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> Special Section

Workstation-Centered Computing Engages Your Idle Cores

> CFD for Medical Applications
> Review: Dell Precision M6500
> Digital Protyping with Autodesk
> Portable CMMs Save Time
> Review: Altium Designer

BEST PERFORMING PROCESSOR FOR DESKTOPS[1]

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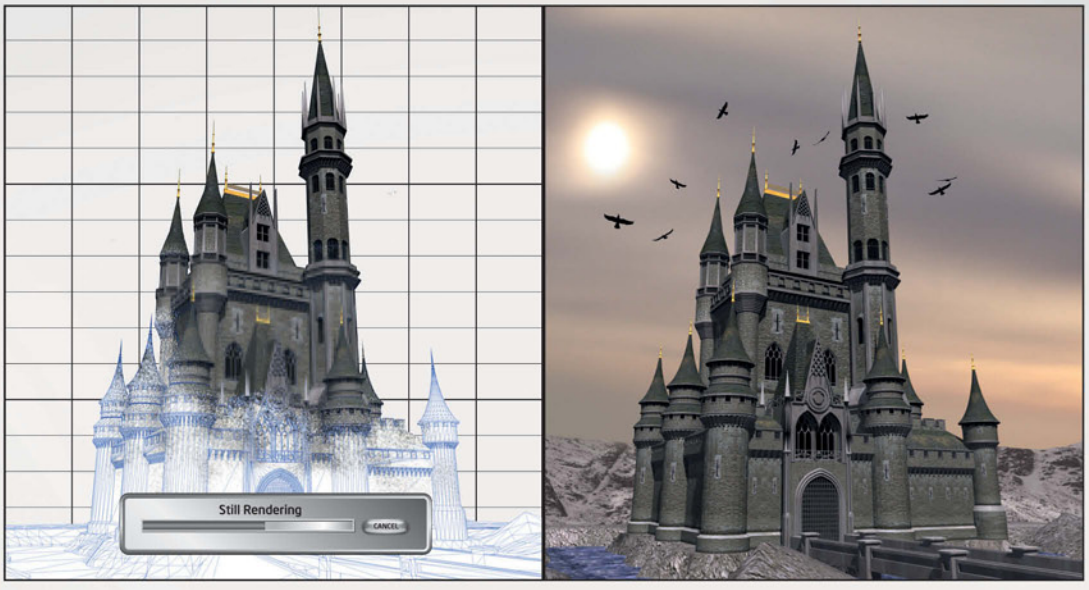

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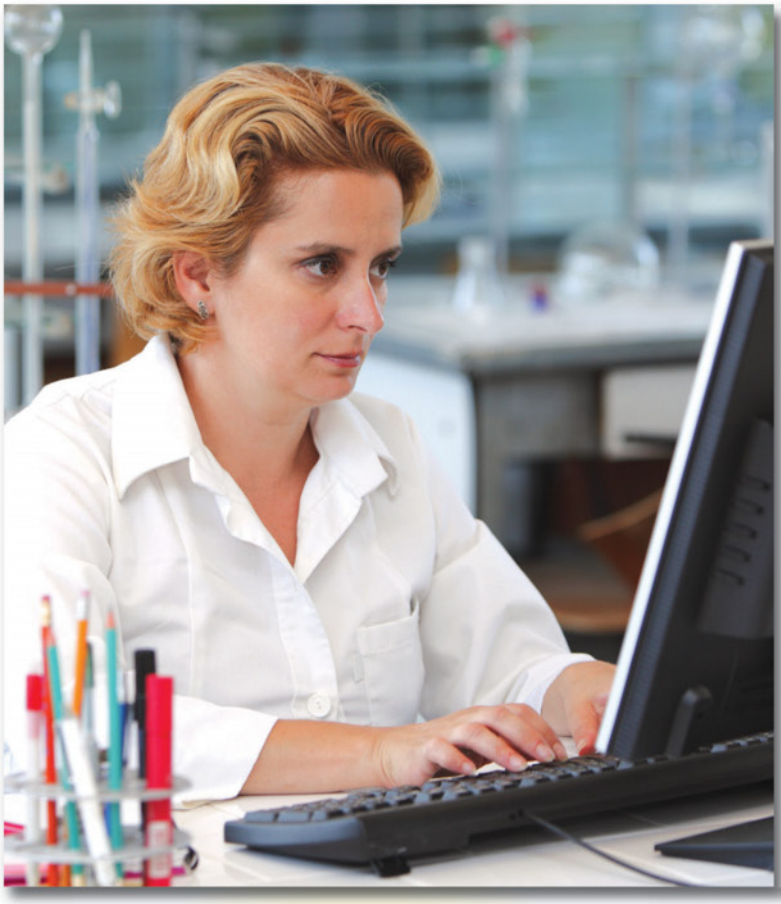

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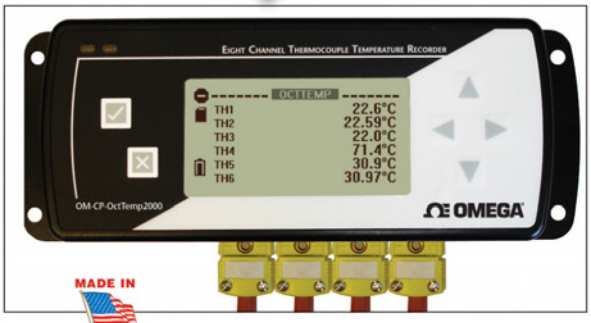

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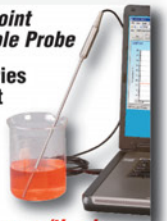

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What is Workstation-Centered Computing?

STEVE ROBBINS
steverobbins@deskeng.com

Supercomputers are in the news with thousands and thousands of cores and teraflops of performance. They have names like Roadrunner, Nebulae and Jaguar. These machines may be the cutting edge of computing, but how often does the average design engineer get access to that kind of power?

Most of us use workstations, and most of us have to face the compromise of power vs. price. Sure, we would like a supercomputer on our desk, or our mobile workstation to finish a massive computational application in seconds flat, but we are faced with the limitations placed on us by our employers' budgets or our own bank accounts.

From doing a basic structural analysis to a full-blown multiphysics simulation, we are asking our workstations to accomplish more and more in a shorter length of time. When our workstations aren't performing fast enough, we long to access the multiple CPUs in our companies' servers or data centers.

> "Tremendous power is moving back to your desktop."

The Need for Speed

Speed is often cited as the biggest obstacle to innovation. What's the solution? Workstation-centered computing is one answer. With engineering workgroups using multi-core workstations configured as LAN clusters, the performance of analysis, simulation and visualization applications improves exponentially. Hardware installation and software adaptation are easier on standard CPU systems. Working on large, complex assemblies, parametric edits can be regenerated quickly, without having to decouple them into sub-assemblies. This also means fewer errors. The CAD model's geometry can stay intact while computations move at blazing speeds.

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scales well to workgroups. If your location has 20 workstations with dual processors, you have hundreds of cores available and the there are no major electrical or cooling issues. With a high-performance interconnect, computational speed will be even faster. As a design comes closer to completion, virtual prototyping becomes reality, shortening the product's time to market. The average time to build physical prototypes can be six months or longer. If more computational power is needed at this stage of the design process, workstation-centered computing makes it easier to use the processors outside of the workgroup.

Back to the Core

When we launched *DE* 15 years ago, workstations were just powerful enough to run 3D CAD models. Analysis was still the dominion of the analyst. Over the years, this has changed. Applications started taking advantage of all those cores in the data centers, already earmarked for other enterprise software applications.

Now, tremendous power is moving back to your desktop, and we are excited about it. We are planning significant editorial coverage on this topic over the next few months, including articles that explore the return on investment and how to implement your own workstation-centered computing system. ■

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

EDITORIAL

Steve Robbins — Executive Editor
Jamie J. Gooch — Managing Editor
Anthony J. Lockwood — Editor at Large
Heather Pittinger — Copy Editor

CONTRIBUTING EDITORS

Mark Clarkson • David S. Cohn • Al Dean
Mike Hudspeth • Tom Kevan • Susan Smith
Peter Varhol • Pamela J. Waterman • Kenneth Wong

PUBLISHER

Brian Vaillancourt (x263)

ADVERTISING SALES

603-563-1631 • Fax 603-563-8192
Brian Vaillancourt — Publisher (x263)
Jeanne DuVal — Account Manager (x274)

ART DEPARTMENT

Darlene Sweeney — Art & Production Director (x257)

A LEVEL 5 COMMUNICATIONS PUBLICATION

Steve Robbins — Chief Executive Officer
Thomas Conlon — President

ADVERTISING, BUSINESS, AND EDITORIAL OFFICES

Desktop Engineering® Magazine
Level 5 Communications, Inc.
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603-563-1631 • Fax 603-563-8192
E-mail: DE-Editors@deskeng.com
www.deskeng.com

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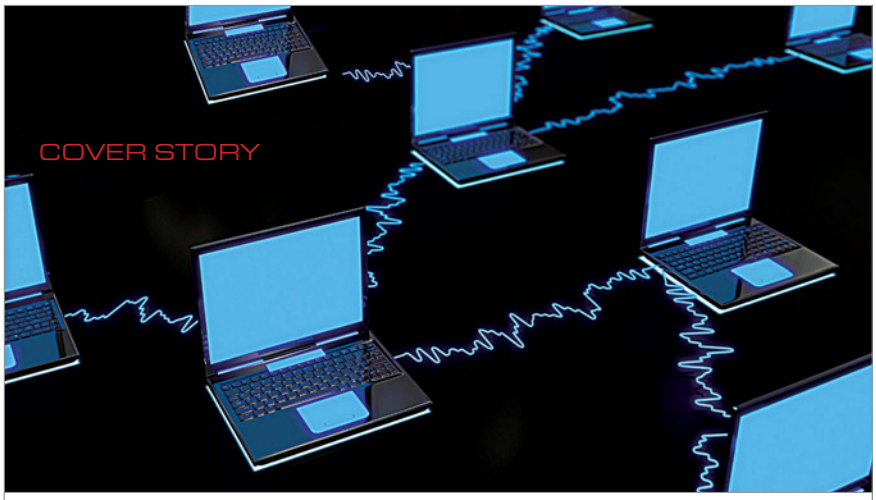

WORKSTATION-CENTERED COMPUTING

SPECIAL COVERAGE /// PAGES 2, 62, 76

Modern multi-core workstations are capable of doing more. Engineers who take advantage of their computers' idle cores can complete more work faster without investing in additional hardware.

"Engineers like to solve problems. If there are no problems handily available, they will create their own problems."

> Scott Adams

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ON THE COVER >

Workstation-centered computing allows engineers to make the most of their workstations' unused CPU cores. Read the introduction on page 2, the application feature on page 62, and the commentary on page 76.

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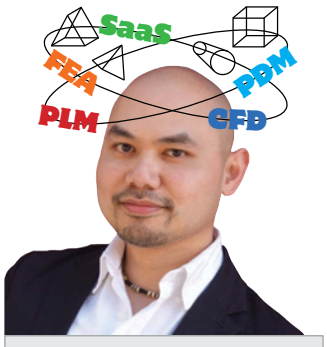
Dassault Systèmes Sets its DraftSight on 2D

> Free software now in public beta.

Dassault Systèmes (DS, 3ds.com), whose motto for its 3DVIA brand is "tell your story in 3D," began giving away a 2D software product for free in June. The downloadable program, dubbed DraftSight (draftsight.com), is to be supported by a user community, called DraftSight Community. The first version now available is public beta. The product is expected to be officially released—as a free product—later this year. Though the initial release is for Windows OS only, DS plans to deliver native Mac OS and Linux versions of DraftSight later.

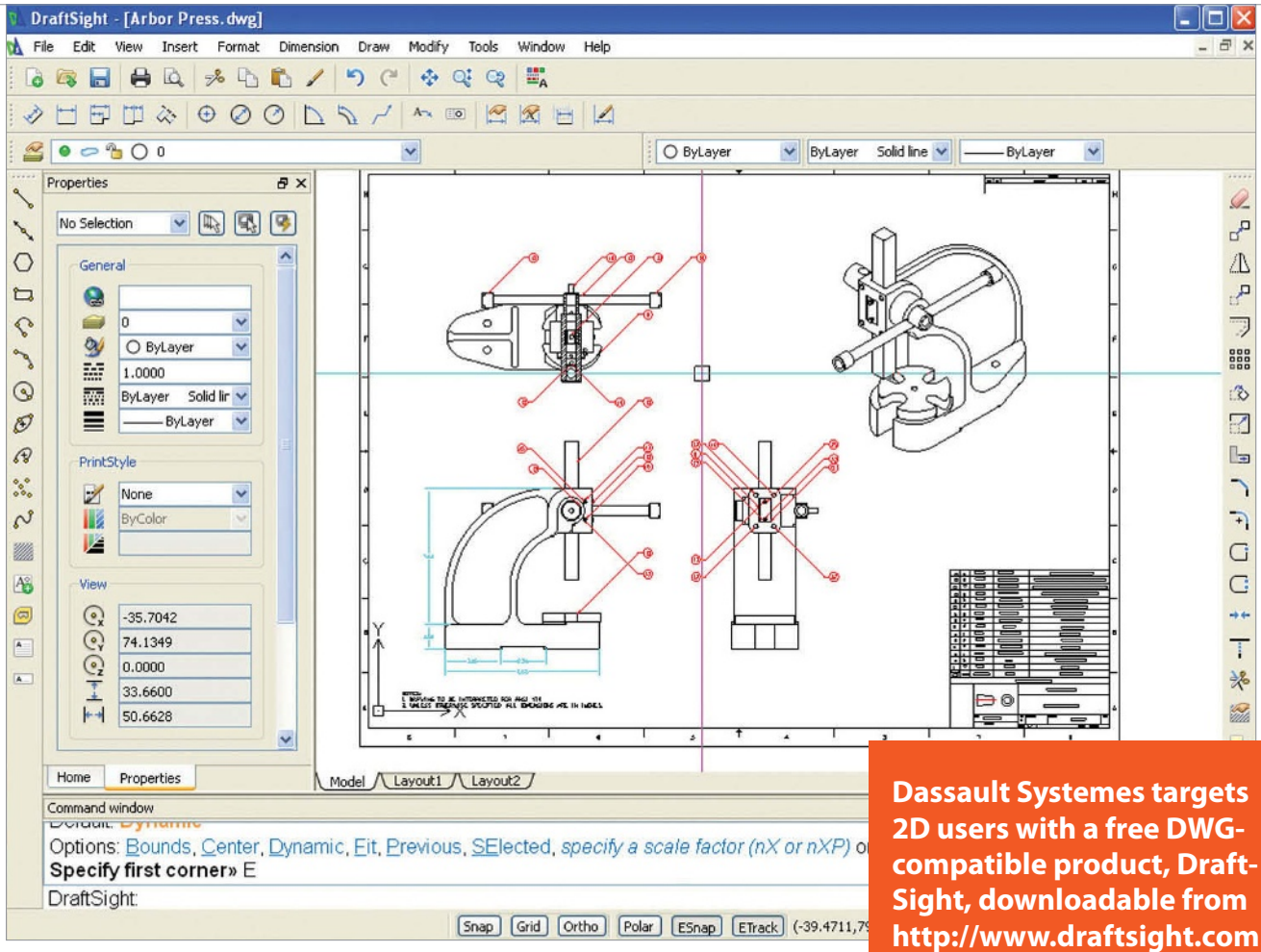


KENNETH WONG
kennethwongsf@earthlink.net

Previously, DS delivered a 2D application called DWGEditor along with its midrange mechanical CAD package SolidWorks. (The program was later renamed SolidWorks 2D Editor, as part of the settlement of DS' legal dispute with Autodesk over the term DWG.) According to Aaron Kelly, a DS product manager, there is no plan to bundle DraftSight with its CAD packages, such as SolidWorks or CATIA, but it "reserves the right to include [DraftSight] in the installation of those products in the future."

