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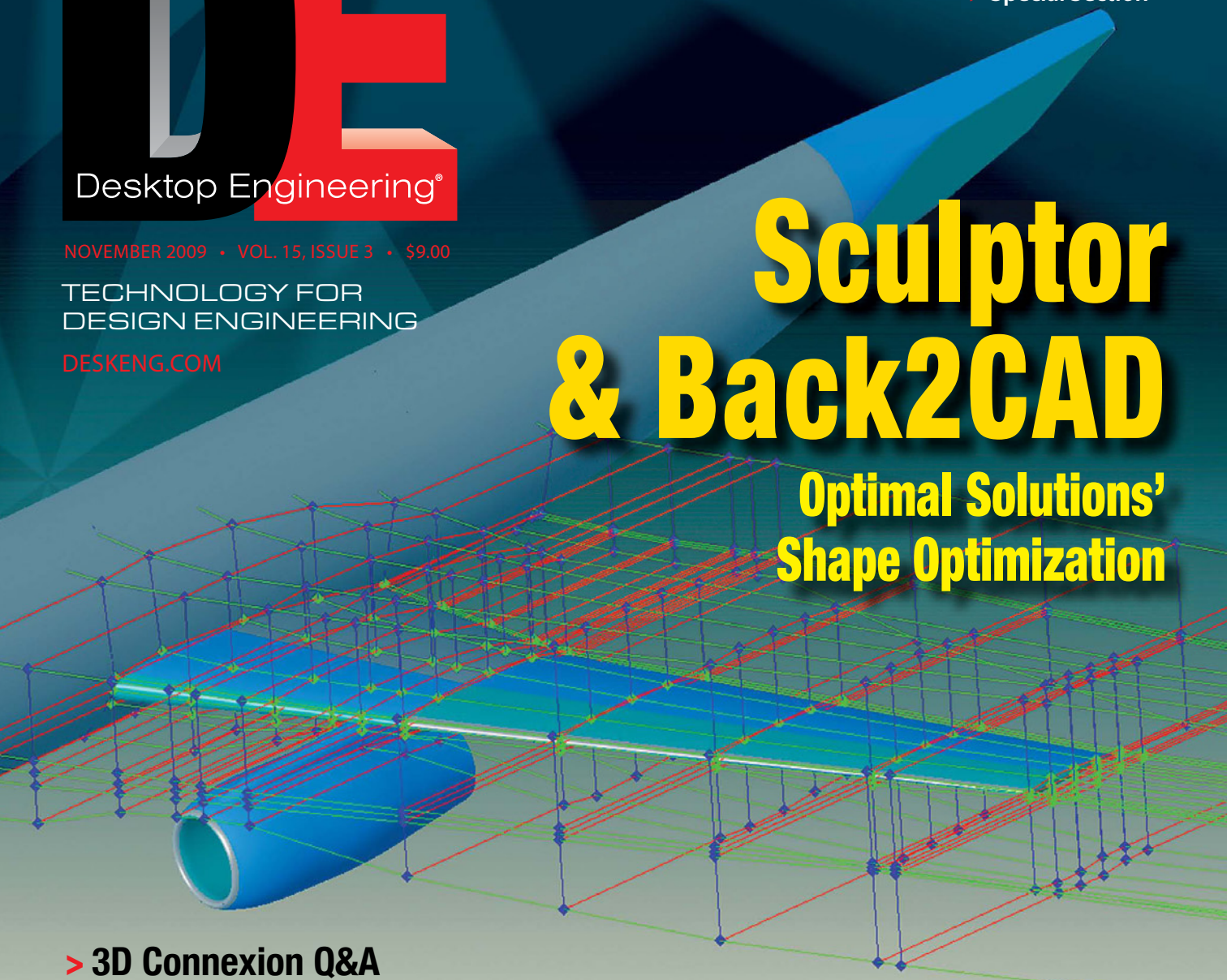

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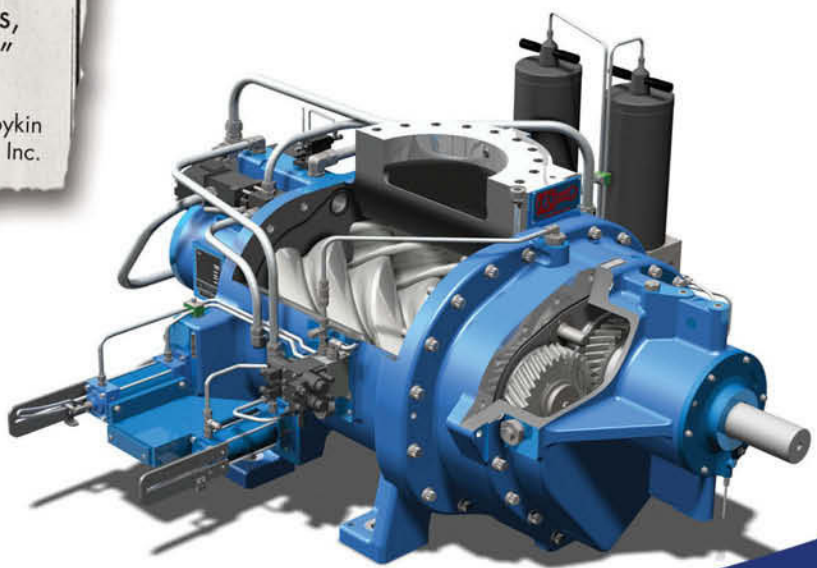

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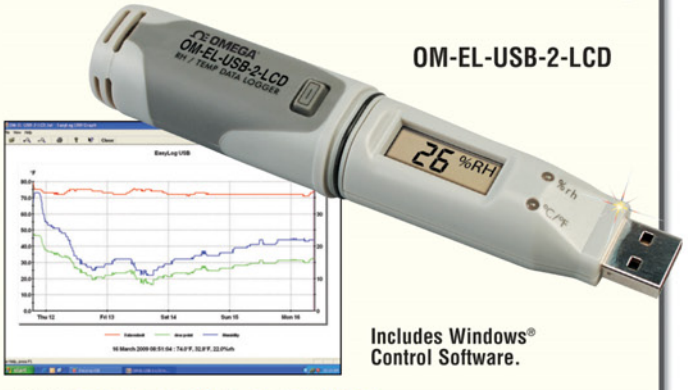

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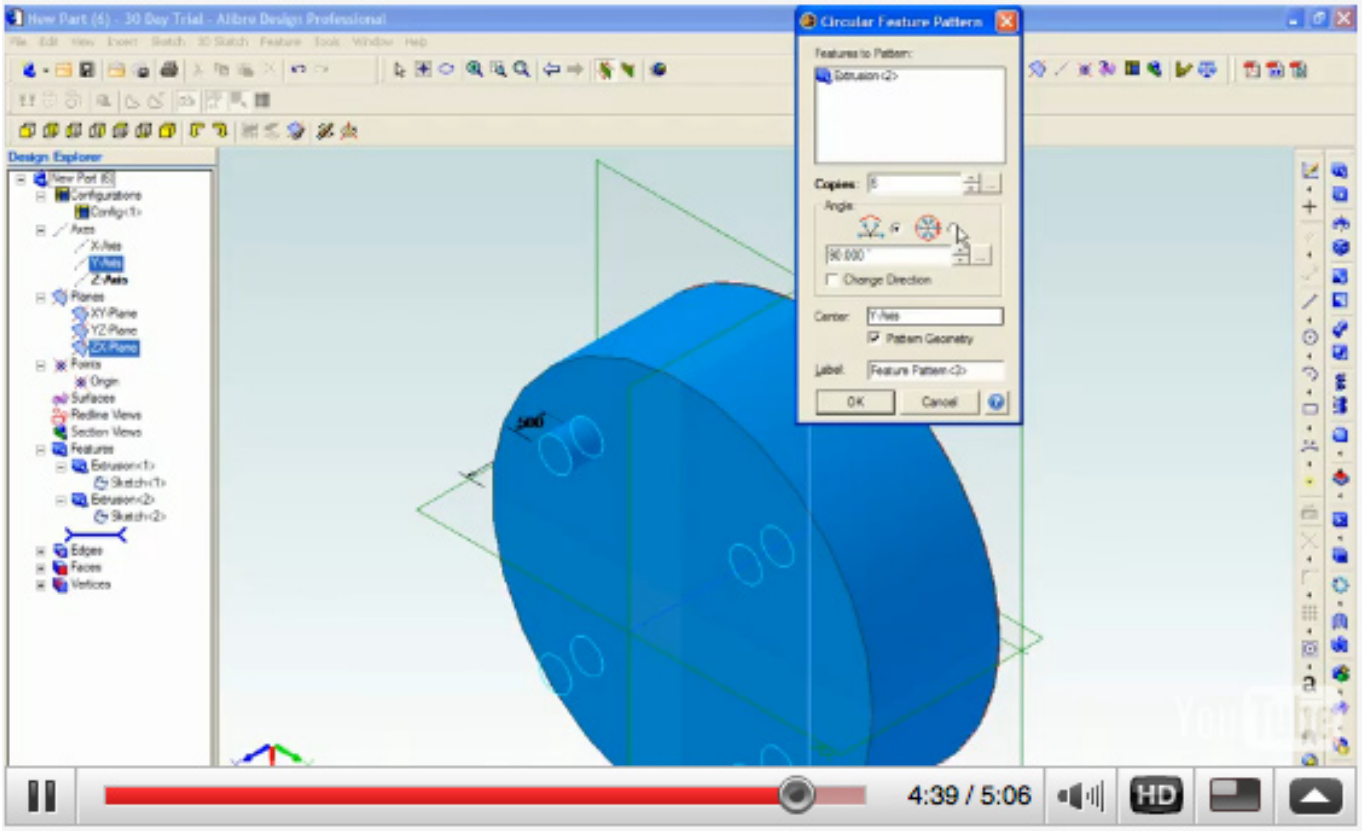
Alibre Design Professional V12

KENNETH WONG
kennethwongsf@earthlink.net

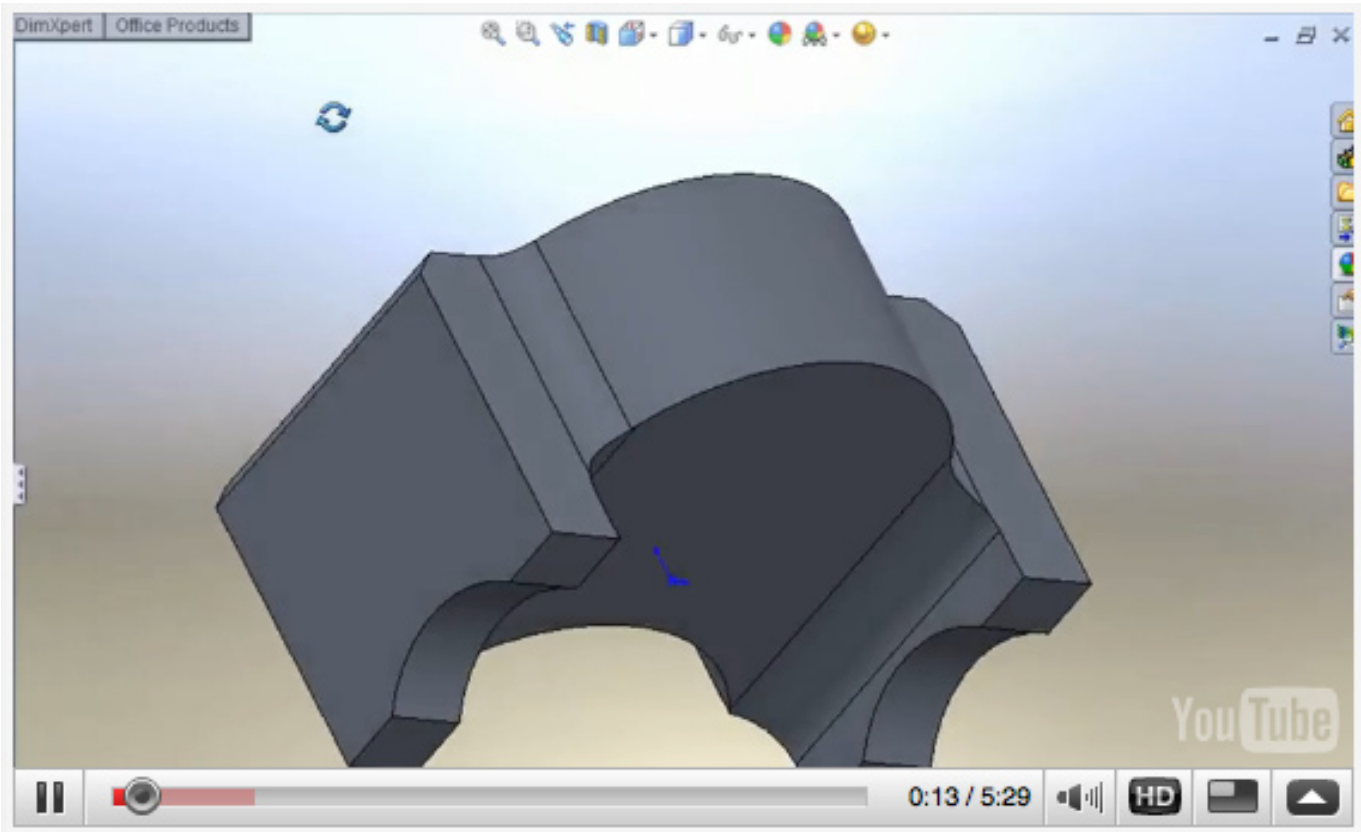
After grabbing headlines with its $99 offer, Alibre Inc. released a new version of its flagship MCAD package. Available in Standard, Professional, or Expert editions, Alibre V12 offers a series of new functions, including the ability to mark features by different colors and generate sheet metal files from 2D line drawings.

Click here to learn more about Alibre Design Professional V12, an affordable mid-range CAD package, and watch a video of it in action. ■



Design Optimization in SolidWorks

In SolidWorks 2010 (Beta code), the Design Study function lets you automatically generate multiple versions of your part by incrementally changing certain parameters, such as bend radius or extrusion height. From the results, you can pick the optimal configuration, which may be drastically different from your initial concept but still meets the required factor of safety, load conditions, or stress tolerance. But the parameters you can experiment with may be limited by how you build your part. Click here to learn more about SolidWorks 2010. ■



Faster Speeds, More Power, Greater ROI

STEVE ROBBINS
steverobbins@deskeng.com

Two years ago at SC07, I got all jazzed up about the speed and accessibility of multicore computing. I spent three days talking with companies about how their hardware enables engineers to leverage CAE to explore complex analyses and improve their company's competitive advantage. Many manufacturers acknowledged simulation as a market driver, but seemed more interested in large data center applications for financial modeling. The world has changed.

At the recent HP CAE Symposium in Detroit, CAE had become the center of the universe for many of these same companies. Why? Because every simulation is a building block leading to more complex analyses that need faster, more powerful computers. For two, accessibility, scalability, and lower costs mean more engineers have access to powerful computers.

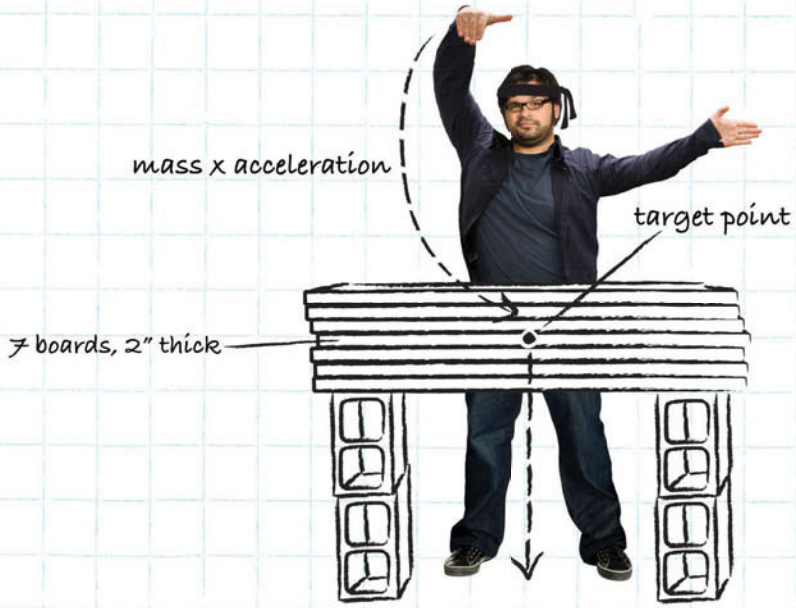
Cluster computing systems, for example, are more accessible because of ease of use. It might have taken weeks or months to set up and validate a cluster a couple of years ago, now it takes a few days. Accessibility means

> Early simulation saves time and money, and improves quality and ROI.

a cluster in a box, or you can lease the hardware. You can even rent time on a service provider to run simulations.

In a couple of years computing technology will be even more efficient and accessible. Moore's Law applies; to more than just transistors. InfiniBand increases interserver speed by up to 2.5 times. Solid-state drives can increase performance by 25%. CPU architectures continue to increase speed via more cores, and intelligent processing, communications, and memory advances. And the algorithms at the heart of CAE evolve at similar rates.

All this explains why simulation is moving to the front of the design. Engineers are a skeptical lot. When simulation software first hit the scene, the cutting edge of engineering used it for validating real-world testing. Soon the results became more accurate, and it became a way to minimize the number of physical prototypes needed for testing.



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Still, simulations could take weeks to complete and were complicated to set up. But now high-performance computing is more accessible, affordable, scalable, and easier to use. And easy-to-use simulation software takes advantage of multithreaded, multicore processing. The effect has been to reduce run times for increasingly complex analyses from weeks to minutes.

Today, you can run a multiphysics simulation on a multicore workstation and get results in a reasonable timeframe. If you need more processing power, you grab what you need off the cluster or some internal or external source. You can create simulations on direct models before you get into parametric designs, saving hours translating and simplifying CAD files, then analyzing and interpreting your results for the CAD expert. This in turn saves time bringing designs to market, produces more manufacturable designs, saves on material costs, and increases your ROI.

So what's in the future? Model-based designs that are simulations of simulations. Drug companies now have a simulated model of the human body that's used to simulate the effect of drug therapies. Aerospace companies simulating the entire engine on a simulation of the complete aircraft. The list knows no bounds.

Design and simulation are vital to remaining competitive. The ability to run multiple simulations of a complex design simultaneously provide engineers insights that weren't available previously. Faster and faster computing has enabled faster, more complex simulations that crave more computing power. It's a feedback loop that's working for everyone's benefit and changing the world of engineering. ■

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

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

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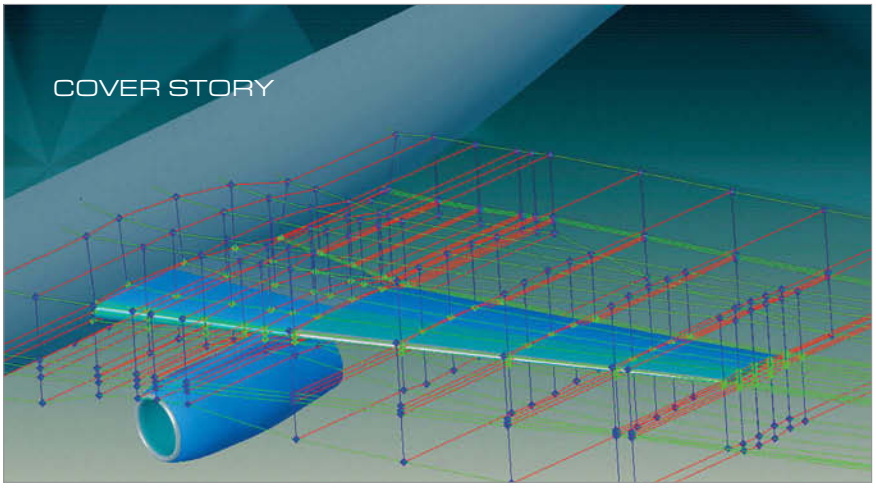

"The most likely way for the world to be destroyed, most experts agree, is by accident. That's where we come in; we're computer professionals. We cause accidents."
> Nathaniel Borenstein

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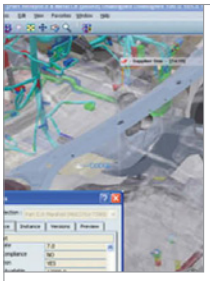
NOVEMBER 2009 VOLUME 15 ISSUE 3



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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 >This is a CAD model of the AIAA's Drag Prediction Workshop fuselage and wing. Around the wing is an ASD (arbitrary shape deformation) volume created by Sculptor. It enables a designer to change the wing's shape by pushing or twisting ASD points in preparation for CFD tests. Sculptor and Back2CAD enable fast optimization of shapes and meshes. To read Mike Hudspeth's review, turn to page36.

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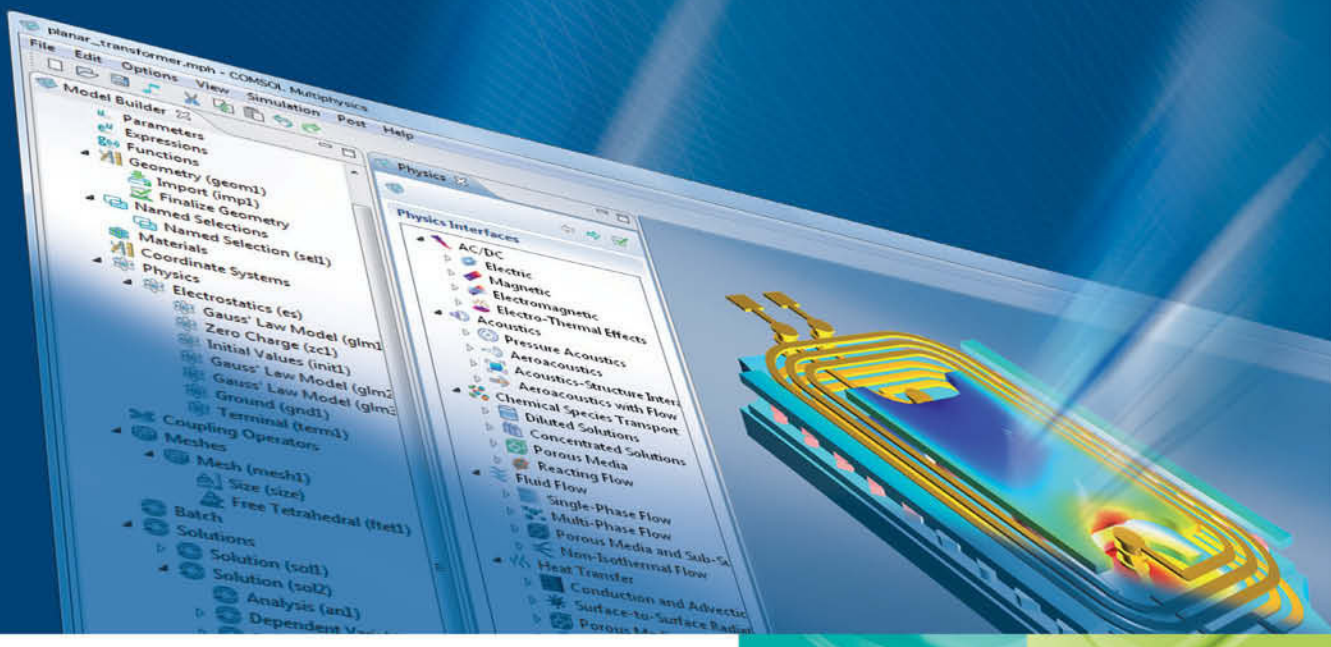

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Storage is No Problem

PETER VARHOL
pvarhol@deskeng.com

Because I was just about at capacity on the 75GB drive on my three-year-old laptop and was not ready to buy a new computer until Windows 7 comes out, I recently looked into alternative storage options.

