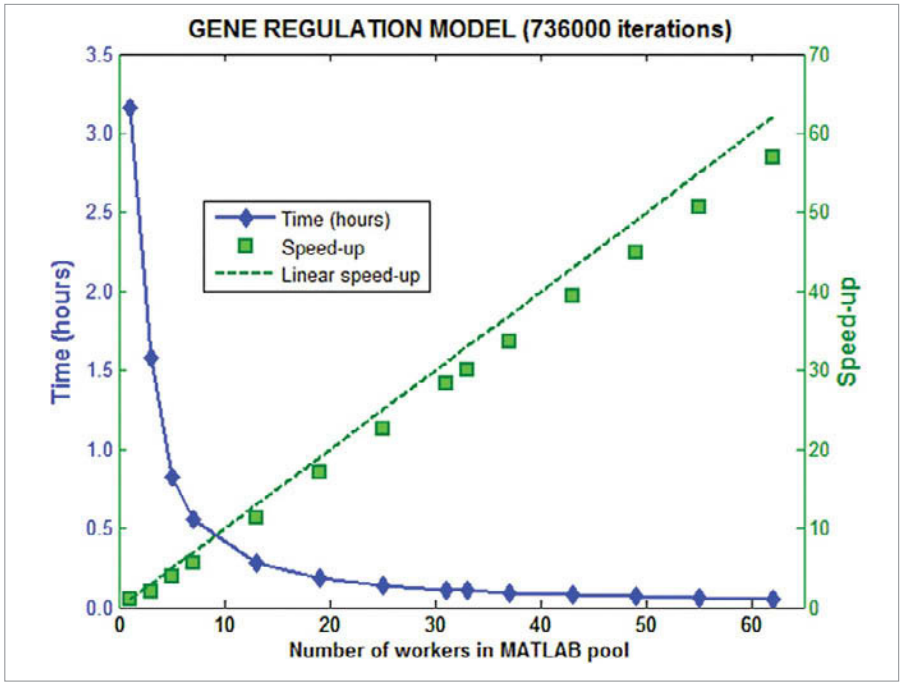


Fig. 1: Running a gene regulation model on a cluster using MATLAB Distributed Computing Server. The server enables applications developed using Parallel Computing Toolbox to harness computer clusters for large problems.

To save time solving these problems, many engineers are turning to both multicore machines and clusters of computers. To use this hardware effectively, they need to use parallel computing technologies.

In order to do this, and until recently, engineers wishing to solve a large-scale problem had two choices: wait until libraries are parallelized or rewrite their code. As we'll see, there is a problem

with current technologies. Instead, we hope to demonstrate how new parallel languages will allow engineers to focus on engineering problems rather than their computer science issues.

Hurry Up and Wait

It might just be possible to wait until the underlying libraries used in your application are rewritten by the vendor to work on parallel hardware. If not, you're faced with rewriting code using existing parallel techniques such as those provided by OpenMP, Cilk, MPI, or Intel's Thread Building Blocks (TBB).

For some classes of problems it is reasonable to expect that parallelization of the underlying library code will completely solve the long-term issue and ensure the algorithms will always run well on parallel hardware. An example might be a vendor-supplied computational library. If your libraries have been parallelized, you are fortunate because you have achieved parallelization of your algorithm with no time investment or code changes. In most cases, though, it is likely that the algorithm designer must make code changes to parallelize the algorithm.

Current Parallel Solutions

Parallel techniques like OpenMP, Cilk, MPI, and TBB extend existing languages such as C, C++, and FORTRAN—with a mixture of macro, preprocessor, and library extensions—to enable various forms of parallelism. Except for MPI, these techniques are all variants of a model for which you execute your parallel code on different threads that all have access to the same shared-memory address space. How you express the parallelism in the code varies greatly, but the underlying model is the same.

These programming models are usually considered fairly simple to use and understand. Shared memory access on a single computer is also usually very fast, making it possible to achieve good performance. However, the shared memory assumption of the parallelism model will likely propagate to the design and implementation of the parallel code. This will effectively tie the algorithm to a machine architecture where the time for memory access is low and roughly constant for all cores—namely a single multicore computer.

While this memory access assumption is true for multicore machines today, it is not true for clusters (even when connected over high-speed interconnects such as Infiniband). This makes such techniques unsuitable for scaling algorithms on cluster hardware. And it is looking increasingly likely that the next generation of processors will have an internal architecture more similar to that of a cluster than the multicore computers available today.

The current alternative to shared-memory parallelism is message passing between many processes, known as the message passing interface (MPI) programming model. In this case, the individual parallel parts of the program are considered independent and the only data transfer between the parts is arranged as part of the algorithm.

In general this model tends to minimize the overall data transfer, since the code designer is forced to think explicitly about data movement while writing the code. It also performs much bet-

ter in a cluster environment for the same reason: The optimized data transfer makes best use of the resources in a cluster. In addition, this approach provides comparable performance to the shared-memory model techniques on a single multicore machine, provided that the message transport layer is of similar performance to shared memory.

However, MPI has often been referred to as "the assembly language for parallel programming" because it is both difficult to program and understand, and mixes algorithm and messaging code together. This leads to complexity in code that is hard to maintain.

Thus, an engineer starting a project today must choose between using a difficult programming model or a simple model that will not work well on a cluster nor likely next-generation hardware. A recent *DE* article, "Multicore Matters" (July 2009), outlined why parallel software is difficult to write, and discusses the deadlock and race condition problems that can arise in MPI and shared memory code.

What to Expect in Parallel

In this context, newer parallel languages become more than an academic exercise in computer language design. The main goal of any new parallel language is to bridge the divide between performance and programmability; that is, to provide a simple programming model that will work well on multicores and clusters now and in the future.

There are many significant ongoing efforts to develop new languages. Several are funded by the Defense Advanced Research Projects Agency (DARPA) High Productivity Computing Systems (HPCS) program: Chapel from Cray, X10 from IBM, and Fortress from Sun. In addition, Microsoft Research plans to set up groups in its labs to work on parallel language development, and here at The MathWorks we have been moving the MATLAB language into the parallel domain.

A good parallel language must:

- Maintain existing serial programming models
- Provide performance on a range of very different hardware
- Provide a variety of parallel programming models to suit different problems.

To encourage users to adopt a new language and allow simple porting of existing code, the serial code in a new language should look very similar (if not the same) as serial code in an existing language.

There are two parallel problems that are commonly encountered. One, task parallel problems undertake many independent computations at the same time, such as large Monte Carlo simulations. Two, data parallel problems work on large data sets that are spread (partitioned) across the cluster, perhaps treating a data set as a single matrix and manipulating it with linear algebra functions.

Addressing Parallel Problems

Addressing task and data parallel type problems is the first thing that all parallel languages set out to do. In the MATLAB parallel language, distributed arrays and the parfor and spmd (single program multiple data) language constructs solve these problems. Distributed arrays (where the whole array data is spread over the available resources) provide a high-level data parallel model. The

parfor construct is a parallel for-loop in which each loop iteration can be executed on any available resource, leading to faster execution of the whole loop. The spmd construct is used to program both with distributed arrays at a low level, and with even lower-level MPI-like constructs. In common with MATLAB, both Chapel and X10 have language constructs that provide these programming models.

Other parallel programming models such as bulk synchronous parallel, task parallel with communication, and map-reduce are needed for some problems, but at significantly lower frequency than the task- and data-parallel models. These other models should be expressible in the language.

A parallel language should also be able to provide protection from deadlocks and race conditions, the bane of current multicore code. MATLAB, X10, and Chapel each include a language subset that is provably free of deadlocks and race conditions; if you program in this subset, you will never encounter these issues.

In addition to this cast-iron guarantee, most parallel languages should be able to detect deadlock conditions in the entire language. This detection ability results from the need for the language to operate effectively on a cluster; to do this it needs a runtime layer (similar in nature to the virtual machine layer in Java) to manage the multi-machine interactions. Automatic deadlock detection can be built into this runtime layer.

Bottom Line for Engineers

These advances leave aspiring parallel programmers in a much better position. They need only express the parallelism of their algorithms in the syntax of the language, with the serial portions of the code being similar to existing code. They may also need to consider some race conditions (i.e., that some parts of the overall algorithm occur in a predefined order).

However, a designer who wants to parallelize an existing algorithm must be willing to invest time to work out how best to express the parallelism inherent in the problem. This task is often subtly different from writing a serial algorithm, and it is here that engineers will need to modify their current approach.

Efficient, robust, and manageable code is produced with this separation of concerns: The language designer provides a clear and easy-to-use set of parallel language constructs and the engineer uses these to express the parallelism specific to their problem. This approach should be the pattern for all scalable algorithmic design on clusters and newer hardware. ■

Jos Martin *is the principal architect for parallel computing products at The MathWorks. He holds both an ßMA and D.Phil degrees in Physics from Oxford University in the UK.*

FOR MORE INFO:

- > Cray, Inc.
- > DARPA
- > IBM
- > International Linear Collider
- > The MathWorks
- > Sun Microsystems

By Christy Lynch

Voltaire Accelerates HPC at Mobility Center

> Clemson University Computational Center for Mobility Systems creates a world-class research facility with a fast interconnect.

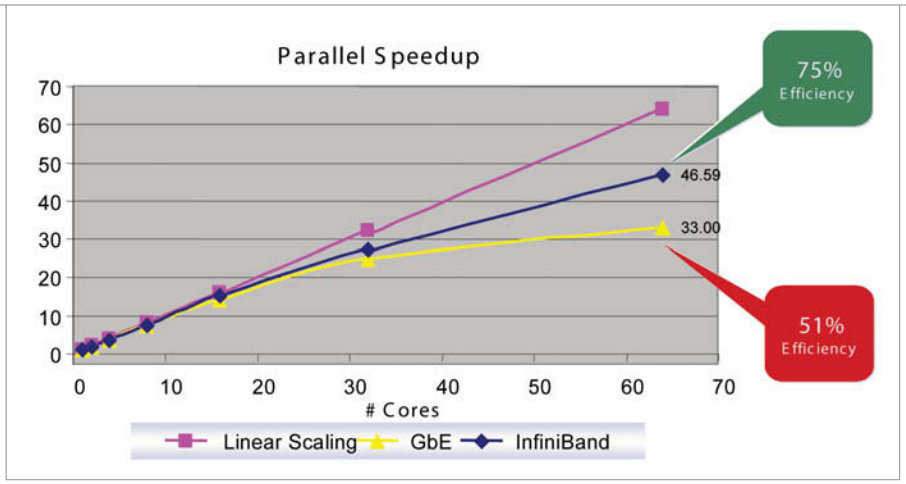
The Clemson University Computational Center for Mobility Systems built a world-class research facility and chose a Voltaire interconnect fabric to tie the 35-teraflop Sun factory-integrated system of servers, networking, and software together.

To help attract leading companies from the automotive industry as well as other industries such as energy, aviation, and aerospace, Clemson University selected Voltaire's scaleout computing fabric solutions as the interconnect for the high-performance computing (HPC) system operated by the Clemson University Computational Center for Mobility Systems (CU-CCMS). The system enables the university to provide simulation test research to automotive and transportation companies that need to reduce overall design cycle times to develop better products faster and at a lower cost.

To reach its primary goal of fostering innovation in the transportation industry while helping grow the economy of South Carolina, CU-CCMS—located in Greenville, SC—joined with BMW, Michelin, Timken, and other corporate partners as well as leaders from the technology sector to develop a "one-stop shopping" computational engineering center for companies in the mobility industry. The center offers a unique combination of benefits: a multidisciplinary team of experienced, career engineers capable of generating results within budget and the time-scale used in the private sector; a dedicated massive computational infrastructure; and innovative mathematical models

developed by CU-CCMS.

"We offer virtual-model testing," explained James Leylek, Ph.D., executive director of the CU-CCMS. "Compared to physical model testing, this approach allows companies to test new models and components more often and much faster so they can stay ahead of competition and go to market faster."



InfiniBand provides much more linear scaling compared to Ethernet by not consuming CPU cycles. This leads to greater system efficiency and scalability. *Graph courtesy of HP-Ansys Scalability Benchmark*

Computational simulations that previously required many weeks of processor time are completed at the center within hours, accelerating design cycle times and saving costs. In addition, manufacturers can simulate multiple design options simultaneously by running computations overnight, bypassing the traditional build-and-test cycle, which is costly and time consuming.

Sun Microsystems delivered and installed a 35 teraflop system based on 43 Sun Blade 6000 Modular Systems, Sun Fire servers and Sun StorageTek systems.

The Voltaire Solution

To achieve the center's mission, Leylek turned to Voltaire's partner, Sun Microsystems. Sun delivered and installed a 35 teraflop factory-integrated system, including servers, networking, interconnects, and software. The system is based on 43 Sun Blade 6000 Modular Systems, Sun Fire servers, and Sun StorageTek systems. An important piece of the project was choosing the right interconnect fabric for the system.

"To ultimately achieve our goal of reducing simulation testing time, we also needed a server interconnect that would allow the servers to exchange data at maximum speed and with the lowest latency," Leylek said. "No matter how much computing power you have, if your servers don't have a fast way to exchange information, you won't reduce testing times."

After considering Ethernet interconnects, which would not provide sufficient bandwidth or ultra-low latencies, and after testing one other manufacturer's interconnect that did not perform consistently, CU-CCMS turned to Voltaire. Voltaire recommended that CU-CCMS deploy a 20Gbps InfiniBand fabric using Voltaire Grid Director 2012 and Grid Director 9024 switches to connect all of the Sun servers and interconnect the blade chassis. To further improve the system's performance, CU-CCMS also selected Voltaire's 10Gb Ethernet gateways to connect the InfiniBand server fabric to the Sun storage.