Users may get free tips from a blog maintained by DS, and support from peers and the community. DS also plans to offer technical support contracts—which include network license, priority phone support, and API extension—for about $250 a year.

DraftSight contains a programmable interface that supports LISP. Kelly verified that a C++ programming interface is currently in development, with support for more programming languages to follow. He described Draft Sight as "an evolu-



Dassault Systemes targets 2D users with a free DWG-compatible product, DraftSight, downloadable from http://www.draftsight.com.

tion of DWGEditor," but revealed the 2D drafting engine behind the new program is not the same one in DWGEditor. DraftSight is based on Graebert's (graebert.com) ARES Commander Edition software, announced in February 2010.

Though DraftSight is a professional level 2D package, Kelly demurred when the software was compared to AutoCAD, the leading 2D drafting CAD program. "Some users may consider [DraftSight] a replacement to AutoCAD, but AutoCAD has positioned itself with a lot of 3D functionalities; we're not doing that [with DraftSight]," Kelly said.

DraftSight reads, writes and edits DWG, AutoCAD's default file format.

PTC: Get Ready for Lightning

> Company plans to jolt the CAD industry.

Jim Heppelmann, PTC's CEO-elect, thinks CAD has become "less exciting." He plans to energize the industry with a new offering, a family of products presently known only by the codename Project Lightning.

On the first day of this year's PTC User World Event, Heppelmann said most CAD releases are "characterized by ongoing refinements to user interfaces, new modules, and so forth … There hasn't been a revolutionary departure since Sam Geisberg's innovation of 1985 [founder of PTC, credited with developing the first commercially marketed parametric CAD program]."

If you say the dust has settled in CAD frontier because it's a mature market, Heppelmann would ask, rhetorically, "How can it be a mature market if it still has such big unsolved problems?" He pointed to three issues as symptoms of market lethargy:

1. Usability
2. Interoperability
3. Large assembly management.

"It's very difficult for a casual user to pick up SolidWorks, Inventor, or Pro/ENGINEER and start working with it. When I think of easy-to-use [prod-

Socialized Product Development

What would a family of social media-inspired applets developed to run behind an enterprise firewall look like? It might look like PTC's Windchill SocialLink, unveiled at PTC User World this year.

Running on Microsoft SharePoint, PTC's Windchill SocialLink allows you to deploy functions similar to Twitter, Facebook, and Blogger. Robin Siatz, PTC's senior VP of solutions marketing, explains, "There's agreement in strategy across the company [PTC] that social product development services should be available to the whole product development system."

Last year, PTC launched a new product called Windchill ProductPoint, also based on Microsoft SharePoint. It is meant as a product data vault, visualization, markup, and collaboration platform, while SocialLink lets you tag content (as you would photos in Flickr), communicate with colleagues and partners in short text blurbs (as you do on Twitter), find potential collaborators within your firm (as you might find friends on Facebook), and receive RSS feeds about your associates' activities.

PTC plans to release SocialLink later this year. PTC's PLM (product lifecycle management) rival Dassault Systèmes, is developing its own enterprise-focused social-media platform, dubbed 3dswymer (in closed beta).

How can you do hours of 3D CAD work in minutes?

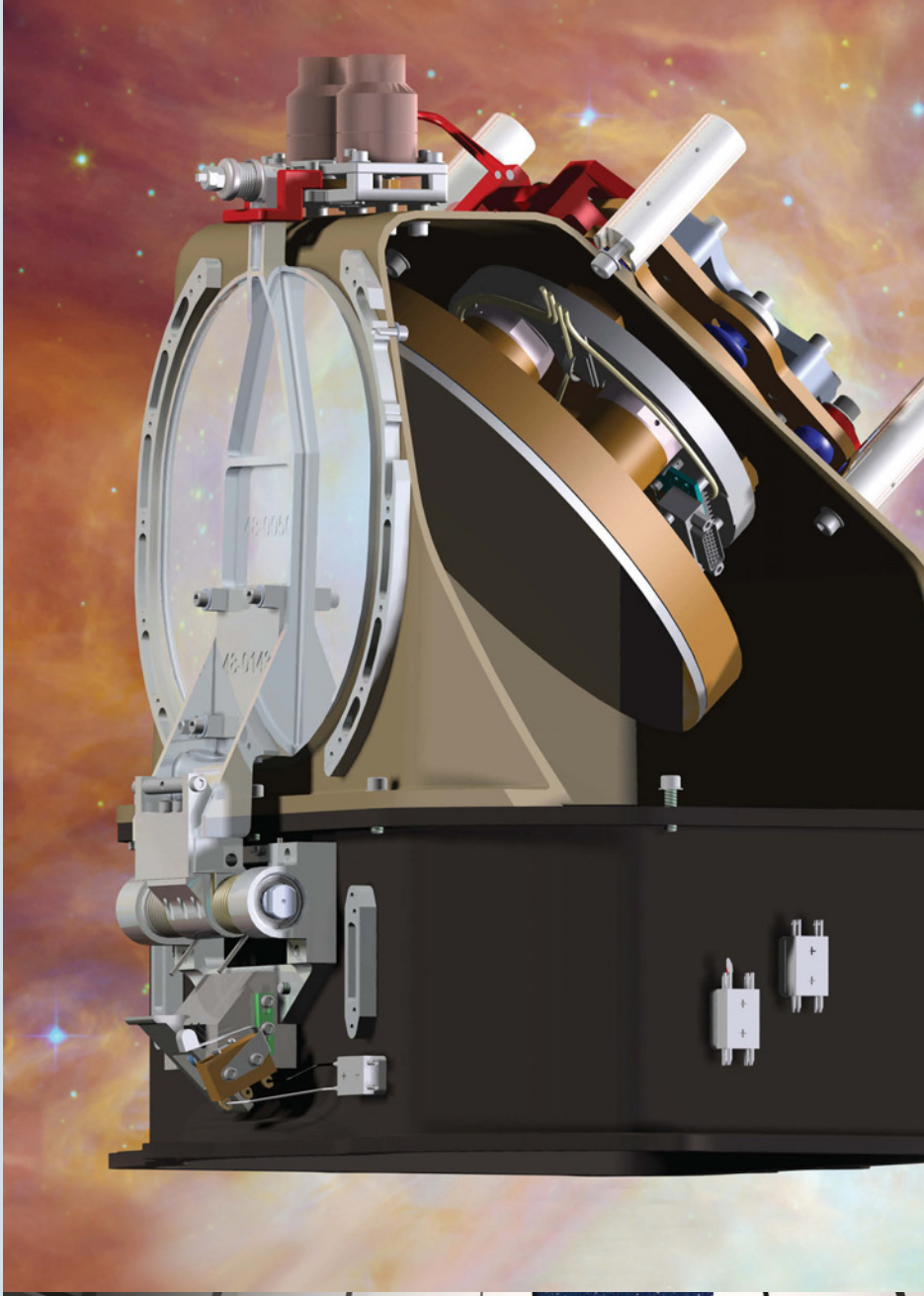
Solid Edge with synchronous technology.

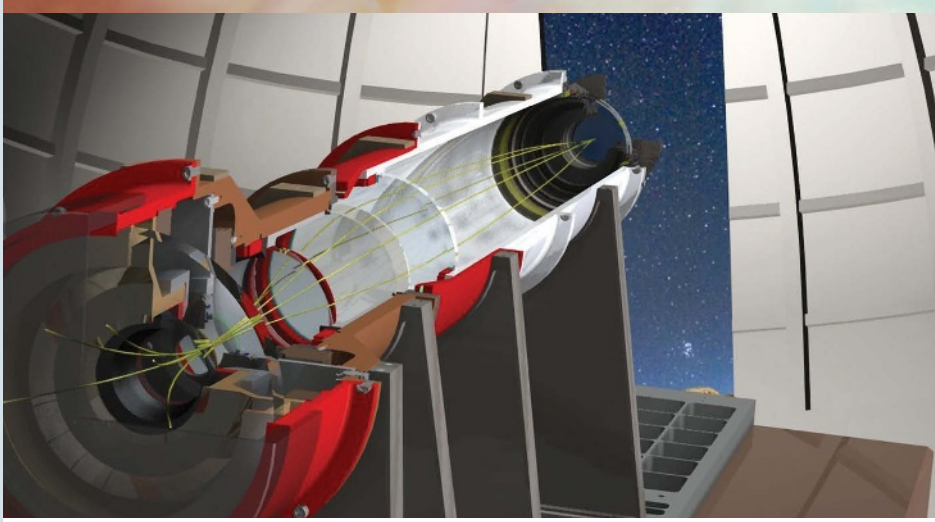
Space Dynamics Laboratory (SDL) in North Logan, Utah reported soaring productivity using the new synchronous technology in Solid Edge.

"Having used five different 3D CAD systems over the past 25 years, it offers me a different thought process that eliminates the complexity of previous systems," said Dave McLain at SDL. "The old days of being locked into a complex process are over."

"What used to take me several hours can now be completed in five minutes using Solid Edge with synchronous technology. With conventional CAD, you can't go back and delete the original features – thus you cannot eliminate discrepancies in features."

Solid Edge synchronous technology from Siemens PLM Software, is the first-ever history-free and feature-based modeling CAD system. The technology combines the best of constraint-driven techniques with direct modeling.





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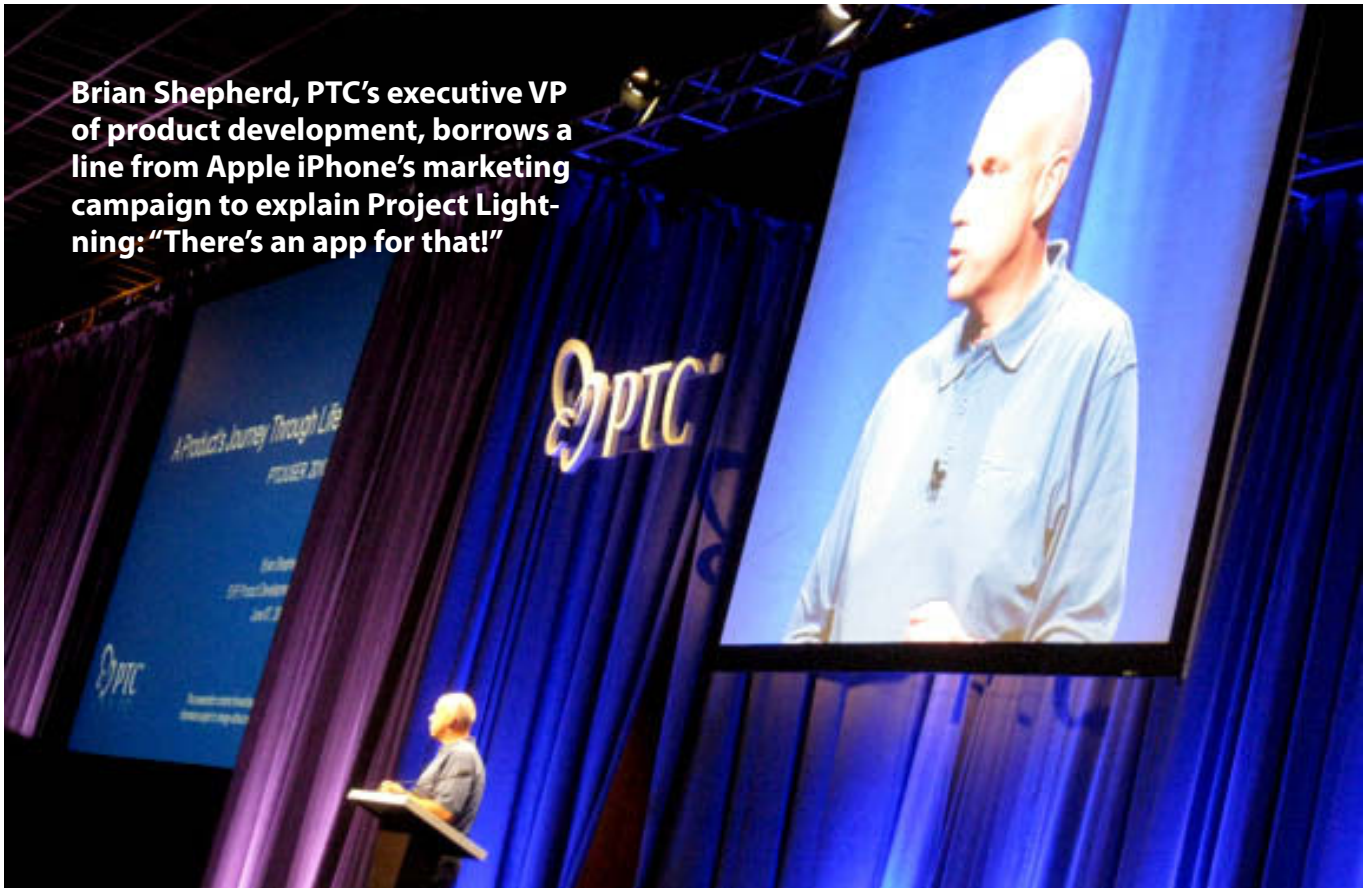

Brian Shepherd, PTC's executive VP of product development, borrows a line from Apple iPhone's marketing campaign to explain Project Lightning: "There's an app for that!"

ucts], I'm thinking Visio, Google SketchUp; I'm thinking of something you can download and, 30 minutes later, be off with the first design," he said. "There's an opportunity to … start targeting a whole new [level] of usability."

PTC's answer is Project Lightning.

"Solving these problems [that Heppelmann referred to] requires a fundamental breakthrough," said Brian Shepherd, PTC's executive VP of product development. "Mechanical CAD has been too focused on the needs of the few, the consumers of CAD information [engineers and designers] … But some are better served by a different approach."

PTC doesn't believe the answer is, as Shepherd put it, "one massive, monster, monolithic application." To explain PTC's vision, he borrowed a line from Apple's iPhone's advertising campaign. Whether you need 2D sketching, 3D direct modeling, surfacing, parametric modeling, or something else pertaining to product development, "We want to be able to say, there's an app for that," said Shepherd.

But those who want to see a glimpse of Lightning would have to wait. Its launch date is set for Oct. 28. For now, here's the best description we can infer from the scant details that have been revealed:

- A CAD program, presumably a lot easier to use than what we're typically used to, serves as the base platform.
- 2D, direct 3D, parametric 3D, markup, configuration, surfacing, and other components may be added to it as modules or apps.

> Click here to listen to my recorded interview with Jim Happelmann.