Several advances have driven storage technology in recent years. First are the higher densities and lower costs for solid-state storage. This technology consists of memory chips, but these receive an additional flow of electricity while the system is off, making them nonvolatile. In other words, they store data even while the system is turned off.

A second advance is higher capacities and smaller sizes for the traditional rotating drives. This has been achieved primarily by the ability to arrange the magnetic particles on the platter in increasingly compact ways. In fact, IBM has demonstrated a way to arrange the magnetic particles standing up, rather than lying flat on the panel, enabling many more magnetic particles on the same platter, and consequently a higher density of storage.

> No matter what your budget, you can find digital storage for your files and apps.

The interface of an external drive with an individual computer these days is almost always a USB 2.0 port. While it is a serial port, it has come a long way from the old RS-232 serial ports, and have the throughput to support data transfer fast enough to make these drives a good option.

The most obvious choice for my storage problem is a solid-state USB flash drive, often also known as a "thumb" drive or memory stick because of its small size. Prices have come down significantly on these devices, and capacities have increased. The largest capacity I have seen for a USB memory stick is 64 GB, and while the price of this is in the $200 range, it is a relatively large store with a great deal of convenience.

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Other types of external solid-state drives are also available, usually in a form factor smaller than a rotating disk drive. They tend to be somewhat more expensive than a disk drive, but somewhat faster in file access, especially reading files.

Rotating drives are of increasingly high capacities, and the prices have come down immensely. It was less than 15 years ago that a dollar a MB was what you would pay for storage (in other words, $1000 for a 1 GB disk). Today, that is laughable.

Because I was looking for an interim solution in the months before buying a new computer altogether, I didn't need an expensive and high-capacity solution. I needed something that would give me a decent amount of capacity and ordinary performance for a few months.

My selection was a Western Digital My Passport, a rotating disk drive with the form factor of a travel passport, only perhaps three times thicker.

My selection was a Western Digital My Passport, a rotating disk drive with the form factor of a travel passport, only perhaps three times thicker. It connects via a USB port, and when connected automatically backs up email and other files that I designate. Given its size, it slips easily into a backpack or can be carried with the computer on trips.

For a 320 GB drive, the price was just more than $60. I have since found an advertisement from a national shopping club (of which I am a member) that is offering a 1 TB drive with a slightly larger form factor for $110.

Of course, I can always find my storage on the Web, for a very low cost or for free, but I can't install applications on it like I can on a local external drive.

But whatever you do, it is easy and inexpensive to choose from a wide variety of storage options for your computer today. ■

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

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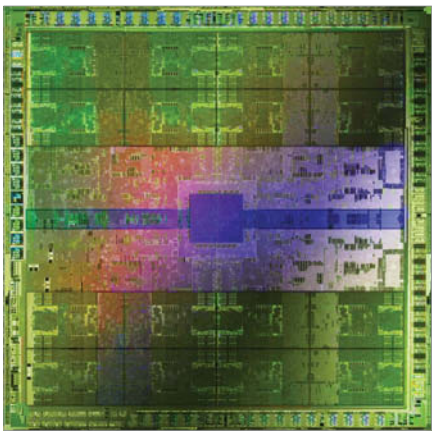
Scenes from the GPU Technology Conference

High-performance computing looks a lot like graphical processing these days. NVIDIA's GPU Technology Conference took place in San Jose September 30 to October 2. There were substantially more people in attendance than had been expected, and the conference facilities of the Fairmont San Jose were bursting at the seams.

The focus was, of course, GPU (graphics processing unit) computing. This encompasses three primary areas—computer visualization, parallel processing, and Web computing. Given the heritage of the GPU, computer visualization is a natural application. For the most part, GPU computing is about graphics, which have higher resolution, are realistic, and are much faster than with general-purpose CPUs.

Parallel processing is also a familiar topic. Thanks to the introduction of CUDA architecture, parallel processing with GPUs is one of the most intriguing models of high-performance computing today. The conference offered the prospect of substantially improving calculations through the use



of CUDA, NVIDIA's GPU parallel computing architecture.

Web computing is an unusual addition to this computing model. For this model, think cloud computing, and think video streaming. From the standpoint of the cloud, there was a demonstration of the ability to call video and other high-end graphics rendered on the fly.

The opening keynote with NVIDIA CEO Jen-Hsun Huang and the second-day general session talk featuring Harvard professor Hanspeter Pfister offered strong and inspirational endorsements of GPU computing. The combination of state-of-the-art examples with outstanding vision of future possibilities made these presentations among the best I have seen.

I later told NVIDIA representatives that they should package up these two keynotes and send them to every high school in the country. Huang offered a series of demonstrations that illustrated both the power and versatility of the GPU, including an application from Ferrari that let you view your car in software, including the prospective options and accessories, down to the color, within a few seconds. Within a decade, any car buyer will be able to view and purchase their customized mode of transportation the same way.

Will GPU computing ever become part of the engineering mainstream? That's a difficult question to answer; any existing application, whether commercial or custom, will require some reworking to run on the GPU. To take advantage of architectures with multiple GPUs using NVIDIA's CUDA architecture, code has to be substantially reworked, so commercial vendors will have to be convinced that such processors are broadly accepted by customers.

— Peter Varhol

FOR MORE INFO:

> NVIDIA

Open Design Alliance Announces DWG 2010 Support Conference

The Open Design Alliance (ODA) has announced the beta release of version 3.1 of its development platform, delivering support for DWG 2010 files. The release also includes a number of new features for both DWGdirect and DGNdirect, including overruling and subdivision mesh surface support for DWG, and improved DGN rendering that now supports dimensions, level overrides, and lineweights.

"Our goal with version 3.1 is to provide our members with stable, high quality access to DWG 2010," said Neil Peterson, chief technical officer of the ODA. "We received positive feedback from our alpha release in July."

Version 3.1 is available immediately at opendesign.com for ODA members.

FOR MORE INFO:

> Open Design Alliance

Maplesoft Partners with Siemens PLM Software

Maplesoft has announced a partnership with Siemens PLM Software. Maple, from Maplesoft, supplies analysis capabilities to users of NX software, from Siemens PLM, so they can use its computational power to analyze and optimize designs.

Maple 13 delivers a suite of math and analysis tools in an interface that scales from quick design calculations to full application development. Using Maple, design engineers can answer questions such as "What are the mathematical relationships between objects?" and "How do changes to object properties impact other objects?" NX connectivity also provides a convenient way to start Maple from within the NX environment.

Some key advantages of connecting NX with Maple include:

• Users can retrieve parameters from an NX CAD model, optimize those parameters, and update the CAD model with the revised parameter values directly within Maple.

• The CAD Link Assistant provides a quick, interactive way to experiment with NX CAD Connectivity without having to write code.

• With the CAD Link Assistant, it is easy to browse the scalar quantities in an NX CAD design, so it can be used as a tool to aid in writing your own CAD-capable worksheets.

• Using Maple programming and API commands, NX users can create tools for part reconfiguration and optimization.

FOR MORE INFO:

> Maplesoft

> Siemens PLM Software

"Extreme Redesign" Global Design and 3D Printing Contest Announced

Dimension 3D Printing, a brand of Stratasys Inc., has announced the launch of its sixth annual "Extreme Redesign: The Ultimate 3D Printing Challenge." This year's contest includes an award added for best green design. The contest challenges computer-aided-design (CAD) students worldwide to submit their most creative, useful, and innovative Extreme Redesigns—whether an entirely original concept, a new perspective on an everyday product, or a fresh vision for a famous piece of art, animation, or architecture.

This year's contest will feature a new Green Bonus. This 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.

To enter the High School or College Engineering categories, students must identify an existing product and redesign it, making the original design better by adding new functionality or aesthetic qualities. For submissions in the Art and Architecture category, the emphasis should be on originality and the overall beauty or aesthetic of the design.

Final submissions must be postmarked by Feb. 1, 2010. A panel of independent judges from various industries will judge final entries. Winners will be selected in April 2010. Complete contest rules and submission information are available at dimensionprinting.com/education/extremeredesign.shtml.

FOR MORE INFO:

> Dimension Printing

Sigma Technology Collaborates with Dassault Systèms SolidWorks Corp.

Sigma Technology, provider of the indirect optimization method based on self-organization (IOSO) technology, has joined the Solution Partner program of Dassault Systèmes' SolidWorks Corp.

IOSO is a multidisciplinary design optimization software developed by Sigma Technology that runs on Microsoft Windows and Unix/Linux operating systems.

According to Sigma Technology, direct coupling between the IOSO optimization environment and SolidWorks 3D CAD software will help engineers use benefits of full 3D objects parameterization while stating and solving complex design optimization tasks with the aid of IOSO.

FOR MORE INFO: > Sigma Technology

Ingenuity Leading Manufacturers Out of Recession

Despite challenges that are out of their control—from the global economic downturn to the fallout of customers closing doors—a new national survey from ThomasNet shows professionals from manufacturing and industrial companies are not only optimistic about their ability to ride out the recent economic slowdown, but even expect to grow in 2009.

Among the 800 executives, managers, and engineers from small, midsize, and large companies responding to ThomasNet's Industry Market Barometer survey, 76 percent say they think the U.S. economy will improve by the second quarter of 2010 or sooner, and 35 percent expect their own businesses to grow by the end of this year. To be sure, the recession has not left these businesses unscathed. More than half (54 percent) report a decline in their businesses during the first half of 2009, mostly fueled by customer losses. But these companies are combining ingenuity with decisive action to direct their own rebounds.

Business leaders report taking a variety of actions to control their destinies. There is no single silver bullet for how they are going about it. Seventy percent are instituting new sales tactics, specifically: looking for business in new industries such as medical or aerospace, exploring new sales channels like distributors, and increasing their online marketing. In order to succeed, 38 percent are developing new and innovative products.

The survey respondents shared some of the lessons they have learned that form the foundation for their new strategies:

- You can't be diversified enough in a down market
- Always energize around sales, innovation, marketing, and cost-control measures
- Stay customer-focused
- Innovation must never end.

For more information on the Industry Market Barometer, visit thomasnet.com.

FOR MORE INFO:

> ThomasNet

CIMdata Releases 2009 PLM Market Analysis Report

Consulting and research firm CIMdata's annual "Product Lifecycle Management (PLM) Market Analysis Report" has been released. The report provides information and analysis on the worldwide PLM market.

It contains analyses of major trends and issues, leading PLM solution suppliers, PLM purchases investments in software and services for geographical regions and industry sectors, and historical and projected data about market growth.

In addition, the 2009 PLM Market Analysis Report presents an analysis of the 2008 PLM market with special descriptions of each of the major sub-segments. The full report comes in two modules and more information is available at cimdata.com.

FOR MORE INFO:

> CIMdata

ANSYS Institute for Industrial Innovation to Open at University of Wisconsin-Milwaukee

ANSYS is supporting a university in breaking new ground with engineering simulation technology.

ANSYS, Inc. is the exclusive provider of multiphysics engineering simulation software at—and the namesake of—a new research and educational facility at the University of Wisconsin–Milwaukee (UWM) College of Engineering and Applied Science. The ANSYS Institute for Industrial Innovation (AI3) will serve as a portal for businesses seeking to partner with the College of Engineering and Applied Science on specific engineering projects. Just as important, AI3 will provide students with state-of-the-art engineering simulation software tools, enabling hands-on experience along with the opportunity to develop design solutions for industry-sponsored projects.

"ANSYS support at the University of Wisconsin–Milwaukee will enable students to get first-hand experience working with the comprehensive product portfolio from ANSYS—the most complete engineering simulation technology available in the world. This not only benefits students and researchers by providing them with an excellent toolset, but also promotes the expansion of ANSYS technology usage once students enter the workforce," said Paul Lethbridge, academic product strategy and planning manager at ANSYS, Inc.

The institute is also charged with increasing the college's research links with business and industry as well as fostering economic growth and development in southeastern Wisconsin through tech transfer and industry assistance.

FOR MORE INFO:

> ANSYS

Wohlers Report Measures Additive MFG Business

In 2008, several companies introduced new additive-manufacturing (AM) systems to the market. EOS, Objet Geometries, Mcor Technologies, MTT Technologies, and three U.S. companies—Optomec, 3D Systems, and Z Corp.—introduced new machines.

In Q4 2008, chemicals giant Huntsman Advanced Materials surprised many when it announced the development of an entirely new additive-manufacturing process and machine. In early 2009, Stratasys introduced the $14,900 uPrint system based on FDM technology. ReaLizer and Bits from Bytes also introduced systems in 2009.

Through the end of 2008, Stratasys had sold 11,366 FDM systems, compared to an estimated 4,274 by 3D Systems.

The full Wohlers Report 2009, a 250-page global study of additive manufacturing, is available at wohlersassociates.com.

FOR MORE INFO:

> Wohlers Associates

PolyWorks' Point Cloud Engineering Software Interfaces with Metris' Handheld Laser Scanners

Metris is introducing its handheld 3D laser scanning solutions integrated into PolyWorks point cloud engineering software from InnovMetric Software. This solution enables design and manufacturing professionals to take advantage of using Metris scanners in combination with leading point cloud analysis software to tackle inspection or reverse engineering tasks. Thanks to the new application programming interface (API), it becomes very straightforward for third-party software vendors to integrate Metris 3D laser scanning, according to the company.

Transparent to PolyWorks users, Focus Handheld Scanning API manages point cloud acquisition by controlling all interaction between the laser scanner and handheld localizer of choice. Also, modifying scanner parameters or running a qualification routine is handled by the Focus API. The resulting data is automatically stored in PolyWorks format and ready for further extensive point cloud processing.

The Focus Handheld API supports Metris ModelMaker in combination with K-Series Optical CMM as well as MCA or third-party measuring arms such as Faro.

Over the next months, users of NRK Spatial Analyzer, Delcam PowerINSPECT, Metrolog, and other point cloud software will be able to use their Metris handheld scanners directly from within these applications.

FOR MORE INFO:

> InnovMetric Software, Inc.
> Metris

LATEST NEWS

Fishbowl Solutions Supports SolidWorks and Autodesk AutoCAD with Bulk Loading Application for WindchillPDMLink

3Dconnexion 3D Mice Enhance New Design Experience in SolidWorks 2010

Hess Explores Benefits of Virtualization with NVIDIA SLI Multi OS Technology on HP Workstations

ANSYS Software Verifies Design of Wimbledon Retractable Roof

Next Limit Technologies Releases Maxwell Render Version 2

Missler Software Launches TopSolid 7 CAD/CAM Software

Planit Releases Edgecam 2010 R1 CAM Software

Mechdyne Introduces Mosaic High-Resolution Display Modules for 2D and 3D Applications

Saelig Debuts Dongle for USB to I2C Connection

MultiSUITE CAD 2010 Structural Detailing Environment Released

Fishbowl Solutions Releases HPGL Compare Data Integrity Tool

measX Releases Version 11 of DASYLab Data Acquisition System Laboratory

Sustainable Minds Enables Greener Product Design

InspectionXpert First-Article 2010 Released by Extensible CAD Technologies

NEi Software Partners with MAESTRO in Shipbuilding Industry

Sescoi Partners Dental Wings and 360SDM to Demonstrate Dental Prosthesis Manufacturing

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.

Notebook Supports Intel's i7 Extreme, Xeon Processors

>Eurocom D900F Panther notebook functions as an engineering workstation and server.

Eurocom has been building mobile workstations and mobile servers for engineers working with compute-intensive CAD/CAM/CAE, math, imaging, and similar applications for a number of years now. They really have defined such systems, carving out a niche of engineering power and portability coupled with a knack for incorporating the latest technologies quickly. With that in mind, you should give Eurocom's D900F Panther-i7 workstation- and server-class notebook a look. It's on the edge of the leading edge.

The D900F Panther-i7 is all about speed, power, and portability—and storage too. The i7 series processors offer speeds up to 3.33GHz and bus speeds of up to 2x 6.4GT/sec, topped with 8MB of L3 cache. The Panther-i7 complements this foundation with as much as 24GB of RAM, NVIDIA graphics acceleration, and 64-bit operating systems like Red Hat, Windows Professional-64, and Windows Server 2008.

READ MY COMPLETE REVIEW:

>Eurocom D900F

Creaform Extends 3D Scanning Line to More Users

> Company sees UNIscan offering new users high-level performance at an entry-level cost.

The UNIscan is Creaform's latest addition to its Handyscan series of handheld 3D laser scanners. Now, Creaform calls the UNIscan an entry-level model, but, looking at its specs, you might not think of it as entry level. What is entry level about UNIscan, however, is its price.

Let me flop this fish on the table right now: The UNIscan is $28,900. Not the kind of change you'll find in the couch, but not a heck of a lot when you consider that the UNIscan will open up entirely new revenue streams while simultaneously eliminating time-eating processes.

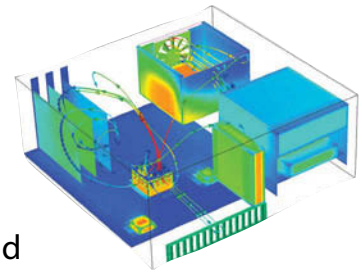
What does that mean? UNIscan gives you options. Without the UNIscan, reverse engineering means you either send a part off to a third party and wait (and pay) or you try your hand at drawing an approximation in, say, Inventor, and fiddling and fussing with the model and prototypes until you've a fairly acceptable re-creation of the part.

READ MY COMPLETE REVIEW:

>UNIscan

Simulate Complex Electronics

> Coolit v.9 CFD offers three ways to build complex IC models, two resistor options.



Many moons ago, I organized a tech support department for an online service. Late one night this guy called complaining about getting screens full of gibberish whenever he sent or received data. I forget how we figured it out, but the guy had buried his modem under a pile of books and magazines blocking his modem's air vents and thus overheating the thing. Would that all electronics thermal issues be so easily solved. Coolit from Daat Research can help you predict and manage the airflow and heat transfer in electronic equipment in more complex scenarios. Just out in version 9, Coolit is a CFD (computational fluid dynamics) toolset optimized for predicting and managing airflow and heat transfer in electronic equipment. It's also optimized to be easy to learn and use. By that I mean it has all the numerics that you need to solve thermal problems, offering fully automatic grid generation and solver setup, materials libraries, and so forth that eliminate many steps that are easy to mess up. That also means you can focus on what you're trying to figure out.

Coolit is also flexible. For example, you can define units, build custom object libraries, and override automatic settings when you want.

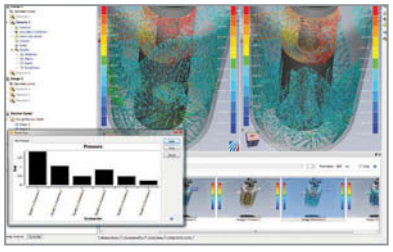
READ MY COMPLETE REVIEW:

>Coolit

Upfront Design Studies Made Easier

> New version of CFdesign 2010 provides CAD-driven multi-scenario environment.

A few years back, I described CFdesign from Blue Ridge Numerics as a disruptive technology. The reason I said that was twofold. One, CFdesign is real CFD (computational fluid dynamics) for design engineers who are not expert in CFD but who really know how to use Inventor, Solid Edge, SolidWorks, and the like. CFdesign integrates with your MCAD system,



and you use it early and often to engineer more robust designs. This all means far fewer "design to analysis back to design" iterations and compressed time to market. Second, and the real disruptive part, CFdesign represented a new way of doing things that leveraged computers rather than computerizing traditional serial processes. Blue Ridge Numerics just came out with the 2010 version of CFdesign; a fine continuation of that heritage.

Multiple design studies and tools to work with tons of data are what CFdesign 2010 brings to this conversation. This means that you can fiddle with heat and fluid settings, meshes, models, geometries, and what have you in a single environment. Then, you can do comparisons, rummage through and align common data sets, then plot and chart your output, again all from one place.

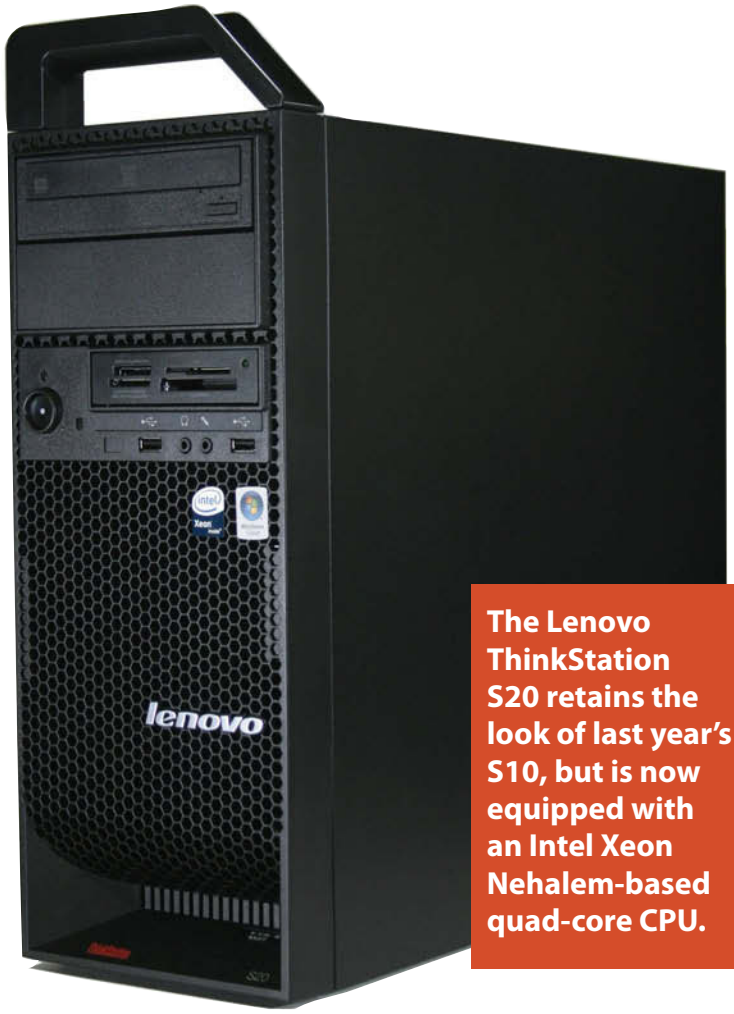
READ MY COMPLETE REVIEW:

>CFDesign

Lenovo ThinkStation S20 Is a Worthy Successor

> Taking the torch from the standout S10, this new single-socket workstation from Lenovo proves itself as a great midrange CAD system.