"One of our major goals is to help auto manufacturers and their suppliers reduce the total time it takes to bring a new model from initial concept to the showroom," Leylek said. "Currently, this takes about 36 months. But we will help reduce the overall time to 18 months by significantly reducing the simulation testing time."

Why Voltaire?

"Everyone we talked to, including our hardware and software partners, as well as our automotive industry partners, reacted positively to our decision to use Voltaire as the interconnect fabric," Leylek said. "After conducting our research on the performance of Voltaire switches, it allowed us to look our clients straight in the eye and confidently commit to reducing simulation testing times."

Leylek also knew that Voltaire's reputation in the automotive industry was already well established. Voltaire has worked with many of the world's leading automotive manufacturers and more than 20 CAE Independent Software Vendors (ISVs) for several years.

"Voltaire switches provide the bandwidth that any high-performance computing center needs if it's going to simulate product performance for a manufacturing company," Leylek said. "The key is to speed-up the testing process, and that's exactly what Voltaire switches help you accomplish."

The Results

With the help of the Voltaire fabric, CU-CCMS now gives automotive manufacturers access to a state-of-the-art computing solution that reduces design cycle times and product costs while also providing a place to test new concepts and innovations. The Voltaire solution has also accelerated the performance of numerous CAE applications running on the Sun Microsystems HPC system. In fact, CU-CCMS's system ranked No. 99 on the November 2008 TOP500 list of the world's fastest computer systems.

"We have been extremely pleased with the quality and the performance of the Voltaire fabric," said Leylek. "It enables us to run more simulations in less time than could have been achieved using an Ethernet-based solution."

In one study with an automotive supplier, CU-CCMS researchers reduced turnaround time for new-product simulation by more than 80 percent. In another case, prototype development that would have required 12 weeks was replaced with a simulation that requires less than 3 weeks—a 75 percent reduction in the time required from concept to results.

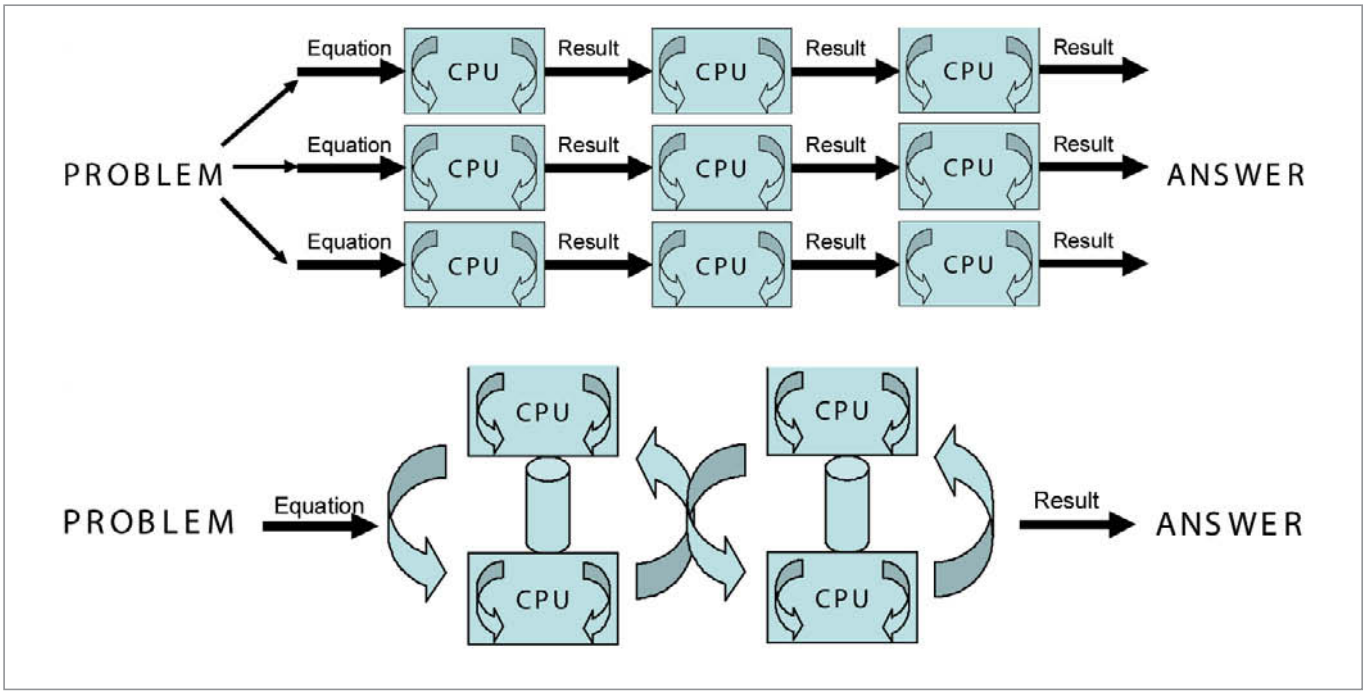
"We provide the performance and scalability testing that the researchers and the businesses need to solve complex design problems," Leylek said. "The Sun system connected by the Voltaire switches delivers a powerful, high-performance and scalable solution that solves the computing challenges faced by major manufacturing companies."

Key Results Delivered by Voltaire Solutions

- Speeds up simulation testing times so that transportation companies can reduce product design cycle times
- Enables CU-CCMS to provide virtual modeling capabilities to manufacturers, which saves time and accelerates time-to-market
- Dramatically improves performance of leading automotive and design software applications housed in the center

Voltaire Products:

- Grid Director 2012 switches
- Grid Director 9024 switches
- 10 Gigabit Ethernet gateways



The top image is an example of an application that requires very little inter processor communication. The problem is broken apart into smaller sub-problems solved individually, assembled into an answer, and fed back to the app. Other applications, however, rely on the tight integration of servers to work together to simultaneously solve a problem and rely on servers that can move data at very high speeds.

CU-CCMS employees use the system to compute, predict, and simulate design problems for a variety of clients in the automotive industry. Some of the tests that the groups run include simulations of computational aerodynamics, vehicle dynamics, acoustics, materials, and manufacturing. However, the automotive industry is just the beginning. In the future, CU-CCMS will expand its services into the aerospace, aviation, and energy industries.

"One specific area of emphasis is gas turbines for jet propulsion, and ground-based turbines for electric power generation," Leylek says. "We've just started talking to some of the global powerhouse companies, and you would be amazed at how impressed they are with the HPC infrastructure here."

With the help of Voltaire, CU-CCMS has essentially created a one-stop shopping resource for any company involved in manufacturing products for the transportation and mobility industries. ■

Christy Lynch *works at Voltaire, a provider of scale-out computing fabrics for data centers, high-performance computing, and cloud environments. Send comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> CU-Computational Center for Mobility Systems

> Sun Microsystems

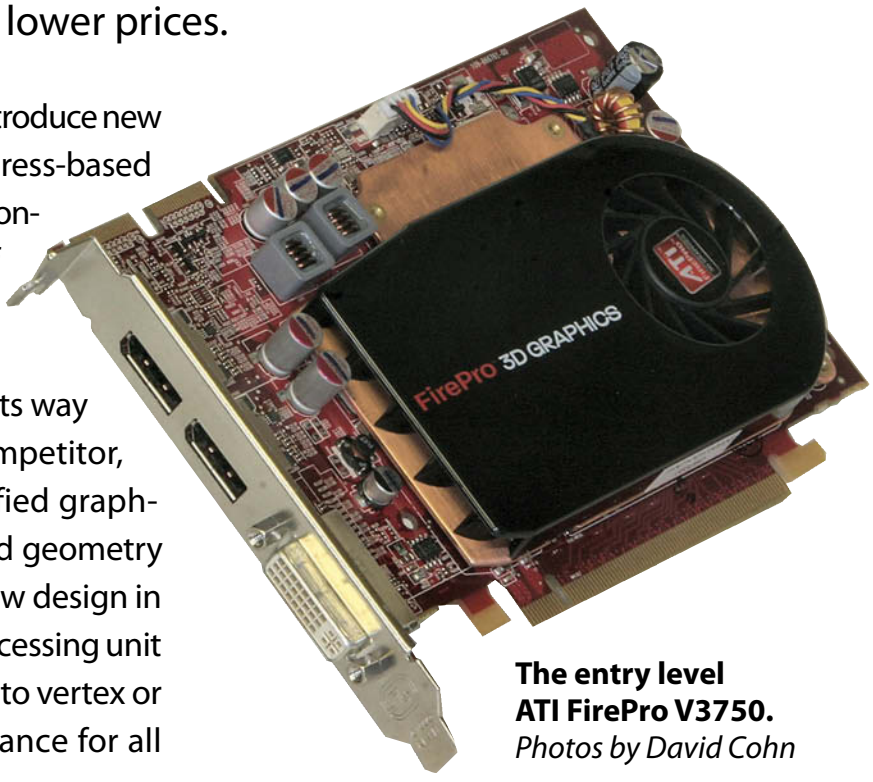
> Voltaire, Inc.

By David Cohn

ATI FirePro V-series Takes the Price/ Performance Lead

> AMD's new ATI workstation graphics accelerators yield improved performance at significantly lower prices.

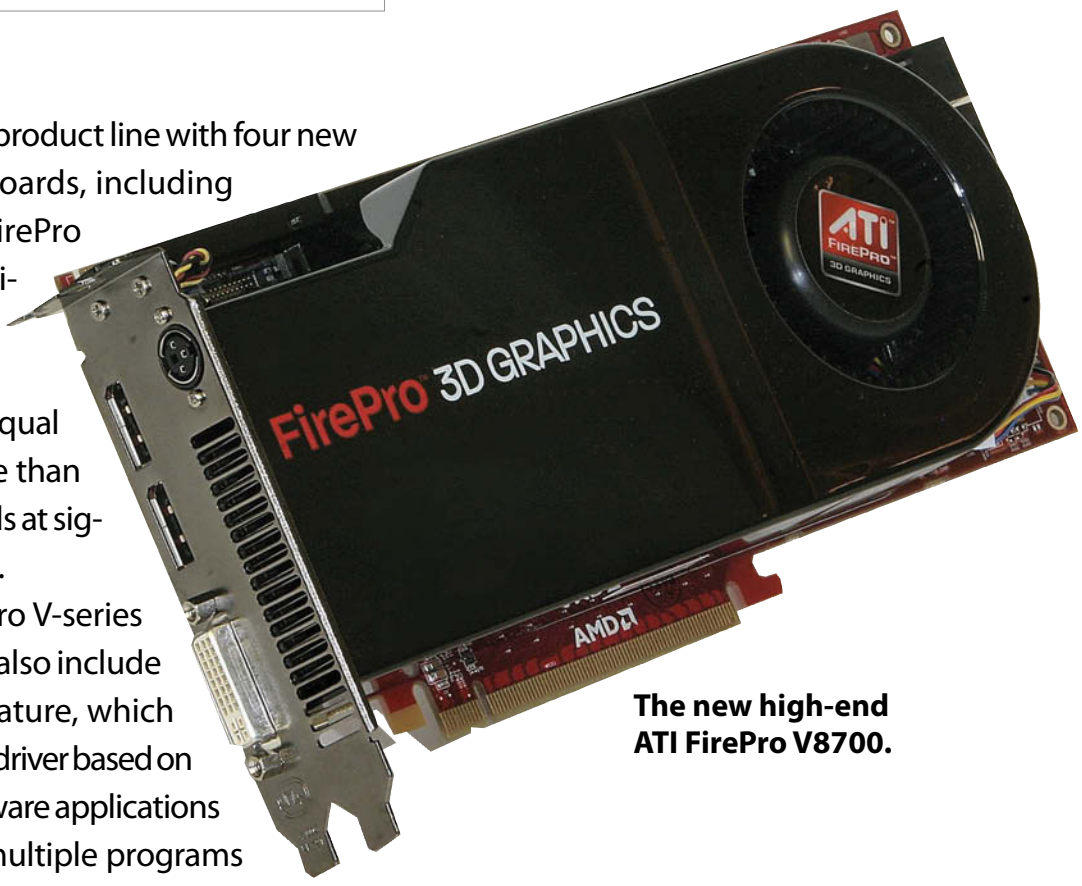
For years, ATI was the first to introduce new technology: the first PCI Express-based boards and the first workstation-class graphics accelerator with 1GB of onboard memory. But after being acquired in 2006 by Advanced Micro Devices (AMD), ATI seemed to lose its way for a while. NVIDIA, its primary competitor, beat ATI to the punch with its unified graphics architecture, replacing dedicated geometry engines and pixel shaders with a new design in which the power of the graphics processing unit (GPU) can be dynamically allocated to vertex or pixel shading, improving performance for all types of professional users.



The entry level ATI FirePro V3750. *Photos by David Cohn*

Last year, AMD began catching up, introducing its own new generation GPUs designed around a unified shader architecture, which the company calls Stream processors. The company also set a new industry milestone with its introduction of the first 2GB workstation graphics accelerator. More recently, the company became the first to introduce a 3D workstation-class graphics card with DisplayPort support.

Now AMD has completed the refresh of its entire



The new high-end ATI FirePro V8700.

workstation graphics product line with four new ATI FirePro V-series boards, including the top-of-the-line FirePro V8700, which we previously reviewed (*see* DE, *April 2009*). The new boards provide equal or better performance than last year's FireGL boards at significantly lower prices.