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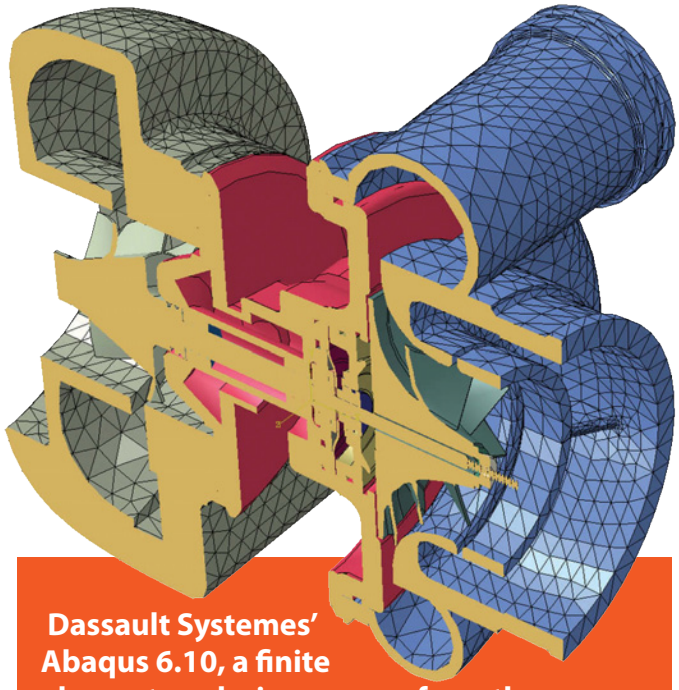
Dassault Systèmes Updates FEA Package and Acquires Search Engine

> Multiphysics in Abaqus 6.10



Dassault Systemes' Abaqus 6.10, a finite element analysis program from the SIMULIA product line, gives you the View Cut option forassemblies.

What happens when saline fluid and human tissues travel through the same tube in a medical device? This is one example of a scenario best served by multiphysics simulation, where the behaviors of liquid and solids must both be given equal consideration. In Abaqus 6.10, the latest release of Dassault Systèmes' (DS) finite element analysis (FEA) package, you can simulate this type of multiphysics event. Multiphysics simulation has been available in Abaqus since 1979, beginning with Abaqus V2, according to DS' site for SIMULIA. So what exactly is new with this release? Abaqus product managers explain that this marks "the first native computational fluid dynamic (CFD)" multiphysics in the software.

• Abaqus, part of Dassault's SIMULIA product line, comes in four variations:

- Abaqus/CAE (computer-aided engineering)
- Abaqus/Standard
- Abaqus/Explicit
- Abaqus/CFD

With multiphysics now available in Abaqus/CFD, you can perform coupled physics simulations with Abaqus/Standard (best suited for static and low-speed dynamic events) and Abaqus/Explicit (for verifying brief transient dynamic events) to understand liquid-solid interactions. With Abaqus/Standard, you might simulate sealing pressure in a gasket joints, steady-state tire rolls, and cracks in airplane fuselages. With Abaqus/Explicit, you might examine cellphone drops, automotive crashes, and ballistic impacts.

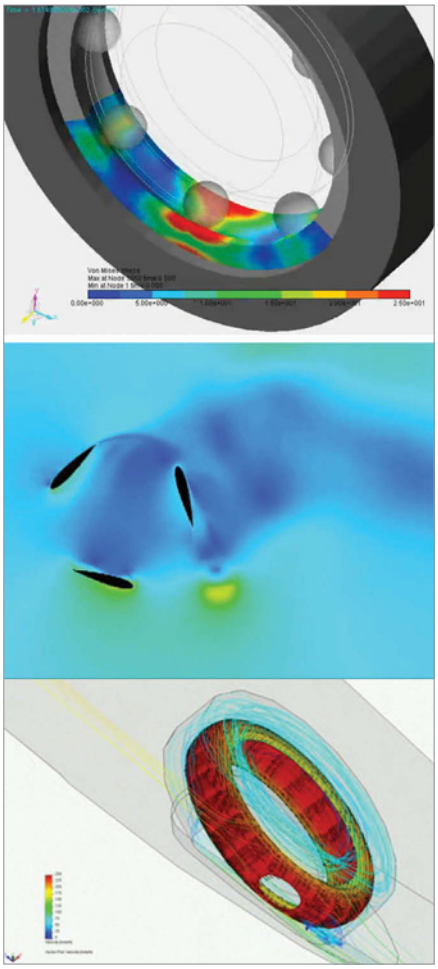
DS supports direct code coupling with partner products (such as CD-Adapco, ACU-SIM, and Capvidia) and customer-developed codes. It also allows code coupling via MpCCI, an interface developed by Fraunhofer Institutes for Algorithms

DE Movie Makers

In May, I issued an open call to story pitches via movies—that is, animated clips exported from analysis programs. (See "Make a Movie, Pitch a Story," May 2010). If a picture is worth a thousand words, why, then a movie is worth so much more, especially in describing the type of simulations engineers routinely do to verity the function and integrity of their designs. My hope is to eventually select one that I will develop into a case study for the October issue.

The entries received so far: multibody simulation featuring a ball bearing with flexible outer race, from Brant at MotionPort; optimized blade shape of a wind turbine, from Travis at The University of Texas; and airflow around the wheels and inside the wheel wells of a motorcycle traveling at 250 mph, from David at Design Dreams. My heartfelt thanks to all of them for piquing my curiosity!

Keep them coming! You can upload them to *DE Exchange*, our new online community, at deexchange.com. Then email me the link to it with the subject line that reads, "DE story pitch"—no explanation, no background, no preface—just the link to the movie and your contact info. As an alternative, you may also upload it to YouTube, then email me the link in the same fashion. Who knows? Yours may be the lead to my next feature story.



Analysis story pitches arrive in the form of short animated movies.

and Scientific Computing (scai.fraunhofer.de). Previously, Abaqus has had a tool that lets you examine your parts in cross-sectional views using its View Cut function. This function is now available in assembly mode with Release 6.10.

> Click here to watch a video demonstration of Abaqus 6.10.

Dassault Plays Semantic with Exalead Acquisition

Today, the knowledge you seek, be it the properties of a new thermoplastic brand or the schematics of a decommissioned World War II aircraft, might be found outside your company's firewalls, on a public forum or an aeronautic enthusiasts' discussion board. The latest compliance requirements about your product are posted somewhere on a regulatory agency's home page. You may have a copy in your internal server, but that's fraught with outdated information that could lead to a hefty fine.

So the ability to index, query, and retrieve not just your own enterprise data but other sources, like online encyclopedias and free research papers, becomes a critical function of product development. How much

is that ability worth? For Dassault Systèmes (DS), it's worth about €135 million (U.S. $166 million). That's how much the PLM (product lifecycle management) company paid recently to snatch up Exalead, often described as the French Google.

"If you're a designer using CATIA, your first priority is not to design a new part," says Michel Tellier, CEO of DS' ENOVIA brand. "You're using as much existing, pre-sourced, prefabricated data as possible."

In the future, Exalead-powered search functions may become part of DS' CAD and PLM toolbars. "We are going to make [Exalead] the core search engine within ENOVIA and across DS' V6 portfolio," Tellier says.

Exalead Co-Founder François Bourdoncle stated in a press release, "To accelerate the deployment of search-based applications in all market sectors, we needed a strong international partner. This alliance represents a tremendous opportunity for our partners and customers who will benefit from Dassault Systèmes' global presence. With our real-time search and natural language capabilities, Exalead provides a unique Web user experience. The combination with 3D represents the next generation of information technology for lifelike experiences. With Dassault Systèmes, the number of people who will benefit from our technology will explode."

Many PLM systems let you locate parts, assemblies, and project documents via predefined filters (a classic method derived from Excel columns), but Exalead's semantic engine provides a guided search based on natural language. (Looking for used cars? The search function will prompt you with the brands available. Know how much you want to spend? Your choices will be further narrowed by the price-range prompts.) For businesses that maintain online catalogs or market configurable products, Exalead could dramatically improve the e-storefront's navigation experience.

DS' CEO Bernard Charles is a firm believer in crowd-sourcing, or mining the social media landscape for nuggets of wisdom. He often refers to his vision as PLM 2.0, a Web 2.0-inspired approach to PLM. But indexing content in online communities is no small feat. Most exists in the form of random comments and unstructured conversations. That's beyond the scope of CAD and PLM, but right at the heart of what a search engine does.

In the announcement about the acquisition, Charles states, "With Exalead and its partners, we can provide a new class of search-based applications for collaborative communities." The groundwork for that may have already been completed. In February, at the user conference for DS subsidiary SolidWorks, the audience got a glimpse of DS' professional networking platform, 3d swymer (currently in closed beta). A new opportunity in PLM 2.0, as Tellier puts it, "is to provide a platform to support these collaborative communities."

> Click here to listen to my recorded conversation with Dassault Systèmes' CEO of ENOVIA, Michel Tellier. ■

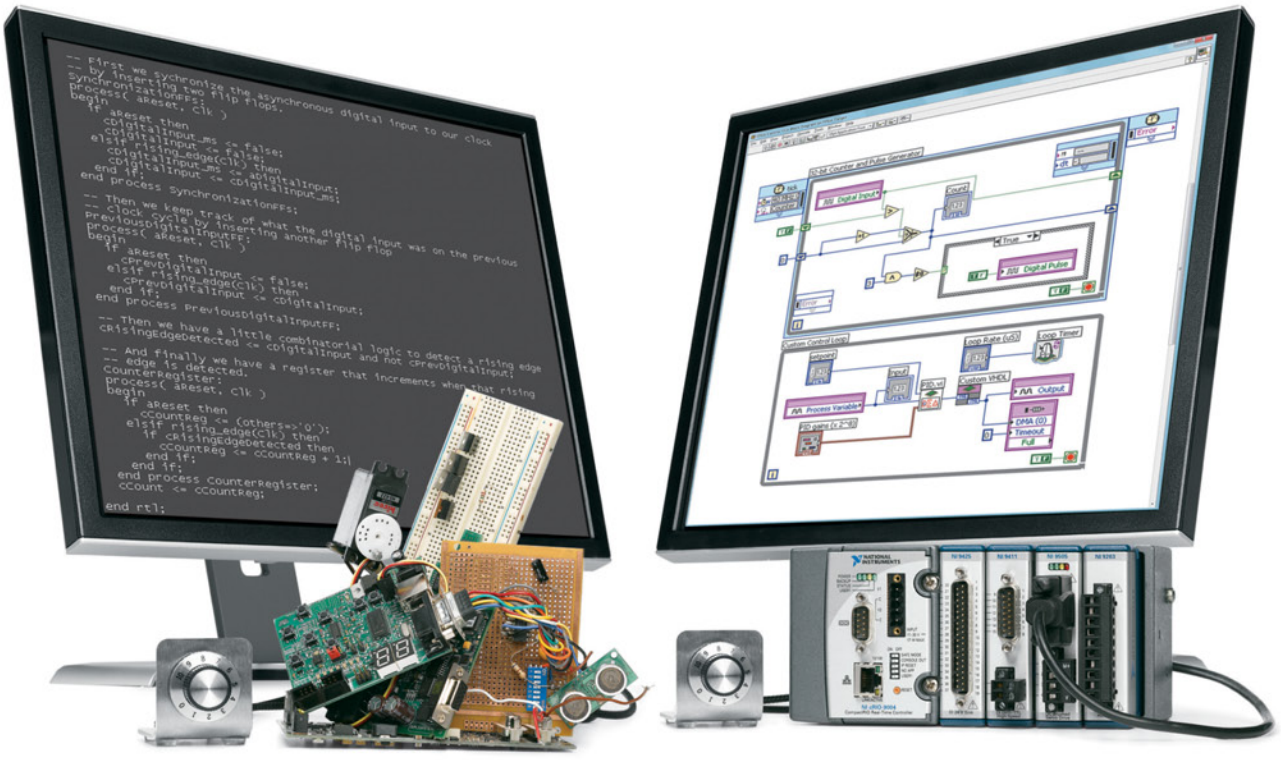
Kenneth Wong *writes about technology, its innovative use, and its implications. One of DE's MCAD/PLM experts, he has written for numerous technology magazines and writes DE's Virtual Desktop blog at deskeng.com/virtual_desktop/. You can follow him on Twitter at Kennethwongsf, or send e-mail to DE-Editors@deskeng.com.*

FOR MORE INFO:

> Dassault Systèmes

> Exalead

Embedded Prototyping. Simplified.



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NATIONAL INSTRUMENTS

OpenCL 1.1 Specification Released

The Khronos Group (khronos.org) has released the OpenCL 1.1 specification, the latest version of the open, royalty-free standard for cross-platform, parallel programming of modern processors. According to the company, OpenCL 1.1 provides enhanced performance and functionality for parallel programming in a backwards-compatible specification.

OpenCL working group members include: AMD, Apple, ARM, Broadcom, Ericsson, IBM, Intel, Kestrel Institute, Los Alamos National Laboratory, Movidia, Nokia, NVIDIA, Presagis, Qualcomm, Renesas, S3 Graphics, Seaweed Systems, Sony, ST-Ericsson, ST-Microelectronics, Symbian, and Texas Instruments.

Khronos also announced the release of a C++ wrapper application programming interface (API) for use with OpenCL, and the availability of OpenCL 1.1 conformance tests. The OpenCL 1.1 specifications, reference pages and cards are available at khronos.org/opencl/.

"The clear commercial opportunity to unleash the power of heterogeneous parallel processing that drove multiple OpenCL 1.0 implementations has also fueled the ongoing industry cooperation to create OpenCL 1.1," says Neil Trevett, chair of the OpenCL working group, president of the Khronos Group and vice president at NVIDIA. "The OpenCL 1.1 specification is being released 18 months after OpenCL 1.0 to enable programmers to take even more effective advantage of parallel computing resources while protecting their existing investment in OpenCL code."

"The release of OpenCL 1.1 is coming at a perfect time, capitalizing on the rapidly growing interest in GPU computing across the industry," says Manju Hegde, corporate vice president, Fusion Experience Program, AMD.

FOR MORE INFO:

> Khronos Group

SWE Reviews Engineering Literature

As part of its year-long 60th anniversary celebration, the Society of Women Engineers (SWE) has released a review of what it deems the most impactful science, technology, engineering and mathematics (STEM)-related literature. The compilation spans the past nine years of SWE magazine's annual reviews of social science literature on women in engineering. The reviews provide analysis of published documents in the engineering and technology fields with a focus on women's issues, ranging from work/life balance to outreach to diversity in higher education.

"This comprehensive collection of literature reviews recognizes the significance of research to address the issues facing women in STEM fields," says Nora Lin, SWE president. "Publishing this collection during our 60th Anniversary Celebration reiterates the advances we've made in the recruitment and retention of women in the profession, and the challenges that lie ahead."

FOR MORE INFO:

> Society of Women Engineers

Amazon Launches Clusters in the Cloud

Amazon Web Services (aws.amazon.com) has announced the availability of Cluster Compute Instances for Amazon EC2, a new instance type designed for high-performance computing (HPC) applications and other demanding network-bound applications.

According to Amazon, Cluster Compute Instances have been engineered to provide high-performance network capability and can be programmatically launched into clusters—allowing applications to get the low-latency network performance required for tightly coupled, node-to-node communication. Cluster Compute Instances also provide significantly increased network throughput than Amazon's standard EC2 offerings.