BY DAVID COHN



The Lenovo ThinkStation S20 retains the look of last year's S10, but is now equipped with an Intel Xeon Nehalem-based quad-core CPU.

Last year, we concluded that the Lenovo ThinkStation S10 was an absolutely perfect system for midrange CAD applications (*see September 2008* DE). Based on that review, we've anxiously waited to see what Lenovo, the company that acquired IBM's Personal Computer Division in 2004, would do for an encore. We're happy to report that the new ThinkStation S20 is a worthy successor.

Launched earlier this year to coincide with the release of Intel's new "Nehalem" processor microarchitecture, outwardly the S20 is virtually identical to its predecessor. It comes housed in an attractive black case measuring 6.87 in. x 18.75 in. x 16.5 in (WxDxH), with a removable handle that adds two more inches to its height. The handle definitely makes it easier to move the system, which weighs 32 pounds. The top portion of the front panel provides two 5.25-in. drive bays, one of which contained a 16X DVD+/-RW dual-layer optical drive. Below these is a smaller bay containing a 20-in-1 media card reader as well as a panel containing the power button, two USB ports, and headphone and microphone jacks. Icons above these ports light up, making them easier to find in low-light conditions. There's also a spot for a FireWire (1394) port, but this $29 option was not included on our system.

The rear panel provides eight more USB ports as

well as a 9-pin serial port, one RJ45 LAN port, six audio jacks, S/PDIF input and output connections, and an eSATA connection. Lifting a small lever on the tool-less chassis is all it takes to remove the side panel to access the well-organized interior.

A single CPU socket contained an Intel Xeon W3540 "Bloomfield" processor with a large heat sink and cooling fan. This 2.93GHz quad-core CPU has 8MB of L2 cache. Lenovo offers the 3.2GHz W3570 as well as less powerful CPUs as options. The motherboard provides six DIMM sockets. Our evaluation unit came with 4GB installed as a pair of 2GB DDR3 PC3-1060 1333MHz memory modules.

The motherboard provides a total of five expansion slots: two PCIe 2.0 x16 slots, a PCIe x4 slot (x16 mechanically), a PCIe x1 slot, and a standard PCI adapter card slot. One of the x16 graphics slots was filled with an NVIDIA Quadro FX4800 graphics accelerator equipped with 1.5GB of memory (visit deskeng.com/articles/aaaptg.htm for a stand-alone review of this graphics board). This large, ultra high-end board covered the PCIe x1 slot and was so close to the standard PCI adapter slot as to make it virtually unusable as well. While both the second x16 and x4 slot remained open, expansion is more limited than in last year's S10. If you opt for a second high-end graphics board, it would cover the other PCIe slot. If you add FireWire, you'd be unable to add a second high-end graphics board.

The system drive cage provides three 3.5-in.

Lenovo S20 Workstation Benchmark

		Lenovo S20 workstation (one 2.93GHz Intel Xeon W3540 quad core CPU, NVIDIA Quadro FX 4800, 4GB RAM)		**HP Z800** workstation (two 3.2GHz Intel Xeon X5580 quad core CPUs, NVIDIA Quadro FX 4800, 12GB RAM)		**HP xw8600** workstation (two 3.4GHz Intel Xeon X5492 quad core CPUs, NVIDIA Quadro FX 4800, 4GB RAM)		**Lenovo Thinkstation S10** workstation (2.66GHz Intel Core 2 Q6700 quad core CPU, NVIDIA Quadro FX 4600, 2 GB RAM)	**Alienware Area-51 ALX Crossfire** workstation (Intel Core 2 Extreme 9650 quad core 3.0GHz CPU overclocked to 4.0 GHz, two ATI Radeon HD 3870, 4GB RAM	**HP xw8600** workstation (two 3.16GHz Intel quad core CPUs, NVIDIA Quadro FX 4600, 4GB RAM)	**HP xw6600** workstation (two 3.0GHz Intel quad core CPUs, NVIDIA Quadro FX 1700, 2GB RAM)	**HP xw4600** workstation (3.0GHz Intel dual-core CPU, NVIDIA Quadro FX 1700, 2GB RAM)	**Appro Xtreme WH 5548** workstation four 1.9GHz AMD Opteron quad-core CPUs, NVIDIA Quadro FX 5600, 32GB RAM)
Price as tested		$3,885		$10,604		$9,307		$2,589	$6,163	$6,915	$4,611	$2,319	$9,217
Date tested		7/29/09		4/24/09		12/22/08		6/30/08	3/24/08	12/24/07	12/21/07	12/20/07	12/27/07
Operating System		Windows XP	Windows Vista	Windows XP 64	Windows Vista 64	Windows XP	Windows Vista	Windows XP	Windows Vista	Windows XP	Windows XP	Windows XP	Windows XP
SPECviewperf	higher												
3dsmax-04		48.43	52.59	50.55	51.51	52.24	**54.61**	37.88	19.61	35.26	33.16	37.37	**19.23**
catia-02		60.40	60.61	62.10	61.66	**63.17**	62.48	48.25	**17.06**	46.11	43.01	46.98	25.30
ensight-03		51.74	**55.33**	53.99	53.62	**54.44**	50.82	43.33	**24.88**	41.89	31.03	30.01	38.74
maya-02		232.92	207.87	213.80	209.74	**234.50**	193.15	191.10	**32.16**	175.60	111.20	111.40	128.50
proe-04		61.56	**64.49**	63.59	61.48	52.73	**57.15**	48.86	**13.04**	40.46	38.27	43.98	21.82
SW-01		136.81	**139.54**	135.24	128.08	109.91	**119.29**	90.90	**28.64**	74.28	55.44	62.12	40.32
tcvis-01		29.17	**38.76**	28.93	28.29	**29.84**	27.58	24.46	**6.26**	23.57	15.34	15.06	24.24
ugnx-01		33.41	33.19	33.34	32.38	**34.17**	31.14	27.04	**12.75**	25.25	14.90	14.29	31.80
SPECapc SolidWorks	lower												
Score	sec-onds	**140.42**	n/a	145.17	n/a	**164.71**	n/a	188.01	n/a	174.62	184.36	167.24	**282.78**
Graphics	sec-onds	47.33	n/a	**41.31**	n/a	**54.18**	n/a	60.13	n/a	57.97	61.52	57.46	**89.03**
CPU	sec-onds	**31.01**	n/a	32.68	n/a	44.36	n/a	41.48	n/a	50.52	50.03	**40.40**	**69.12**
I/O	sec-onds	**65.86**	n/a	71.94	n/a	**69.96**	n/a	90.18	n/a	**69.96**	77.04	73.43	**125.34**
SPECapc SolidWorks	higher												
Score	ratio	5.91	n/a	**6.38**	n/a	**4.84**	n/a	4.56	n/a	4.46	4.28	4.82	**2.98**
Graphics	ratio	3.92	n/a	**4.85**	n/a	**3.55**	n/a	3.15	n/a	3.33	3.11	3.29	**2.15**
CPU	ratio	**10.41**	n/a	9.87	n/a	7.27	n/a	7.72	n/a	6.39	6.45	**7.99**	**4.67**
I/O	ratio	**4.81**	n/a	4.40	n/a	**4.52**	n/a	3.51	n/a	**4.52**	4.11	4.31	**2.53**

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

drive bays with quick-release acoustic dampening rails. Our evaluation unit came equipped with a pair of 250GB Seagate Barracuda 7,200rpm drives configured in a RAID 0 array; they appeared as a single 500GB drive. While that can boost performance, it's not the safest configuration since all data will be lost if either drive fails. The BIOS also supports RAID 1 and RAID 5 and the motherboard includes five SATA connectors. Other SATA as well as SAS drives are available. Buyers can opt for less powerful NVIDIA Quadro or ATI FirePro graphics boards.

The 610-watt power supply provides ample energy, including the auxiliary power needed by the big NVIDIA graphics board. In spite of fans on the CPU, rear panel, power supply, and graphics card, the S20 was virtually silent after its initial startup.

Industry-leading performance

This time around, Lenovo pre-installed the 64-bit version of Windows Vista and also sent us drives that we could swap out, so we could repeat our tests using Windows XP 64-bit Edition. Once again, Lenovo proved its engineers know how to combine first class components and then configure the system for cutting-edge performance. The ThinkStation S20 equipped with the NVIDIA Quadro FX 4800 graphics board turned in some of the fastest SPEC viewperf scores we've ever seen on a number of the datasets. Perhaps more amazing, those top scores were recorded while operating under Vista.

When we turned our attention to the SPECapc SolidWorks benchmark, which is more of a real-world test (and breaks out graphics, CPU, and I/O performance separately from the overall score), the S20 again proved itself a very worthy workstation, beating all previously tested systems on the CPU and I/O portions of the test.

The AutoCAD rendering results also surpassed those of any single socket system we've ever tested, but that was to be expected, since the new Intel CPU supports hyper-threading. With hyper-threading enabled, the CPU appeared to the operating system as if it had eight processor cores, and AutoCAD's multi-threaded Mental Ray rendering engine took advantage of all eight threads. Our only complaint is that you must access the BIOS setup as the system boots in order to enable hyper-threading, but the Lenovo pre-boot splash screen doesn't indicate which function key to press to do so.

The AutoCAD rendering results also surpassed those of any single socket system we've ever tested.

Lenovo rounded out our evaluation unit with its Preferred Pro USB Fingerprint keyboard, a full size 104-key keyboard with an integrated fingerprint sensor and accompanying software so you can swipe a finger across the sensor rather than type passwords. Although a mouse was not included, a Lenovo-branded Primax 400dpi optical USB wheel mouse is available as a $10 option.

In addition to the 64-bit versions of Windows XP and Vista that we received, you have the option of having 32-bit versions of either OS pre-installed, as well as ordering a system with no installed op-

erating system. Red Hat Enterprise Linux (64-bit) is also available. For those awaiting the release of Windows 7, Lenovo has a free Windows 7 license upgrade available to qualified S20 buyers. Several versions of Microsoft Office as well as other application software are also available at the time of purchase. Lenovo backs the system with a three-year limited onsite warranty. The S20 uses 50 percent recycled plastic, meets Energy Star 5.0 criteria, and is GREENGUARD certified.

The ThinkStation S20 joins its predecessor as an absolutely perfect midrange CAD workstation.

Base systems start at $920. As configured, our evaluation unit priced out online at $3,885. You could certainly reduce that price significantly by opting for a single hard drive and lesser graphics board, and still end up with an excellent system. Whichever choice you make, the Lenovo continues to impress us. The ThinkStation S20 joins its predecessor as an absolutely perfect midrange CAD workstation. ■

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

Lenovo ThinkStation S20

Price: $3,885 as tested ($920 base price)
Size: 6.87 in. x 18.75 in. x 18.50 in. (WxDxH)
Weight: 32 pounds
CPU: Intel Xeon (Quad) W3540 2.93GHz
Memory: 4GB DDR3 SDRAM at 1333MHz
Graphics: NVIDIA Quadro FX 4800
Hard Disk: two Seagate Barracuda 250GB SATA 7,200 rpm drives in a RAID 0 array
Floppy: none
Optical: 16X DVD+/-RW Dual-Layer
Audio: onboard integrated SoundMAX (mic, headphone, line-in, front, rear, center/subwoofer, and S/PDIF in and out)
Network: integrated 10/100/1000 LAN
Modem: none
Other: One 9-pin serial, ten USB 2.0, 20-in-1 media card reader
Keyboard: 104-key Lenovo Preferred USB Fingerprint keyboard
Pointing device: none

FOR MORE INFO:

> Lenovo

Netbook + NI DA Make for Low-Cost Virtual Instrumentation

> > Netbooks are a compelling new deployment platform for data logging, simple signal analysis, and mobile measurements.

BY NATHAN YANG

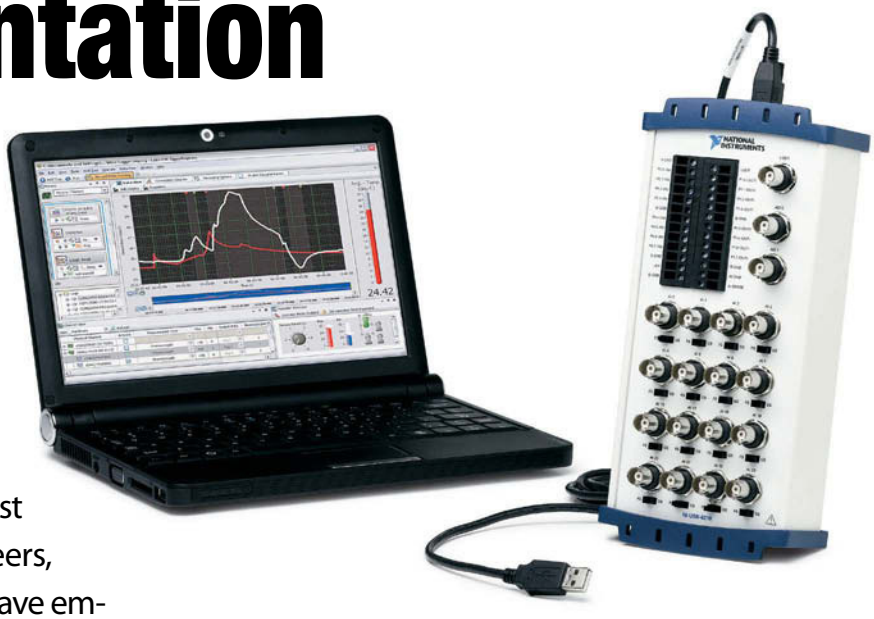


Figure 1: Bus-powered USB data acquisition products work well with netbooks because they offer high-performance I/O in a small, portable form factor.

Since the introduction of the first PC in the early 1970s, engineers, scientists, and professionals have embraced its ability to simplify their daily tasks. PCs evolved from an academic and hobbyist contraption to a powerful platform, helping reduce product-development time, automate repetitive tasks, advance computationally intensive science, and more.

Instrumentation and data logging have also significantly evolved since the early days of large, single-function desktop boxes. Virtual instrumentation replaces traditional boxed instruments by combining a software-defined PC-based system with modular analog and digital data acquisition (DAQ) hardware—a solution called virtual instruments. The advent of netbooks introduced a new, lower-cost, and more portable computing platform for virtual instrumentation than previous solutions.

Netbooks Prove Popular

Netbooks are defined as much by their features as their lack thereof. In fact, the term "netbook" drew more than 36 million hits on Google recently without a universally recognized definition. In a razor-thin margin industry, PC manufacturers are still changing the features of netbooks in an attempt to capture more market share and outsmart the competition.

Most netbooks offer an eight- to 10-in. screen, Windows XP or Linux OS, wireless networking, and USB connectivity. They typically do not have optical drives, full-sized keyboards, HDMI connectivity, or

	Desktop	Laptop	Netbook
Processor	Intel Core 2 Duo 2.1 GHz	Intel Core Duo 1.6 GHz	Intel Atom 1.6 GHz
RAM	4 GB +	2 GB +	512 MB to 1 GB
Storage Capacity	500 GB +	250 GB +	8 GB SSD or 60 GB + HDD
Screen Size	17 in. +	14 in. +	8 to 10 in.
Weight	15 lb + [1]	5.5 lb +	2 to 3 lb
OS	Windows	Windows	Windows or Linux

[1] Screen not included in weight.

This table illustrates a feature comparison for typical computing devices.

the ability to run processor-intensive applications. At the core of a netbook is a low-power processor. Most netbooks are equipped with the Intel Atom, a 1.6GHz CPU that consumes a maximum of 2.5W—an insignificant power draw compared to a typical Core Duo notebook processor, which requires up to 30W.

Netbooks provide a radically different approach to computing by adeptly addressing 80 percent of standard laptop use cases for less than $400. A small and mobile PC is not a new concept, but this is the first to gain widespread adoption. Previous attempts (including miniature laptops and PDAs) offered insufficient battery life, uncommon processors, and other usability limitations. The new netbooks address most of these trade-offs with respectable computing power and, most importantly, compatibility with widespread Windows x86 software applications.

New Virtual Instrumentation Platform

A wide variety of PC-based data acquisition devices exist on the market, from plug-in PCI Express boards to external plug-and-play USB devices. Because of the external nature, low-power requirements, and more than adequate data rates, bus-powered USB data acquisition devices are a perfect match for netbook-based virtual instrumentation. However, engineers and scientists must be aware of a set of important limitations as netbooks are not drop-in replacements for standard desktops or laptops.

First, consider the core component of a netbook, the Atom processor. These processors support hyperthreading, a proprietary technology from Intel used to process two threads simultaneously on a single core with unused resources. Hyperthreading does not provide true parallelism like dual-core processors, but it does deliver significant performance improvements for multithreaded software applications. Performing benchmarks for 1024-sample fast Fourier transforms (FFTs), a very common type of signal processing, were at approximately 8kFFTps on a single thread. Running two threads increased the overall performance by 50 percent to 12kFFTps.

As shown in Figure 2, which is a benchmark chart comparing FFT performance, netbooks deliver substantially lower performance than standard laptops and quad-core processors. However, 12

kFFTps is sufficient for most basic measurement and data logging applications.

Next is the most noticeable attribute of a netbook: its size. Typically weighing less than three pounds, netbooks are the smallest and lightest family of x86 computing devices on the market, a plus. And while the screen size makes for a compact shape, it poses a challenge in usability, with most Web pages barely fitting in the WSVGA screen resolution of 1024 x 600. They also require more scrolling because of their short vertical view. This is especially noticeable when viewing large amounts of data or programming in either text-based or graphical programming environments.

A third consideration is storage. Netbooks can provide plenty of disk storage, especially when equipped with a rotating hard-disk drive (HDD). Solid-state drives, on the other hand, are more energy-efficient, but often offer inadequate storage space and can cost substantially more. An SSD-equipped netbook typically features only 8GB of storage.

Netbooks can provide plenty of disk storage, especially when equipped with a rotating hard-disk drive (HDD).

A fourth consideration is peripheral and network connectivity. Because of the Atom's 945 chipset, most standard PC connectivity options are available,

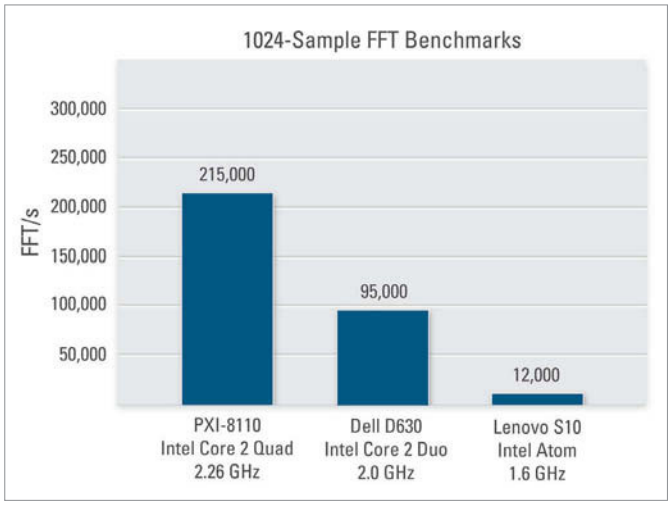


Figure 2: Benchmark Chart Comparing FFT Performance.

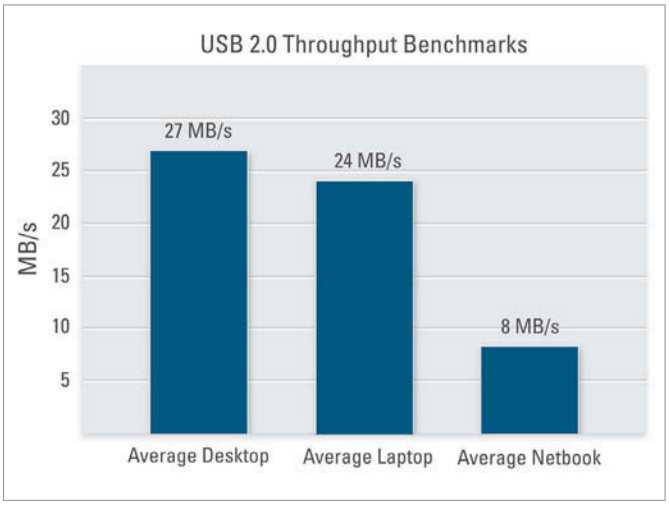


Figure 3: Benchmark Chart Comparing USB Throughput.

including Ethernet, USB, 802.11g, and ExpressCard. As can be seen in Figure 3, a benchmark chart comparing USB throughput, netbook USB 2.0 performance typically peaks at 8 MBps, much less than a conventional laptop or desktop. Nevertheless, this is more than sufficient for typical low channel-count applications—one can still perform 4 million 16-bit measurements per second.

Software Considerations

The adoption of Linux OS with netbooks has increased partially because of higher Microsoft Windows OS licensing fees. However, these do not offer strong third-party software support, and Linux distribution-specific hardware drivers are hard to find. These limitations also apply to the virtual instrumentation space, confining Linux-based netbooks to mostly Web browsing and basic computing. Thus, for most engineering and scientific applications, it is recommended to use either Windows XP or Windows 7.

Any application software running on a netbook

Netbooks are a compelling new deployment platform for data logging, simple signal analysis, and mobile measurements.

also needs to take into consideration the smaller screen size. Flexible user interface (UI) tools with a large library of customizable objects can help maximize the display area and provide a comfortable user interface.

In addition, because of improved performance seen earlier due to the availability of hyperthreading on Atom processors, users should ensure that their software applications are multithreaded. This can be achieved by selecting an inherently multithreaded programming environment like NI LabVIEW, or by explicitly implementing it in a standard programming environment such as Microsoft Visual Studio.

Finally, to use a netbook for virtual instrumentation with any pre-developed end-user software,

it's imperative to make sure that it can be properly operated at a resolution of 1024 x 600, 168 fewer pixel rows than the standard 1024 x 768.

Windows operating systems typically work best for engineering and scientific purposes, and choosing the right software development environment can help maximize the use of netbook resources. For processor-intensive applications, netbooks can offload demanding computing algorithms to standard desktops or large servers through Ethernet and wi-fi connectivity.

Netbooks are a compelling new deployment platform for data logging, simple signal analysis, and mobile measurements. And when all the pluses and minuses are examined thoroughly, most engineers will see that netbooks can significantly lower the cost of virtual instrumentation in a highly portable form factor. ■

Nathan Yang *is the product manager for data acquisition at National Instruments. You can send e-mail about this article to DE-Editors@deskeng.com.*

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ANSYS Mechanical Solves Challenges of a Megayacht Builder

> Megayacht builder Delta Marine uses finite element analysis to ensure interior design flexibility while maintaining desired strength, vibration, and weight characteristics in the composite structural members of its boats.