All of the new FirePro V-series graphics accelerators also include AMD's AutoDetect feature, which optimizes the graphics driver based on the user's specific software applications even while running multiple programs simultaneously. With AutoDetect, users no longer need to manually adjust application-specific driver settings to achieve top performance.

All four boards in the new FirePro V-series are designed with a 10-bit display pipeline and support for high dynamic range (HDR) rendering, enabling the boards to produce more than one billion colors. All four boards are also PCI Express 2.0 compatible, support hardware acceleration of DirectX 10.1 and OpenGL 2.1 advanced features, and are compliant with Shader Model 4.1. All but the entry-level FirePro V3700 include a single DVI-I connector and a pair of the new DisplayPort (DP) connectors.

The New ATI FirePro V Family

At the entry level, the new ATI FirePro V3700 ($99 MSRP/$85 average street price) provides 256MB of GDDR3 memory with a 64-bit memory controller. While those specs are similar to the previous generation FireGL V3600, the board's GPU features just 40 unified shaders (compared to 120 in the V3600). The more modest GPU and a memory bandwidth of just 15GBps results in a slight decrease in performance but enables AMD to offer this entry-level 3D graphics board for less than $100, another industry first. The FirePro V3700 requires a single PCI Express X16 slot and consumes just 32 watts of power. The board provides two DVI-I ports, both supporting Dual Link.

Not wanting to short change entry-level users, AMD also released a more powerful entry-class board, the FirePro V3750 ($199 MSRP/$169 street). This board offers the same amount of memory as the V3700 but its new GPU provides 320 Stream processing units and increases the memory interface to 128-bit. With a memory bandwidth of 24.4GBps, the board still retains the small form factor as the V3700 and also keeps power consump-

SPECviewperf Results for ATI FirePro V-series

	ATI FirePro V8700 NEW!	ATI FireGL V8650	ATI FireGL V8600	ATI FireGL V7700	ATI FireGL V7600	ATI FirePro V5700 NEW!	ATI FireGL V5600	ATI FirePro V3750 NEW!	ATI FirePro V3700 NEW!	ATI FireGL V3600
Manufacturer's price	$1,499.00	$2,799	$1,899	$1,099	$999	$599	$599	$199	$99	$249
Average street price	$1,229.00	$2,319	$1,349	$799	$769	$499	$439	$169	$85	$179
SPECviewperf 10.0 (from ATI)										
3dsmax-04	44.51	44.46	44.46	44.63	44.64	44.44	44.10	43.94	35.33	40.37
catia-02	44.67	45.00	45.00	45.15	44.68	43.64	43.63	41.55	38.10	40.43
ensight-03	48.67	51.60	51.60	54.93	47.25	42.19	37.21	34.67	23.98	26.21
maya-02	247.97	237.97	237.97	253.98	219.07	193.54	167.50	160.37	79.09	110.39
proe-04	44.64	44.17	44.17	44.55	43.77	44.40	43.16	42.99	32.12	40.90
sw-01	98.96	99.47	99.47	100.02	96.89	96.64	93.22	90.53	59.06	79.52
tcvis-01	38.77	36.95	36.95	37.94	34.32	35.75	33.45	30.18	16.94	24.65
ugnx-01	58.39	60.27	60.27	70.63	52.89	48.74	41.04	37.13	15.71	28.44
SPECviewperf 10.0 (HP xw6600)										
3dsmax-04	42.98	43.20	n/a	n/a	43.23	42.93	42.83	42.60	35.12	39.41
catia-02	42.2	41.27	n/a	n/a	41.18	41.63	40.67	39.91	37.08	38.40
ensight-03	48.5	51.34	n/a	n/a	47.04	42.06	37.31	34.43	23.96	24.85
maya-02	242.82	243.36	n/a	n/a	220.58	193.27	168.09	160.32	79.64	111.29
proe-04	36.24	35.25	n/a	n/a	35.19	36.03	35.34	36.03	31.16	34.53
sw-01	78.05	78.84	n/a	n/a	78.63	77.76	78.30	77.79	56.65	72.43
tcvis-01	35.89	33.70	n/a	n/a	32.91	34.34	31.81	29.59	16.63	23.89
ugnx-01	58.43	49.90	n/a	n/a	43.79	48.80	30.38	36.97	15.81	20.69
SPECIFICATIONS										
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	PCI Express X16	PCI Express X16
Extra power required	Yes, 2	Yes, 2	Yes, 2	Yes	Yes	No	No	No	No	No
Form factor	4.38 in. x 9.50 in.	4.38 in. x 13.25 in.[2]	4.38 in. x 13.25 in.[2]	4.38 in. x 9.5 in.	4.38 in. x 9.5 in.	4.38 in. x 6.62 in.	4.38 in. x 9.0 in.	4.38 in. x 6.62 in.	4.38 in. x 6.62 in.	4.38 in. x 6.62 in.
Slots used	2	2	2	2	2	1	1	1	1	1
Max Power (watts)	151W	225W	225W	110W	134W	56W	<75W	48W	32W	<50W
PCIe version	2.0	1.1	1.1	2.0	1.1	2.0	2.0[1]	2.0	2.0	2.0[1]
Length	full-length	full-length	full-length	2/3-length	2/3-length	half-length	half-length	half-length	half-length	half-length
Processors	800	320	320	320	320	320	120	320	40	120
Memory configuration	1GB (DDR5)	2GB (GDDR4)	1GB (GDDR4)	512MB (GDDR4)	512MB (GDDR4)	512MB (GDDR3)	512MB (GDDR4)	256MB (GDDR3)	256MB (GDDR3)	256MB (GDDR4)
Memory interface	256-bit	512-bit	512-bit	256-bit	256-bit	128-bit	128-bit	128-bit	64-bit	128-bit
Memory bandwidth	108.8 GBps	108.0 GBps	108.0 GBps	72.0 GBps	51.0 GBps	28.8 GBps	35.0 GBps	24.4 GBps	15.0 GBps	16.0 GBps
Display Connectors	DVI-I, DP, DP	DVI-I, DVI-I	DVI-I, DVI-I	DVI-I, DP	DVI-I, DVI-I	DVI-I, DP, DP	DVI-I, DVI-I	DVI-I, DP, DP	DVI-I, DVI-I	DVI-I, DVI-I
Dual Link DVI Port	Yes, 1	Yes, 2	Yes, 2	Yes, 1	Yes, 2	Yes, 1	Yes, 2	Yes, 1	Yes, 2	Yes, 2
HD component video	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Stereo 3D Support	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
OpenGL	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
DirectX/Shader Model	10.1/4.1	10/4.0	10/4.0	10/4.0	10/4.0	10.1/4.1	10/4.0	10.1/4.1	10.1/4.1	10/4.0
Maximum analog resolution	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536	2048 x 1536
Maximum DisplayPort resolution	2560x1600	n/a	n/a	2560 x 1600	n/a	2560 x 1600	n/a	2560 x 1600	n/a	n/a
Maximum Dual Link resolution	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600	2560 x 1600
Maximum Single Link resolution	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200	1920 x 1200

Footnotes:

[1] PCI Express 2.0 compatible

[2] Board measures 11.25 in. plus 2 in. metal bracket extension, for a total length of 13.25 in. Requires extended ATX (EATX) case.

tion to just 48 watts. Yet the board outperforms last year's entry-level graphics card while costing significantly less. The FirePro V3750 provides a single DVI-I port and two DP connectors, and comes with three useful adapters: DP to single link DVI-I, DVI-I to VGA, and DVI-I to component RGB.

The ATI FirePro V5700 is AMD's new mid-range entry. With a suggested retail price of $599 ($499 street), it sets a new price/performance standard and is likely to become the most popular board in the new lineup. It's no wonder. The diminutive V5700 requires just one PCIe X16 slot and consumes just 56 watts, yet provides 512MB of GDDR3 memory, a GPU with 320 unified shader processors, and a memory bandwidth of 28.8GBps. And, like the V3750, the V5700 provides one DVI-I port and a pair of DP connectors.

At the top of the new AMD lineup is the ATI FirePro V8700 ($1,499 MSRP/$1,229 street). This full-length board comes with 1GB of DDR5 memory and a 256-bit memory interface. Its GPU provides a whopping 800 unified shader processors (compared to 320 in last year's FireGL V8600 and V8650). The FirePro V8700 has a memory bandwidth of 108.8GBps and provides both HD component video and stereo 3D support as well as a single DVI-I port and a pair of DP connectors. But at this level, all that power comes at the expense of higher energy consumption. The V8700 uses 151 watts, considerably less than its predecessor, but still requires two auxiliary connections to the system power supply. As with other ultra high-end boards, the V8700 has a large cooling fan that increases the overall thickness of the board to more than an inch, rendering the adjacent expansion slot unusable.

FOR MORE INFO:

> AMD

ATI Fire Pro V3700
> Price: $99 (suggested retail), $85 (average street)

ATI Fire Pro V3750
> Price: $199 (suggested retail), $169 (average street)

ATI Fire Pro V5700
> Price: $599 (suggested retail), $499 (average street)

ATI Fire Pro V8700
> Price: $1,499 (suggested retail), $1,229 (average street)

Benchmarking the Boards

We tested the four new ATI FirePro boards using the same HP xw6600 workstation equipped with a pair of 3.0GHz Quad-Core Xeon E5450 processors, so all of our results are directly comparable. This is the same system we used to review the latest NVIDIA Quadro FX boards as well as the previous generation of ATI FireGL graphics boards, so readers can easily compare boards and see for themselves whether the performance improvements warrant upgrading from their current graphics boards.

All tests were performed using version 10 of the SPECviewperf benchmark (spec.org) at a resolution of 1280 x 1024. We also compared our results to those published on the AMD website. Our results closely parallel those published results.

While the new generation of ATI boards don't provide the same speed improvement over the previous generation as we saw last year, the new ATI FirePro

While the new generation of ATI boards don't provide the same speed improvement over the previous generation as we saw last year, the new ATI FirePro boards equal or surpass the performance of the older boards, while costing significantly less.

boards equal or surpass the performance of the older boards, while costing significantly less. All of the new ATI FirePro boards are fully certified with most CAD and DCC applications and use a unified video driver. Drivers are available for most 32- and 64-bit operating systems, including Vista, XP, and Linux.

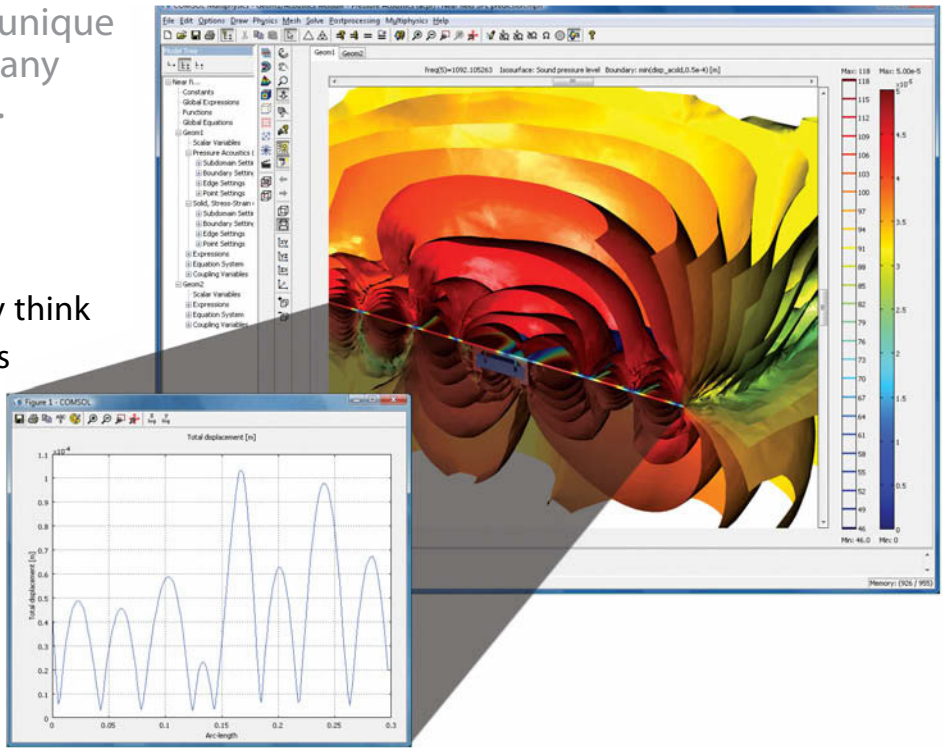
With these new boards from AMD, ATI is once again competing head-to-head with NVIDIA. And when companies like that compete, users are the winners. ■

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

COMSOL Solves SFX Unique Speaker Design

> Solution helps model unique driver that uses virtually any surface as a loudspeaker.

BY ROD HABESHAW



An isosurface plot generated with COMSOL Multiphysics illustrates the sound-pressure levels that emit from a typical panel surface when driven with the Gel Audio transducer. Here the results are shown for one frequency (1092 Hz), while the graph shows the extent of surface displacement.