The idea of cloud computing on clusters may be catching on with design engineers. MathWorks now enables its customers, using MATLAB and Parallel Computing Toolbox on their desktops, to scale data-intensive computation problems up to access greater compute power with Cluster Compute Instances for Amazon EC2, which are running MATLAB Distributed Computing Server.

"Cluster Compute Instances give MATLAB users the opportunity to test and run their high performance computing problems for data-intensive applications in the cloud at a price and performance level that allows us to continually innovate and meet customer needs," says Silvina Grad-Freilich, senior manager, Parallel-Computing at MathWorks. "We're thrilled to allow our customers to leverage Amazon Web Services as an easily accessible way to meet their needs for increased compute power."

Fuel Cell Simulation Advancements Presented to DOE

Enhancements in the simulation of automotive fuel cell performance were recently presented to the Department of Energy (DOE) Hydrogen Program and Vehicle Technologies Program Annual Merit Review and Peer Evaluation Meeting. This program seeks to improve the ability to use simulation to conduct a detailed study of how various fuel cell component structures and properties affect the gas and water transport in Proton Exchange Membrane (PEM) fuel cells. Engineers from ESI North America have been part of this project during the last three years.

Proton exchange membrane fuel cells can be used as a zero-emission power source for many transportation applications. The most critical technical challenges facing the commercialization of fuel cell vehicles are cost reduction, durability, water management, freeze tolerance, and power density.

This four-year project was started in 2007 with a total budget of $6.4 million. The project is expected to be completed in May 2011.

FOR MORE INFO:

> ESI North America

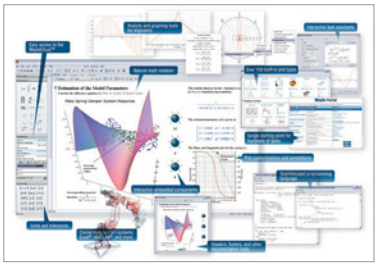
EDITOR'S PICK OF THE WEEK

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

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

Maplesoft Releases New Versions of Maple and MapleSim

>Improvements intended to save design, modeling, and simulation time.



There are gold standards in the engineering and scientific software business. Maple from Maplesoft is one of them. So, when a new version of Maple is released, you know that everything about mathematical computation systems has advanced again. With the simultaneous release of MapleSim 4, you also know that an emerging standard in physical modeling and simulation has advanced. This is good news for engineers designing, modeling, and simulating real-time and hardware-in-the-loop applications, scientists performing cutting edge research, and students training for careers in engineering, science, and mathematics.

The Maple symbolic computational engines lie at the heart of most every application offered by Maplesoft as well as many third-party applications that you rely upon.

READ MY COMPLETE REVIEW:

>Maplesoft

Geomagic Releases Studio 12 and Qualify 12

> Offers parametric exchange for five MCAD packages and introduces 3D PDF for quality inspection reports.

Geomagic recently introduced version 12 of its Geomagic Studio reverse engineering software and Geomagic Qualify, its inspection software. I think that it is fair to say the gap between point processing and the productivity you've always imagined has closed considerably. These applications seem to enable you to use point processing to do the types of 3D inspection, CAE and physical analysis, as well as quality control applications that you always thought would be possible one day when the technology was there. Geomagic Studio 12 and Geomagic Qualify 12 could be the solutions that make you believe that the technology is here.

Geomagic Studio enables the automatic reconstruction of the design intent and parametric characteristics of your scanned object. That means your scanned data is ready for work in Autodesk Inventor, CATIA, NX, Pro/ENGINEER, or SolidWorks with a minimum of fussing.

READ MY COMPLETE REVIEW:

>Geomagic

More Xtreme-X Supercompter Configurations Offered

> Appro offers Xtreme-X Supercomputer configuration options for entry level up to high end; also improves cluster management software.

Supercomputing has and will continue to revolutionize the playing field for practitioners of high-level analysis in industries as varied as automotive, aerospace, and oil and gas exploration. Until recently, however, supercomputing was restricted to outfits that could foot the hardware and administrative costs. But over the past couple of years, the cost of getting into supercomputing has come down to the point where small- and mid-sized organizations can get onto the field. One of the leaders in this price/performance breakthrough has been Appro. And they've just made the entry-point more attractive as part of an expansion of their Xtreme-X Supercomputer line and cluster management software.

The Appro Xtreme-X Supercomputer offers a scalable architecture that groups high-performance servers together into a unified, fully integrated scalable unit (SU) that can be provisioned and managed as a stand-alone supercomputer.

Read my full message online at:

READ MY COMPLETE REVIEW:

>Xtreme-X

Z Corporation Unveils High Resolution Prototyping System

> New ZBuilder Ultra rapid prototype machine delivers functional plastic models.

With the introduction of the ZBuilder Ultra, a durable plastic rapid prototyping system, Z Corporation offers everything from 3D scanners, 3D software for pre-processing build files (even for medical imaging), 3D printing and rapid prototyping materials, as well its color 3D printers. That means Z Corporation has your hardware, materials and software needs for physical model capture, concept modeling, detail design, and functional design verification covered.

For end users, the ZBuilder Ultra means a bunch of things. For one, it means direct printing to a 3D part. Since the ZBuilder Ultra's high-resolution digital light processor (DLP) projector solidifies a liquid photopolymer into a smooth-finished part—with no stair stepping—you have a part that can withstand high-end functional testing and that you can use right away.

A second thing the ZBuilder Ultra means is compressed design cycles. Think of the possibilities of costs saved with tooling alone if you can verify form and fit quickly and inexpensively.

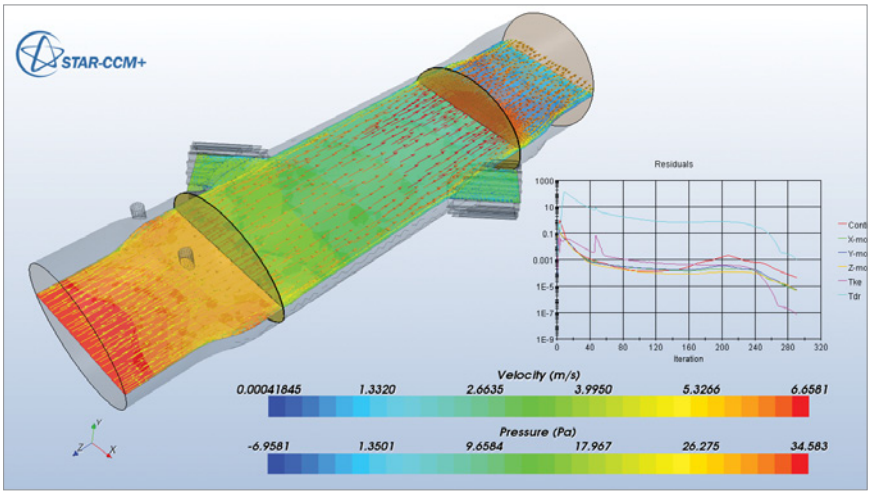
READ MY COMPLETE REVIEW:

>Z Corporation

Medical Applications Tap Power of CFD

> Software simulations open windows to understanding critical fluid flow.

BY PAMELA J. WATERMAN



Plane-section pressure profile and velocity vector field for gas flow through a respiratory device component, showing effects of cross-sectional geometry transitions and flow conditioners. Analysis done with CD-adapco's STAR-CCM+ software. *Image courtesy CareFusion*

As natural as breathing. That phrase takes on new meaning when a medical condition makes ordinary breathing a moment-by-moment struggle.

We generally don't think about our blood circulating until someone mentions heart attack or stroke. But in the medical field, these fundamentally human functions translate into daily design challenges as device manufacturers strive to understand and improve their life-critical products. *DE* looks at several design projects where computational fluid dynamics (CFD) software sheds light on complex fluid behaviors.

Taking the Burden off Testing

In most projects, early-stage research leads to multiple design concepts, any of which may lead to a great product. But because no company can afford to build them all, CFD can be invaluable in identifying the best possibilities before anything gets built. Dr. Chris Varga has seen that firsthand in his position as senior principal research scientist at CareFusion, a global medical technology company.

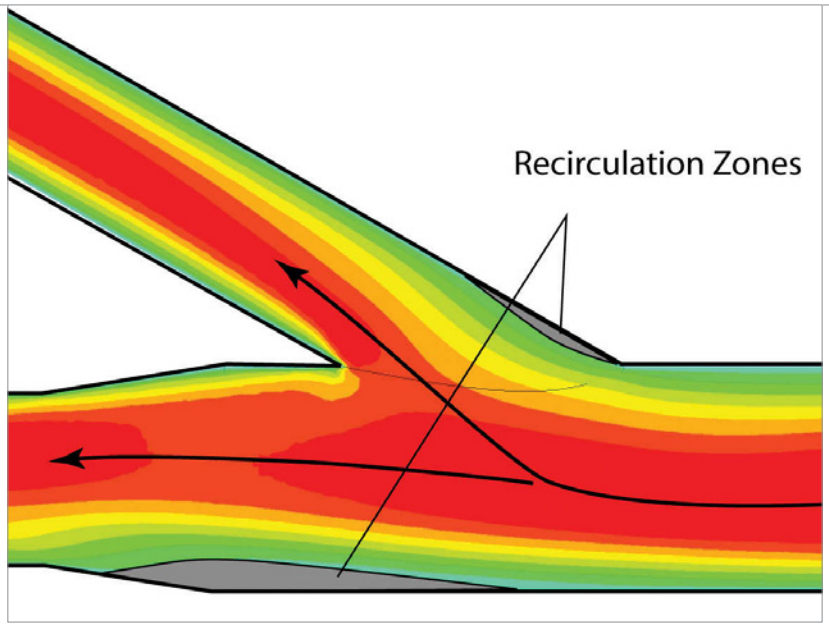
Varga's division has a long history of designing respiratory care systems and diagnostic products, going back more than 50 years. Since 2006, it's relied on CD-adapco's STAR-CCM+ software to quickly analyze gas flows through ventilator components, breathing devices, diagnostics systems and disposable medical devices, visualizing such parameters as pressure, temperature and velocity through certain geometries.

"With traditional build-and-test development,

we have limited access through external measurement ports, so we can't get at the same information that we can with CFD," he points out. "With STAR-CCM+, we can iterate through tons of concepts and refine them. We have a high confidence level that after being built, they'll be ready to do what we expect them to do.

"Another aspect of CFD that is a little underappreciated is that it allows us to really push the envelope with aggressive, even wild ideas and test them virtually," Varga adds. "It lets us take more chances, where we probably wouldn't have had the support to build them. The cost is just a few hours of computer time."

His group also uses the STAR-Works package (a version of STAR-CCM+ embedded in Dassault Systèmes' SolidWorks), allowing the engineers to rapidly evaluate the effects of design changes without requiring deep knowledge of fluid behavior or solid meshing techniques. On a current project, Varga estimates that using CD-adapco's packages has saved them tens of thousands of dollars in prototyping costs—and weeks to months of building and testing time.



▲ **ANSYS CFX analysis of blood flow in branched region of an artery, showing predicted recirculation zones.** *Image courtesy University of St. Thomas*

◀ **Contour plot obtained with Abaqus/CFD analysis software, showing the variation of pressure inside an abdominal aortic aneurysm sac at a certain instance of the cardiac cycle.** *Image courtesy SIMULIA*

Understanding Flow Anomalies

Nuclear plant reactor experience may not seem immediately relevant to medical device design, but for Enfield Technologies' Principal Engineer Dan Cook, it served as the key to understanding valuable CFD analysis results. The company produces pneumatic control systems, including precision valves. Most deal with choked-flow applications where the valve regulates high differential pressure (DP) flow (upstream minus downstream) based on simple flow profiles and well-behaved equations.

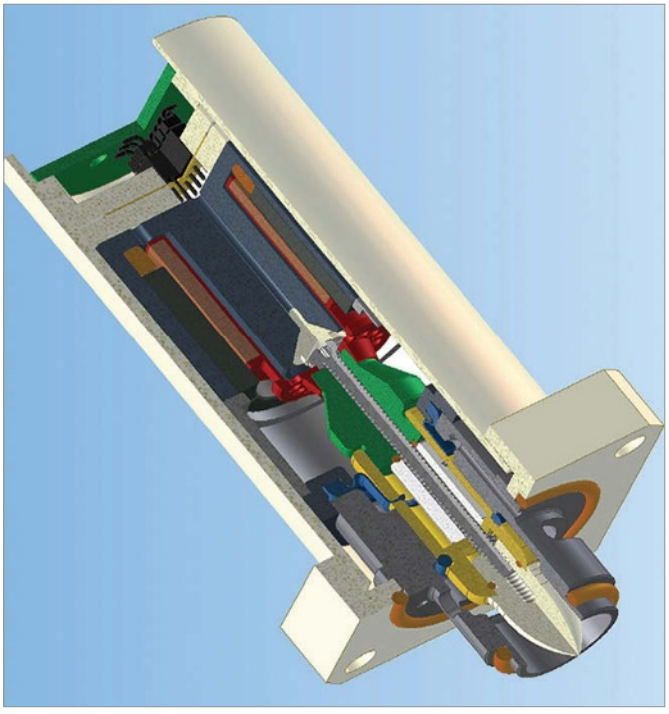
The valve for one customer's portable respiratory system, though, needed to operate in a non-linear manner, with a slowly increasing flow profile for 50%

of the valve movement and a sharper increase for the second half. The project required a rather large, but precise servo-controlled valve that could regulate air flows up to 200 standard liters per minute (SLPM) while operating with a low DP of about 16 cmH_2O (a medical field unit of pressure analogous to mmHg). The company chose a basic "poppet" valve design, with a sealed sliding stem to control the flow-port opening and closing.

Various designs done in Autodesk Inventor were built and tested as part of the complete software-controlled, electromechanical respiratory system, generating preliminary flow-profile data with the valve at different open/closed percentages and under a range of operating conditions. During these physical tests, an odd flow anomaly occurred at approximately half-stroke: When increasing the initial flow, the flow value suddenly dropped by 3%. Reversing the motion did not restore the flow-rate value.

Cook used Blue Ridge Numerics' CFdesign software to easily upload the Inventor solid model and recreate the pneumatic system. He set up input pressures, back pressures and upstream restriction coefficients and quickly ran several simulations, using the cut-plane function to see velocity and pressure characteristics at exact points along the flow streamlines. These visualizations clearly showed an area of instability just when the valve was near the 50% open position.

Remembering a theory associated with nuclear reactor physics, Cook speculated he was seeing an unusual bi-stable flow effect that would have been almost impossible to isolate without the CFdesign results and visualization tools. The software allowed



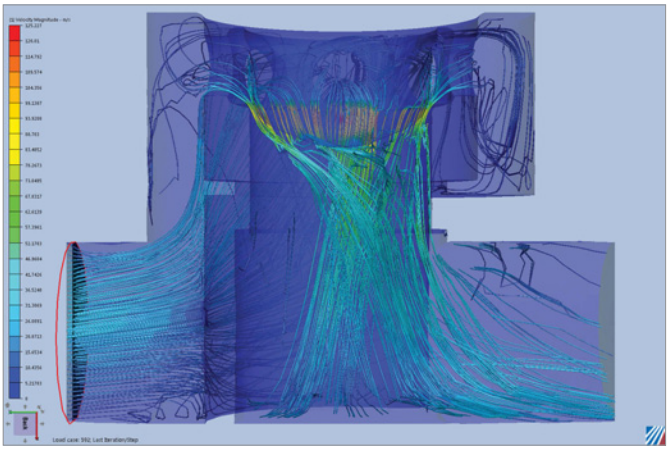
Cutaway CAD diagram of respiratory system valve that displayed an operational anomaly in need of analysis with CFdesign software.
Image courtesy Enfield Technologies

him to view the unbalanced flow, messy vortices and crossing streamlines caused by the original internal valve geometry. With this insight, his team was able to change the geometry details and create the desired smooth flow profile.