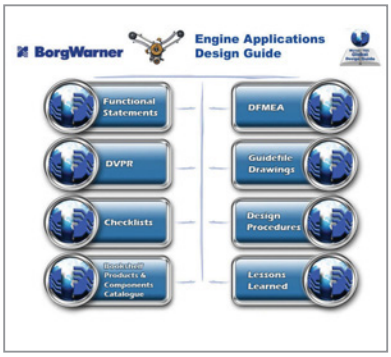
Purchasers of 100-ft. plus megayachts have come to expect the ability to customize the interior design to a level that matches their wildest dreams. Delta Marine has become one of the world's leading builders of this type of craft—in part through its expertise in designing carbon-fiber structures that enable virtually any interior configuration while providing high levels of strength, durability, and performance. However, giving interior designers the freedom to place walls or partitions to achieve a certain look creates structural design challenges by increasing the complexity of the load paths.

Although the design of Delta's most recent megayachts has encountered complex load distribution challenges, designers were able to produce vessels that are beautiful, strong, and fast.

> Continue Reading

SharePoint Server 2007 Transforms Static Repository to Dynamic Platform

> Communications, collaboration, and knowledge sharing are key ingredients to achieving innovation and streamlining design, development, and business processes. Old technology doesn't cut it. To succeed, companies must turn to Web-based infrastructures.



BorgWarner, a leading supplier of automotive power-train technology, sought to support collaboration across its business to better compete in the global marketplace. With aid from consultant CDW, the company deployed Microsoft Office SharePoint Server 2007 to transform its intranet from a static repository for policy documents into a dynamic collaboration platform.

Now users across product development, supply chain, manufacturing, and finance groups can better manage workflow processes, enhance global team collaboration, locate documents for greater reuse of knowledge assets, and provide training resources—all of which helps bring products to market faster. In one year, BorgWarner achieved its ROI by increasing overall productivity and cutting intranet costs by 64% annually.

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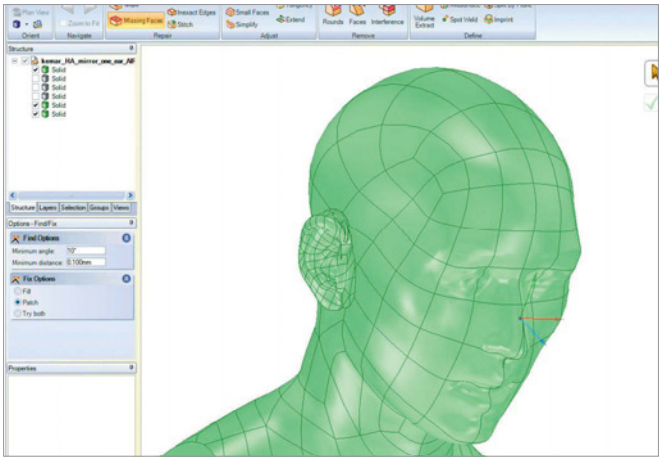
Widex Enhances Hearing Aid Technology with SpaceClaim



> Each design application has its own particular demands and requires a special combination of tools to achieve excellence. The optimization of hearing aid designs calls for a unique skill set—the ability to perform basic functions in one area but extensive expertise and creativity in others. This is the case with Widex, a leading provider of digital hearing aid technology.

Constant review and evaluation of designs and approaches requires simplifying CAD designs, analyzing acoustics and vibration, and using a specialized algorithm-development and simulation environment. To meet these needs, the hearing aid technology developer assembled a collection of tools that provided flexible and easy-to-use interfaces, interoperability, and specific technical functionality. This software mix streamlined processes, reduced cycle time, and optimized use of resources.

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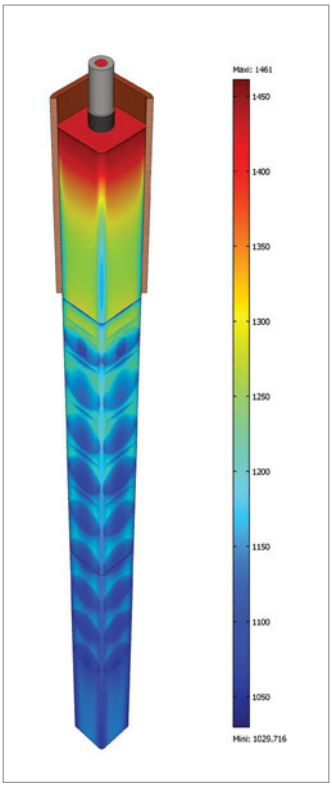
Ugitech Optimizes Steel Casting Process Using COMSOL Multiphysics



> A manufacturer of stainless steel uses multiphysics modeling and simulation to optimize the speed of its continuous casting process while maintaining the quality of its product and the safety of its operations.

The steel maker used modeling to examine the early solidification of its product after it was removed from the mold. During this phase, cracks, segregations, depressions, and air gaps can form, diminishing the quality of the steel. Through multiphysics modeling and simulation, the company was able to better understand what was happening inside the steel bloom as it passed through the casting machine, create profiles for the 150 grades of steel that it manufactured, and thus better control its processes by optimizing the temperatures and speeds of its operations.

> **Continue Reading**

3Dconnexion 3D Mice Improve Design Efficiency

> Input devices like the SpacePilot, SpaceExplorer, and SpaceNavigator help designers and engineers improve their processes from start to finish

BY JIM ROMEO

Your mouse can add another dimension to engineering design. By moving within your design space in three dimensions using just your mouse, your engineering freedom is suddenly expanded.

3Dconnexion's 3D mice have the potential for opening up the possibilities for design engineers who embrace the technology. To understand the company's product and its approach to the market, we spoke to Froi Lomotan, director of advanced software technology for 3DConnexion.

Froi Lomotan, 3Dconnexion

What Sets 3Dconnexion 3D mice apart and what do they offer the design engineering community?

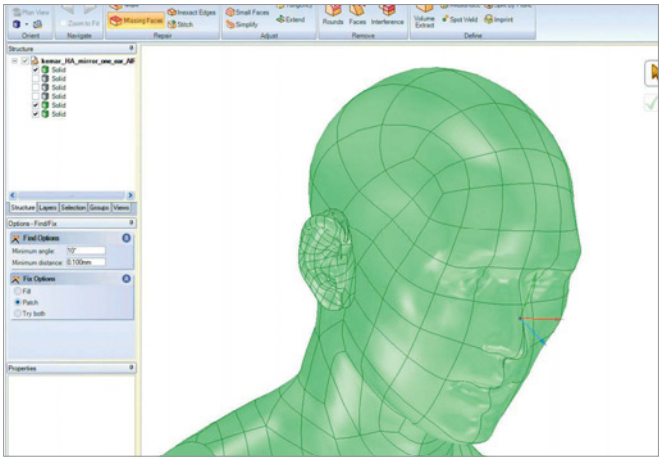
Lomotan: 3Dconnexion 3D mice provide an immersive design experience that dramatically improves the design process from start to finish. Unlike traditional mice confined to motion on one flat plane, 3Dconnexion 3D mice enable design engineers to move in all three dimensions simultaneously, using six degrees of freedom.

At the heart of 3Dconnexion's 3D mice is the controller cap, which makes otherwise complex movements simple and streamlines the entire design process. Unique, pressure-sensing technology allows the cap to become a virtual extension of the designer. Gently pushing, pulling, twisting, or tilting the cap a fraction of an inch enables users to simultaneously pan, zoom, and rotate 3D imagery with complete precision. In addition, a subtle increase in pressure accelerates movement and a decrease in pressure enables users to make intricate adjustments.

Using 3Dconnexion's 3D mice provides a blended navigate-command flow instead of a linear navigate-command process. The result is a much more natural and intuitive way to interact with 3D content. This includes a streamlined design workflow, reduced interaction with the interface, allowing greater focus on the design, reduced physical fatigue and discomfort, and increased productivity—on average, more than 20 percent

3Dconnexion's professional series of products include the SpacePilot and SpaceExplorer, and the

Widex Enhances Hearing Aid Technology with SpaceClaim



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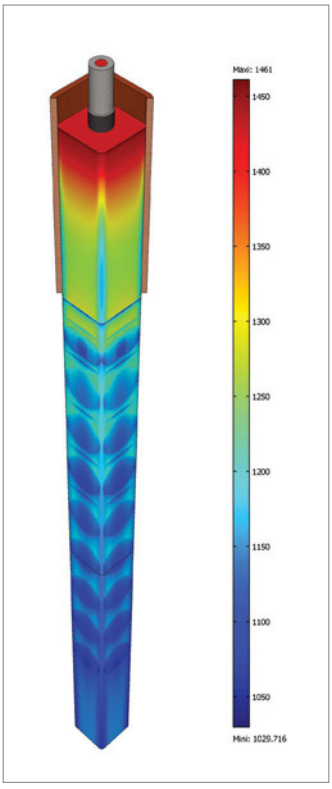
Ugitech Optimizes Steel Casting Process Using COMSOL Multiphysics



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Is your product designed to interface with off-the-shelf software and other applications? How important is this for the design engineering environment?

Lomotan: The vast majority of 3Dconnexion's professional design engineering user base utilize applications that are purchased from resellers or direct from the ISV, not off the retail shelf. However, 3Dconnexion's 3D mice are designed to work with off-the-shelf software. IMSI's TurboCAD is an excellent example of this. As is the case with other control and input devices, since there is no industry-standard 3D interface, 3Dconnexion's 3D mice may not work with all software applications automatically.

In addition, 3Dconnexion's software development kit (SDK) is free and available on the website at 3Dconnexion.com, including code samples and documentation, enabling developers of 3D design and visualization applications to quickly and easily implement support for 3Dconnexion's 3D mice. A typical implementation only takes one week.

How can the product be configured for multiple users? Can it be set up for a group as well as an individual access?

Lomotan: 3Dconnexion's 3D mice are designed for use by a single user, similar to traditional mice. However, they can be easily moved from workstation to workstation as needed.

In your view, what does the design community need in today's engineering environment and how can software help them get there?

Lomotan: Design engineers and other professionals with similar workflows are typically using complex applications hours upon hours each day. As a result, they are always looking for ways to streamline the design process while increasing the quality of their designs. In addition, the design community needs interfaces that connect them directly to their content. A user interface should 'drop away,' allowing direct interaction with the design.

Design engineers also need a streamlined review process where they can verify designs iteratively in less time with as little cost overhead as possible. 3Dconnexion 3D mice significantly improve the design and review process by allowing design engineers to focus on the design itself and not maneuver through the application, making it easier to identify problems or design flaws. This can have a significant financial impact on the product development process, as it helps to ensure that costly changes are minimized in the final stages of design.

More than 80 percent of CAD design engineers surveyed in the "The Economic Payback of 3D Mice

3Dconnexion 3D mice significantly improve the design and review process by allowing design engineers to focus on the design itself and not maneuver through the application, making it easier to identify problems or design flaws.

for CAD Design Engineers" study believe that using a 3D mouse improved their product designs and indicated that using a 3D mouse made it easier to identify any problems with the design.

Looking forward, where do you see engineering software going and how will 3Dconnexion 3D mice be a part of that?

Lomotan: The growing complexity of 3D applications has generated a need for more advanced navigation and control that cannot be attained with a traditional mouse. As such, the application interface and 3D environment along with the hardware needed to support the complete design process are paramount.

Future applications will continue to blur the distinction between where the application ends and the interface for the 3D device begins. For example, in the future we expect to see design engineers using devices that have application content on them. 3Dconnexion's goal is to continue to evolve our 3D mice to provide greater comfort, increased control and expanded performance with the latest technologies to continue to help designers interact more naturally and directly with their designs.

Can you give us some examples of what industries and more specifically, some projects that have used your product?

Lomotan: 3Dconnexion 3D mice are used in leading organizations across a wide-range of industries, including CAD, architecture, engineering and construction (AEC), digital content creation (DCC) and geographic information systems (GIS).

When you speak to prospective customers, what is it about your product that usually gets their interest and leads to Them becoming a customer?

Lomotan: The substantial productivity and design performance that design engineers can gain make a 3Dconnexion 3D mouse a "must have" design tool for today's 3D professionals. Key benefits for design engineers as they look to enhance their design performance and overall workflow with a 3D mouse include ease-of-use and easy integration into design processes; learning time is minimal compared to the time savings a user can expect to achieve; easier to identify problems, improving the overall quality of designs; help in decreasing time spent managing application complexity and allow for more time on the design itself; reduced physical fatigue and discomfort; and support by more than 130 of today's leading 3D applications. ■

Jim Romeo *is a freelance writer specializing in industrial technology topics and can be reached at jimromeo.net. To comment on this interview, send e-mail to DE-Editors@deskeng.com.*

FOR MORE INFO:

> 3Dconnexion

Virtual Clay Using Sculptor & Back2CAD

> Optimal Solutions Software has a modeler you can bend, twist, and pinch to save significant time in model optimization.

BY MIKE HUDSPETH

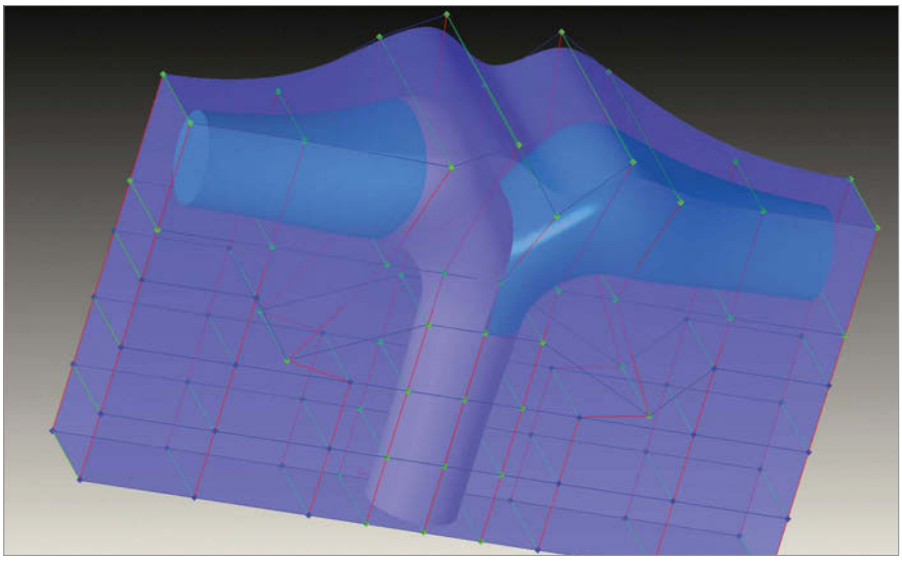


Figure 1: In Sculptor you don't actually manipulate the model but the space around it. You create an envelope and stretch the daylights out of it. That way, if you need to make engineering changes to the original model, you can.

How many times have you worked on a digital model and come to a place where you think to yourself, if I could just grab that there and bend it or twist it? Anyone who has modeled in 3D has asked that at one time or another.

3D modelers are wonderful at many things, but up until lately they haven't been good at the kind of on-the-spot manipulation you can achieve in a fully stocked machine shop. I say lately because there is a trend afoot that brings just this kind of capability to your desktop.

A company called Optimal Solutions Software has released a couple of solutions that should cause everyone to sit up and take notice. Sculptor, a mechanical deformation program, and Back2CAD, a module for transfering an optimized shape back into the CAD program, were created to cut big time out of the design optimization process. Because the two work in tandem, this review is going to be something of a "two-fer." Both products deserve serious attention.

Don't Leave Your Records In The Sun

Sculptor allows you to freeze the mesh on a model in order to get fast feedback on the altered shape. You do this by creating an envelope around the model (*see Figure 1*). This is called an ASD volume (Arbitrary Shape Deformation). It's really just a shape that approximates and encloses the volume

of the model. When you have created the envelope you want, you freeze the mesh.

Now, you are ready to deform it. The mesh is similar to FEA or CFD mesh files. It uses an .mdf (main data file) file extension. Points are defined by the user (as many as you need) to establish where you want the model deformed, then you deform the envelope, not the model.

It's very like the Alcubierre drive proposed by physicists where a spaceship doesn't move but instead warps space around it so that the ship appears to move, thereby surpassing the theoretical lightspeed speed limit. Of course, you're not likely to jump to hyperspace while using Sculptor, but you can do some fascinating things to your 3D model.

T-Splines, an optional module ($1,000), allows you to create splines to control your model's deformation. You can manipulate your model in a number of ways (*see Figure 2*). You can use a slider, input numbers directly, or even click and drag control points in the graphics window. You can group control points to make bigger changes to more of your model. And it's not just *x,y,z* movement. You can rotate (twist) groups of points. Drag works in 2D mode when done in an orthographic view. That means you are restricted to moving along a given axis, which makes it very easy to understand what you can expect to get.

You do need to be careful not to deform your model beyond a workable level. If you bend and twist it too much you may have trouble maintaining a viable internal volume (*see Figure 3*). You could end up with internal "bubbles" of model space. That will be a problem when going back to your 3D modeling program.

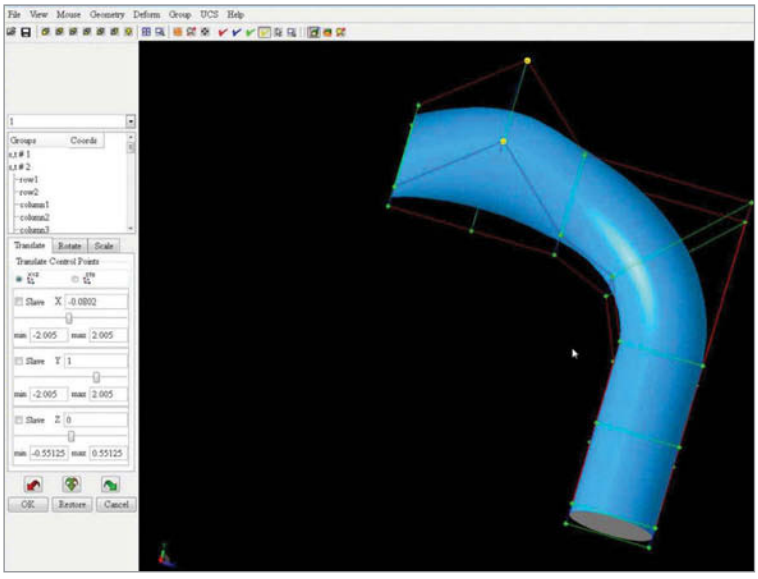


Figure 2: Sculptor has some pretty intuitive controls. Just pick your points and move them via sliders, numerical input, or just click and drag in the graphics window.

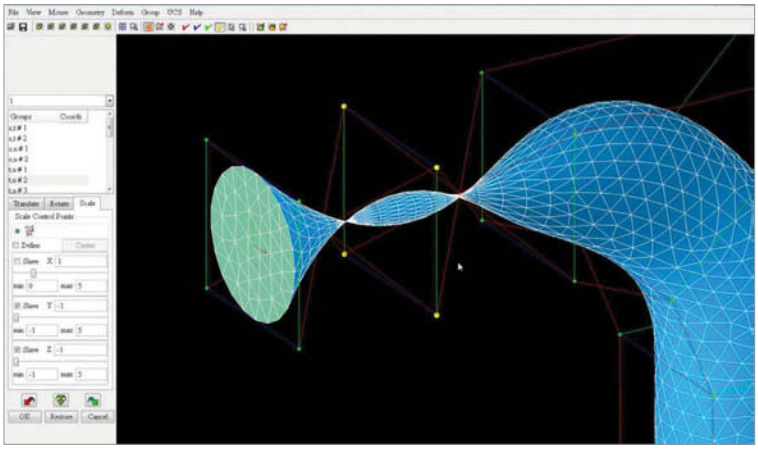


Figure 3: This looks like the famous East Indian trumpet bird to me. In any case, you can bet your bottom tuppence you won't be able to manufacture whatever it is supposed to be. This is a good indicator of the shape manipulation possible.

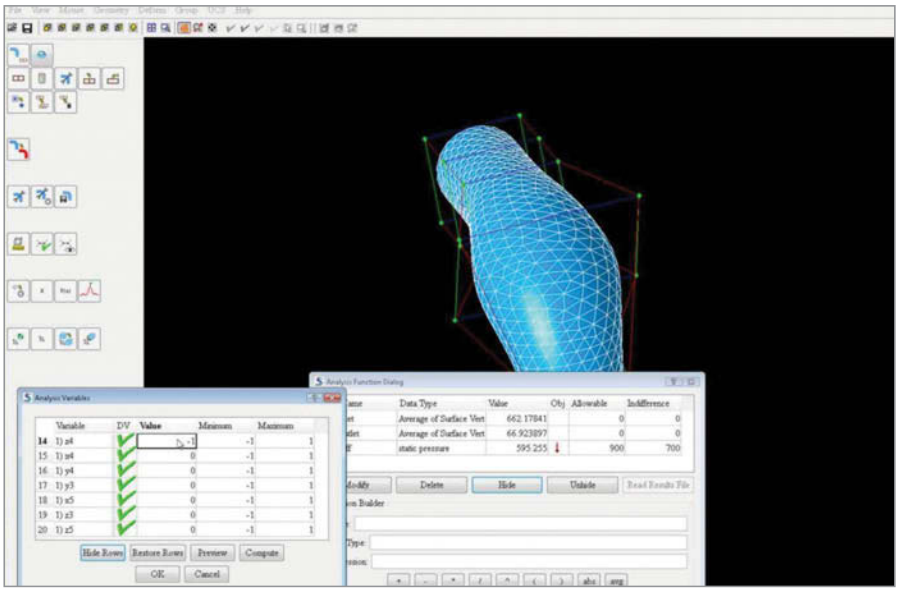


Figure 4: You can control the variables you use to find just the right mix of model deformation.

Remember, Sculptor doesn't constrain you in how you deform, so you need to restrain yourself. Regardless of what you do to them, your models will retain their C2 continuity. That means they will smoothly transition from one face to another. This is important for appearance as well as aerodynamic performance. And because Sculptor uses the ACIS modeling kernel, Optimal Solutions Software works closely with Spatial Technologies to wring every ounce of functionality out of the kernel.

With their deformation and optimization capabilities and tight compatibility with most 3D modeling programs, Sculptor and Back2CAD are great tools for any designer.

What Else?

Sculptor has some powerful analysis functions as well. You can query the model about all kinds of things like model volume and surface area. That helps you to assign forces like static pressure. You can then see the results of taking your model to 500 miles per hour. Once there, if you're not completely satisfied with what you see you can optimize the design. That's where the deformation gets down to business. You can do it yourself or have Sculptor do it for you. Optimizer, the optional automated optimization module ($1,000) works to parameters you set up (*see Figure 4*). You select the variables you want for optimization.

Sculptor also has Element Quality Checking to keep the mesh accurate. You can even save the model as it optimizes along the way to create different states. That's for those great "what if" scenarios (*see Figure 5*).