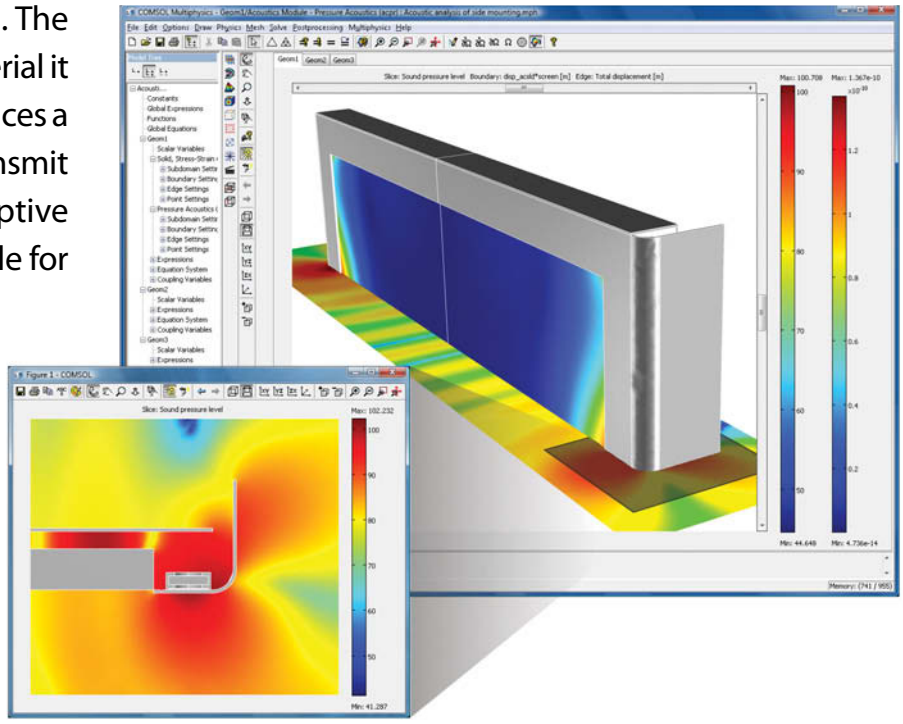
While we traditionally think of loudspeakers as separate boxes, at SFX Technologies Ltd. of Dunfermline, Scotland, we are using COMSOL Multiphysics to help us design a new type of loudspeaker driver that uses virtually any surface—from a tabletop to walls and from mirrors to dashboards—to produce high-quality sound. When a GA (Gel Audio) transducer is placed against a surface, the surface itself becomes the loudspeaker. It's virtually impossible to model this complex process on a theoretical basis on paper, which makes it a perfect candidate for numerical simulation. After having worked with several modeling packages, we found that COMSOL Multiphysics offers the combination of features and usability that best matches our requirements.

Gel as the Interface

Our speaker technology is quite unique: users mount a GA transducer to a panel without being permanently bonded to it, oftentimes using two-sided adhesive tape. The transducer's magnet and coil receive analog audio signals from an amplifier, and the gel acts as an intermediary material that transfers the acoustic waves to the

wall, tabletop, or even billboard. The panel, whatever resonating material it may be composed of, then produces a waveform. Hard surfaces will transmit sound better than softer, absorptive surfaces, but designs are available for a wide variety of applications.

While the driver can be as small as 11mm x 16mm x 2.5mm, the result is a "speaker" with good high-frequency response with the added advantage of also generating very good bass response without the need for a large speaker box. GA transducers were initially popular in places where customers didn't want speakers to be visible or accessible, such as in bus stops or public-address systems. Now, though, they are being incorporated into products such as small televisions to generate very good bass response without requiring a subwoofer. We are also looking at putting them into mobile phones for better audio response.



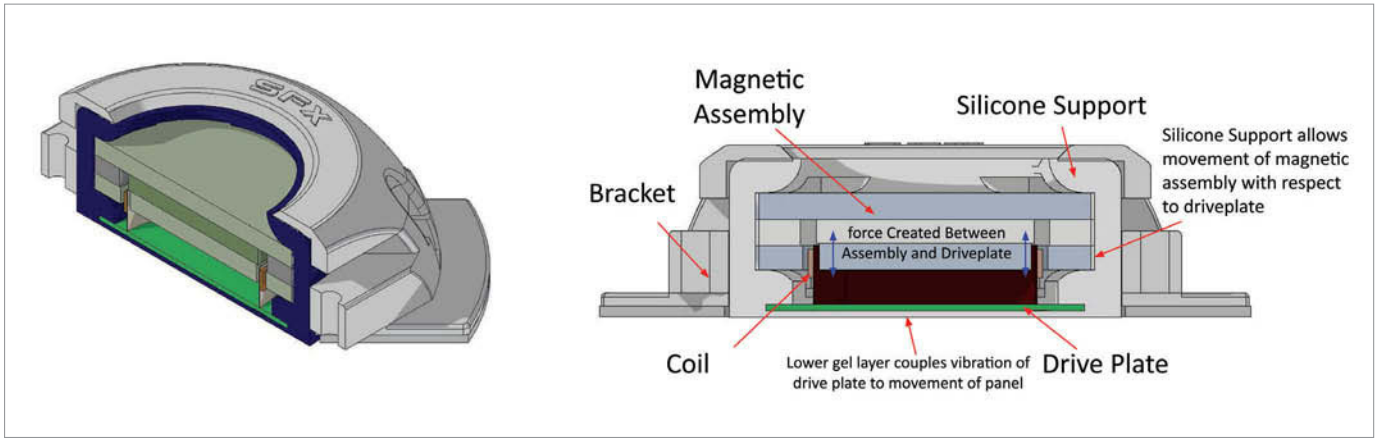
A Gel Audio transducer inside a television can produce very good bass response using the TV case as the resonating surface. The simulation of the sound pressure level at 1900 Hz shows the screen's structural displacement and a close-up 2D plot around the transducer as a slice plot.

In these cases, it is difficult to test prototypes because handset manufacturers have tight time-to-market schedules. Simulation results can show them what they can expect when drivers are incorporated into their phones so that development can simultaneously proceed on both the phone and the driver.

Previously, it would take us three months to build an initial prototype of a new design, but now we use COMSOL Multiphysics and the Acoustics Module add-on, which enables our design team to achieve a first prototype within a month. This time difference is vital for us, especially when using simulation in our design process because we must get our devices on the market quickly. This technological advantage will be even more vital as we expand from the commercial arena into consumer products.

Complicated Route to Simple Results

Our modeling process takes place in three major stages. First, we create a model of the coil and



When placed on a panel such as a wall, mirror, or dashboard, a Gel Audio transducer turns that surface into a loudspeaker with good frequency response across the audio range.

magnet to determine the forces that are generated at all frequencies. We next take these results and use them in a simulation of the panel to obtain its deformation and acceleration across the frequency band of interest. In the final step, we simulate the acoustic field that the panel would generate. Although we model intricate movement of the loudspeakers, the result we want from the simulation is relatively simple: a plot of the sound pressure level coming from the loudspeaker versus frequency.

Getting to this result, however, requires a complicated route. Simulation is first necessary to size the various mechanical components, such as the coil and magnet in the driver, and examine their effects. Further, while those two components produce unidirectional movement, the panel on the other side of the gel can produce a very complicated waveform, especially at high frequencies, consisting of movement that might lead to sound distortion and modal shapes that change with frequency.

A primary goal of the modeling is to find the optimal assembly—the right amount of gel and the best way to attach it to the surface—and doing so by considering structural-acoustic interactions. Too much gel makes the driver inefficient and unresponsive; too little leads to sound distortions. Initially, our design group used an FEA solution that loosely couples structural mechanics to acoustics iteratively. But this made modeling the acoustics domain an elaborate operation and didn't really allow us to model what we wanted. We were therefore pleased to find out that we can do all this work in a straightforward manner using COMSOL Multiphysics Version 3.5a. And things just got better using the new predefined multiphysics coupling template between the Solid, Stress-Strain, and Pressure Acoustics modeling templates in the Acoustics Module.

Every Case Unique

COMSOL proves to be very useful for us at SFX because almost every design we consider is unique; we work with a wide variety of panels and panel materials, and for each, a different driver and

mounting is required. For instance, the panel that acts as the loudspeaker might be made of any of a variety of plastics, various rubbers and elastomers, or a composite material such as cardboard. In this case, our modelers improvise by representing the panels with isotropic materials. Besides using COMSOL Multiphysics for all of our

COMSOL proves to be very useful for us at SFX because almost every design we consider is unique.

new speaker designs, we are also examining new ways of shaping panels, where modeling provides an understanding of the involved phenomena as well as concrete design parameters. In addition, we are also starting to combine traditional loudspeakers and GA transducers in the same system. Modeling is essential in these efforts where the acoustics-structure interaction from both devices, and their effects on each other, must be considered. ■

Rod Habeshaw *studied acoustic engineering at Salford University, UK, and then worked as a consultant in noise and vibration. He is currently a senior acoustics engineer at SFX Technologies Ltd. Send comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

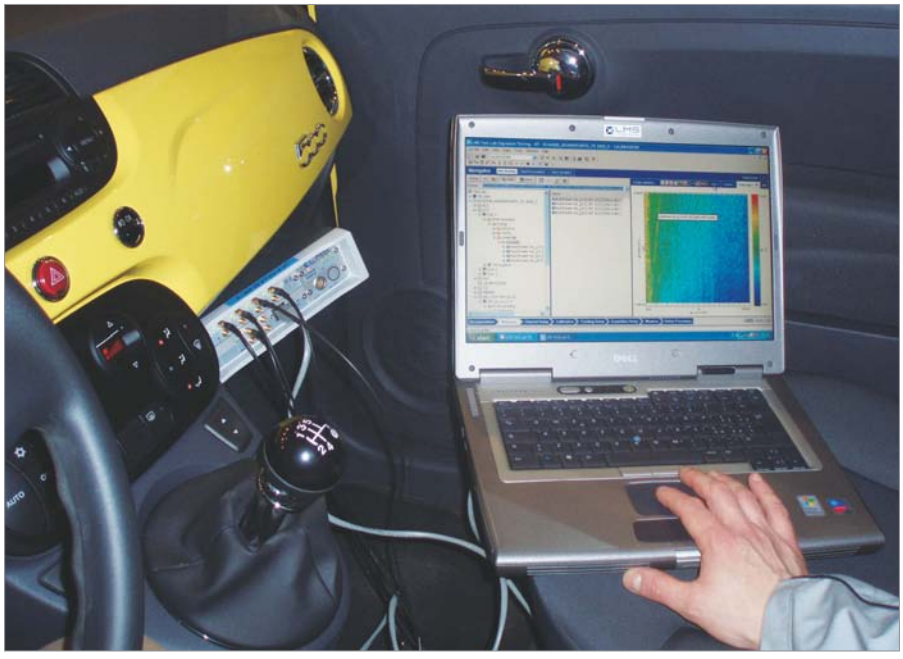
> COMSOL

> SFX Technologies Ltd.

Fiat Counts on LMS for Speed and Efficiency

> Time-effective design and testing enabled by LMS Test Lab at the car-maker's multiple facilities.

BY JENNIFER SCHLEGEL

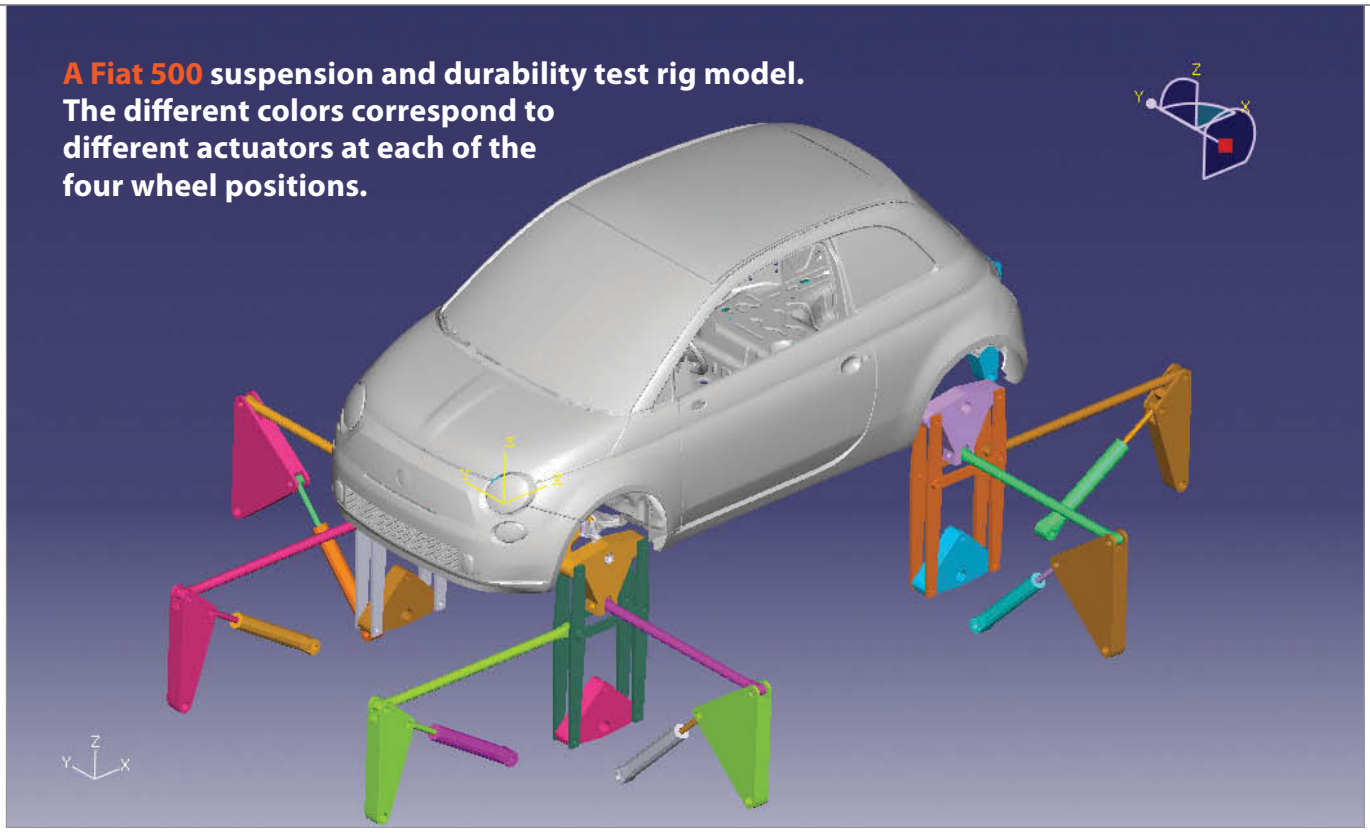


LMS created this uniform on-the-road testing system especially for Fiat. The LMS SCADAS Mobile front-end is not only compact enough to slide right onto the dash of the Fiat 500, but its seamless connection with the LMS Test.Lab software also lets technicians and engineers set up automated test runs on-the-fly on their laptops.