"The proper application of a powerful tool like CFdesign can mean the difference between winning and losing contract dollars," he says.

Analyzing Blood as a Transport Fluid

At the University of St. Thomas in St. Paul, MN, analyst John Abraham has been using ANSYS software for more than 15 years while teaching the intricacies of such mechanical engineering topics as heat transfer and fluid flow. As an in-



Analysis of valve velocity streamlines done with CFdesign software, showing area of anomaly. *Image courtesy Enfield Technologies*

dustry consultant, he recently used ANSYS CFX to simulate pulsating blood flow in an artery that has undergone an orbital atherectomy for plaque removal.

This procedure involves a micro miniature, almost whip-like, diamond-tip catheter-wire that abrades plaque as it traces an offset spiral path through the artery. Centrifugal motion presses the tiny tip outward into contact against the artery wall, hardly blocking any blood flow while it does its "sanding" job. Most of the loosened plaque particulates are smaller than red blood cells and should flush out along with normal blood flow.

The goal of Abraham's work was to predict whether the moving particulates would travel deep into the capillary structure, possibly leading to clotting, or flow directly through the larger arterial branches. Previously, such understanding could only have been gained through a series of very expensive and complicated experiments performed with custom-made glass models.

To conduct the CFD simulation, Abraham first used MRI images from an actual patient to construct CAD geometry of the arterial system. Because of the excellent CAD file-integration and meshing capabilities of ANSYS CFX, he was able to easily create the relevant fluid-flow region and set up the input parameters. He adds that ANSYS is also able to track particles very well.

CFD analysis predicted that the particles would indeed flow properly along with the red and white blood cells in the plasma, without clogging either capillaries or downstream sections of the arteries themselves. As a follow-up, Abraham's group did have the full-scale arterial model built in glass and pumped dye through it at the appropriate pressure. However, many fewer tests were needed to verify the expected behavior, thanks to the CFD results on hand.

Fluid-structure Interactions in the Real World

It's hard enough modeling and investigating biofluid behavior under textbook conditions, but often the challenge involves simulating a damaged or diseased system. That task falls in the family of problems that SIMULIA is addressing even more than before with new multiphysics capabilities in Abaqus 6.10 Unified Finite Element Analysis software.

While Abaqus still offers co-simulation coupling with other analysis software, including full CFD connectivity with packages from such companies as CD-adapco and ANSYS, the 6.10 version offers internal Abaqus CFD capabilities that go beyond simple coupled Lagrangian methods for fluid-structure interaction analyses. The software uses a hybrid finite element/finite volume approach

that takes away typical user concerns about how to integrate the solid model with the CFD analysis set-up. Targeted initially to structural engineers, Abaqus CFD now addresses laminar turbulent fluid flow and thermal behavior. It also addresses interaction with structures, which themselves can behave in a nonlinear manner.

Subham Sett, SIMULIA's Life Sciences lead engineer for medical devices, recently worked with CFD users in that industry to understand the critical parameters that define various cardiovascular flow situations.

"One application example is that of a simplistic convergent/divergent nozzle to represent a blood-handling, ventricular assist device; that's pretty straightforward," Sett says. "Another, more realistic example is that of (simulating) flow through an abdominal aortic aneurism (AAA) through a full cardiac cycle."

He points out that setting up the boundary conditions for the latter case requires FSI analysis based on non-Newtonian behavior, flexible arteries and similar material densities, all of which present quite a challenge—especially when a stent has been implanted in the damaged area.

"You don't know what kind of realistic loading conditions to give," he says. "As a first step, engineers think that if they can get some realistic loads coming from the fluid, and apply it on the structure, 'Maybe I have a better chance of designing a better product.'"

What Sett likes about SIMULIA'S CFD implementation is that it gives users a chance to remove some of the typical approximations in their analyses, and gain stability in the operation of coupled CFD/FE code. Improved credibility is key to solving such problems as predicting whether a stent, once in place, will experience forces that actually displace it over time.

CFD: A Modern Medical Miracle

Accurately simulating the interactions between intricate medical devices and the wide range of possible fluid behaviors seems a staggering job, but today's CFD packages are certainly making progress in doing so. Advances in modeling, multiphysics, usability and visualization are helping engineers improve product performance while saving time and money in development.

What's next? As SIMULIA's Sett says, "The Holy Grail will be when they can do all of this *and* account for all the intricacies and behaviors of the human system." ■

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

FOR MORE INFO:

> ANSYS
> Autodesk
> Blue Ridge Numerics
> CareFusion
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Desktop CFD Tools Assess Contaminants

> Keeping airborne organisms to a minimum is a major health care facility design goal.

BY ANDY MANNING

Patients in hospital isolation rooms produce transmissible airborne organisms by coughing, sneezing, speaking or just breathing. These actions, if not under control, can result in spreading airborne infection.

The designer of ventilation systems for patient rooms needs to be conscious of these contaminant threats, and should account for them appropriately. It is impractical to completely isolate the patient using solid barriers, particularly for less severe cases. The ventilation system itself, therefore, has to act as one of the primary control mechanisms in the room. This can be done in two ways: precise targeting and control of the contaminant source; or creating high levels of mixing, which leads to increased removal effectiveness and can be potentially supplemented by other mechanisms such as ultraviolet germicidal irradiation (UVGI).

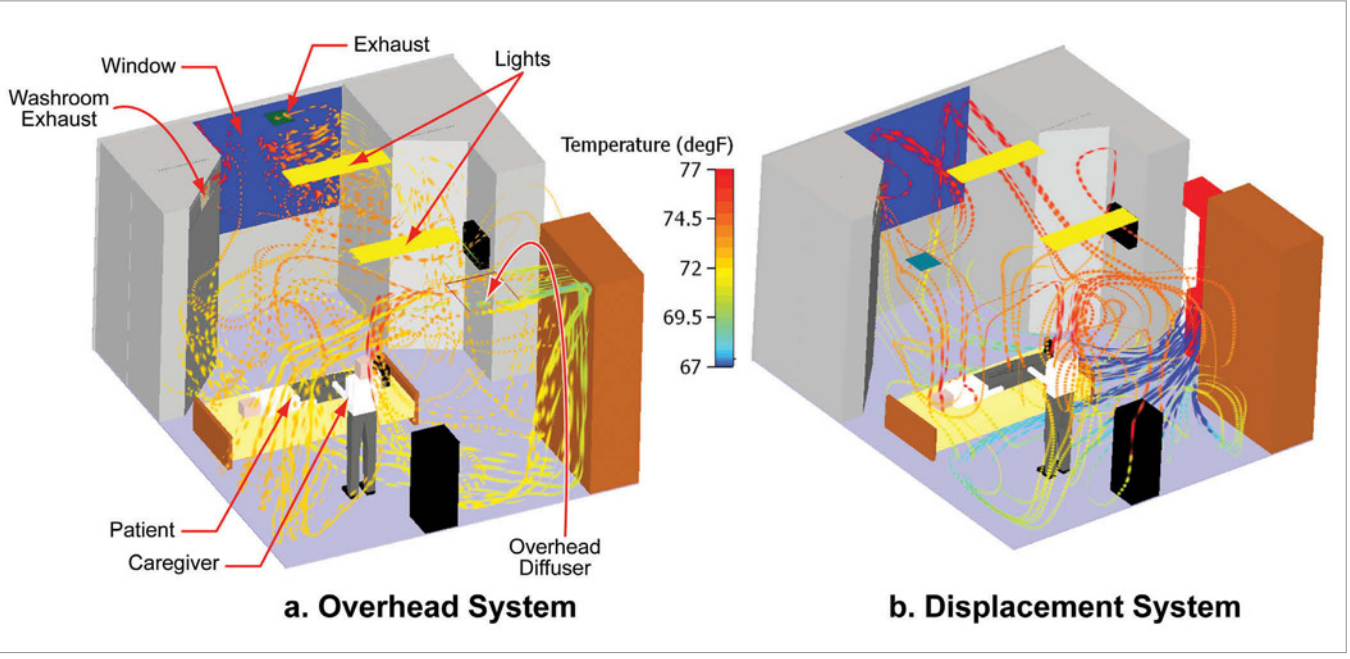

Figure 1: Contrasting two ventilation schemes in a conventional patient room. The displacement system delivers effectiveness similar to that of the overhead system, but with a lower ACH value.

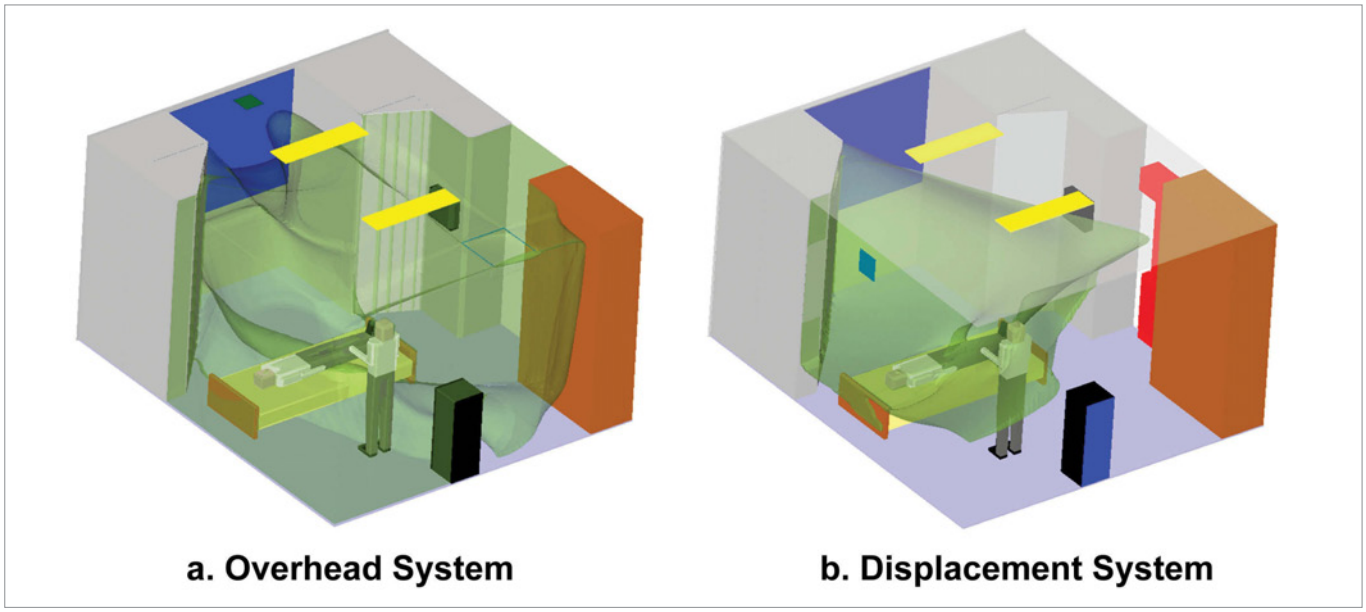

Figure 2: The overall ventilation effectiveness increases when the return grille is located on the side wall, closer to the patient.

The design approach must take into account the primary function of the room. Standards such as American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 170-2008 outline the minimum air changes per hour (ACH), pressurization relationship to adjacent areas, relative humidity (RH), etc., for a range of health care facilities. However, it's imperative for the designer to use supplemental analysis techniques to ensure the ventilation system outlined by these guidelines is able to provide control. Put simply, it is not enough to apply an ACH to a room and expect that it will perform correctly—regardless of the ventilation system design.

Software-based computational fluid dynamics (CFD) tools, such as Mentor Graphics' FloVENT, allow designers to consider different ventilation system layouts before installation in the physical room, and allow determination of the impact of parametric changes efficiently and cost-effectively. Several CFD studies (cited in the references section) have addressed patient rooms.

A View into a Room

CFD analysis has become the tool of choice for evaluating air handling in all kinds of structures and rooms. "Virtual" rooms and airflows have been validated, with good correlation against experimental (physically measured) data. It is common for designers to model the flow behaviors of several ventilation approaches to determine which ones provide the best performance from the standpoint of patients and others who enter the room. Two ventilation system approaches—overhead and displacement diffuser systems—are common in hospitals.

Figure 1 depicts two views of a typical patient room. The annotations point out the room's standard features such as a bed, windows, exhausts, lighting, etc. The overhead ventilation system in

Figure 1a meets ASHRAE Standard 170-2008. The room has an overhead ceiling supply diffuser, and high- and low-exhaust locations. The ACH in this case is 6, and the exhaust flow rate is relatively evenly split between the ceiling and washroom returns. The ceiling return is next to the window in this instance. The contaminant source is assumed to be the patient's regular respiratory function.

In a model-based design environment, changes to the ventilation system and room environment can be applied and analyzed. Parametric changes might include diffuser type and location; outside weather conditions; air change rate; supply temperature; auxiliary heating and cooling systems; solar loading; ceiling height and more.

Models can also assess standard measures of the ventilation system's performance with respect to contaminant removal and control. Appropriate indices include:

> VE: Ventilation Effectiveness (ASHRAE 62.1 - 2007)

> PEI: Personal Exposure Index, a measure of the contaminant concentration in the breathing zone of a particular individual

> ACE: Air Change Effectiveness (ASHRAE 129-1997)

> ADE: Air Distribution Effectiveness[1], applicable specifically to displacement ventilation systems.

Figure 1a shows the flow pattern in a room with an overhead system compared to a displacement ventilation system (Figure 1b) providing 4 ACH. While the flow patterns produced are different, the performance of the ventilation system, as measured using the indices above, is similar. So, the use of the displacement system is a viable alternative to the overhead system and can operate at a lower ACH value. This could reduce energy use through reduced supply capacity.

Using the modeling environment, some new constraints can be applied to the first-round recommendations. A follow-up analysis could test using baseboard heaters in the room. The CFD tool confirms that baseboard heaters are acceptable, because the interaction between the heater plume and general airflow (tracked by vectors similar to those in Figure 1) is well away from the patient. The analysis also reveals that the impact of solar loading is more damaging, and should be avoided.

An alternative proposal to increase the supply temperature so the ventilation system can be used as the heating mechanism concludes the flow rises immediately upon exiting the diffuser and does not penetrate into the room. A timely discovery such as this can save many hours of trial-and-error design and experimentation.