There are additional modules available to increase your productivity. The Grid-Clip module ($1,000) allows you to work with large models easily. Essentially it helps you mask off the portion of your model that you want to deform. Any changes made there will then be "sewn" back onto the rest of the model. The Cylindrical ASD module ($1,000) allows you to use polar coordinates to deform your

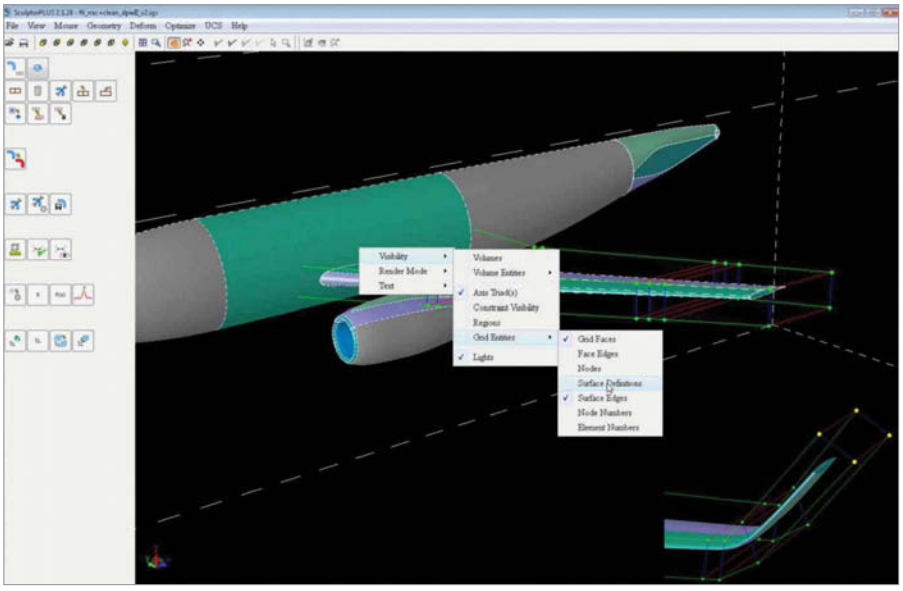


Figure 5: With Sculptor you can start out with a plain-Jane straight airplane wing and warp it to get a performance enhancing winglet at the tip.

model. It can also be used simultaneously with the standard Cartesian coordinates in Sculptor.

Of course, once you are satisfied with your model you are going to want to take it back into whatever 3D modeling program you use. Sculptor isn't a competitor to any modeling program—rather it's a complement. If you've used 3D modeling programs for any time at all you already know that they all have limitations to what they can do well. With something like Sculptor that's not a limitation you have to worry about.

When it comes time, you use Back2CAD ($5,000) to, you guessed it, take it back to your modeler. Back2CAD doesn't even care what kind of mesh it uses. What that means is that you can generally take an optimized mesh and export it into the native format of whatever 3D modeling program you use. Optimal Solutions has partnered with most of the big players in 3D modeling so they can all play nice together. You can export to and from ANSYS, CATIA, ICEM, Inventor, NX, Pro/ENGINEER, SolidWorks, etc., even IGES and STEP.

With their deformation and optimization capabilities and tight compatibility with most 3D modeling programs, Sculptor and Back2CAD are great tools for any designer. You can get into a license of Sculptor for right around $10,000 then add on whatever modules you need. Sculptor is available for most current PC operating systems, but not Mac.

Now you can grab that model, and work on it almost like clay. Pretty handy. ■

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 e-mail about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Optimal Solutions Software

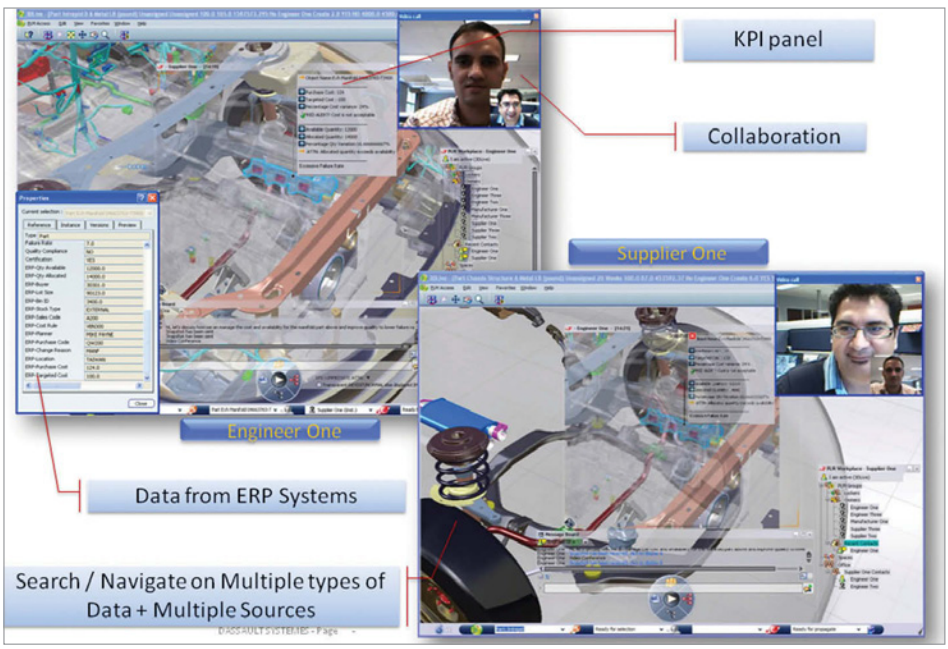
ProductPoint, ENOVIA, InnoCentive Form Virtual Think Tanks

> Companies are casting their nets further in the ideas market to collaborate on innovation by leveraging social networks.

BY TOM KEVAN

Innovation is the introduction of something new—an idea, a method or approach, a suite of technologies. And modern engineering, specifically product design and development, rises or falls based on its presence. Economic realities are driving the design community to rethink how it achieves innovation. No longer is it the product of one engineer's genius or the skill of a company's engineering team. Increasingly, the ideas of customers, suppliers, and outside experts are being tapped to create broader development networks. To enable the communication and collaboration needed by these networks, companies and technology providers are adapting social networking paradigms to the product design arena.

"The major revolution with social networking is that innovation doesn't have to come from within



Dassault Systèmes' 3DLIVE enables users to attach data from multiple systems to a 3D Object. If an engineer wants to discuss an issue regarding a part with a supplier, the engineer sees the supplier online and initiates a chat through the Buddy List functionality. The two have the same view and share notes, section cuts, and dimensions in real time.
Image courtesy of DS

a company," says Marc Halpern, research director for the Gartner Group. "Innovation can come from outside a company. So a manufacturer reaches out to those in the world that have the best expertise and knowledge. Via social networking, you get to the right people quickly."

Adaptation

Social product development is the result of a circuitous evolution of the social networking trend that first appeared in the commercial sector, where online communities of people who share interests and activities are created. In these Web-based communities, participants interact using a variety of social computing technologies, such as e-mail, instant messaging, blogs, wikis, and online forums.

With the evolution of social computing tools, product lifecycle management (PLM) technology providers have begun to see that the functionality of the tools can greatly enhance the design process. The vendors realize that they can provide better ways for the stakeholders to communicate and work together. But there are too many risks associated with using commercial tools such as FaceBook, Twitter, and LinkedIn, where a company's intellectual property can be accessed by anyone, including competitors.

In its paper, "Social Computing in the Enterprise," Microsoft offers a vision of companies balancing the "benefits of knowledge sharing and relationships with sound IT and business principles." Along these lines, technology providers have begun adapting social product development tools for an enterprise framework by including more security and control. Access and participation are becoming context driven, with the functionality defining the roles people play, the programs they have access to, and the tasks they perform.

The collaboration and communication features and benefits of social networking and social computing are now gaining traction in the product-development arena. Engineers and managers can now search and access shared files. They have the ability to work together, view relevant data and design visuals in common workspaces, and discuss design issues in joint work sessions.

"We've always talked about doing collaboration," says Kenneth Amann of CIMdata. "Now we are beginning to see people use more direct-interaction capabilities…. If we really want to get everybody involved, we want to find the people who are pertinent to the work, to interact with them directly. It becomes more of a social interaction."

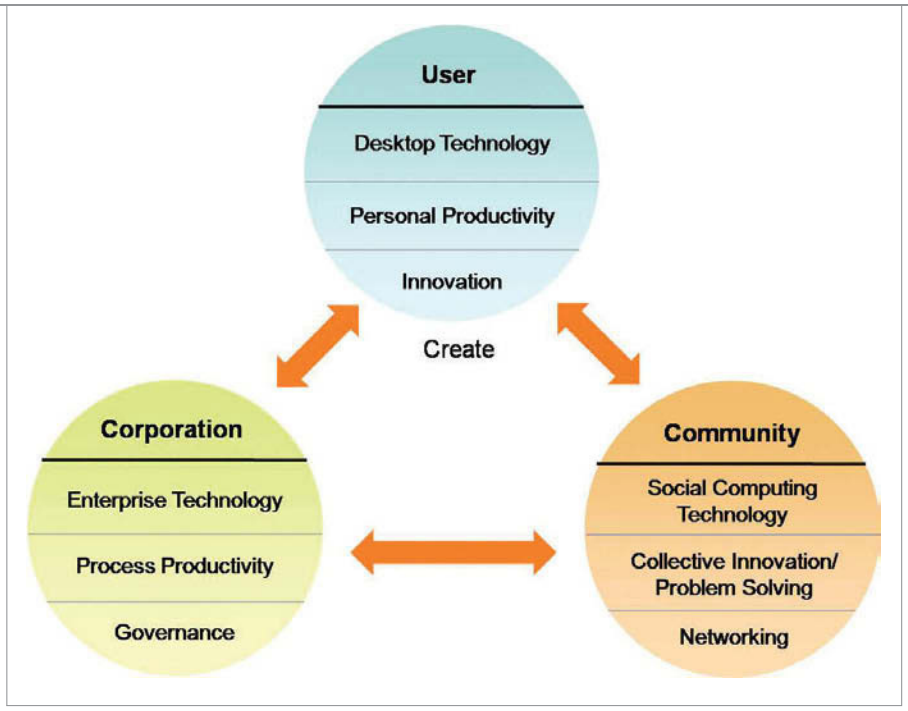
Forces of Change

It's one thing to understand how a new technology has evolved, but it is quite another to see what market forces are driving its development and why you should use it. In the case of social product development, no one element is pushing the technology's growth and adoption. Many factors are involved, but at the top of the list are two economic realities.

The product development process has become more global in nature, and the broad distribution of design teams is a fact of life. "The global nature of product development is forcing companies to find ways to get high-level performance over wide-area networks," says Chad Jackson, research

director for the Aberdeen Group.

In addition, increased competition is forcing companies to strive for shorter product-development cycles. "We consistently see that shortened development cycles are the top pressure that engineers are facing," says Michelle Boucher, research analyst for Aberdeen Group. "They are constantly trying to be faster, work more efficiently, and be able to interact and collaborate more easily, which lends itself very nicely to Web 2.0 technology."



Social product development software consists of three types of applications. Individual user authoring programs; corporate software for control of the design process via PLM, PDM, and configuration management; and community software for real-time ad hoc collaboration required to improve interaction within the design community.
Image courtesy of PTC

Another factor driving social product development is the rising influence of the mechatronic design approach. "Electrical engineers, mechanical engineers, and embedded systems engineers have different design and validation processes, yet they need to be able to integrate them," says Jackson. "So communication and collaboration is at a premium. You can actually use social media, or Web 2.0 technologies, to document design decisions centrally and collaborate around what decision to make [among] those different stakeholders."

Says Boucher, "In the last study we did on mechatronic system design in January 2008, the top challenge is overcoming the silos of knowledge of the engineering disciplines and breaking those communication barriers. Finding different ways to communicate would definitely be a way to solve that."

Demographics are also coming into play. "The younger generation of engineers moving into the workforce has grown up on these social networking tools," says Robin Saitz, senior VP of communications for PTC. "They will expect, and potentially even demand, these types of applications in their work environment because that is what they know."

Finally, the pressure for design innovation is moving social product development forward. "We did a case study on Procter & Gamble," says Gartner's Halpern. "Through this type of social network, the claim was made that Procter & Gamble was trying to get 50 percent of its innovation from the outside so that they don't suffer from the 'not invented here' type of blindness. The claim was made that by using this type of technique that Procter & Gamble's 7,500 engineers were able to leverage input from more than 50,000 people on

the outside, on a global basis, to stimulate greater innovation."

The Strength of Weak Ties

If you step back and look at the big picture, two types of applications have provided the backbone of product development functionality: authoring software, for CAD and source code development, and enterprise control software, for PLM, PDM, and configuration management. One element that's been missing is software technology that enables the real-time ad hoc collaboration required to improve interaction within the design community; the core of social product development. These applications enable design communities to find and capture information, connect with people, and leverage networks to solve problems

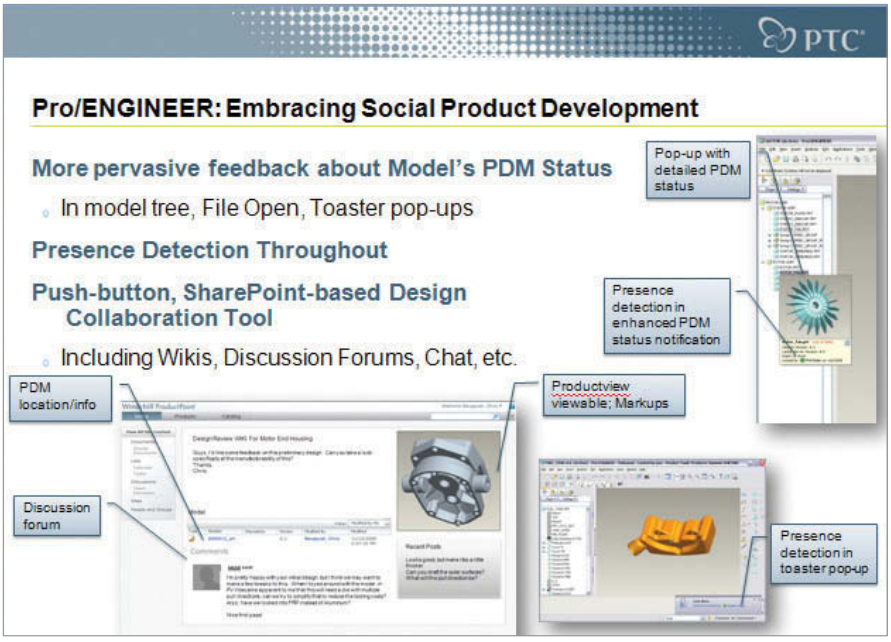
Social product development networks are made up of a number of communities both inside and outside the enterprise. "Each organization has a number of communities of innovation," says David Ritter, CTO of InnoCentive. "Each of these communities has different characteristics, wants, and needs, and they can contribute to the innovation processes in a particular way. These can include enterprise employees, customers, and the rest of the world. There's lots of latent knowledge and solutions … coming from places that seem quite unlikely."

"The real benefit of social networking is the

strength of weak ties," says PTC's Saitz. "It is leveraging the people you know to get to people you don't know who can help you."

Pioneers

For a glimpse of the impact that social product development will have on the design process and how it has begun to be integrated into PLM tools and services, let's take a look at three products. It's important to understand that these products are the starting point as the full potential of the technologies has yet to be realized.



PTC's integrated suite of PLM products, which includes Pro/ENGINEER, derives its social computing functionality from Microsoft SharePoint technology. The features include instant messaging, presence detection, and status notification, as well as the ability to create blogs and wikis.
Image courtesy of PTC

PTC offers Windchill ProductPoint to enable designers to manage collaboration on structured data and ProductView for viewing, marking up, and measuring 3D geometry by non-CAD users to be integrated with its Pro/ENGINEER MCAD solution. By building ProductPoint natively on top of Microsoft's SharePoint platform, PTC makes a variety of social product development functionality available throughout its entire PLM suite. The features include instant messaging, presence detection, and status notification, as well as the ability to create blogs, wikis, and MySite pages for products and subassemblies. Essentially, PTC has taken general social computing tools and tailored them for product development teams.

Typically designers don't have a good way to capture design intent—to describe for other team members what they are thinking and what the problems are. PTC's technology enables them to use a wiki in ProductPoint to be exposed within Pro/ENGINEER. Members of the design team can edit the model notes in the wiki to express what they are thinking and the notes can be viewed and edited through a browser.

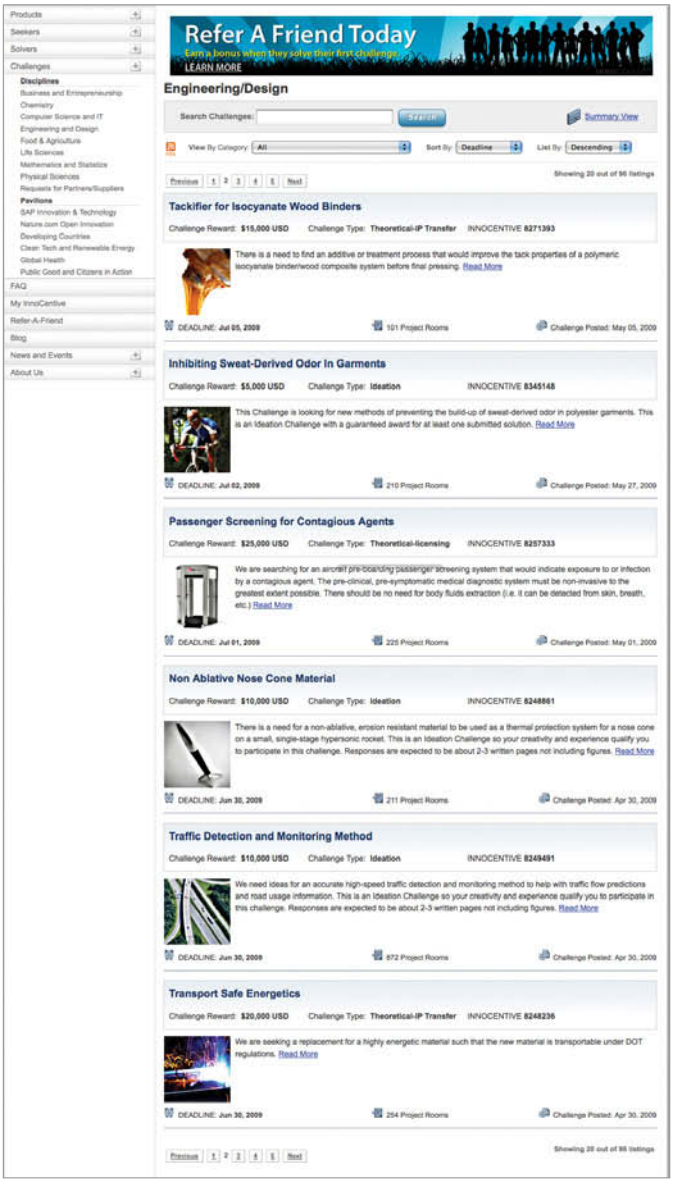
In another approach, InnoCentive.com provides a program that connects companies, academic institutions, public, and nonprofit organizations with a global network of more than 160,000 of the world's brightest minds. Enterprises, primarily Fortune 500 companies, with design problems (called Seekers) post challenges on the company's website. Each challenge has a bounty, or cash prize, associated with it, which ranges from $5,000 to $1 million. People registered with In-

noCentive (called Solvers) post solutions to the problems. The Seekers evaluate the submissions and decide whether they meet their criteria for success. If they find a solution that meets their requirements, they pay the award, and the intellectual property is transfered from the Solver to the Seeker. Other companies with similar services include YourEncore, Yet2.com, and NineSigma.

"It is the diversity of the community that looks at these problems that matters most in ensuring that they get solved," says InnoCentive's Ritter, explaining that it is the social aspect of product development that makes it possible to find the one person in the world uniquely qualified to answer the specific question.

While it does not offer InnoCentive's potential numbers of untapped imaginations, Dassault Systèmes' ENOVIA emphasizes the importance of a shared workspace and 3D modeling in social product development. "We think the presence of 3D makes a real difference in PLM, and one of the things that differentiates collaboration from communication is the shared workspace," says John Squire, a VP for ENOVIA.

For example, in 3DLIVE's shared workspace, you can physically navigate through multiple levels of detail of a product's 3D model. By clicking on a part, you can view all relevant metadata, including the name and email address of the primary designer, the part's development stage, the original



InnoCentive's Disciplines pages list all challenges related to a particular field. On the Engineering/Design page, users get a brief description of each, awards, posting dates, and deadlines. They can also see how many people have responded to the challenge.
Image courtesy of InnoCentive

requirements, and the NC machining instructions. Each workspace also has a special window that allows multiple people to collaborate online, using instant messaging or video conferencing, with participation and viewing privileges defined by security clearances. Not limited to any single product, these features are integral to ENOVIA's core architecture whether in 3DLIVE or CATIA V6.

Dassault recently announced a partnership with the European social networking company blueKiwi, and is expected to feature blogs, posts, wikis, and user profiles in upcoming software offerings.

As the world of social networking develops, it will be interesting to see how it aids the rapidly shrinking world of engineers and designers. It will almost certainly increase the pace at which we innovate and collaborate. ■

Tom Kevan *is a New Hampshire-based freelance writer specializing in technology. Send your comments about this article to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Aberdeen Group
> CIMdata
> Dassault Systèmes
> Gartner Group
> InnoCentive, Inc.
> Microsoft Corp.
> NineSigma Inc.
> Parametric Technology Corp.
> yet2.com
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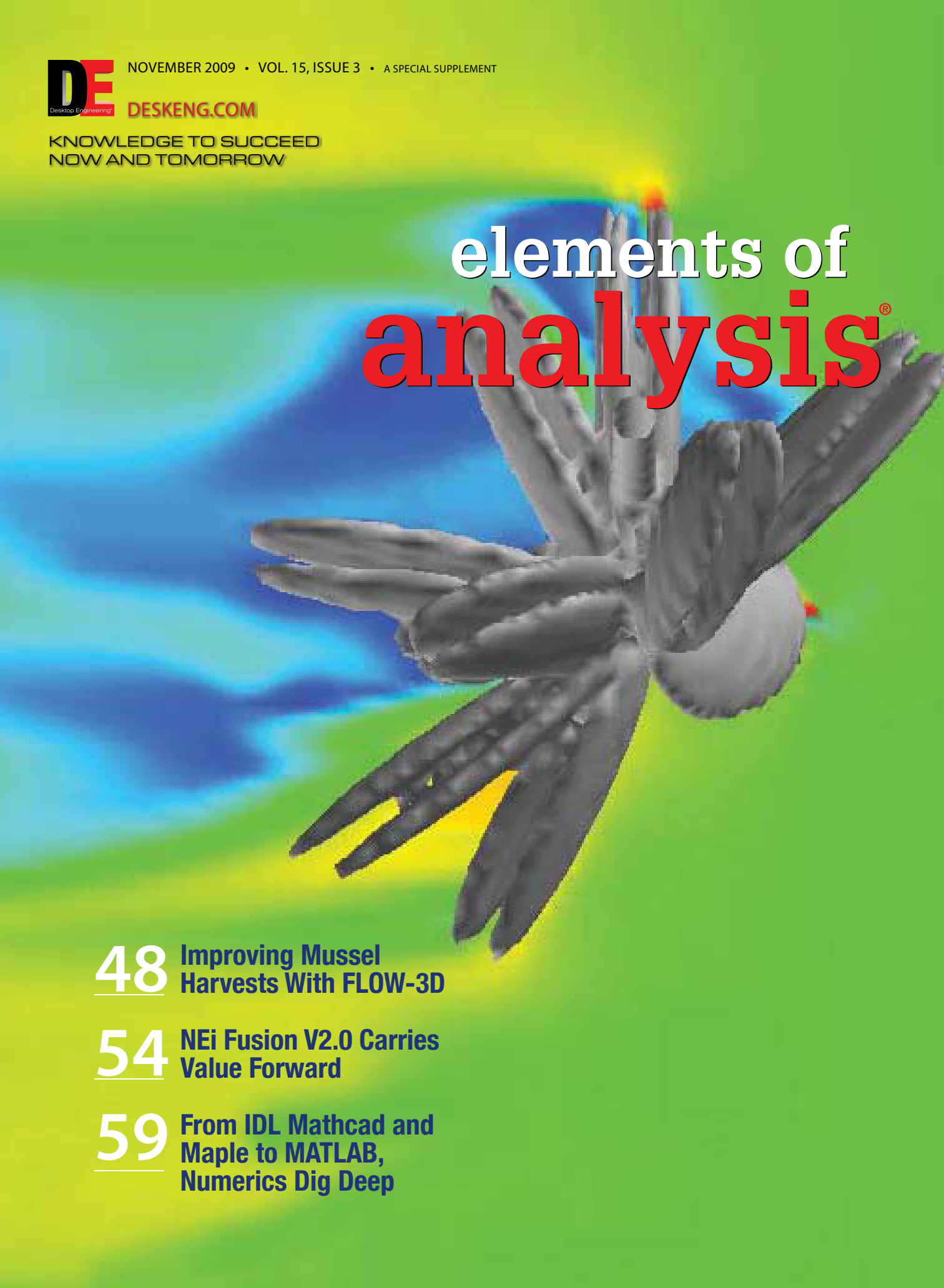


By Pamela J. Waterman

Modeling Commercial Aquaculture Systems Employing FLOW-3D

> Marine flow analysis using CFD is increasing shellfish production and minimizing its environmental impacts.