Fiat, which has improved the quality of its vehicles over the past decade by focusing on innovation and efficiency, found itself facing an ambitious release schedule of 20 new vehicles from 2007 to 2009. To meet that schedule, Fiat realized it needed to change the way it developed and designed cars.

One aspect of that change was to chisel weeks off the testing process. To successfully design and test cars like the Fiat 500 and the new Bravo in a speedy 18 months without compromising quality, Fiat altered certain aspects of its vehicle development chain. Starting in 2003, its noise, vibration and harshness (NVH) engineering team migrated to LMS Test.Lab. The resulting configuration—a platform of 12 laboratory (including a dedicated fixed system in the wind tunnel) and 16 mobile field test systems (including a pilot project on the production line)—stepped up NVH engineering productivity while raising process automation and data management standards at the same time.

To extend engineering capability and productivity in this engineering discipline, Fiat decided to convert its entire range of LMS CADA-X test

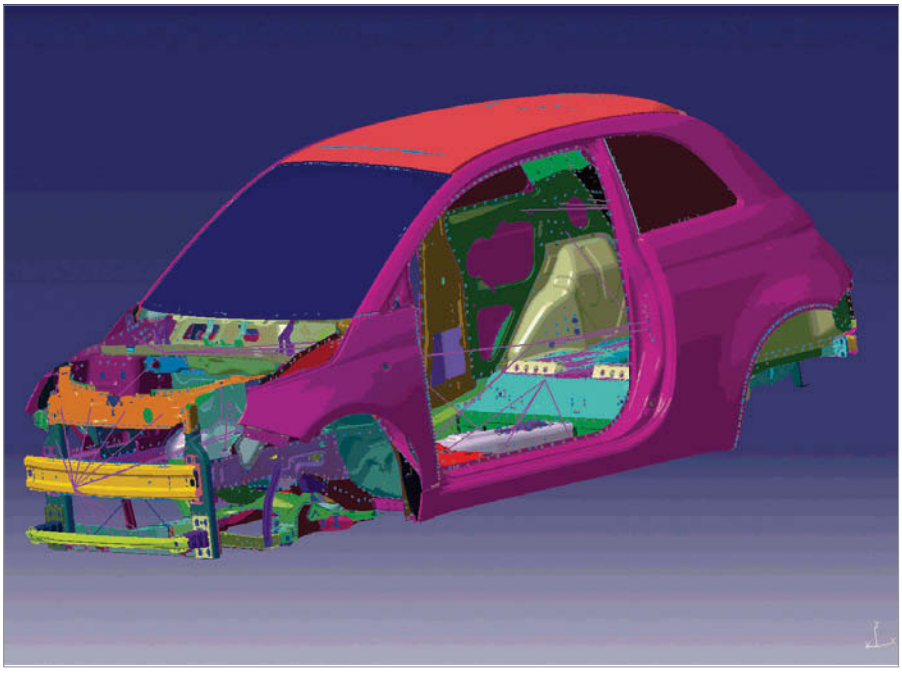


A Fiat 500 suspension and durability test rig model. The different colors correspond to different actuators at each of the four wheel positions.

solutions to the next-generation LMS Test.Lab platform.

"After executing Fiat-specific test processes using LMS Test.Lab," says Giovanni Toniato, NVH manager at the auto company's engineering and design department, "our NVH specialists reported a considerable increase of 25 percent in testing productivity and an impressive improvement of ease of use, both for laboratory and field testing applications."

With integrated report generation features including LMS Active Pictures in Microsoft Word and PowerPoint presentations, as well as customized templates and system-integrated formats, Fiat managers can access critical testing data and results without having to depend on a technical expert to extract or interpret any of the data for them.



An FE model of the body in white. The colors represent the different body sections.

"Thanks to a number of floating licenses, several key managers can access the vital LMS Test.

Lab data they need right from their desks," says Toniato. "They can also integrate a dynamic visual into a presentation or report. This immediate access to essential information saves valuable time for every team member and prevents unwanted bottle necks."

Seamless NVH Data

To streamline the system for all the different labs, design centers and R&D locations, the local team at LMS Italiana customized the LMS data acquisition, management solution to meet Fiat's precise needs. Besides standardizing templates and customized printing capabilities, it also included adapting the system to specific archiving rules and integrating a customized acquisition procedure so that users could easy match various procurement numbers with specifications from a dedicated list. Several dedicated modules were also customized locally to further close the gaps between the required specifications, the data acquisition process, and the actual testing process itself.

In a crunch, the test team can opt to run tests on the track in the morning and analyze and document the results onsite in the afternoon.

Part of this system integration includes a dedicated solution at Fiat's renowned Balocco proving grounds. Several LMS SCADAS front-end portable units combined with LMS Test.Lab Mobile software solutions are used. Because of built-in mobility, rapid test setup, online monitoring, immediate visualization, and onsite report-generation capabilities, LMS Test.Lab Mobile cut the routine testing process from weeks to several days. In a crunch, the test team can opt to run tests on the track in the morning and analyze and document the results onsite in the afternoon.

"Traditionally, Fiat test drivers at the Balocco

Optimizing Durability on Virtual Prototypes

At Fiat, the increased speed of vehicle development as well as the market demands for reduced emission levels and better performing, lighter-weight cars point to the need for new ideas and innovative tools that can be easily integrated into the internal methodology and processes to drive new vehicle development and specifically anticipate fatigue life prediction.

There were several key technological factors in Fiat's choice to use LMS Virtual.Lab Durability as a reference standard, such as intelligent filtering to reduce CPU time, strain life fatigue and stress life fatigue approaches, and implementation of gradient effects in fatigue life prediction.

On the graphic user interface side, LMS Virtual.Lab Durability is flexible when it comes to interchanging various linear and nonlinear FE data. Furthermore, it makes it easier to remesh the spot weld areas for the stress-based finite model approach.

track not only perform the instrumental test, but they also integrate it with a subjective test," says Toniato. "It can be challenging to prepare an error-free and easy-to-use procedure that lets our people concentrate not only on measurements, but also on their subjective impression."

To eliminate variables, like typing errors and miscalculations, LMS Italy created an easy-to-use on-the-road system that guarantees that every single measurement is done exactly the same way, matching the same parameters in the lab and on the track.

The new LMS system allows test personnel save time and guarantees quality results track-side at the proving grounds or in the vast testing center in Torino, Italy.

"Working with a single open-platform system facilitates the work of all Fiat test operators, who regularly deal with varying NVH test assignments, covering classical modal, dynamic stiffness, transfer path, acoustic response, and sound quality measurements," says Toniato. "Through this open environment, we succeed in providing the freedom that is required to efficiently capture and perform any test assignment."

According to Filippo D'Aprile, the director of vehicle architecture and integration in Fiat's engineering and design department, "the migration to LMS Test.Lab really paid off. We've been able to tailor it to Fiat's broad user community with floating versions for our experts and locked-parameter versions for general usage. Our entire organization can now benefit from the same software for the lab and proving ground measurements, which significantly streamlines the process. Our experts only need to use one system. This cuts our training time and cost."

"Our entire organization can now benefit from the same software for the lab and proving ground measurements, which significantly streamlines the process. Our experts only need to use one system. This cuts our training time and cost." *— Filippo D'Aprile*

Besides the numerous solutions in the front-end of design, Fiat is currently using a LMS Test.Lab solution in a production line pilot program in their Cassino, Italy, plant. Configured to match the exact NVH parameters in the lab and proving environments, the system re-measures various NVH parameters of cars as they come off the production line to guarantee overall quality.

"Thanks to our successful partnership with LMS, we've started to integrate LMS Virtual.Lab modules into our testing structure. We find the noise and vibration and correlation modules can really accelerate our processes. We also opted for LMS Virtual.Lab Durability as a CAE department standard as well," says Toniato.

By deploying LMS Test.Lab and teaming up with LMS to further streamline its NVH test processes, Fiat has succeeded in raising test productivity. At the same time, LMS Test.Lab allows Fiat's NVH specialists to gain a deeper insight into underlying technical phenomena, providing validation at various stages in the development process. It has become an essential aspect of the company's ability to develop high-performance, comfortable and appealing vehicles that people want to drive. ■

Jennifer Schlegel *works in the marketing department at LMS International. Send comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Fiat Motors

> LMS

Reverse-Engineering Now Standard Practice

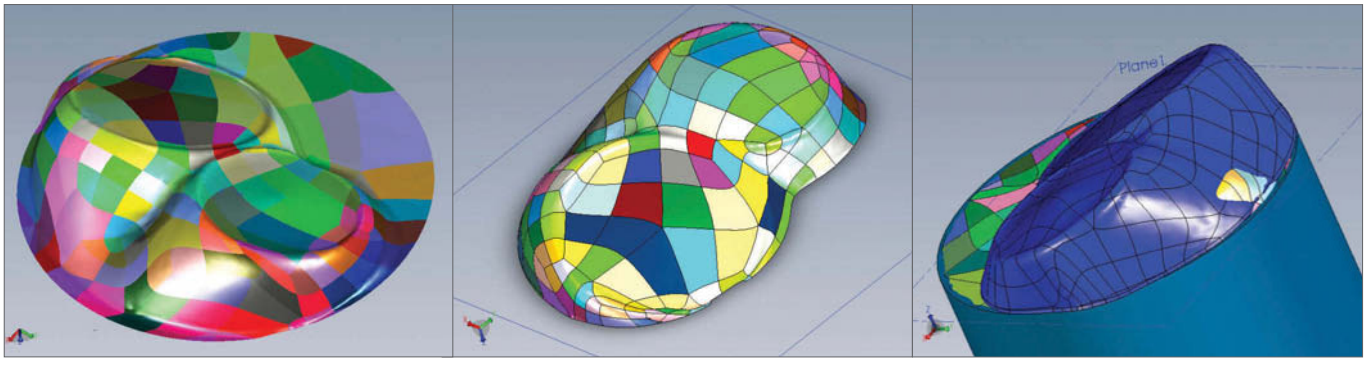
> Dissecting the digital capture of shapes and development of models for creating unique manufacturing workflows.

BY KENNETH WONG

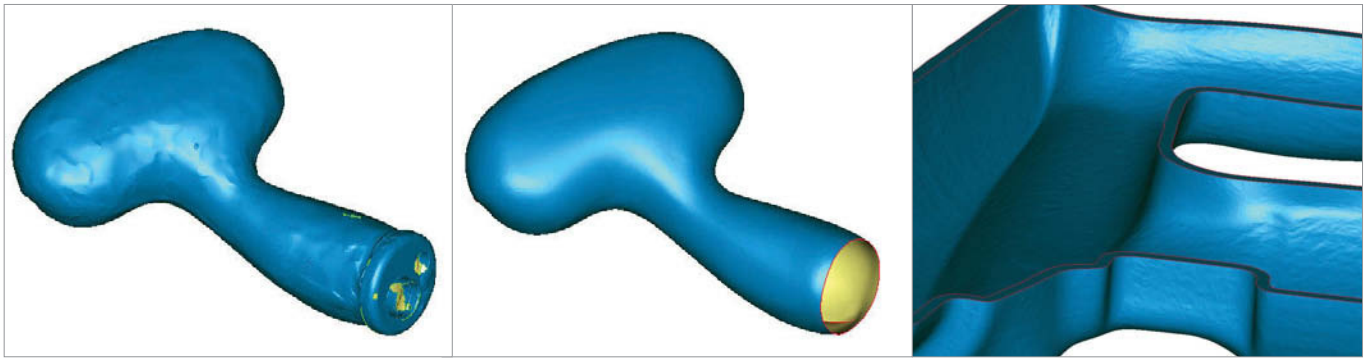
In general, reverse engineering refers to the process of identifying, extracting, and studying the underlying methods involved in the manufacturing of an existing object. Among mechanical engineers who rely on CAD, the term refers more specifically to the use of a hardware-software combination—typically, handheld or automatic scanners to capture the shape of an object and complementary software packages to convert the digital data into an editable set of geometry—to study an existing product's shape, structure, and integrity. This method has proven to be particularly useful in developing tailor-made items (prosthetics for amputated patients), one-of-a-kind products (piston heads for modified vehicle engines), or discontinued mechanical parts (municipal water pumps whose original manufacturer has gone out of business). In this article, we take a closer look at reverse-engineering solutions from a number of companies, along with examples of how their products were successfully deployed.