The model also shows the location of the return grille is critical to contaminant control. The CFD analysis suggests ventilation effectiveness increases when the return grille is located closer to the patient, and decreases when farther away. This is evident in Figure 2a and 2b, showing the 3ppm concentration isosurface for the overhead case and displacement cases, respectively, when the grille is moved to the sidewall. In the former case, the isosurface fills the volume of the room, while in the latter, there is a cleaner zone away from the patient bed.Isolation Rooms and Energy Savings

When the task becomes one of designing an

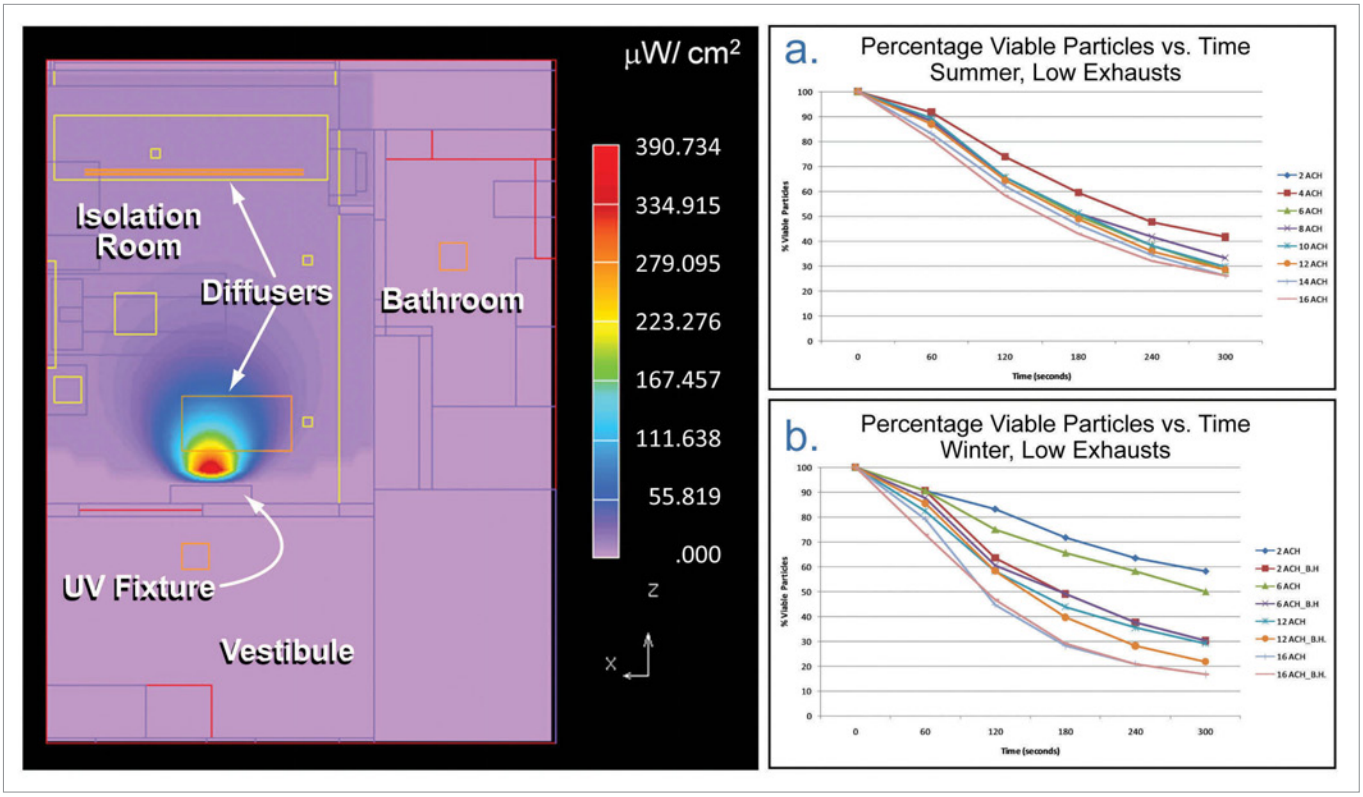

Figure 3: This analysis explores the effect of UV light working in conjunction with ventilation to reduce viable mycobacterium tuberculosis particles in an isolation suite.

isolation room, the priorities go beyond simply changing the air in the room with a predictable frequency. In such a situation, increasing the ACH is not enough. CFD analysis can help designers evaluate the use of UVGI as a means of reducing the number of viable mycobacterium tuberculosis particles in an isolation room[2]. The particles are usually emitted by coughing, and tend to disperse all around the patient and bed.

The design emphasis is on ensuring the conditions provided by the ventilation system are well mixed. The ventilation system must remove the viable particles—both via the room exhaust and by subjecting the particles to prolonged exposure to the UVGI field created by the lamps in the room.

Figure 3 depicts the floor plan of an isolation suite typically found in hospitals. The suite consists of three rooms connected via door openings between them. The main room is equipped with four slot diffusers near the window, and a low induction diffuser on the ceiling. As with the "standard" room described earlier, the CFD toolset enables the designer to expediently change mechanical and environmental parameters.

In this case, the set of parametric changes touched both mechanical and environmental variables: the supply flow rate (2 ACH to 16 ACH); weather conditions, both summer and winter (with appropriate supply temperature settings); and the ventilation system with low exhausts, high exhausts and low exhausts with baseboard heating for winter cases. The UV lamp, located on the partition between

the isolation room and vestibule, was evaluated with UV outputs of 10, 20 and 40W. Figure 3 shows the UV field for the 10W lamp.

The upper graph (a) plots the variation in the number of viable particles over time for the summer cases. These curves show that the increase in ACH beyond 6 ACH is a waste of supply flow capacity; that there is little benefit in supplying large values of ACH to the room. Knowing this, the designer can reduce energy use and operating costs during the summer load conditions.

The lower graph (b) in Figure 3 reveals the benefit of adding baseboard heating to the room. In particular, heaters help to increase the mixing in the room, and thereby increase the likelihood that the particles will be removed. The potential saving in energy cost is large, even with the added costs associated with the heaters and UVGI lamps. This is because the recommended ACH is reduced by as much as 50%, to 6 ACH when the heaters are used—compared with 10 to 12 ACH without the baseboard heating.

These are just some of the evaluations that demonstrate the benefits of using CFD tools to numerically analyze the contaminant control in patient rooms. Lower values of ACH can be shown to work just as effectively as higher values, and can lead to reductions in energy operating costs, while the optimization of supply and/or exhaust locations can improve the contaminant control in general. ■

Andy Manning *is director of thermal engineering for the Mechanical Analysis Division of Mentor Graphics Corp.*

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FOR MORE INFO:

> **American Society of Heating, Refrigerating and Air-Conditioning Engineers**

> **Mentor Graphics**

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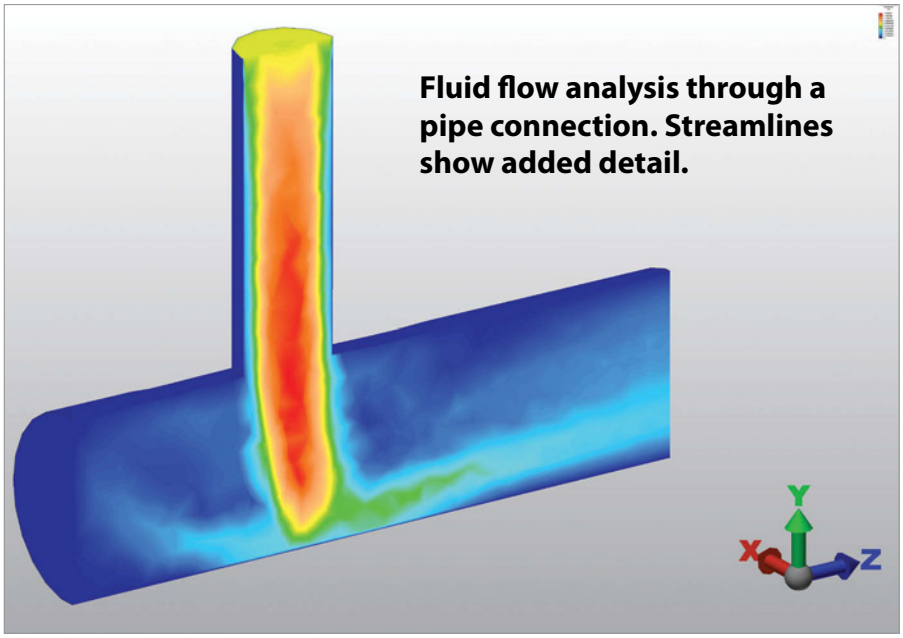
Digital Prototyping with Autodesk

> Digital prototyping can save costs via fewer prototypes, faster design validation, less material waste, more accurate quotes, and risk mitigation.

BY ERIC SCHUBERT



Fluid flow analysis through a pipe connection. Streamlines show added detail.

In today's manufacturing community, the topic of simulation has been receiving increased attention from companies making consumer products, industrial equipment and sporting goods, among other things. But what is it about simulation that provides such a benefit to these industries? Who should use simulation products? And why is simulation changing the engineering world?

The term "simulation" refers to a computer analysis of what a part or assembly will do when subjected to real-world conditions, and it is a very important aspect of digital prototyping. Digital prototypes are more than just three-dimensional models; they offer numerous advantages for design teams, including simulation. But what can the process of simulation do for the engineering process above and beyond rendering a 3D model?

Production of physical prototypes, whether accomplished in-house or through contracting/outsourcing, can be expensive in both time and labor costs. If any destructive testing is involved, then multiple prototypes will almost certainly be needed, thereby increasing these costs even further.

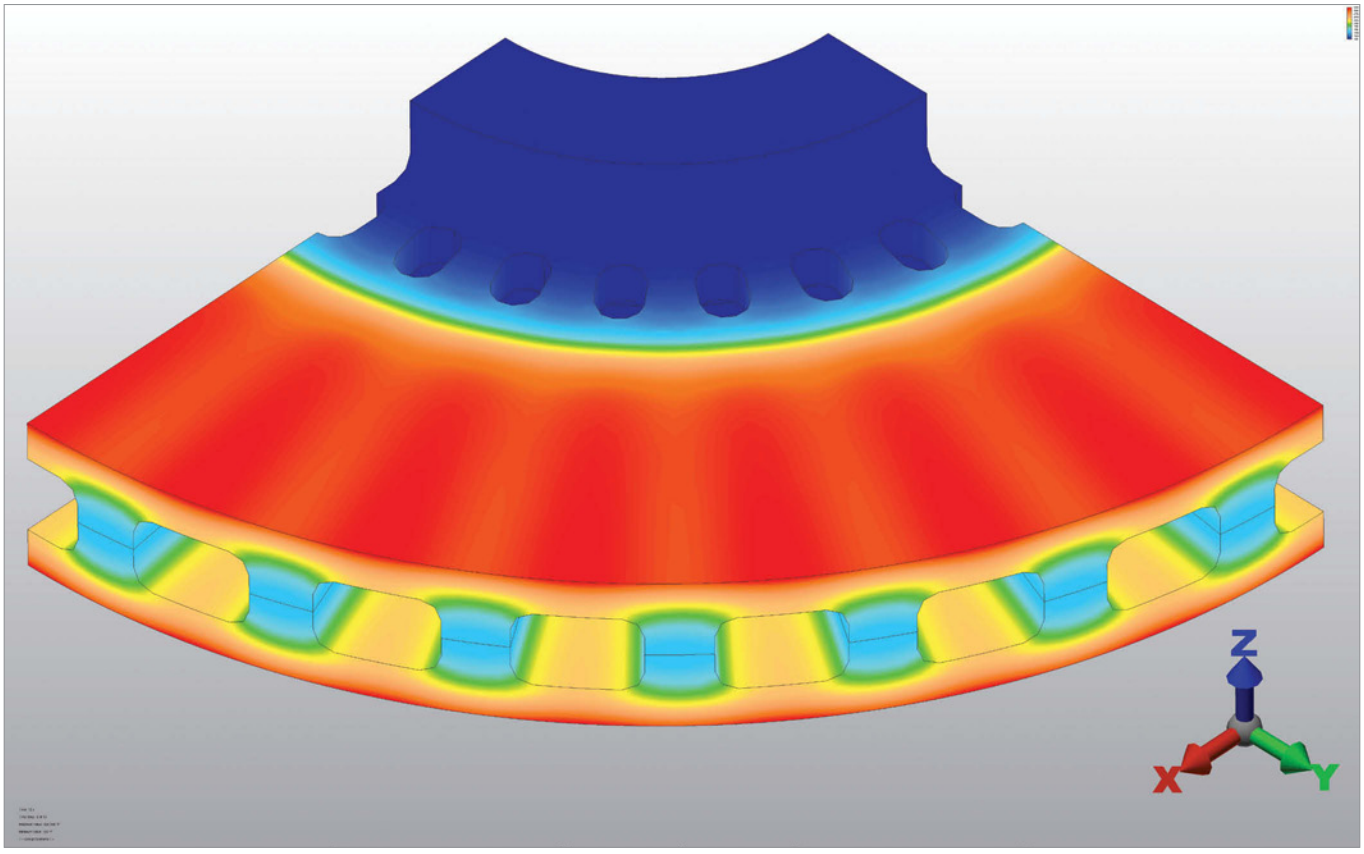
Digital models made during the design process, however, can be repurposed to run analyses without a need for physical prototypes. Current finite element analysis (FEA) software allows a broad range of testing that can be performed on these digital prototypes—from simple stress analysis to more advanced functions such as fatigue, impact, vibration, thermal, electrical, and fluid flow analysis. Consider the recent trend of

parts being overdesigned to ensure safety, which results in wasted material and increased cost to the company. Alternatively, a good FEA package can provide insight into a product early in the design phase to help maximize design efficiency and reduce material costs.

Autodesk Inventor for FEA

At MasterGraphics, we use Autodesk Inventor Simulation, which includes basic FEA tools right in the software for performing stress analysis. This available FEA allows a designer to test the model under anticipated loading conditions. When using Inventor, this can be done in an environment familiar to designers. The integration of FEA into Inventor is beneficial for simple linear stress and frequency response analysis. It also means that the parameters used to construct the model can be varied directly within the simulation environment to test multiple configurations, materials or thicknesses, and to find the most efficient and effective design. The lack of need for translation and the familiar interface mean the learning curve for Inventor Simulation comes easily for current Inventor users.

Material choices tend to bring an element of complexity to the table. There are thousands of different materials available these days, so how



Stress analysis on a disc brake placed under a thermal load shows dissipation of heat away from the outer face throughout the model.

can you be sure you've chosen the best one for the job? A solid study of material characteristics will certainly help (you can easily eliminate materials that don't meet specifications for your application), but there will likely be a range of different plastics, alloys, composites and the like that could still be in the running.

Physically testing each of these materials can be quite costly. Using a simulation tool to test each material type can help eliminate poor choices for a given application and improve the characteristics of a component by discovering a stronger, lighter, more cost-effective material to perform the job. These software tools help to eliminate most of the confusion around material choices and help to reduce wasted prototypes and time spent on testing each potential candidate material.

Standalone FEA

Sometimes the need for a higher-end simulation product is required. Algor has been around more than two decades, and it was recently acquired by Autodesk and integrated into the company's overall digital prototyping portfolio. Standalone FEA tools, such as Algor, offer significantly more features and benefits than the basic tools in Inventor. Four different Algor products (simulation, mechanical event simulation, computational fluid dynamics and multiphysics) provide tools that can run simulations for non-linear stress models

(such as rubber or silicone), fluid flow analysis, permanent material deformation, and electrostatic analysis—all of which can be coupled with thermal analysis to combine multiple simulations for more complex design scenarios.

These additional capabilities can be valuable to companies producing medical and safety equipment, performing earthquake-proofing, making machinery, automotive and aerospace industries, and a variety of other applications. Because many customers are requiring performance validation before contracts are signed, having the capability to analyze an assembly and predict performance can be quite a boon to winning a large deal. There is truly something for every application in the simulation world.