Many factors influence marine aquaculture: tidal fluctuations, water temperature, food concentration, and stocking density, among others. Success in this industry depends on balancing what you can control with what you can't, and putting years of experience behind day-to-day decisions. Nowadays there's another tool to help identify productive sites and plan management strategies, especially considering sustainability: computer modeling targeted to aquaculture. A Maine-based business has been busy promoting this tool as an integral part of the shellfish aquaculture industry, and to prove it they use it to run their own commercial mussel farm.

This shot of Killary Harbour, Ireland, shows longlines used for mussel harvesting. A Maine-based business has been using CFD to optimize longline placement.
Images courtesy Blue Hill Hydraulics

Challenges in Managing WaterResources

Since 2004 Blue Hill Hydraulics of Blue Hill, ME, has been using advanced numerical modeling methods to solve difficult flow problems. Their work in microfluidics, aquaculture, and river hydraulics has helped clients involved in dam removals, fish passage protection, and the design of laboratory equipment.

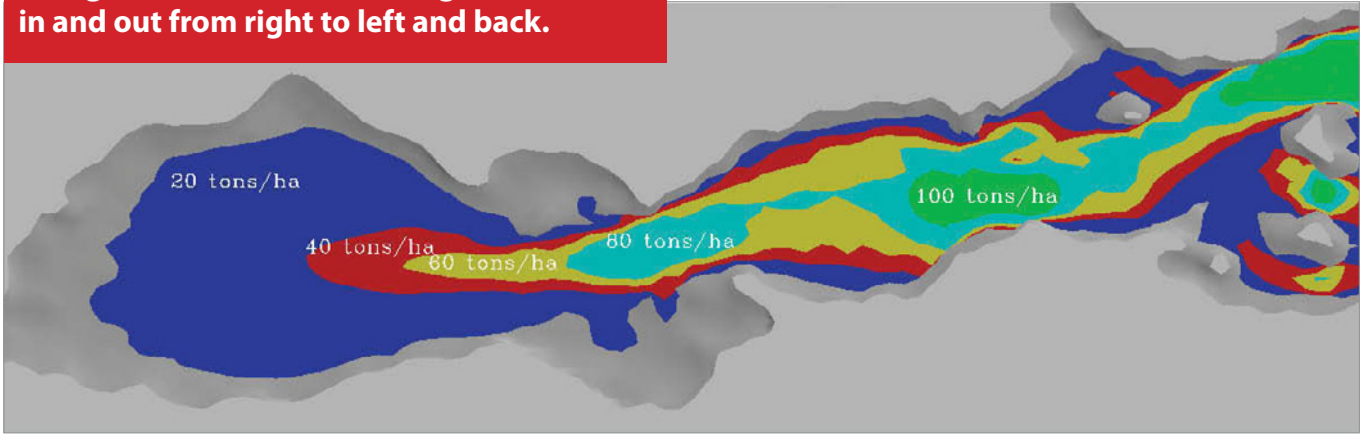
When the Irish Shellfish Association (ISA) approached Blue Hill Hydraulics (BHH) in 2005, they, like others, were looking for new approaches to improve the siting and operation of nearshore aquaculture operations. To increase the production of shellfish such as blue mussels, manila clams, geoducks, and oysters, BHH regularly answers questions about the number of shellfish that can be put in a particular area (i.e., optimum stocking density) and the best spacing to grow them to market size in a given period of time (i.e., 18 months).

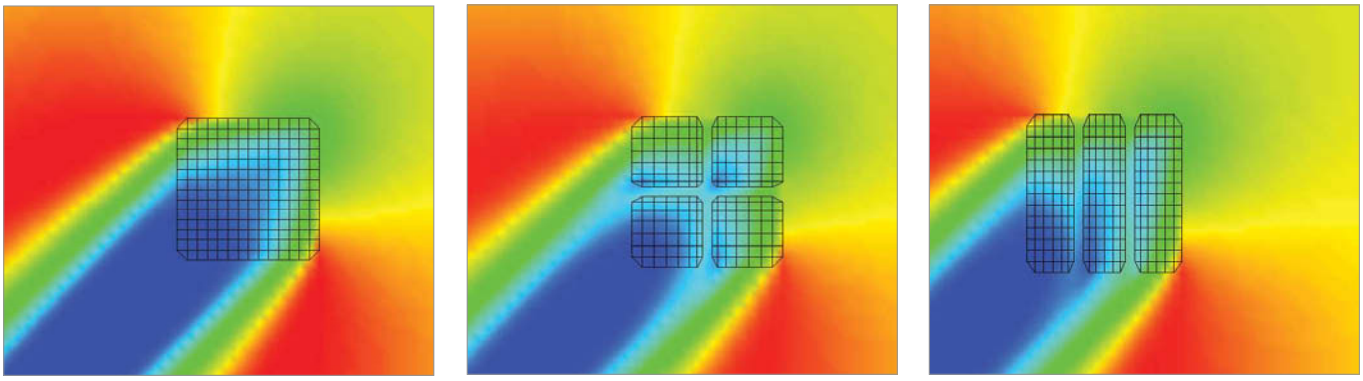
Mussel fishermen are using CFD to determine how best to arrange their longlines.

Detailed answers to these questions depend on the specific type of aquaculture method used. Common techniques for growing mussels involve the use of rafts or longlines as the base structures from which to hang ropes suspended in the water. Farmers place seed mussels inside biodegradable "socks" that surround the ropes, then the mussels attach themselves to the ropes in a natural anchoring response that takes place before the socks decay.

With this method, planning factors include the length and diameter of rope, the design of protective predator nets, particulate (food) density in the ocean water, and water temperature. Similar issues are involved for oysters raised in

This FieldView visualization simulates optimized seeding density for maximum meat yield (tons per hectare) using bottom culture technique. Mussels are dropped directly onto the floor of the ocean inlet, grow to harvest size, and are picked up with dredges. Inlet entrance is at right; tide flows in and out from right to left and back.





This FLOW-3D simulation was created to optimize longline raft placement in a mussel fishing ground. The flow patterns are simulated to measure speed of the current at a particular location. Speed changes occur as a result of different rope spacings (flow rate colored by speed; red is fastest).

flat net-bags stretched across gridded trestles. To reach the goal of maximizing the number of shellfish grown to market size in a minimum amount of time, understanding the way water flows through the system is critical.

Seasoned farmers have always made decisions based on years of experience, but natural fluctuations in harvests and a greater concern for the environment has more recently inspired investigation of unfamiliar situations. They're now looking for better ways to determine how to grow more shellfish faster and how localized nutrient concentration is affected by the presence of the farms themselves. The ISA, with funding from the Irish government, asked BHH to create a computer model that would take these and other concerns into account and serve as a tool for making better decisions in the future.

A Systematic Approach to Growth Analysis

John Richardson, president and principal engineer at BHH, and Carter Newell, a marine biologist and president of Pemaquid Mussel Farms in Maine, have worked with computer modeling since the 1980s. Clients of theirs include commercial growers' groups in Virginia, Connecticut, Washington, and British Columbia.

The duo's first project involved modeling bottom-culture farming techniques. The two analysts used a numerical modeling approach to identify culture sites that would support growth of the greatest number of shellfish. Since this type of analysis involved working with the combined parameters of both food consumption and fluid flow, they needed an advanced computing capability that was easy to use.

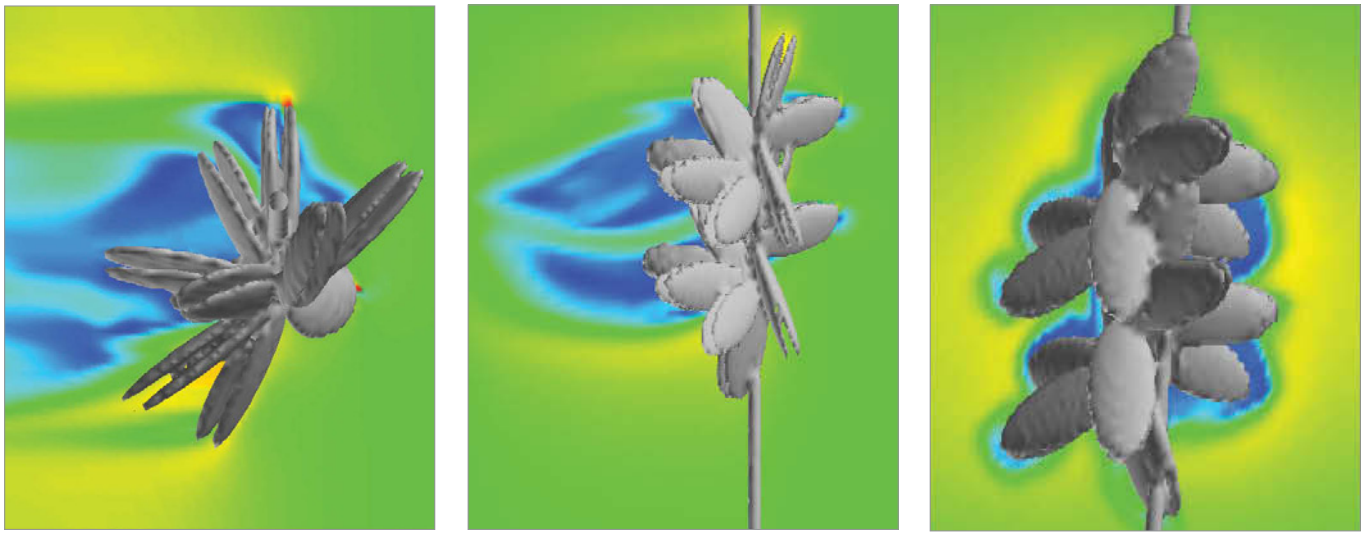
Computational fluid dynamics (CFD) computer programs are designed to simulate fluid flow in three dimensions and are sold by at least a dozen commercial companies. All such codes can predict the movement of particulate (nutrient) matter in the water, but calculating the interaction of the food particles with the shellfish, and doing so efficiently, narrowed the options to FLOW-3D from Flow Science of Santa Fe, NM. This software's

ability to model flows through porous media, as well as its easily customizable structure, made it the cost-effective choice.

Modeling Shellfish: Water Interactions

Richardson, a mechanical engineer with 15-years of FLOW-3D modeling experience, designed a system where a menu-screen would prompt the user to input such field data as number of longlines, their length and spacing, drop-line spacing, rope length, rope diameter, shellfish density, particulate availability, and water flow speed. Once a given set of inputs was defined, FLOW-3D would calculate mean values for food concentration in micrograms per liter at any location inside of the computed region, as well as the change in water-flow speed as the mussels grew or more were added to the production site. These simulated results provided a framework for evaluating alternative farm layouts, which could then be run with a revised set of input parameters. The results are visualized using FieldView software from Intelligent Light.

Behind the menu-screens lay the processing power of FLOW-3D. Of particular interest was the approach used to identify obstacles in computed regions. FLOW-3D uses a method known as Fractional Area/Volume Obstacle Representation or FAVOR for short. Unlike other, less flexible



This simulated flow around an individual mussel clump on a rope hanging from a longline is accomplished using FLOW-3D from Flow Science. The top view, side view, and end view (from left) are colored by water speed in feet-per-second, and visualized with FieldView software.

CFD programs, this software performs calculations in a structured grid where cells are partially blocked or completely blocked depending on the location of obstacles in the computed region. This practical approach to grid generation gives the user the control to model flows with a high degree of detail in some regions while modeling flows more coarsely in others (thus minimizing overall calculation times).

Richardson defined areas occupied by shellfish as porous obstacles with the porosity of each based on the number of shellfish present. As a calculation proceeded, the porosities of each region were changed based on the amount of locally consumed food. In addition, the availability of food downstream was reduced by the amount of food already consumed. Accounting for these consumption effects forms an important factor in the design of shellfish aquaculture farm layouts.

Once an obstacle is located within a modeled region, FLOW-3D lets users give it multiple properties—not only can you make the object porous, you can let it move with the water's flow, and you can even designate thermal properties. It's these special features that Richardson particularly likes, again contrasting the software's approach to that of most other fluid-flow packages.

"The FLOW-3D input structure is compact and very flexible," says Richardson. "With a little creativity, the setups for very unique problems can be constructed, giving you a lot of value and insight for the money."

According to Richardson, the ability to model flow through porous regions in FLOW-3D is perfect for determining stocking densities that maximize production based on a given set of growing conditions. He found it easy to incorporate both porous- and open-flow regions in his models; he noted, too, that the preprocessor automatically remeshes the problem when you want to rerun the model with a different setup. Other CFD programs can require complete manual remeshing

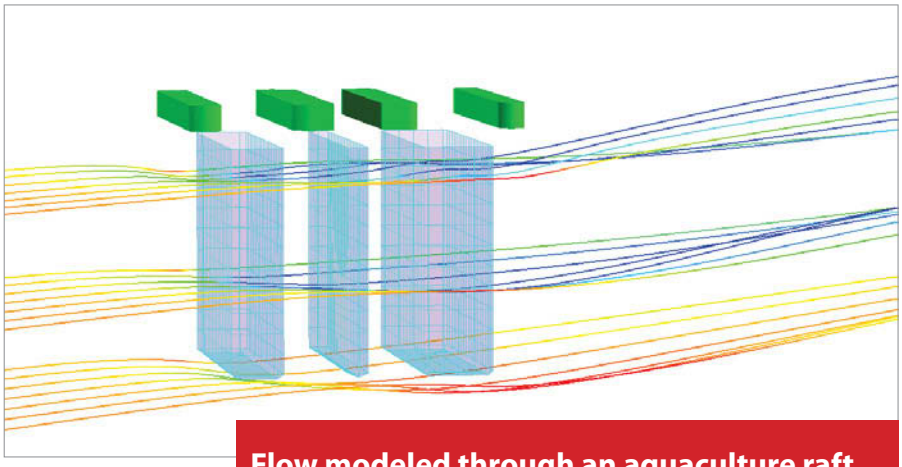
of the problem every time an obstacle is moved.

Field Results Versus Simulation Results

Using field data collected by Newell to calibrate FLOW-3D's performance, Richardson was able to correlate predicted flow speeds inside the farming structures to actual measurements within a 4.5 percent error. Food concentrations were also measured at different locations, and the simulated values showed less than 3.9 percent error. Other factors that were considered, such as rotating and anchoring the longlines to be oblique to tidal currents, were shown not to have a significant effect on the availability of the food supply and therefore not worth a layout change.

Taken together, the FLOW-3D results showed how farmers could adjust the stocking density and distribution of their shellfish to maximize the productive capacity of their farms. Shellfish growers have subsequently made a number of changes to the size and distribution of growing areas in Killary Harbour and are reaping the rewards of this work. Furthermore, the Sea Fisheries Board (BIM) is making this analysis available to other interested parties in Ireland.

Richardson and Newell are continuing to use their study methods to help shellfish growers increase their production and minimize their impact on the environment in the United States and abroad. Closer to home, the duo is using the analysis tools to improve the production of their own mussel and oyster farms located on the Damariscotta River in Mid-Coast Maine, and in the mouth of the Penobscot River Down East.



Flow modeled through an aquaculture raft (floats are green, areas occupied by shellfish are transparent blue; the latter regions are modeled as porous regions in FLOW-3D and visualized with FieldView.

According to Richardson, "It is FLOW-3D's inherent simplicity that lends itself to use in real-world problem solving. Rather than spending large amounts of time pre-processing (i.e., setting problems up), users can spend their time applying the results of their work." ■

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

FOR MORE INFO:

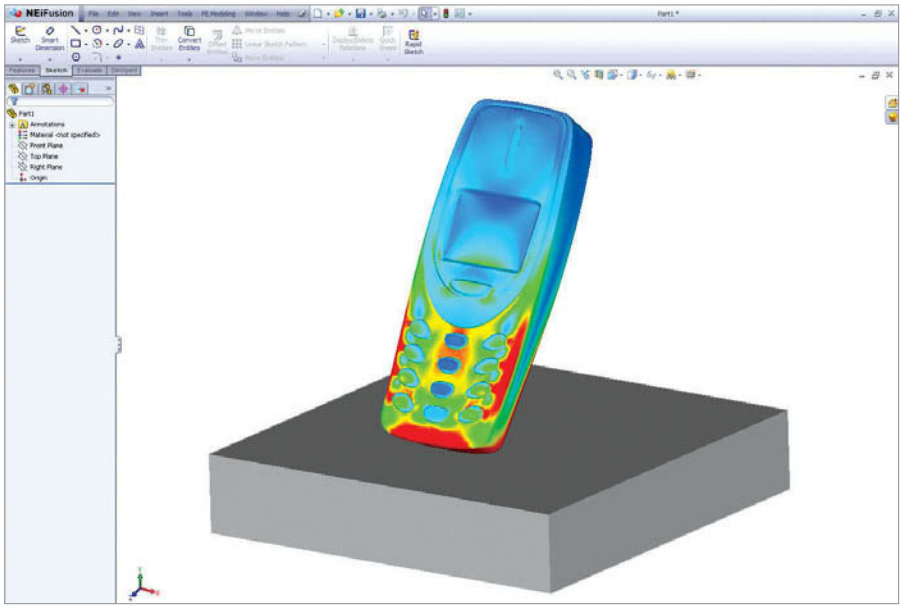
> Blue Hill Hydraulics
> Flow Science
> Intelligent Light
> Pemaquid Mussel Farms

By Vince Adams

NEi Fusion V2.0 Carries Value Forward

> NEi Fusion has managed to fill the void between complex pricey systems and inexpensive yet limited tools.

A design engineer shopping for a finite element analysis (FEA) solution these days might be overwhelmed by the available choices. In most cases, one would have to trade off functionality for cost. A common misconception, or rationalization, is that new users only need a linear static solution that analyzes parts. Another misconception is that an FEA solution embedded in one's CAD system will yield the highest level of productivity due to the integration of features, UI (user interface), and file formats.



Drop test simulation is easy with NEi Fusion's Automated Impact Analysis.

The reality of FEA in a product design environment is that the solution you need is the one that solves your problems. NEi Fusion from NEi Software (Westminster, CA) has been doing that for designers with powerful, scalable FEA and an interface that rivals the more limited CAD-embedded solutions for ease-of-use. More importantly, in these tough economic times, NEi Fusion is value priced, and, with a Nastran-based core solver, you can have confidence that the results you provide to your customers, be they internal, external, or even yourself, are accurate.

A CAD-Enabled Interface

One of the most striking features of NEi Fusion is

that the user interface is powered by SolidWorks. All the geometry creation, modification, and import tools that have made SolidWorks an industry leader are available to NEi Fusion users. Even the Feature Tree motif is maintained in NEi Fusion to provide a natural progression through a project and a convenient way to visualize FE model components. Users are offered a choice between drop-down menus, icon-based toolbars, or Feature Tree interaction.

NEi Fusion benefits from the rich visualization tools that SolidWorks is known for. While users may discount the value of real-time rendering when evaluating FEA tools, this will quickly become one of those features you can't live without. No one says that powerful simulation can't be coupled with stunning graphics.

NEi Fusion has integrated solid (volumes), shell (surfaces), and beam (wireframe) elements. This flexibility is important in many engineering environments for growth and scalability. The automated meshing tool is reliable and fast. The beam-element modeling tool is advanced enough to recognize cross-sections of solid geometry while providing a manual property input mode for more experienced users.

NEi Fusion Version 2.0 also includes concentrated mass, spring, bushing, damper, rod, pipe, and cable elements.

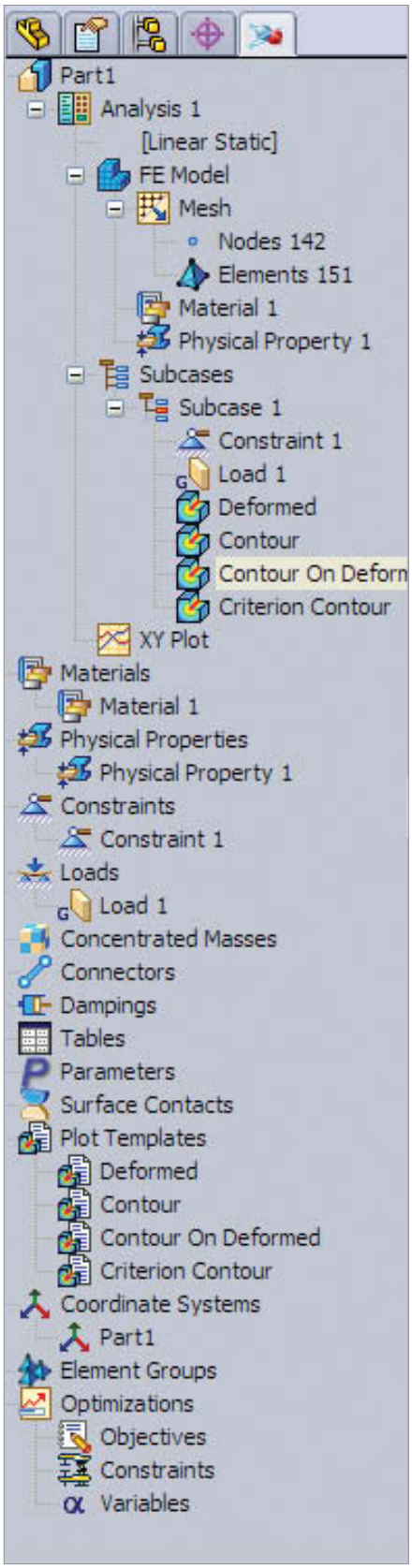
Material Properties

NEi Fusion provides a basic set of engineering material data sufficient for determining initial design direction. It also allows you to add or customize any material so that it more directly applies to a specific engineering challenge where more precise results are important.