Head-On Product Development

Scott Sulprizio and his brothers run a family business, United Engine and Machine Company, founded by their grandfather Deuta Sulprizio, Sr. in 1922. During World War II, the firm briefly dabbled in supplying PT boat equipment and



By digitizing its piston heads (top view: left and hollow inside view: center), United Engine and Machine is able to verify how its product will fit on the target cylinder head (right) and identify potential problems beforehand.



The use of Geomagic software allows Advanced Design Concepts to automatically parse the irregularities in its original scan data of projects (left) to a smoother version (center). This information is later transformed into a shell (right).

small munitions, but it eventually returned to its roots as a piston maker. Since it primarily serves after-market automotive customers, it relies on reverse-engineering to capture its customers' unique cylinder heads to produce matching piston heads.

"Our goal [in using reverse engineering] was not only to scan the cylinder head but also to capture the numeric values we can apply to our piston-head making," says Scott Sulprizio, co-owner. "We use a Faro [mechanical coordinate measuring machine] to capture the specific points—circular points, dowel points, dowel angles, head-plane dimensions, and everything else associated with a cylinder head. Then we use a laser scanner to capture the form of the cylinder head." For editing the captured point-cloud data, the company uses Verisurf and Mastercam.

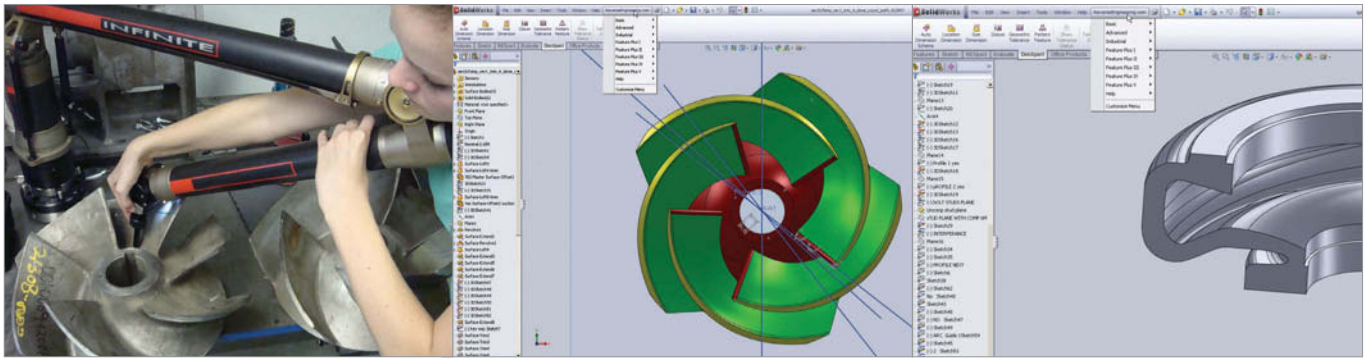
A digital model reconstructed from a combination of the two—specific points on the cylinder head and the overall shape of the head itself—lets United Engine and Machine design and produce a piston head that fits the target cylinder head like a glove.

Reverse engineering tools helped the company not only develop new product lines but keep its product portfolio manageable. Instead of storing plaster or rubber molds of each cylinder head, the company maintains a digital library, easily handled in a computerized document control system. This allows for storage of the entire data capture process, which then can be used for a variety of projects.

For instance, take the Chevrolet Big-Block family," explains Sulprizio. "All cylinder suppliers offer a slightly tweaked version of Big Block. With reverse engineering, we can study them and see where the variations are, then come up with a piston head that works across three different manufacturers' cylinder heads."

One of the many features he likes about Verisurf, Sulprizio says, is the abilitiy to display the collected point clouds from a scanning session in various levels of detail, automatically create a mesh from the point clouds, and convert the mesh model into a surface model that can be imported to Mastercam.

Currently, United Engine and Machine is accumulating an entire archive of 3D digital cylinder heads from different manufacturers. This growing



Using ReverseEngineering.com's CAD plug in, the company's clients are able to capture the shape of industrial mechanical parts no longer produced by the original equipment makers. The process allows companies like BMC Industries to find a market reproducing discontinued parts.

library gives the company an advantage over its competitors, allowing it to swiftly design piston heads with great detail as 3D files that can be fed to its CAM system.

Getting a Grip on Point Cloud

Plowing snow with an industrial-size municipal vehicle is no game, but a playful device like a joystick could make the job easier. So FORCE America, which specializes in mobile hydraulic systems, components, and replacement parts, offers its clients a joystick-like device to control the plow blades (*see "Advanced Design Uses Geomagic to Halve Prototype Time" at deskeng.com*). Before the joystick became a reality, it existed merely as a clay prototype.

As the reverse engineering manager of Advanced Design Concepts (ADC), the firm contracted to help design the joystick-style electrical control system, Greg Groth received one of the early clay models.

The shelled housing of the handheld control must incorporate a series of internal mechanisms. So the first thing Groth did was to produce the internal components in physical form. Using the reference drawings supplied by the client, Groth and his team modeled the necessary internal components in CAD, then printed them out as physical prototypes in an Eden 3D printer from Objet Geometries, an investment the firm made a few years ago. (Most of the internal components, such as buttons and circuit boards, were standard parts that could be purchased, so he didn't need to model every one of them.) This allowed him to determine how the outer shell and the internal parts would fit together.

When the clay model was ready for digitizing, Groth and his colleagues used an ATOS GOM white-light scanner to capture the general shape. The use of Geomagic point-cloud processing and surfacing software allowed Groth to automatically smooth out the curvature irregularities picked up by the scanner. Afterward, Groth created a shell structure with the desired wall thickness from the 3D geometry. The model was then further refined in PTC's Pro/ENGINEER. The 3D printer, white light scanner, laser scanner, and Geomagic software are all part of what ADC calls digital shape sampling and processing (DSSP).

Digging into Point Clouds from CAD

If you're in need of a replacement part for a municipal water-pump system supplied by an original equipment maker that has gone out of business, who do you turn to? One company is the California-headquartered BMC Industries, which takes pride in its ability to "completely reverse engineer, customize, and manufacture parts and systems."

As part of its bailiwick, BMC will duplicate the creations of original equipment manufacturers that have gone out of business. BMC's reverse engineering capability is enabled by ReverseEngineering.com, which develops and markets a line of CAD plug-ins that let you scan a physical object, collect the target points, then convert the data into a 3D model—all directly from within your preferred CAD program.

For example, a municipality once called BMC Industries explaining that it was only getting 18,000 cubic feet of water coming out of a pump that should have been supplying 20,000. "The pattern makers who replicated the part from the original manufacturer that has gone out of business was good at what they did," says Braxton Carter, chief technology officer for ReverseEngineering.com, "but they probably weren't able to fully examine the tricky surfaces of the impeller, so their [replacement] part wasn't able to produce that extra 2,000 cubic feet."

With ReverseEngineering.com's software, Carter says, BMC was able to compare the original part and the pattern maker's replacement part and identify the differences. "Then [BMC] did a laser scan and a hard probe [of the original part]," he added. "Within three hours, they had a solid model of the [corrected] impeller," ready for reproduction.

ReverseEngineering.com's dedication to bridging CAD and point cloud data is evident in its lineup of plug-ins, which essentially encompass every major CAD system in the market. It produces point-cloud capturing and processing tools for SolidWorks, Solid Edge, Siemens' NX, PTC's Pro/ENGINEER, CNC's Mastercam, AutoCAD, Autodesk Inventor, Rhino from McNeel North America, and KeyCreator from Kubotek. Its application programming interface (API) for scanning devices accommodates Immersion, Romer, Faro, Polhemus, and 3D Creator from Boulder Innovation.

"We use a proprietary algorithm that lets the software lock on to the true part coordinate system, so when you laser-scan, you see the result as you would in your CAD system's drawing view," explains Carter.

Carter says the company is planning to open its device-to-CAD integration API so that scanning machine makers may use this code—called High-res Integrated Point-cloud Processor (HIPP)—to develop plug-ins compatible with supported CAD programs.

"Ultimately, we'd like our API to become known as the standard," says Carter. The code, however, will remain ReverseEngineering.com's proprietary technology, not open source.

Popular Reversal

The critical part of reverse engineering is the software-aided cleanup process to automatically identify, crop, and remove the irregularities and extraneous points collected in a scanning ses-

A Few Simple Tips

If you're just starting out in reverse engineering, here are a few tips that you might find useful, straight from long-time practitioners.

"If you have a part with shiny surfaces, like aluminum, you should use a spray-on developer [a thin coat of white paint] to give the part texture. It makes it easier for the laser to pick up the details. The shinier the material, the harder it is to scan. Dull, gray surfaces seem to work best."
—***Scott Sulprizio**, co-owner of United Engine and Machine Company, Verisurf and Mastercam user*

"A white light scanner cannot penetrate deep into cavities, so we use it in conjunction with a laser scanner."
—***Greg Groth**, reverse engineering manager, Advanced Design Concepts*

"You should really map out your repeatable part-alignment areas [the scanned areas that you have chosen to deliberately overlap so the software can use the specific points or markings on these areas for subsequent alignment]. If there's a feature in those areas that cannot easily be replicated in vector lines because of the clipping, you could lose a lot of time."
—***Braxton Carter**, chief technology officer, ReverseEngineering.com*

"Have your articulated mechanical arm in sync with the laser probing arm. You can use the arm to directly define certain boundary curves, hole locations, and other features that are not easy to define in point clouds."
—***Braxton Carter***

sion. Geomagic, which supplies the conversion software used by Advanced Design Concepts, has been around since 1996. Its software now enters its 11th incarnation. Verisurf, used by United Engine and Machine Company, is now in its 10th release, known as version X. ReverseEngineering.com has been refining its algorithm since 1986. As point-cloud processing algorithms mature, extracting meaningful geometry out of scan data gets easier and faster. Once associated with industrial espionage, reverse engineering has earned legitimacy over the years because it's quickly becoming a standard practice. ■

***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 KennethWongCAD, or send e-mail to DE-Editors@deskeng.com.*

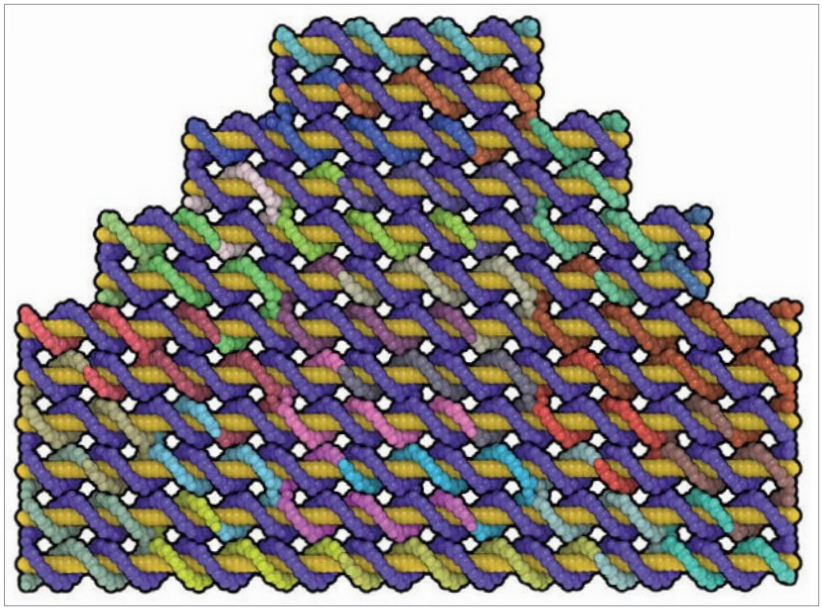
Nanotechnology Enables Real Atomic Precision

> From the bottom up or the top down:nanotechnology garners $1.6 billion of the President's 2010 budget.

BY SUSAN SMITH

While nanotechology might mean different things to different people, the term was originally coined to describe the building of things from the bottom up with atomic precision. That, says Steve Vetter, CEO of Molecular Manufacturing Enterprises of Saint Paul, MN, means "a place for every atom and every atom in its place."

Noted physicist Richard Feynman gave a talk at the 1959 meeting of the American Physical Society at the California Institute of Technology (Caltech) entitled, "There's Plenty of Room at the Bottom," about designing to the atomic level versus miniaturization. He talked about microscopic biological systems that can manufacture substances and move around on a microscopic scale.