Autodesk also provides its Dynamic Simulation environment within Inventor to test kinematics in assemblies. These simulations can discover the types of stresses, torques, or forces that will be introduced during motion. As the assembly is animated, the points of interest can be monitored on an output graph and maximum or minimum values can be found. While the Dynamic Simulation environment does not perform stress analysis, it can reveal what the forces would be in an FEA model and can export those forces directly over to a stress analysis. A Dynamic Simulation run can also be used to size motors or actuators for moving components. A kinematic analysis of an assembly can be a great way to discover information about a design's inner workings and find out what forces should be when setting up a finite element analysis.

Pre-analyzing Failures

Risk is always a topic of concern when designing a product. Designers must consider what would be considered a "failure" during intended use of a part or assembly. Is "failure" considered a fracture or buckling of a key component? Perhaps "failure" is simply too large of a deflection value. Simulation products provide methods to determine when and where a component will fail.

The analysis will indicate high-stress or high-deflection regions to point out areas where ribs or supports should be added to provide additional strength. The accompanying documentation of initial analyses also bring some measure of protection against any legal issues that may arise, which may bring into question the validity of a design or safety of a product. Mitigating any significant risk factors in a design can be crucial for a product's success in the marketplace.

The benefits of using simulation products are enormous. When manufacturing or designing any product, the chances are very good that simulation tools can be used to enhance and streamline the design process. ■

Eric Schubert *joined MasterGraphics in 2005, specializing in the manufacturing industry. As an application engineer, Schubert assists manufacturing companies with implementing Autodesk Inventor Simulation and Autodesk Algor solutions, also providing post-implementation support and training. Please send comments about this article to DE-Editors@deskeng.com.*

25 Things Managers Should Know about FEA

> Engineers comment on what their managers should consider when it comes to using finite element analysis.

BY DEREK PASHLEY

Editor's note: *This article has been adapted from an article that originally appeared in benchmark, a NAFEMS publication. For more information, visit nafems.org.*

NAFEMS, an independent member organization dedicated to computer modeling and simulation methods, asked engineers what mangers needed to know about finite element analysis (FEA). Selected responses are below. Contributors are mainly stress engineers or engineers from similar disciplines. If your managers need to be educated about FEA, show them a copy of this as a conversation starter.

NAFEMS

NAFEMS is the International Association for the Engineering Analysis Community. It says it is the only independent, international membership body for companies involved in simulation and analysis at every level. With more than 950 members worldwide, the organization is a powerful voice in the CAE world, drawing support and membership from industrial users, software vendors and academic institutions from around the globe. If you work with simulation, consider being part of NAFEMS.

> Visit nafems.org for more information.

The Design Process

1 Think about where FEA is placed in your design process. Hand calculations and/or FEA before CAD (for 3D definition) is smart. There are uses for CAD programs to produce a preliminary design, too. FEA has ramifications beyond computer-aided engineering (CAE). Input data comes from the real world and components are made there too. FEA and simulation aren't really CAD add-ons or a subset of CAE. It's about understanding everything you've done to date and what you are about to do. People who get this right are those who see FEA as an extension of hand calculation and design by numbers, people who get this wrong think the computer has a hotline to a greater truth beyond our comprehension.

2 Analysis by FEA after CAD, is not design, it's autopsy (or design fault finding). This is an important point: FEA is often used too late to be effective and just flags problems rather than solv-

ing them, but customers—internal or external—sometimes have to have their needs met, even though it may diminish the efficacy of the design process.

3 CAD is for making shapes. CAD is no more "design" than Microsoft Word is "Twelfth Night." In less hype-worthy times, the D in CAD used to mean "drafting." Maybe by CAD we mean "finalized production definitions," and doing the FEA after doing this is almost as daft as doing it after you've made stuff. Apologies for being "off subject" of FEA.

4 If you must go around the "draw it, stress it, change it loop," then at least use CAD, particularly for 3D definition with FEA in mind in order to help mesh generation. Otherwise you put a lot of time in before the "stress it" bit.

5 Dimensional reduction and feature removal of 3D models is hard and expensive, and probably shows your design process is not very sensible. Instant detail not only costs, but it almost always kills analysis projects before they get going.

6 It is false economy not to insist on proper documentation of an analysis. This applies to documenting programs as well.

7 Using different people for meshing and analysis is asking for trouble. When driving anywhere, keep steering and changing gears in the same department and don't get your spouse to change gears and the kids to brake. This sounds stupid, but isn't any more stupid than splitting meshing, solution, and post processing. The reason is that analysis and post-processing often mean feedback to a previous stage to do the job properly.

8 Correlation with physical tests is very useful, if not imperative. Remember that test measurements are approximate too.

9 Sadly, in some people's experience, the higher up an organization you go, the more they get into a "simulation means we don't have to test" mindset. It can mean less testing, however.

10 Analysis is not carried out for the sake of analysis. It can be required to assess and substantiate a design to demonstrate that it meets its functional and safety requirements. Also, an individual analysis can be part of a design optimization task or a robustness assessment.

FEA Outside the Design Process

11 FEA can also be useful in post-mortems/failure investigations. In such cases, data on the root cause may be in short supply, emphasizing caution is needed and collaboration with other parties.

12 What is designed is not what is made, because of material variability, dimensional tolerances, surface finish, etc.

13 The solution is approximate.

14 Ten element models can provide more design information than 2 million tetrahedra. 'The object of computing is insight.' Big tet models may have their place though ... if they cost little to create and analyze, or you can't get the design information any other way.

Software Programs

15 Graphical displays can be deceptive, e.g. magnified displacements can mislead when looking at interferences, gaps, and contacts.

16 Post processing often gives pictures of response smoothed over the mesh; this gives prettier pictures, but unaveraged stresses (or whatever) are more informative.

17 Licences can be expensive ... or too cheap. Meaning cheap and nasty, or cheap and bug-ridden, or cheap and undocumented, or cheap and unsupported, or cheap and people don't take it seriously, leading to the CAD add on "stress checker = spell checker" view.

18 Recognize that FEA can cost. Executing programs sometimes needs machine grunt and space. Making do with a kit that is not up to the job is another WOMBAT (waste of money, brains and time).

People Make the Decisions

19 People need education in the technology and maybe training in the use of individual programs. You have to invest in people and it takes time. Training bolted-on to a sales package is rarely enough.

20 Your competition has access to similar tools. It's how you use them that matters, which really means that the people matter more than the program.

21 If you have a decent education and can use one of the "traditional" codes, you don't really need expensive training in how to read a user's guide for the traditional other programs. This doesn't mean that vendor training is not useful, just be careful where you spend this year's training budget.

22 Managers and analysts should understand the need for verification and validation.

23 Encourage analysts to work closely with those from other disciplines, such as mate-

rials, plant engineering, non-destructive testing, and the customer, even, since this will minimize the risk of missing something important.

24 Your people need to know and work within their limits and get advice if going outside—what Vince Adams calls the "personal problem solving environment"—and learn to widen it.

25 Encourage analysts to go to user group meetings. Personal contact with other users can be useful. Some say that going to user group meetings is essential. See also "personal problem solving environment" above. ■

Derek Pashley *is a member of NAFEMS Education and Training Working Group (ETWG). Now semi-retired, he spent about 30 years doing methods development for Rolls-Royce in Derby, UK. This article was produced with help from Laurence Marks, in particular, and the NAFEMS ETWG, specifically Adib Becker, Trevor Hellen, Nawal Prinja. Andy Morris, and Mark Chillery. For more information, visit nafems.org.*

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Making PCB as Easy as 1-2-3

> > Altium Designer provides guidance for users who are called on to perform printed circuit board design and field programmable gate array tasks.

BY MIKE HUDSPETH

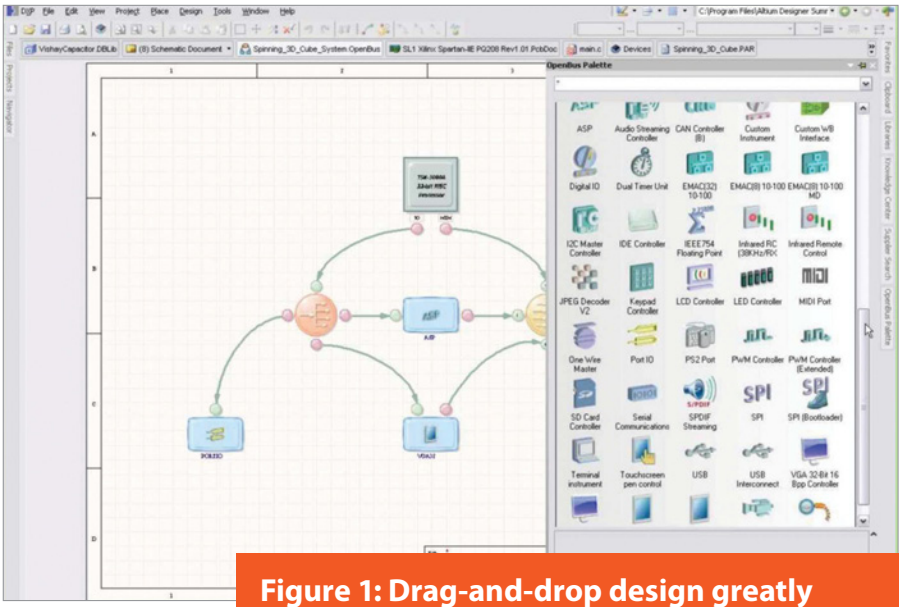


Figure 1: Drag-and-drop design greatly simplifies your designing.

Have you ever been on an airplane and looked out the window to notice how much the cityscape far below looks like a printed circuit board (PCB)? From the sky, most buildings look similar to electrical components—like memory modules and processors. If you're like my wife, you don't spend a lot of time looking out the windows of the plane. She'd rather just ignore what's down there and let someone else worry about it.

There are many people who seem to think the same way about their PCB design. As long as it works, they leave it up to their electronics people. In fact, it may sound strange to read this from an industrial designer because we aren't usually known for our PCB designs. But in a manufacturing environment, everyone has to know a little about everything else just to stay competitive. Believe it or not, I have been called on from time to time to do some PCB design, so I've had to learn. Knowing about PCB design means knowing something about the tools for it. One intriguing tool is Altium Designer from Altium Limited.

As with any industry, companies abound that make software to do just about everything you could want. Altium has been in business for 25 years providing tools for electronics design, and exists for electronic design automation (EDA). The company wants to quell your organizational pain points. The main two points it helps with are collaboration and process bottlenecks. And when you aren't fussing with those, you can apply more of your time and energy to differentiation.

Altium Designer has broad appeal with industry. Huge numbers of companies are running this software. In 1999, the company changed its name from Protel to Altium. It used to make PCAD (which was retired in 2008) and combined it with Protel. The result was Altium Designer. But don't get the idea that the products are merely bolted together. Unlike some of its competitors, Altium reworked its software from the ground up, so the solutions could be completely integrated and use the same database for everything—and they have some very cool capabilities.

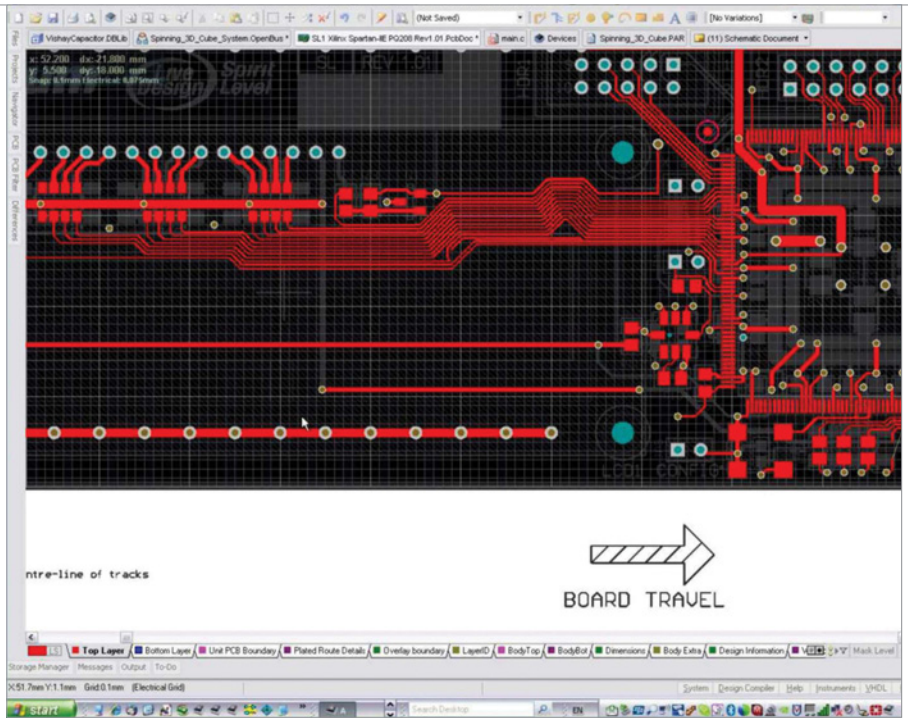


Figure 2: With up to 48 layers, you can design some pretty

What is it?

Altium Designer is a System Design Platform for field programmable gate array (FPGA) and PCB design. Altium says its competitors are more like tool chain vendors: Their products were made by multiple vendors as standalones, and then bought and bolted together later. Altium describes itself instead as a platform vendor (with a platform architecture). It uses a unified data model, so nothing about its software is an afterthought. Altium Designer has a very aggressive, six-month release cycle, so it's never going to be long before something new is on your doorstep.

What Does It Do?

Altium Designer is a data manager. It's like the PDM system for electronics. That means it comes with version control. Yep, that's right: You can manage all the different versions of your designs with this one tool. You can create and vault, check out and change—even generate engineering change order (ECO) documentation. The Release Manager captures all the documents that go with your design (PDF, Gerber, etc.). That way, you can control all aspects of your design. The Output Job file pulls together everything in the whole project—FPGA files, PCB files, MCAD files, PDFs, Excel spreadsheets, Word documents—anything that is associated with it. That way, you can archive it off or transfer it anywhere you need to.