NEi Fusion also provides composites modeling and failure analysis tools—another high-end capability one wouldn't expect in a value-priced solution. Furthermore, the ability to perform progressive ply failure analysis (PPFA) is in NEi Fusion V2.0.

Boundary Conditions

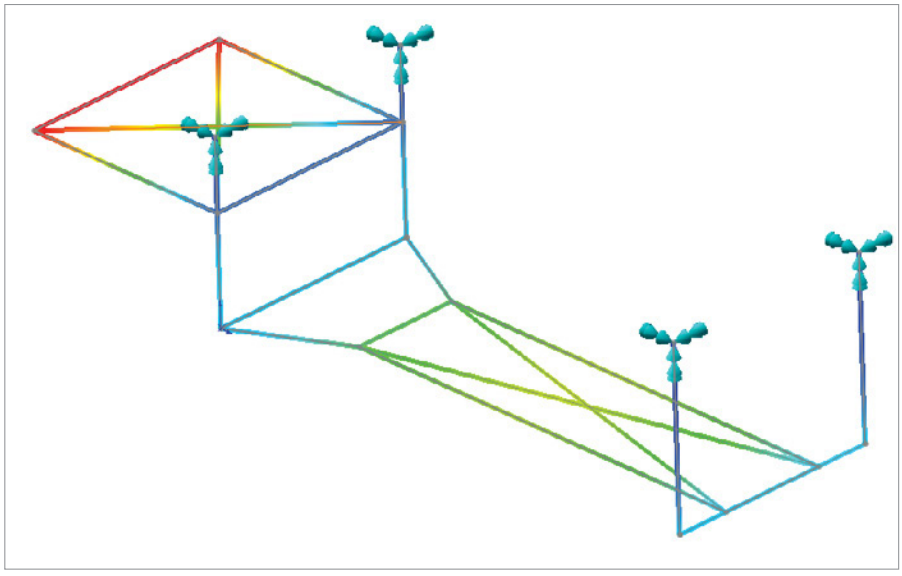
Since all NEi Fusion configurations support assemblies, users are encouraged to explore more natural responses as components interact with each other as opposed to guessing at restraints



This is the NEi Fusion Feature Tree.

that rarely offer realistic deformations. While experienced analysts may know how to choose and interpret appropriate restraints, part-time and design users should appreciate and take advantage of these assembly-modeling tools.

One of the more unique tools is automatic contact generation. Faces between parts that you indicate as touching, in the assembly mating tools, will be understood as contacting by the Nastran solver. This can save countless hours of modeling time on large assemblies. The effects of friction can be included.



In addition to solids and shells, NEi Fusion can model complex beam element structures.

Additionally, NEi Fusion provides a variety of contact types not typically found in value-priced tools, such as welded, sliding, and rough contact. And the expected toolset of standard loads and restraints is still available. These can be coordinate-system based or use geometric references.

Analysis Types

NEi Fusion is packaged two ways. The NEi Fusion Designer product offers Linear Static, Modal, Buckling, Linear Steady-State Heat Transfer, Assembly Modeling with Contact, Optimization, and Composites capabilities. Additionally, the Buckling and Modal, or natural frequency, solvers allow users to include pre-stress effects where tension or compression from operation impacts these responses.

The NEi Fusion Advanced product includes the capabilities of Designer along with Nonlinear Statics, Transient and Frequency Response, Nonlinear Transient Heat Transfer, and Automated Impact Analysis (AIA). This greatly extends a user's ability to model more realistic structural and thermal conditions, still benefiting from the easy-to-use CAD-enabled UI.

In NEi Fusion V2.0, both the Designer and Advanced products will be coupled with a Nastran Input File editor that opens up an even deeper set of functionality offered by the NEi Nastran product. This is a more traditional analyst interface outside of the NEi Fusion CAD-like environment.

Impact Analysis Wizard

Some of the most difficult types of problems to simulate involve impact between moving parts. A common application is a drop test. Since a meaningful physical drop test isn't typically possible until production-quality prototypes are available, advance simulation in the design phase can be

invaluable. The cost to change a problem found in conceptual design is minimal compared to the cost of changing production tooling.

NEi Fusion has provided AIA to guide engineers through the traditionally complex setup of drop test or impact problems. Simple wizard screens request information on initial velocities or accelerations. NEi Fusion then automatically determines contacting surfaces and solver time-stepping to ensure meaningful results. This feature alone can justify an investment in conceptual analysis.

NEi Fusion has managed to fill the void between complete yet expensive simulation systems and inexpensive yet limited tools.

NEi Fusion hasn't skimped on results viewing and interpretation tools either. The standard set of stress, strain, displacement, and x,y plot visualization tools are available. Results can be animated and saved to AVI files for project documentation.

A customizable automatic report generation tool is provided with a step-by-step wizard interface. The HTML report created is professional looking and complete.

Another exceptional capability typically offered only in more advanced products is optimization. Once an engineer had determined that performance is acceptable, the optimization tools in NEi Fusion can help to quickly evaluate numerous parameters and geometric configurations. The output from these studies can guide engineers to a minimal cost or weight design while keeping stress or displacement, even natural frequencies, within desired parameters.

When the Solution is Complete…

NEi Fusion has managed to fill the void between complete yet expensive simulation systems and inexpensive yet limited tools. It is a CAD-enabled simulation workhorse with a legacy stretching back to the toughest automotive and aerospace analysts in the market—traditional Nastran users.

Any design engineer or analyst struggling with the limitations of complex interfaces or limited capabilities should give NEi Fusion a hard look. While the product is based on established technologies, NEi Nastran and SolidWorks, the combination is still new enough to show exciting improvement with every release. Couple this with a knowledgeable and willing support team and you have a solution for design analysis with the ability to scale with your growing needs. ■

Vince Adams *is DE's expert in simulation, having worked and taught in the field for 20 years. He is the co-author of three books and numerous articles on FEA and design analysis. Comments should be sent to DE-Editors@deskeng.com.*

FOR MORE INFO:

> NEi Software

> SolidWorks

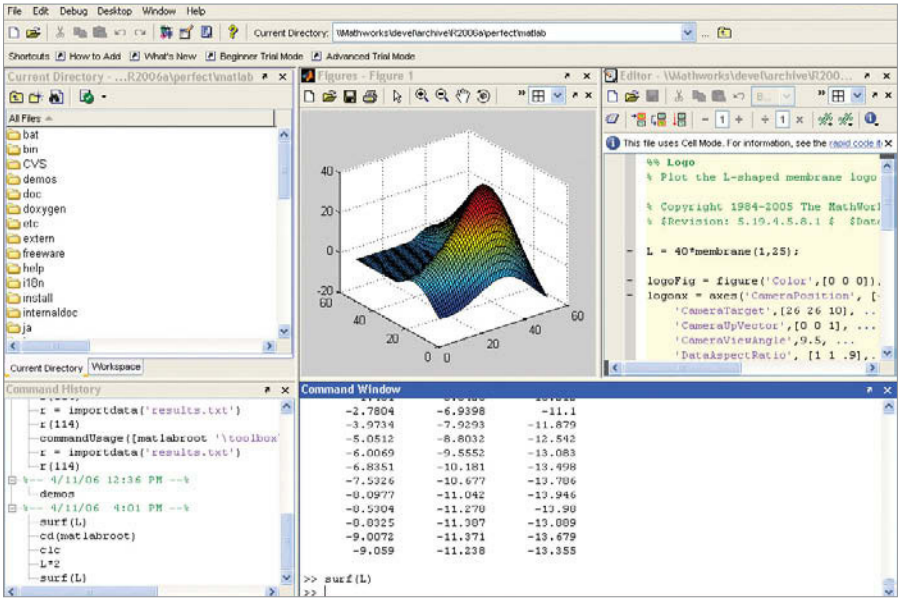
DE MARKETPLACE

By Pamela J. Waterman

From IDL to Mathcad, and Maple to MATLAB & NAG, Numerics Dig Deep

> Five powerful numerical analysis packages that enable you to quickly analyze data or explore the extreme with custom code.

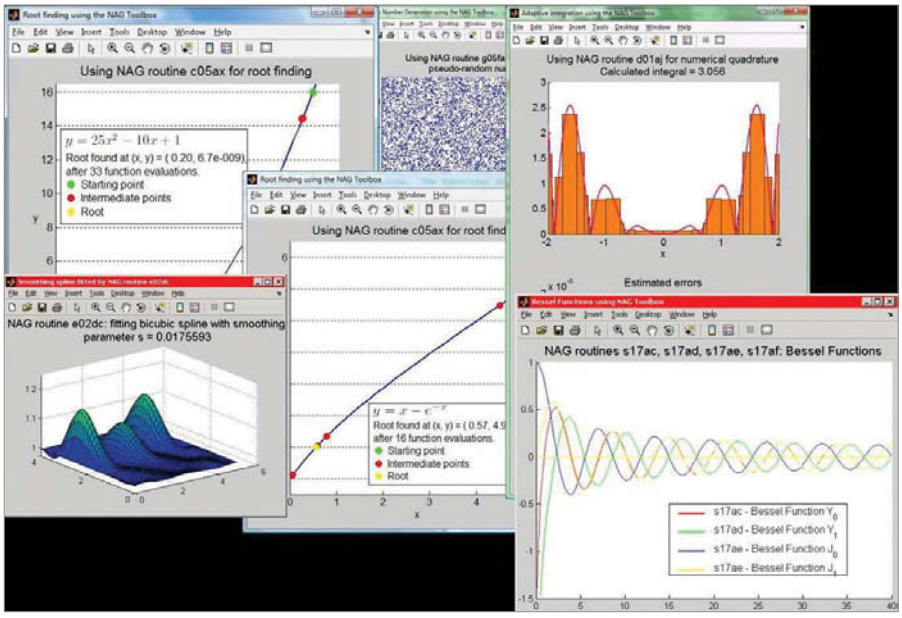
Numerical analysis tools would have helped when I was in grad school. Just a little too late for me, the mid-'80s saw a tumble of development efforts for software packages that could handle the detailed data generated across every field of science and engineering. Whether images from the Mars Mariner missions, CAT scans, sensor data from automotive crash testing, or stress values from mechanical simulations, raw data mushroomed and we scrambled to release its deepest meaning.



The MATLAB development environment, now with support for Windows XP Professional x64 Edition, lets users interactively analyze and visualize data, develop algorithms, and manage projects.
Image Courtesy of The MathWorks, Inc.

The rise of PCs, workstations, and mainframes spread numerical analysis from its high-end roots in academia and proprietary industry enclaves to the desktops and eventually laptops of every-day users. Now, whether you crave the ability to clean up, analyze, and interpolate reams of acquired or simulated data, "write" and solve integrals in a snap, benefit from automatic unit conversion, or compose scripts that guide other users through standard procedures, you'll find onscreen power like never before.

DE takes a top-level look at a number of intensely capable packages, their origins and their options. Seasoned users will get a peek at just-released news, too.



Design engineers seeking a broad range of mathematical and statistical functionality important to rapid product prototyping without the considerable expense and bother of sourcing multiple MATLAB toolboxes, can now access 1,415 rigorously tested numerical routines in the Mark 22 Release of the multipurpose NAG Toolbox for MATLAB.
Image courtesy NAG

Some Numerical Considerations

For many engineers and scientists, Excel is the new graph-paper/slide-rule/graphing calculator (choose one or all). Indeed, this simple looking spreadsheet program hides pretty deep capabilities for performing such numerical tasks as writing formulas, finding means or graphing. Got lots of data? Excel 2007 supports spreadsheets up to 1 million rows by 16,000 columns and operates on multicore processor platforms.

But many people also use Excel as just the first step in much larger calculation jobs, feeding data to downstream software that has the power and flexibility to analyze, interpolate, plot, and visualize millions of data points and help users devise new algorithms for further analysis across innumerable (no pun intended) application areas.

This article highlights five packages that tackle some or all of these tasks: IDL 7.1, Maple 13, Mathcad, MATLAB, and Numerical Algorithms Group (NAG) Toolbox for MATLAB. You might find similar or complementary capabilities in Mathematica, Origin8, Tecplot and LabView software. Stay tuned to DE to learn more about the latter group in a follow-on piece.

Whiteboards, Natural Math, Unit Conversions

Mathcad (from PTC's 2006 Mathsoft acquisition) seems like a vast intelligent whiteboard on your computer screen. It performs analytical and engineering calculations by letting users build mathematical formulas (both numeric and symbolic) and add documentation just as if they were doing it by hand—but better. (Click-and-drag integrals are awesome!)

Mathcad Director of Product Management Mark Walker points out that some of what sets Mathcad apart from other analytical and engineering calculation software packages is how flexible it is at any stage in a project. He says, "It can help whether you're in the early stages of establish-

ing requirements, building a conceptual idea or design, moving toward the detailed design, [or] evaluating the design."

"The way it does so," Walker explains, "is it builds a very self-evident document of what the engineer has explored and the concepts he has put together, by combining natural 'live' math notation [unlike the text-based 'string' equations of Excel] with live plots, images, and text; it also manages [converts] units throughout the process." Mathcad also has two-way integration with PTC's Pro/ENGINEER and Windchill products.

Extensive online engineering handbooks for civil, electrical, and mechanical applications let Mathcad users open and import formulas that are immediately "live" for entering sample data, getting instant numerical values, and clicking to plot the results. The company's next release will support design of experiments, manage the order of operations on the fly as users make changes, and improve the user interface, aiming at the goal of "15-minute new-user operation."

Another ever-so-handy and powerful tool for mathematics and modeling is Maple 13 from Maplesoft. With its 1988 commercial product introduction, Maplesoft broadened its academic user base into the workaday engineering realm, moving from Fortan command lines to a Technical Document Interface.

Maplesoft's suite of tools for engineering is designed to reduce error, shorten design time, and help users manage data, models, results, and knowledge in a single computational environment. Maple 13 combines numeric computations with symbolic capabilities. Live math lets you enter and evaluate functions as well as optimize parameters with data input from Excel, CAD files, and other packages.

New features in Maple 13 include use of faster, more robust leading-edge solvers that can handle most every type of mathematics and identify the particular solvers used along the way—a critical aspect for standards compliance and validation. Unique context-sensitive menus let you right-click and access commands particular to the information over which the mouse hovers. New fly-through animations of plotted data let you not only rotate a 3D plot, but actually follow a path or curve of your choice. And optimization functions, always a strong feature, have been enhanced in such a

Third-Party Assistance in Mastering Numerical Analysis

A Web search turns up quite a few options for getting help beyond vendors' webinars and user groups:

> Steven Karris of Orchard Publications (orchardpublications.com) authors introductory level MATLAB-based texts.

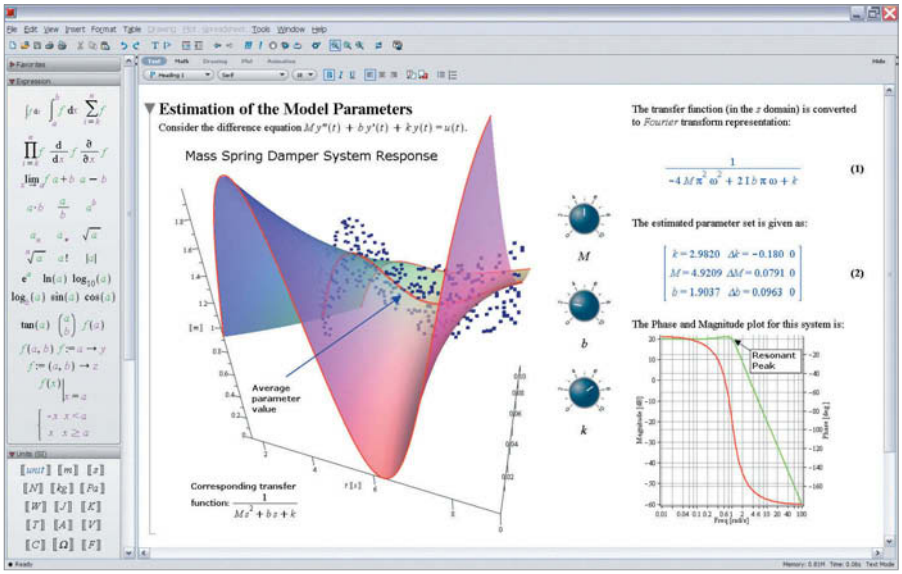
> Richard Johnson of Datatool (datatool.com) conducts on-site MATLAB training courses for beginner to advanced levels.

> Kenneth P. Bowman is the author of *An Introduction to Programming with IDL*.

> Brent Maxfield recently revised his *Essential Mathcad for Engineering, Science and Math* (with CD, Second edition); find both of these texts at amazon.com.

way that you can automatically determine many values from a 3D plot, such as global maximum and minimum.

According to Maplesoft application engineer Samir Khan, users can embed interactive components such as a knob, dial, or slider bar with code behind it, make "live" value adjustments, and see the results for a particular mathematical function. You can also plot new parameters on an existing plot and output new values, and drag a different equation onto an existing graph and plot it as well. More than 150 plot types are built in.



Maple 13 combines numeric computations with symbolic capabilities. Optimization functions have been enhanced and fly through animations of plotted data let users follow a path or curve of choice.
Image courtesy Maplesoft

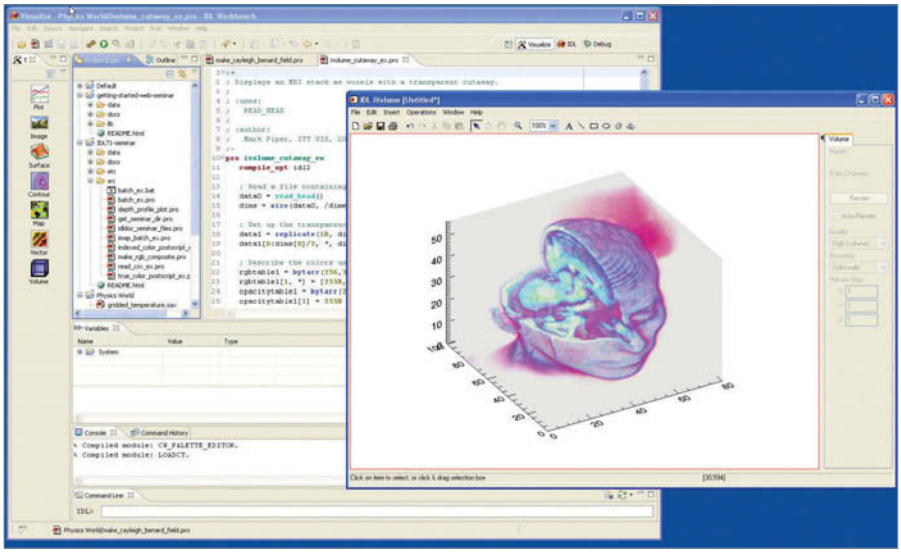
Extensions include Maple Portal, which offers great how-to guidance; MapleSim 2, which lets you combine electrical, mechanical, thermal, and signal-control blocks to model and simulate physical system designs; and MapleNet, a program for sharing Maplesoft interactive solutions across the Web.

Digging into the Data

IDL (originally termed Interactive Data Language) from ITT Visual Information Solutions terms itself a "computing environment for understanding complex data through interactive visualization and analysis." Chris Torrence, IDL product development manager, says no programming experience is necessary for putting together the basic scripts that read in data or produce numbers or plots. He adds, "The language is simple. You can stay at this level or build programs for other users, including widgets and buttons."

What differentiates IDL 7.1 is its ability to help users create tools that offer command and control over how one analyzes complex data. The latest version of the software, based since 2007 on the open-source Eclipse code, now boasts a "modern" environment via the IDL Workbench. It features drag-and-drop tools for data management, allows opening many file types without writing code; operates cross-platform in Windows, Mac, and Linux environments, and tracks the commands you wrote for a given operation so they can be copied and reused.

IDL 7.1 supports 64-bit architectures and multithreaded processes, and can start separate instances of IDL running simultaneously. The latter capability helps application programmers who



IDL Workbench view of IDL 7.1 showing an MRI stack visualized as voxels. IDL enhances data visualization with a new modern development environment including an intuitive development interface, drag and drop toolbar functionality, and advanced code-editing tools. *Image courtesy ITT Visual Information Systems*

need, for example, to ensure that the user interface is still responsive while a long Fourier transform is running in the background.

MATLAB from The MathWorks has been an engineering workhorse since its debut in 1986. Offering more than 1,000 mathematical functions as well as dozens of application-specific algorithm toolboxes, MATLAB is a rich programming environment for data analysis, algorithm development, and numeric computation; with visualization as a key component of all of these tasks. The software's technical computing applications encompass such fields as signal and image processing, data analysis and statistics, mathematical modeling, and control design, with specific toolsets ranging from aerospace to finance.

Both the name and the fundamental approach of MATLAB stem from its working with matrices. Continually building on the attributes of matrix math, Release 2009b, announced in September, includes extended support for multicore and multiprocessor systems as well as improvements for handling large data sets. But as always, users do not need to be programmers by training, and wizards and optimization suggestions serve as excellent guides.

Data exploration is one of the main tasks for MATLAB. Users can easily load data from a source file such as Excel, load an algorithm that will identify a value of interest, and create plots of interest. Paul Pilotte of MATLAB points out, "There's a level of automation here. Once you have a plot looking like you want it, you can press a button and it will automatically generate the MATLAB code" that will create that same type of plot the next time.

The resulting code is thus much more robust and tested compared to writing one's own program in say, generic C++. Data visualization can be customized to the nth degree with functions that apply curve fitting, image processing, and comparisons of measured versus theoretical values.

You can also use the internal compiler to create programs that will run on operating systems outside of the software, even by colleagues without a copy of MATLAB. This supports the option of creating embedded MATLAB as real code for real

end products. Be sure to tap into the huge online user world for beginner or expert information.

Numerical Algorithms Group (NAG) has taken a different tack in this arena, existing in a sort of parallel universe. For more than 30 years, the company has developed a family of software component libraries targeted to different programming languages or configurations that eliminate the need to write traditional code and compilers. As NAG Product Developer Mike Dewar puts it, "We deliver algorithms."

NAG's products for the general solution of mathematical and statistical problems work with Fortran or C, as well as such computing platform structures as symmetric multiprocessor computers or distributed memory systems. However, one of the most popular packages is the NAG Toolbox for MATLAB, now in its Mark 22 release.

With this version, announced in September, design engineers have access to 1,415 rigorously tested numerical routines for stand-alone operation or migration into Fortran, C, and such. According to NAG, an advantage of calling their routines via MATLAB is that many arguments become optional or unnecessary, which makes code easier to read and maintain. All NAG Library routine documentation includes examples done in MATLAB code.

To get started, users just need to know MATLAB. Dewar explains that they offer such functions as meshing routines and differential equation solvers, but says it's up to the user to put them together in the way that they need for a particular problem. Applications range from physics and engineering to finance and bioscience.