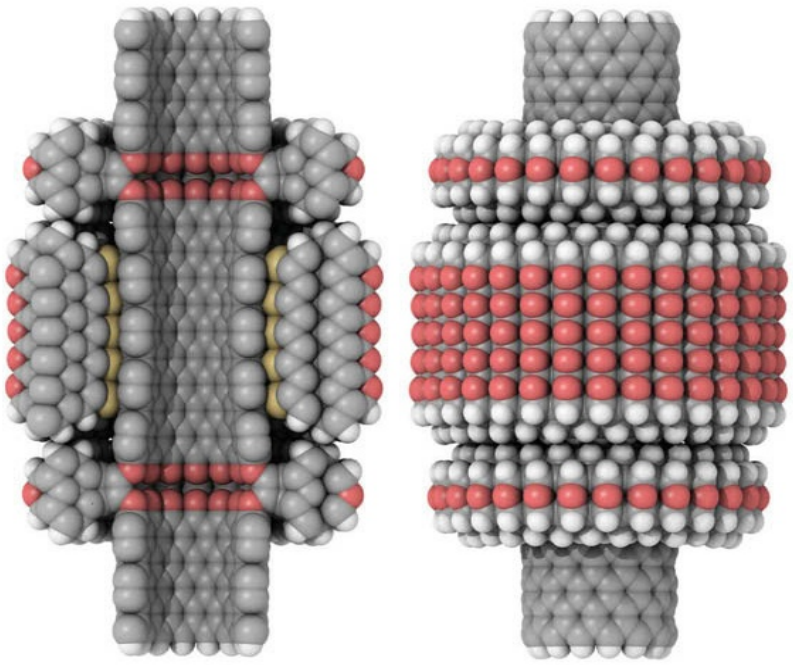


This model, titled DNA origami, was modeled using NanoEngineer-1, which includes special support for DNA structure design. It represents a milestone in the field of nanotech due to the affordability and simplicity of fabricating billions of DNA nanostructures at one time. In the image above, each strand of DNA is given its own color.
Image courtesy Paul Rothemund, CalTech

Yes, Manufacture

For almost 20 years Boris Fritz has run rapid prototyping labs at Northrup Grumman. "I began to realize a lot of work done in nanotechnology is actually additive layer fabrication," he said. "I wanted representation at the Society of Manufacturing Engineers (SME) for nanotechnology because SME focuses on manufacturing."

Nanotechnologists typically focus more on nanoscience, said Fritz, than on the manufacturing side, yet ultimately nanoscience is headed toward creating useful manufactured products. The scale



The strength and stiffness of carbon nanotubes have made them important as building materials in many current nanoscience applications. Their range of use is expected to extend to molecular manufacturing applications in nanoscale scaffolding and molecular electronics. Their cylindrical shape and electronic structure make them interesting components in designs of molecular bearing assemblies.
Image courtesy Damian G. Allis, dept. of Chemistry, Syracuse University

being investigated is measured in nanometers, a bit more than 20 times the diameter of a hydrogen atom; the average human hair is about 100,000 nanometers in width.

To help get us there, the National Nanotechnology Initiative—managed within the framework of the National Science and Technology Council (NSTC)—resolved to coordinate federal nanotech research and development in 2001. Spearheaded by the Foresight Institute (FI), the initiative took a detour, according to Vetter, when members of the Nanotech Business Alliance and "others" shifted the definition of nanotechnology away from "building from the bottom up with precision" to "building anything under 100 nanometers."

"That's the current definition you'll find almost anywhere because there's almost $1 billion of government money heading towards that definition," explained Vetter. "The problem is there are a lot of things under 100 nanometers, in fact one of the chip manufacturers said everything we do is under 100 nanometers, so every chip would qualify as nanotechnology, which is crazy. It's too broad of a definition; it completely siphons off the money that should be going to the atomic precision stuff."

FI and many of its followers are doing what they can to fix this. According to Vetter, the group hired a consultant in Washington to try to help at one point, but "it is a steep uphill battle…. There has been a tiny bit of progress in the sense that recently a few small DARPA grants have focused on a few key steps leading toward atomically-precise manufacturing."

The President's 2010 budget for nanotechnology provides $1.6 billion for the National Nanotechnology Initiative (NNI), which does show commitment and promise for the industry. Currently the NNI involves the nanotechnology activities of 25 federal agencies, 13 of which have budgets for nanotechnology research and development for 2010. Included on the list of participating federal agencies are the Department of Homeland Security and the National Institutes of Health (NIH).

CAD and Nanotechnology

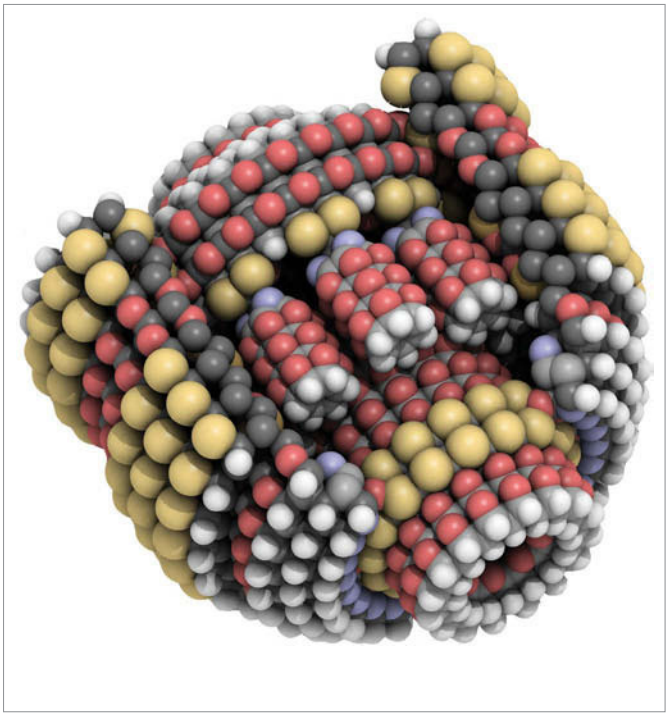
If Feynman's vision is correct, then how designers scale down CAD capability to design at the nano level and how the process of building from the bottom up is controlled at the nano level becomes the challenge.

Software called NanoEngineer from Nanorex.com, developed by Mark Sims, begins to address the challenge. In this case, the software for nano design is a CAD software. The trick is taking the effects of classical physics in normal scales and reconciling them with the atomic world of quantum mechanics.

According to Tihamer Toth-Fejel, a senior research engineer at General Dynamics of Falls Church, VA, additive rapid technologies might offer some answers. He says there are a number of processes that will be able to do this at the nanoscale; the DARPA-funded Tip-Based Nanofabrication Project, for example, has nine different teams working on developing this technology.

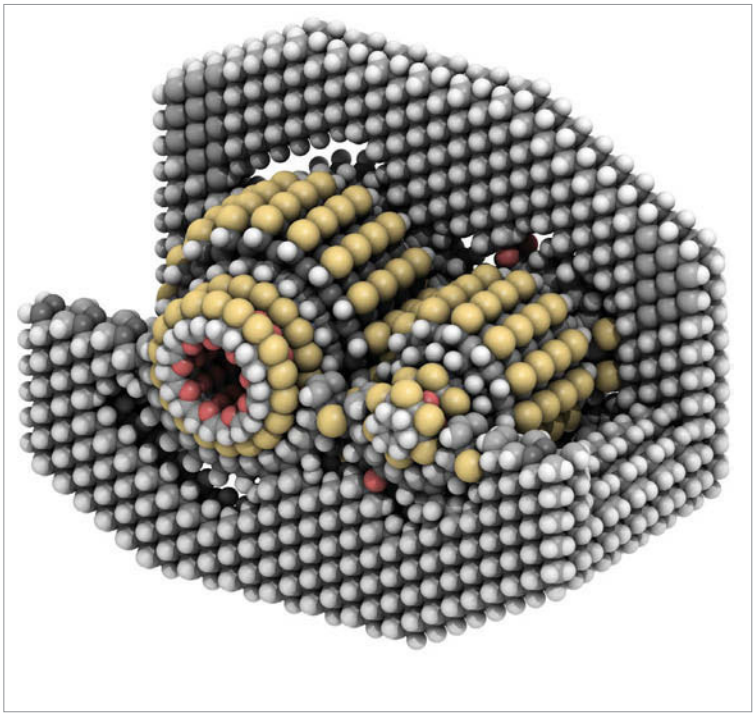
At the nano level, dip-pen nanolithography from NanoInk is used to achieve a layer-by-layer process using atomic force microscopes (AFM) with non-passive tips that interact with atoms.

"It doesn't just give you an interpretation or visual image, so you have these silicon nitrite tips and diamond tips, where the tip goes from 8 microns down to 15 nanometers—so it's the world's smallest pen, 15 nanometers, and there you can have an ink that writes the stuff in the atoms," said Fritz. "It's a solvent that holds nanoparticles or DNA so you can interact and deposit things layer by layer. The dip-pen lithographic process will use as many as 55,000 pens in an array with multiple materials to create things at the nano level." One of the goals, said Fritz, of making integrated circuits at the nano level to produce more powerful computer chips.



This is the MarkIII(k), a nanoscale planetary gear that couples an input shaft via a sun gear to an output shaft through a set of planet gears. The planet gears roll between the central sun gear and a ring gear on the inner surface of the casing.
Image courtesy of K. Eric Drexler , Nanorex, Inc.

It's a type of atomic spray painting on surfaces, one layer at a time, using a kind of chemical vapor deposition process. Nearly perfect crystals can be grown, one atomic layer at a time. For example, 70 percent of the world's supply of solid-state semiconductor lasers used inside of CD players are made this way. "This method can produce a square centimeter of this semiconducting laser that's over one quadrillion atoms with as few as three atoms out of place."



This is the SRG-I(c), a nanoscale speed reducer gear modeled using NanoEngineer-1. This gear assembly includes a pinion gear (small), an output gear (large), and a casing with embedded bushings that hold the two gears in place so that they mesh. The goal of the SRG-I(c) was to create a simple speed reducer gear with as few atoms as possible.
Image courtesy of Mark Sims, Nanorex, Inc.

Futuristic Nano

Fritz said there are other ways. Chemistry has been doing nanotechnology forever, it turns out, but it has been doing it without precise control. That precise control of only three atoms out of a quadrillion being out of place defines nanotechnology. Chemistry creates a chemical reaction of Avogadro's numbers of atoms (10^{23}) but comes with no global location control or local orientation control over where each atom goes.

That kind of control is exemplified in the example from Nanorex's NanoEngineer, which helps design DNA to generate a specific shape (such as billions of DNA smiley faces) which could lead to hundreds of throwaway supercomputers on a fingertip.

Changing the Future

Self-replication is not a new idea; it was a dream of mathematician and philosopher Renee Descartes in the 17th century. Fritz describes the best example of self-replication in nature as fire. "As long as you have the substance to burn and oxygen and heat, the fire will keep on replicating forever. It's a self-replicating process. At the nano level we could start replicating things, like one desktop nanofactory making a second desktop, like one robot making another robot. But right now a lot of that self-replication is happening in rapid prototyping –so you have places like MatLab at MIT and RepRap and several others talking about this."

The additive layer allows for full assemblies to be grown layer by layer at the nano level. At Nanorex.com, founder of the Foresight Nanotech Institute, Dr. Eric Drexler, considered the "father of nanotechnology," has designed a roadmap that shows the building of subassemblies into higher-level assemblies inside a desktop factory, which then manufactures the product of your choice. The ultimate goal is to create a desktop nanofactory appliance that could be used in your home to build anything you need.

DNA and fake blood cells, or "respirocytes," are also in the works. "If we replace 10 percent of your blood with those respirocytes, then you can hold your breath for four hours," Fritz said. "That way, if you have

a heart attack you can call the hospital and tell them you're going grocery shopping first and then stop by the hospital and they will have everything ready."

DNA Origami was invented by Dr. Paul Rothemund, and a practical application has been demonstrated at Arizona State University to help doctors identify pathogens by giving a scraping to the lab on a chip. It can determine which pathogen you're suffering from just by analyzing its RNA—assuming of course that the one you are suffering from is part of its "library." Currently, it can only identify three RNA strands, but it does it almost perfectly, even with extremely low concentrations.

Another possibility are "foglets," micron-size robots made of nanoscale parts that have little arms that hook together. The idea was developed by J. Storrs Hall, author of Nanofuture: What's Next for Nanotechnology. Foglets are run by a simple software that enables billions of them to act like shapeshifters. A large enough collection could reform into different furniture, or with more complex control algorithms, behave like the Star Trek Holodeck or the Terminator T-1000 killer robot.

Current Nano Applications

Toth-Fejel believes we are in the "stone age" of nanotechnology. "In nanotech, applications that have relatively disorganized size and surface effects are already on the market—I'm talking about nanoparticles, nanocoatings, and carbon nanotubes. The companies involved at this stage are working on increasing production while lowering costs."

With nanoparticles and nano coatings there is slightly more engineering required to increase precision, since now we only have fairly high control in just one dimension. Carbon nanotubes (CNTs), allotropes of carbon with a cylindrical nanostructure, are a good example. They have been constructed with length-to-diameter ratios of up to 28,000,000:1, which is significantly larger than any other material. These CNTs are strong, with unique electrical properties, and are efficient conductors of heat.

The National Institute of Standards and Technology (NIST) did a study of the 50-100 carbon nanotube companies in the U.S. only to learn that there are many problems in the making and selling of carbon nanotubes. Zyvex Materials has developed a technique for embedding carbon nanotubes in epoxies, which would offer 10 percent greater material strength with only two percent loading.

Meanwhile, engineered nanoparticles like dendrimers, silsesquioxanes, and celluistic nanocrystals are poised to enter the market. A successful example of the use of nanocrystals is the nano pants, which offer stain resistance in dress pants and ties. This type of application is what's known as "nano-enabled," where some difficult engineering at the chemistry level is done so that the exact properties of a molecule being built is tightly controlled, adding 0.001 percent by weight of a material to a product, thereby significantly increasing the value of the final product.

Productive Nanosystems

Toth-Fejel's area of interest is in Productive Nanosystems, currently making progress in the laboratory phase, with product demonstrations possibly five years out. The bottom-up approaches, like DNA Origami, need to build logic circuits com-

plex enough to do error correction (like modern computers do), while top-down techniques like Patterned Atomic Layer Epitaxy need to bootstrap by using one probe to build another.

One of his current projects involves Pattern Atomic Layer Epitaxy, in which a scanning probe selectively removes hydrogen atoms from a silicon surface, and then allows another layer of silicon to deposit on the dangling bonds left behind. This top-down process is funded by DARPA for Zyvex, and expects to match the first phase of its research process in the next month or so.

Reducing Environmental Impact

Many people are concerned about nanotoxicity, which Toth-Fejel says is a valid concern, as additional surface area will make nanoparticles more reactive. This occurs because the surface area to volume ratio of particles grows exponentially as they are made smaller and smaller, meaning that more atoms (per pound) are exposed to the environment, especially the atmosphere or water. The result is that chemical reactions (such as oxidation) occur much faster. But on the other hand, researchers hold that nanotech will help reduce pollution and energy waste significantly in manufacturing, as it is more precise.

Nanoparticles tend to clump, which makes them difficult to produce. "When we engineer particles we'll be able to make them so they're biodegradable and make them more stable when we want them to be stable," said Toth-Fejel. "Or vice versa. You can design at a level that will give more control over green processes, where you want less waste."

Although respirocytes may make it possible for people to live longer, Toth-Fejel says that nanosystems might make it possible for people to get off the planet using the technology to develop low-cost launching platforms and systems.

Manufacture of solar energy cells has traditionally required a multimillion dollar facility to produce photovoltaic solar cells at 40 percent efficiency, prohibitively expensive for most people. Nanosolar is using nanoparticles to increase the efficiency of organic photovoltaic solar cells from 2 percent to 5 percent, thereby lowering the cost of solar electricity.

The researchers at NanoSolar are printing nano solar cells by the roll much like the garbage bags from grocery stores. To be able to build them with 40 percent efficiency roll to roll, could literally "change the world."

Many different nanotechnologies are converging on the same basic concept—to control not just trillions, but kilogram quantities of atoms—and make them atomically precise. ■

FOR MORE INFO:

> Molecular Manufacturing Enterprises
> National Nanotechnology Initiative NSTC (National Science and Technology Council)
> Foresight Nanotech Institute
> Zyvex
> Nanorex.com
> NanoInk
> MatLab
> RepRap

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

NVIDIA Targets Viz Pros with Quadro Plex

> **NVIDIA** (nvidia.com) has unveiled new Quadro Plex solutions targeted at scalable visualization professionals who interact with 3D models and analyze large volumes of data.

Quadro Plex-based solutions enable professionals in fields such as energy exploration, architectural design, medical research, and consumer packaged goods to run software applications across multiple ultra-high resolution displays or projectors.

The solutions are built on the NVIDIA Quadro Plex visual computing system, featuring two Quadro FX 5800 GPUs and 8GB of memory. By connecting two Quadro Plex systems to a single workstation, users can view images at a resolution of 36 megapixels, span visuals across two 4K projectors or eight auto-synchronized displays, and drive stereoscopic 3D content. The estimated street price starts at $10,750.

Omega Introduces New Wireless RTD Probe/Transmitter

> **Omega's** (omega.com) new wireless RTD probe/transmitter assembly features a stainless steel probe connected to a polypropylene watertight transmitter housing.

Units are shipped ready to install and operate with the push of a button. The assembly is available with or without 3-A approved thermowells for clean-in-place sanitary applications.

Each receiver also includes free software that converts users' PCs into multi-channel temperature monitors, chart recorders, or data loggers. Each wireless probe assembly transmits process temperature, ambient temperature, signal strength, and battery status in real time.

This FCC/CE compliant product works with all OMEGA UWTC Series USB or Web-Enabled Ethernet Receivers and Wi Series Meter/Controller/Scanner and DIN. Prices start at $265.

Maxwell Technologies and ANSYS Release Simplorer Library

> **ANSYS, Inc.** (ansys.com) has announced that an ultracapacitor components library from Maxwell Technologies, Inc., (maxwell.com) an ANSYS customer, has been made available for use in Simplorer technology. As a result, automotive, aerospace, and industrial power engineers developing hybrid vehicles and other electric-powered products and systems now can use the energy-storage device models in their simulations. Ultracapacitors are energy-storage devices that efficiently deliver bursts of high power and recharge rapidly from any energy source over hundreds of thousands to millions of cycles.

For more information, visit Maxwell Technologies, Inc. and ANSYS.

ACS Software Updates AutoEDMS Document Management Solution

> **ACS Software, Inc.** (autoedms.com) has released Service Release 4 (SR4) Update for Version 6.5 of AutoEDMS. This release enables AutoEDMS cus-

Exact Metrology Introduces Artec3D Scanners

> **Exact Metrology, Inc.** has added the Artec3D Scanner to its metrology product offering. Artec3D Scanners require no mounts or markers. They are suite to a variety of applications including computer graphics and animation, medical imaging, archival, and prototyping.

Complete systems including hardware, software, and training start at less than $15,000.

The Artec3D Scanners work like a regular video camera, but instead of a two-dimensional image, the result is a three-dimensional image captured at speeds of up to 15 surfaces per second. A user walks around the object and scan it from various angles while the software combines all the scanned images into one. The scanners are equipped with wide-field-of-view

3D and mega-pixel 2D sensors, and the technology allows capture of both shape and surface texture of objects in a snap-shot or video mode.

For more information, visit Exact Metrology Artec3D.

The Artec3D Scanner from Exact Metrology had the most visitors at deskeng.com in August.

tomers to better manage, share, and view their data and digital assets more effectively.

AutoEDMS offers the aVue viewing system in both Desktop and Client-Server Editions. Both provide a single uniform interface, and one set of tools for natively viewing and printing various electronic documents. AutoEDMS aVue is an art viewing technology that supports many file formats, including AutoCAD 2009 DWG and DWF, MicroStation v8, Acrobat PDF, and Word/Excel 2008.

In Version SR4, the AutoEDMS Workflow Engine, which automatically routes documents between people and departments, offers performance improvements in workflow operation, particularly for workflows with multiple steps and several documents.

National Instruments Announces LabVIEW 2009

> **National Instruments** (ni.com) has announced LabVIEW 2009, the latest version of its graphical system design software platform for control, test, and embedded system development.

LabVIEW 2009 is designed to simplify the development challenges of parallel hardware architectures with new virtualization technology that takes advantage of multicore systems as well as by offering new compiler improvements and IP that enhance field-programmable gate array (FPGA) design.

For more information, visit National Instruments LabView.

Backup4all 4.2 Released by Softland

> **Softland** (backup4all.com) has released Backup4all 4.2, an update it includes full Unicode support and compatibility with 64-bit operating systems.

Backup4all allows users to create zip backup copies of single files or file folders of virtually any size, which allows them to access the backups with any zip-compatible utility. It also supports AES encryption so that users can secure their backups, and it allows users to password protect the Backup4all interface.

Among several improvements, Backup4all now backs up millions of files and folders with moderate resource usage, it is now compatible with 64-bit operating systems, file versions can be compared, and a new option to select a new filetype for log files.

For more info, visit Softland.

ZWCAD 2009i Released

> **ZWCAD Software Co., Ltd**. (zwcad.org) has announced the availability of ZWCAD 2009i software. This release introduces new capabilities to help users tackle design problems, including automatic paper space, plot stamps, and improved CTB support.

According to the company, ZWCAD 2009i's operating stability has been improved, as has productivity while editing complex drawings via speed enhancements.

New plotting features include support for paper space, plot stamps, and settings in CTB files. Objects to be printed can be placed in paper space. With the help of plot stamps, drafters can add information along the edges of the plotted media, such as drawing names, dates and times, and plot scales. CTB files allow users to specify line end styles, line join styles, and fill styles.

For more info, visit zwcad.org.

SigmaTEK Systems Releases SigmaNEST V9

> **SigmaNEST** Version 9 features simplified menus and icons and new functional paths that eliminate redundant steps and clicks. These enhancements, when combined with menu views based on machine and function, new pop-up information windows, and quick-find search tools, result in improved efficiency, according to the company.

"We knew just modifying the menu style, or ribbon, wouldn't provide the depth of changes our customers expect to truly achieve improve their processes," says Glenn Binder, vice president of Sales and Marketing with SigmaTEK Systems.

Other enhancements optimize specific tasks, including file importing and support tools for SolidWorks, Autodesk Inventor, Siemens NX and Catia solutions; new DLL-based plug-in functionality; and extended automatic save functionality.

Bunkspeed Releases HyperShot v1.9

> **Bunkspeed**.(bunkspeed.com/hypershot) has announced the immediate availability of HyperShot v1.9, an upgrade to the HyperShot product released two years ago. HyperShot is a digital camera for 3D data. This new version delivers improvements in the area of material definition that allow clients to give an even more realistic

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look to their finishes, as well as create new materials quickly. Overall usability, performance, and integration with leading 3D CAD applications has also been enhanced, according to the company.

HyperShot v1.9 is available for immediate purchase and download on both Windows and Mac systems. The upgrade to v1.9 is free for existing customers. For more information on HyperShot, visit Bunkspeed.

Measurement Computing Introduces Message-Based DAQ Protocol

> **Measurement Computing** (mccdaq.com) has released two new data acquisition products featuring a new OS-independent protocol that allows DAQ devices to be programmed with simple text-based messages.

A new 7000 series product line, which includes the USB-7202 and USB-7204 boards, combines small form-factor, bus-powered USB hardware, and a light and agile software framework that can be ported to multiple operating systems. The software framework is called Message-Based DAQ (MBD).

MBD is a protocol that permits the programming of DAQ devices using text-based messages. The MBD protocol greatly simplifies driver and application development, because all DAQ operations are programmed through a common command interface.

For more information, visit Measurement Computing.

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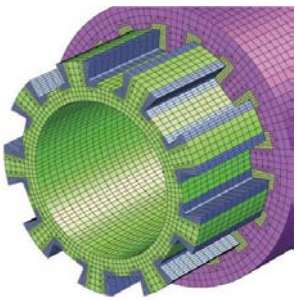

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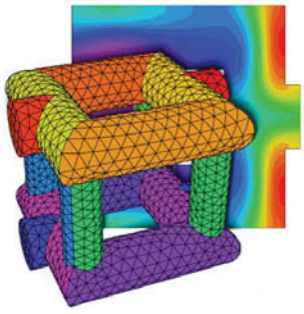

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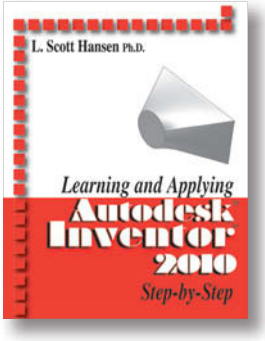

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Transforming the Auto Industry for Long-Term Success

KEVIN BAUGHEY
Dassault Systèmes

This next year is critical for the American automotive industry. Given the struggling economy and strict terms of the bailout, Detroit's Big Three need to quickly develop and execute a plan that can help them not only survive, but to emerge with advantage once the market starts to improve. To accomplish this, the auto manufacturers have to transition through four distinct phases over the course of the next 14 months to ensure the long-term sustainability of the North American auto industry.

In the first phase, given the industry's heavy losses and shrinking customer base, automakers and suppliers have to ensure that they are managing their bottom lines as efficiently as possible. In addition to the obvious operational requirements, companies need to evaluate the viability of their product lines and how they're managing the process of innovation from concept to end-of-life.

>PLM must provide flexibility to enable much faster reaction to change.

As part of this, all information across the extended enterprise needs to be integrated to improve decision-making accuracy and speed. Decisions can no longer be made without critical pieces of information that, in the past, were too difficult to gather or not deemed relevant. Questioning everything within the organization to achieve a lean efficient base is a crucial starting point.

Once the firms have conducted their internal audits and implemented short-term containment actions, phase two must be implemented. A business and technology strategy must be developed that enables adaptability to changing global conditions as well as management of the changing nature of the supply chain. Beyond the design and

development of new products, this involves determining regional customer needs around the globe and regional development capabilities that can be leveraged globally. For example, India is a preferred location for software development.

The third phase involves implementing innovation for the next generation.

After establishing this business model, it's imperative for the automakers to be able to harness their innovative processes for a new generation of vehicles. This means implementing a technology solution that enables them to manage all of the information and business processes from all key stakeholders from suppliers to consumers.

With product lifecycle management (PLM) technology, automakers can maintain traceability from ideas and requirements throughout the product lifecycle, closing the gap between what is produced and what the market wants—and thus accelerating market-driven innovation. Creating a unified database of information and business processes is crucial to become a true learning organization.

Creating a unified database of information and business processes is crucial to become a true learning organization.

Managing and competing in a global economy is the fourth and final phase.

The next generation of automotive firms will be adapting and accelerating development faster than ever before. The most effective firms will exploit opportunities quickly by shifting the footprint of the firm as opportunities are identified.

For an industry that has typically been viewed as slow moving because of the heavy assets and infrastructure required to produce complex products, this will pose a challenge. Therefore, eliminating aspects of the enterprise that weigh down the firm will be critical. To do this, automakers will require a PLM infrastructure that provides the flexibility needed to enable much faster reaction to future changes rather than serves as a hindrance to change.

With some short-term adjustments and a long-term focus on global collaboration and unified business processes, the North American automotive industry can emerge from its current state to become a competitive force once again. ■

Kevin Baughey *leads the Automotive Industry Solutions group for the ENOVIA brand within Dassault Systèmes. Send e-mail about this subject to DE-Editors@deskeng.com.*

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