However, NAG provides extensive documentation and flow-charts for guidance. For example, if you were solving an optimization problem, it would start off by asking, do you have just one variable or many variables? And then, do you have constraints, and if you do, are they linear or nonlinear? "We try to break things down into easy decisions," says Dewar, "and hopefully at the end of it we recommend 'use this particular NAG routine to solve your problem.' And then (it gives) an example of how it's used."

The end result is a routine you can use back in MATLAB, perhaps for working with experimen-

Using Numerical Analysis Programs to Manage Intellectual Property

No one wants to admit to getting older, but since people do retire (or, unfortunately, get down-sized), corporate knowledge in the form of engineering know-how will disappear unless companies take steps for its capture. Numerical analysis software packages can help with this task, since they reflect the thought process on a particular task or project. Today's "whiteboard" packages can simplify the hand-off to younger engineers by presenting an intuitive, easily documented (rather then an Excel-like) interface.

— PJW

tal data and calling a NAG-generated curve- or surface-fitting algorithm.

More Numerical Toolbox Choices

As always, we can never cover all the possibilities in the known universe in one article. Two other well-known numerical packages that deserve a detailed look are Origin8 from OriginLab and Mathematica from Wolfram Research. Coming more from the hardware/data-acquisition side of engineering is LabView from National Instruments.

Lastly, you can find somewhat specialized numerical and visualization packages that may suit your application area, such as Tecplot software for in-depth analyses of computational fluid dynamics results. We'll take a closer look at those packages in a forthcoming issue. ■

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

FOR MORE INFO:

- ITT Visual Information Solutions
- Maplesoft
- Microsoft
- National Instruments
- Numerical Algorithms Group (NAG)
- OriginLab
- PTC
- Tecplot, Inc.
- The MathWorks
- Wolfram Research

Dentistry Moves to the Future with EOS, Ex One

> > 3D printing, new materials, and regenerative therapy are among advancements in the dental R&D crystal ball.

BY SUSAN SMITH

Figure 1: A batch of laser-sintered copings and bridges, made of cobalt chrome.

Rapid manufacturing may soon offer dentists—and patients—an affordable and attractive option. Aside from the obvious need for tooth preservation and gum health, people with dental concerns want their teeth to look good as well. And while appearance has been a vital economic driver for dental prosthetics, that is about to change.

According to Howard Kuhn, former director of research for the Ex One Company, LLC, and a professor at the University of Pittsburgh, 3D printing of ceramics will provide more attractive and less-expensive crown copings that look like porcelain, and use of a new material may aid in tissue regeneration.

When Cost Is the Issue

"Instead of using gold alloy for the crown," said Kuhn, "people are turning to chrome cobalt alloy, which is a lot cheaper but has a noticeably silvery color. People are forced into using something that is cheaper rather than something that will improve appearance." Gold alloy offers an attractive appearance when it shows through at the bottom of a crown. And while Ex One's division Imagen produces gold alloy for dental copings, it has since developed new alloys in response to demand for cheaper materials.

< Figure 2: An image of dental copings and bridges being laser-sintered.

V Figure 3: Ceramics are desirable for dental applications because the material is so close in composition to that of tooth porcelain.

EOS is a company that offers a new type of cobalt chrome for dental work. EOS CobaltChrome SP2 alloy comes in powder form and can be sintered via the direct metal laser-sintering (DMLS) process by which micro layers of powdered metal are fused together by a laser. Its EOSINT M 270 has been used by some companies to create dental prosthetics and implants with CobaltChrome SP2, which is completely biocompatible. EOS customer Leader Italia manufactures implant components in an EOSINT M 270 using titanium powder.

EOS asserts that dentists and their patients will note how the fit and margin lines on copings offer greater consistency than previously cast parts. The resulting surfaces of the implants have interconnecting cavities that lock into the host bone. The geometry and connections of the cavities can be between 2 to 100 microns and make it possible for bone to penetrate inside the implant as bone cells grow.

According to Kuhn, DMLS provides very good properties "if you can get around the residual stresses in there." The region where the laser impinges on the powder is very small, thus melting the particles together and leaving then the surrounding material to cool rapidly. "When you cool material rapidly, it produces a fine microstructure, which is a key to getting good properties," said Kuhn. "They often get properties that are better than the properties you can get in the same material if it were cast. That's a major advantage of [laser sintering]."

But even so, the cost of equipment is high, Kuhn said.

Advantages in Ceramics

3D printing of ceramics, on the other hand, is currently in the research and development stage. Considered a major trend in the dental industry, ceramics—especially porcelain—are attractive because they closely resemble natural tooth enamel in composition.

Typical metal copings have a silvery or grey appearance and when porcelain, which is naturally translucent, is fired on top, the metal substrate will show through at the base of the tooth's crown where the porcelain is thin.

Ceramics would provide a more natural (and attractive) appearance without that line of grey metal visible beneath the porcelain. "Most ceramics have a nice white color," said Kuhn, "and the porcelain that is fitted on top is on a white base. Porcelain, being translucent, has a better appearance when the coping is ceramic itself."

There are three ways digitally printing of ceramics (which need a binder) is currently being researched: printing of the ceramic bed with pre-ceramic nanoparticles in the binder; printing with pre-ceramic binders embedded; and direct printing of ceramic powders. In all cases, the parts are either sintered to the required density or sintered lightly and infiltrated with a binder to finish the product.

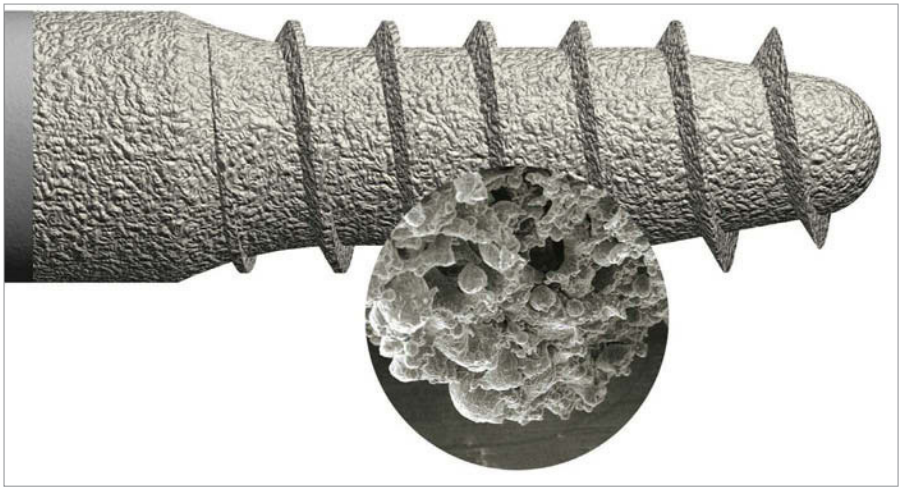


Figure 4: Photographs of the dental screw and microphotographs of the screw with bone bonding to it and of the porous surface of the screw.

Changing Material Composition

Some modern copings have been made using a CAD/CAM approach, whereby the shape is milled from a block of ceramic with a CNC machine, but recent research into harder ceramics make that approach unlikely.

"Zirconia is a harder material," Kuhn said. "The problem is not in making the shape; the problem is in getting the particles to either sinter at full density or near full density—in other words, to have good strong integrity attachment of particles together or infiltrated with a compatible material that provides a fully dense and high-strength material."

3D printing allows the user to change the composition of material by injecting nanoparticles through the printhead. And you can place the nanoparticles in selected regions to get different properties in different parts of the coping.

"That's one of the things SLS can't do," said Kuhn. "With SLS, the layer of powder is spread, so you're fixed with a layer of powder and can't vary that type of powder throughout the part. That selective variability is one of the advantages of 3D printing

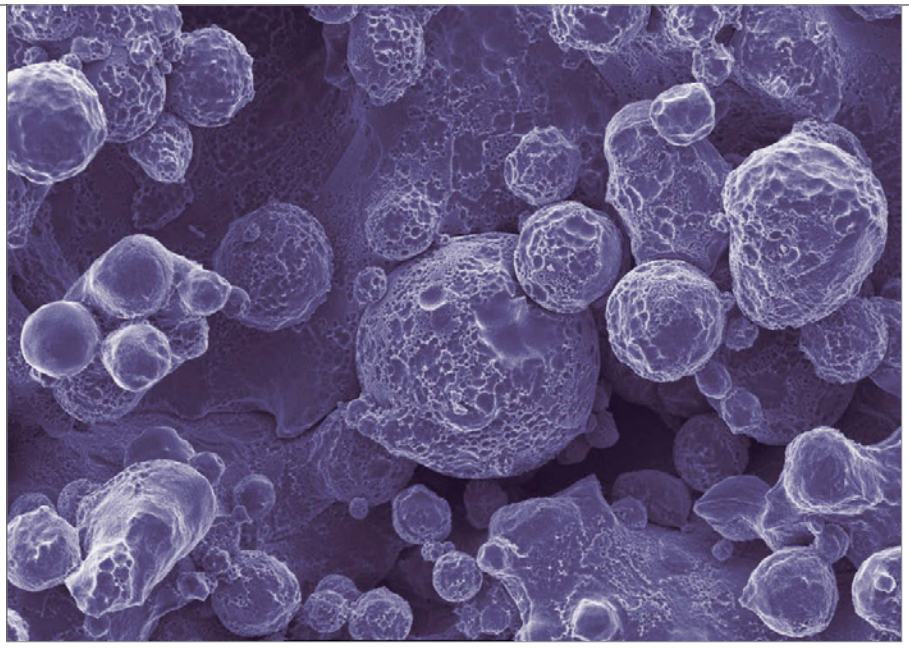


Figure 5: Leader Italia uses direct metal laser-sintering in titanium to create a dental screw that bonds well with bone. The geometry and connections of the cavities are between 2 to 100 microns, and are selected during the project. The geometry makes it possible for bone to penetrate deep inside the implant body, where it creates pits and pores that are colonized by bone cells.

heads. Clearly, its disadvantages are that you have the secondary operations that you do have to go through … after the printing is done. Making a shape is pretty easy, but making the shape and getting the kind of material properties [you want], that's where the problems lie."

3D printing allows the user to change the composition of material by injecting nanoparticles through the printhead.

While a number of glass and porcelain systems have been pursued, they have not yet been refined in 3D printing to the point of being commercial.

Pre-Ceramic Polymers

Another possibility is to use stereolithography (SLA) to make parts using pre-ceramic polymers with low melting points, in either powder or liquid form. In liquid form, photosensitive polymers would be used, as they are easy to spread and polymerize into the desired shape. With powders it takes only a low-level laser to sinter them together. With a pre-ceramic polymer, the user would heat the polymer, and it would then convert into a ceramic.

Although SLA shows promise, Kuhn said there are not many polymers that do this, but it is being pursued because it combines the ease of forming the part with the benefit of converting it into a high-strength ceramic. Kuhn noted that this conversion to ceramic is a very carefully controlled thermal process, and "the idea is to get as much of the polymer converted to ceramic as possible. If you get 80 percent of it converted to ceramic, then you're doing very well."

For ceramic copings to be successful, they must be compatible with the porcelain that must be fired on top of them. According to Kuhn, that's the easy part, "the hard part is developing the combination of the ceramic print material and the infiltrant material so that you get good density and high strength…. If you just print ceramic material using the 3D printing process and then sinter it, the particle size that is required to sinter to full density is very small, on the order of 1 micron, too small to be used in the 3D printing process. Typically 10 microns is the lower limit…. If you stay with particles that are 10-

15 microns, you can generate the shape but you can't sinter that to full density."

Certain glass materials can be liquefied and possibly used as an infiltrant for ceramic copings. The trick is coming up with the right combination of ceramics and infiltrant glass.

"The glass must have a melting point that is low and then you want to be able to get it up to a high temperature beyond its melting point," said Kuhn. "The higher the temperature, the more fluid the glass is, the more likely that it will be absorbed by surface tension into the pores in between the ceramic particles. That's where the real material science is." The challenge of achieving strong material structure is coupled with that of finding the right type of glass that can infiltrate properly, maximizing the good properties of the ceramic.

As Kuhn continues pursuing these avenues, it is certain that digital manufacturing and rapid technologies will have an expanding role to play in dentistry's future. ■

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

FOR MORE INFO:

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15. Extent and Nature of Circulation	**Average No. Copies Each Issue**	**No. Copies of Single Issue**
a. Total Number of Copies (*Net Press Run*)	62,958	62,685
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e. Total Nonrequested Distribution (*Sum of 15d (1), (2), (3), (4)*)	1,548	2,034
f. Total Distribution (*Sum of 15c and e*)	62,335	62,072
g. Copies not Distributed	623	613
h. Total (*Sum of 15f and g*)	62,958	62,685
i. Percent Paid and/or Requested Circulation	98%	97%

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Conduant Introduces NTX16 PCI Express Recorder

> **Conduant Corporation** (conduant.com), has introduced its NTX16 PCI Express Recorder, which provides more than 800MB/s recording and playback performance. The NTX16 supports high-volume data streaming applications including high-speed data acquisition, high-resolution video, satellite data downloads, and digital signal processing (DSP).

The NTX16 PCI Express features direct peer-to-peer streaming across a PCI Express cable interface for applications requiring high bandwidth data capture and fail-safe performance. PCI Express cabling provides compatibility when interfacing with systems supporting VPX, VXS, XMC, CompactPCI Express, and PXI Express environments.

The NTX16 can operate as a standalone system with network control or can be directly connected to a host computer via a PCI Express 8-lane bus interface. External I/O options are available including Serial FPDP and LVDS.

The 7-in.-high chassis accepts up to 16 storage drives for 32 Terabytes of storage capacity. The 20-in.-deep NTX16 PCI Express Recorder system is rack mountable.

Lattice Technology Releases 3ds Max Converter V 4.0

> **Lattice Technology** (lattice3d.com), develop-

Z Corporation Unveils Low-Cost Portable 3D Laser Scanner

DE Readers' Choice Award

>**Z Corporation** has introduced what it claims is the world's most affordable portable 3D laser scanner. The $28,900 ZScanner 600 extends Z Corporation's fast line of handheld, self-positioning scanners, which are more portable than traditional 3D scanners. ZScanners streamline data capture for reverse engineering, product design, cultural preservation, and other applications.

The ZScanner 600 features resolution down to 0.1 mm and XY accuracy up to 80 microns, according to the company. ZScanners capture data in one continuous scan rather than in numerous shots from fixed positions, eliminating hours of post-processing time to integrate static shots into a cohesive scan. ZScan Lite software, included with the scanner, automatically produces an .stl file for import into a 3D CAD software package or output to a 3D printer.

"The ZScanner 600 is a tremendous addition to our scanning family and one that delivers incredible value...." said Z Corporation Director of Product Management Joe Titlow. "Our goal with 3D scanners is the same as that of our 3D printers: making high-end, fast and easy-to-use technology affordable for everyone who needs it."

For more information, visit Z Corporation.

The ZScanner 600 from Z Corp had the most visitors at deskeng.com in the month of September.

ers of digital manufacturing applications using the XVL format, has announced the release of its updated 3ds Max converter into XVL format files.

Version 4.0 of this XVL Converter application supports the new XVL v10 format. XVL v10 can compress 3D data to 0.5% of its original size, according to the company, allowing anyone in the manufacturing supply chain to quickly view and understand complex 3D data.

The latest version supports 3ds Max 2008, 2009, and 2010, and 3ds Max Design 2009 and 2010 formats, ensuring that the most recent versions of the product can create XVL data.

For more information, visit Lattice Technology.

Omega OM-EL-USB-2-LCD is Stand-alone Data Logger

> **Omega's** (omega.com) new standalone datalogger, the OM-EL-USB-2-LCD, features a high contrast LCD that can show a variety of temperature and humidity information.

With this unit, the user can cycle between current readings, including maximum and minimum stored values for temperature and humidity. It features immediate, delayed, and push-to-start logging.

In addition, logging and alarm status is shown using two high intensity LEDs. The data logger is supplied with a lithium battery and Windows Control Software.

Pricing starts at $97.

Sherborne Sensors Releases New Digital Servo Inclinometers

> **Sherborne Sensors, Inc.** (sherbornesensors.com) has announced the North American debut of its Digital Servo Inclinometer (DSIC), a tilt measurement device that offers RS-485 ASCII digital output and built-in active temperature correction, with unsurpassed total accuracy of 0.08° over a temperature range of -20 to +70°C.

Available in either single- or dual-axis versions, the core design of the DSIC is based upon the same technology as other Sherborne precision inclinometers. The unit's integral precision servo mechanism exhibits almost zero hysteresis, and provides better than 0.001° resolution, according to the company. During factory calibration, each DSIC is programmed with individual output characteristics over temperature, to further optimize unit accuracy.

For more information, visit Sherborne Sensors, Inc.

Leica Geosystems AG Laser Measurement Tech Now on Bricscad V9

> **Leica Geosystems AG** (leica-geosystems.com) and Bricsys NV have announced that the latest release of Bricscad now supports the Leica DISTO D8 plug-in, formerly only running on AutoCAD. The Leica DISTO D8 is a handheld laser measurement device equipped with a digital Pointfinder (4x zoom), 2.4-in. color display, 360° tilt sensor and Bluetooth technology.

"We are excited that our plug-in software is now supported by Bricscad V9," said Markus Hammerer, program director at Leica. "It allows a user to draw layouts for a room directly from our measurement device on the Bricscad software."

This can help ensure there are no measurements missing and that there are no errors by writing measurements down or by typing them into the computer.

For more information, visit leicageosystems.com.

Creaform Launches UNIscan Scanner

> **Creaform** (creaform3d.com), developer and manufacturer of the Handyscan 3D line-up of handheld, self-positioning and portable laser scanners, has launched the UNIscan, the latest and most affordable addition to this family of 3D scanners.

Starting at $28,900, this scanner is positioned as the entry-level model of the line-up. The UNIscan offers equal resolution and speed of acquisition and an accuracy of up to 80 micro in addition to self-positioning and portability. The UNIscan comes with VxScan Express, a version of Creaform's proprietary data acquisition software offering fewer functionalities.

Corsair Announces Intel Certified Dominator Memory, Power Supply

> **Corsair** (corsair.com) has announced that both 4GB and 8GB Dominator memory solutions have passed Intel's XMP-Ready certification for the new Core i7-870 and Core i7-860 CPUs.

The 8GB Dominator GT 1600MHz CAS 8 is qualified and guaranteed to run at a frequency of 1600MHz with timings of 8-8-8-24 at a voltage of 1.65V. The 4GB Dominator GT 1600MHz CAS 8 is also qualified and guaranteed to run at a frequency of 1600MHz with timings of 8-8-8-24 at a voltage of 1.65V.

In related news, the company has launched the Corsair Professional Series HX650W modular power supply. The HX650W joins the HX750W, HX850W, and HX1000W as part of Corsair's Professional PSUs. The Pro Series HX650W is also tested and guaranteed to operate at 100% load at an ambient temperature of 50°C. ■

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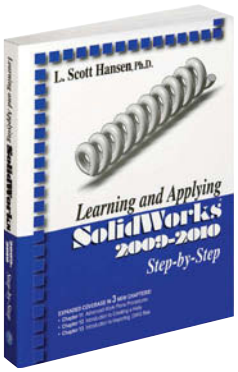

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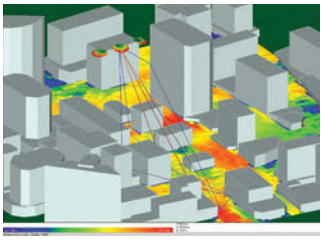

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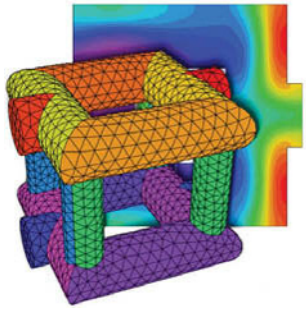

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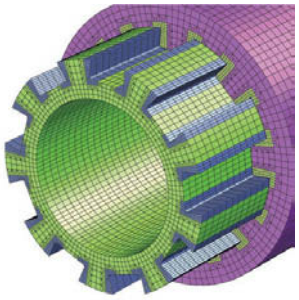

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PLM and Compliance: A Green Foundation

MIKE ZEPP
Dassault Systèmes

Over the past few years, concern for the environment has gone from a nice-to-have feature to a major business issue that influences decisions. Greening your product—and greening how you make your product—is discussed at the highest levels of the organization and affects who companies partner with, what materials are used, and ultimately how much revenue the product generates.

That said, a balance between environmental and business considerations must be maintained for the organization to run profitably and provide affordable, high-quality products. This balance, then, is important not just for green-company credibility from the public, but for the real business benefits than can result from such an initiative.

While most people are familiar with both the theory and practical use of product lifecycle management (PLM) technology and how it can help design and manufacturing organizations collaborate on a global scale to cut costs and improve efficiency, few may have considered how PLM technology can assist in environmental efforts and contribute to making the organization greener. For most, the first step toward a greener design and manufacturing process begins with compliance. With strong environmental regulations implemented by the European Union (and gaining ground in the U.S. and Asia), ensuring materials compliance went from one region's headache to a global issue. Progressive companies have turned to PLM to assist with the real-time collection of product

> Going green has enabled some to both increase quality and lower costs.

and materials data from all sources and to keep track of what changes need to be made before going to market.

Because compliance has become a mandatory component of doing business worldwide, it makes good business sense to set up automated processes that can meet both current and future mandates. Aside from the ramifications of non-compliance (shipment delays, heavy penalties, loss of market share, negative public image), using traditional methods such as spreadsheets hurts a company's ability to compete. By using PLM to help green the entire product development process, companies also gain public recognition. This leads to interest from investors and support from environmentally conscious consumers.

PLM assists in incorporating "design for recycling" in the product development process. This enables companies to take into account how materials used in one phase of development will impact the disassembly and recycling of the product when its life is over. It means they can proactively design-in materials that can be reused, reducing the "environmental footprint" of their products. Finally, some companies have seen that going green enabled them to both increase quality—providing a stronger value to consumers by taking a renewed interest in what makes up the products—and lower costs. They do this by streamlining proof of compliance and avoiding late-stage changes, managing the process from the beginning.

In fact, having such a system in place paves the way for organizations to think ahead of the environmental regulators and ensure that their products are compliant with expected rules and regulations, preventing future changes from needing to be made. There are companies in the high-tech industry who are beginning to eliminate all Halogen-based substances—an action that is not currently mandated beyond a small class of brominated flame retardants.

Using PLM as the foundation for balancing business needs with those of the environment will help ensure your company's transformation into a strong and successful green business.

With new materials and regulatory directives being introduced on a regular basis, companies competing globally can ill-afford to be in violation—and need to implement processes that can help them manage this business-critical issue. Using PLM as the foundation for balancing business needs with those of the environment will help ensure your company's transformation into a strong and successful green business. ■

Mike Zepp *is the director of material compliance solutions for ENOVIA, Dassault Systèmes. Send e-mail about this commentary to DE-Editors@deskeng.com.*

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