With difference visualization, Altium Designer can compare two files, a little like those "What's The Difference" games you play in the newspaper. It will find everything that is different and highlight it so you can decide what to do. Altium Designer also includes a code editor for programming your soft processor, as well as a full set of FPGA libraries

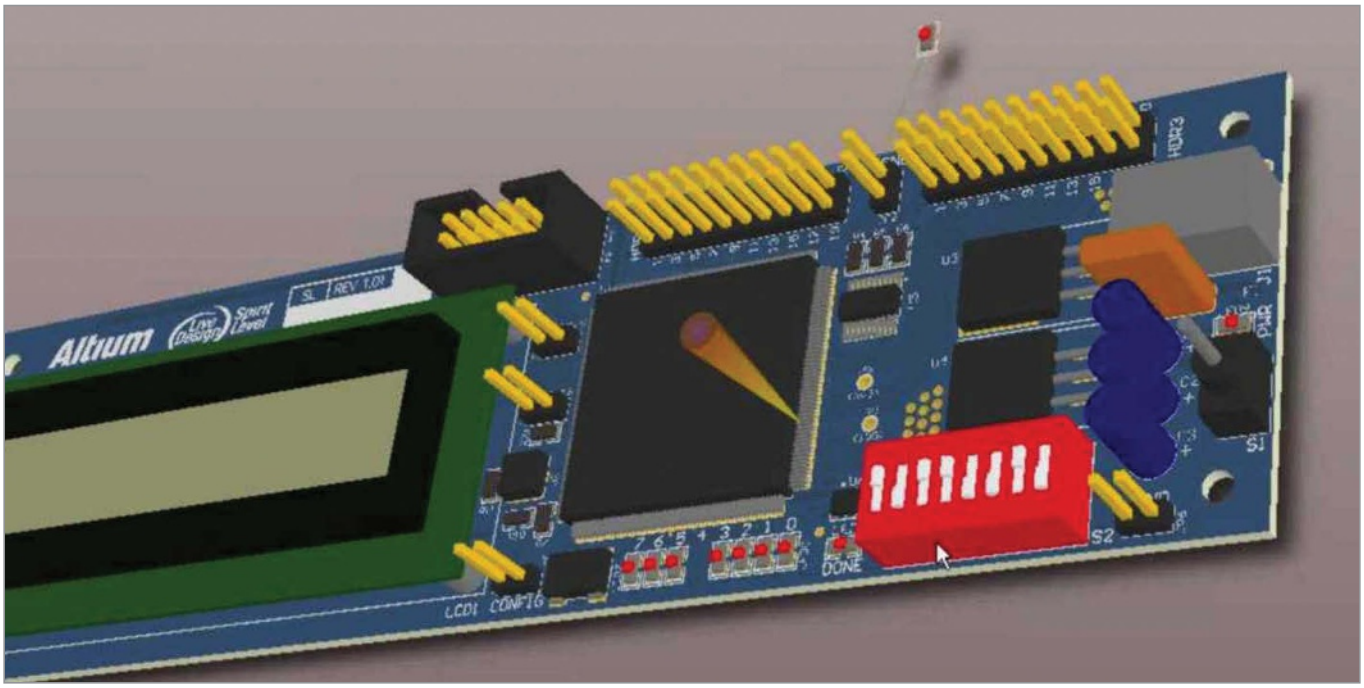


Figure 3: With 3D visualization, you can see exactly how your boards are going to look when they come off the factory floor.

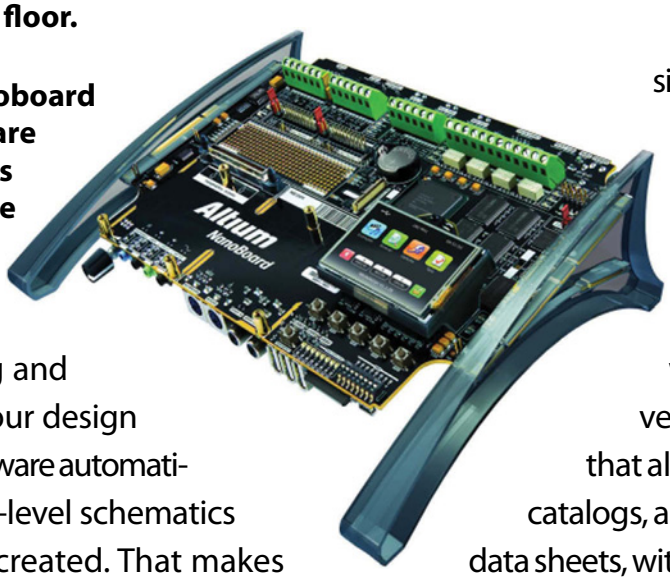


Figure 4: The Altium Nanoboard 3000 prototyping hardware will let you comb the bugs out of your designs before your actual boards are ready.

from which you can drag and drop components into your design (see Figure 1). Then, the software automatically generates the board-level schematics based on the FPGA you created. That makes using it very easy.

Information at your Fingertips

Altium Designer is project-based. You set up a hierarchy of files, and it keeps track of everything. It comes with lots of libraries that make building your designs very easy. Because each library component has properties, Altium Designer will even populate a detailed bill of materials for you. But what if you can't find a component you want? Altium has strategic partnerships with many component vendors (such as DigiKey) that allow you to search online catalogs, and even embedded PDF data sheets, with all the information you could ever need.

Altium is very big on recycling—data, that is. If you're like most, every so often you create something that you are really proud of. Maybe you'd like to use it over and over again. You can create what Altium calls "snippets" to use as the need arises. It's a lot like user-defined features in that you can save out little pieces—even whole

circuits—that you might want to use in other projects. You can use snippets to create your own company library. You can even edit your snippet. And while you're doing all that dragging and dropping, don't worry about spacing. If things get too close, Altium Designer will show you interferences between the components on your board. Complexity is not a problem with Altium Designer. You can create some incredibly complex PCBs (see Figure 2) with up to 48 layers.

3D Visualization

If all we've discussed so far sounds exciting, just wait. Altium Designer offers a 3D PCB design visualization mode. Yep, you can see—and work on—your PCB as it will look when you have actual hardware (see Figure 3). You can see how the physical board will be built: You can zoom it, rotate it—even fly through it (to see how things are connected). Altium Designer even has 3D Connexion controller integration, so you can work on it in as natural a way as you could imagine.

It's not just for a pretty picture, either. You can do things with the models. You can export to MCAD programs like SolidWorks very easily, but that's not where the real function (and fun) is. You can import MCAD models right into Altium Designer. And why would you want to do that, you ask? Remember those interferences Altium will show you? That's right, it works in 3D mode, too. Altium Designer will tell you if parts won't fit. It will perform x, y and z clearance checks. Clearance checking will highlight interferences. You can import an enclosure and check to see that your board will fit inside without poking through. Altium uses industry standard STEP to transfer files to and from MCAD. You can even link out to the model so an engineer can still make changes—and then later, update your models to stay current.

Altium also makes instant FPGA prototyping a breeze with its Nanoboard 3000 ($395, see Figure 4). This handy little piece of hardware lets you prototype all kinds of things with its modular design. You can program and debug your software, then upload it to your real hardware when it's ready.

At about this point, you are probably wondering how much all of this is going to cost you. List price for the Board Implementation Suite is $4,995. The basic front-end license is $995. There is no official Mac version, but many Altium customers can run it with Windows emulation. It will run on a laptop, so you know it's not a resource hog. Free tutorial videos are available on the Altium Wiki. ■

***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's DE's expert in ID, design, rapid prototyping, and surface and solid modeling. Send him an email about this article at DE-Editors@deskeng.com.*

FOR MORE INFO:

> Altium Limited

Portable CMMs Save Time

> Discover how rapid shop floor inspection makes quick work of quality.

BY RON BRANCH

Portable coordinate measurement machines can be temporarily mounted in many areas of the shop, so they can be moved where they're needed.

For the machine shop that supplies the aerospace industry, PCMM (portable coordinate measurement machine) and MBD (model-based definition) are everyday terms that are integral parts of its daily inspection routines. To drive quality and control processes, aerospace original equipment manufacturers (OEMs) have altered the inspection methodology and the tools of their supply chain. Many of these suppliers are small- or mid-sized machine shops that have invested in inspection hardware, software and processes to satisfy quality standards. With the success of these supply chain efforts, PCMMs and the MBD Inspection technology are expected to spread to other industrial segments.

It might seem as if these new inspection tools and processes would place a big burden on the machine shop while benefitting only the manufacturer. It is true that this approach to quality control and inspection does demand more than what the usual assortment of hand tools and gages can deliver. It places more emphasis on CMM-based inspections, which could mean a big investment in quality control. However, the new quality practices actually benefit the machine shop, fabricator or toolmaker—and cost less then they might expect.

By deploying PCMMs to the shop floor, small businesses are realizing great gains without staffing up in the quality control department. These companies are performing thorough and accurate measurements more quickly than previously possible. They have adopted a convenient and efficient measurement process that covers ev-

erything from incoming inspection through final part inspection. They have also gained greater control over their processes.

So, how do these small shops respond to the demands of aerospace manufacturers and realize all of these advantages? They have adopted a rapid shop floor inspection approach: taking 3D measurements on the floor at the source for immediate feedback and reporting against the engineering quality specifications.

This approach is a growing trend outside of the aerospace industry, and a strategy that many non-aerospace machining and fabrication shops are using today.

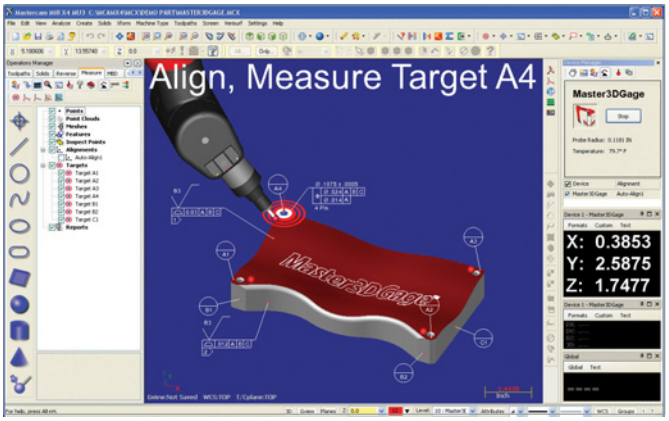
Rapid Shop Floor Inspection Tools

There are three items needed to implement rapid shop floor inspection:

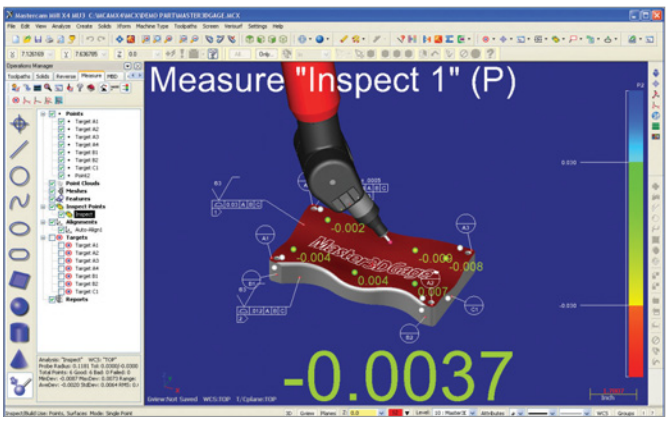
1. hardware,
2. software and
3. engineering data.

To conduct inspections on the shop floor, a PCMM is needed. Although there are several options, a common PCMM choice for a small machine shop is an articulated arm with a positive contact probe.

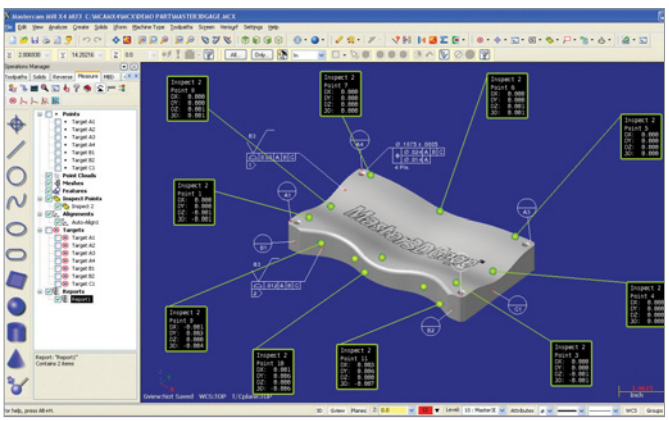
Temporarily mounted on a rigid surface, these lightweight devices are easily transported anywhere in the shop. Arms have joints that let the machinist extend and rotate the measurement probe into every channel, bore or pocket. With a reach of 2 to 12 ft., the arms do not have physical size limits common with stationary CMMs. These features make them versatile inspection tools.



Step 1: The first step of the process is to align the physical part with the digital CAD model.



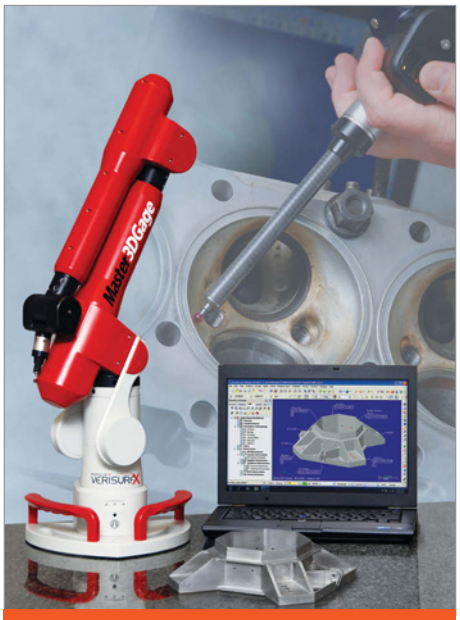
Step 2: Measurements can be taken by touching the probe to the part, or by dragging it.



Step 3: The inspection results can be output in tabular format with reference images.

6 Ways to use Rapid Shop Floor Inspections

1 Inspecting incoming parts. When the truck backs up to the dock, roll the arm over to meet the incoming parts. Instead of sending them to wait in the queue at the CMM, they can be inspected as they arrive. With on-screen feedback, each is passed (or failed) before being carted into the plant. The system will record all results for traceability and trend analysis.



Portable coordinate measurement machines can be used for one-time measurements, or for regular evaluations and testing.

2 Checking parts in/out of the process. Before starting a new manufacturing operation or sending parts on to the next process, use the arm to confirm the quality of the part.

3 Verify tooling. Use the arm to inspect jigs, fixtures and dies when put into service. For long-running tools, use it for routine measurements to check for wear, damage or distortion.

4 Align parts and tools during the build. Use the arm to check the positioning of pieces held by a welding fixture. Adjust the parts as recommended by the inspection software before hitting them with the first tack weld.

5 Monitor process controls. In the day-to-day operations of most machine shops, lot sizes are too small for statistical process control (SPC), production part approval process (PPAPs) and *process* capability indices (CpKs). But this does not mean that machine shops do not have to worry about process control. Over time, process parameters shift and tools wear, so the machine shop needs to routinely check output quality to catch variance before it becomes a problem.

For process control, rapid shop floor inspection can help in two ways. First, it can assist in identifying the process variables that must be controlled to produce good parts. Second, it can be used for spot-checking to confirm that those parameters are stable.

6 Problem detection and diagnosis. Rather than inspecting parts or processes to a predefined plan, the arm can be used to query the part to determine where the problem lies and what its root cause is. The arm offers the flexibility to conduct "what-if" diagnosis to understand the cause and effect.

The second component of a rapid shop floor inspection system is the software that receives all of the information from the arm. In the most basic mode, the software will log and report measurements taken with the arm. However, the big gains in time and efficiency happen when the software's full functionality is leveraged. For example, the software will create prompted inspection plans as datums and features are selected while in teach mode. It will also provide real-time inspection data with visual, on-screen references. To really expedite the inspection process, it can import a CAD reference model for direct comparison of the manufactured part to its design intent.

Because the arm will be used in a variety of applications, the software will allow the user several modes of operation:

>Direct measurements for on-the-fly spot checking as an alternative to a hand tool.

>Measurement to drawings in accordance with datums, dimensions and geometric dimensioning and tolerancing (GD&T) callouts.

> Direct comparison to a CAD model that contains the dimensional requirements.

The final piece of the rapid shop floor inspection solution is the quality specification and inspection plan. As just stated, the inspection work can be performed by referencing a part's engineering drawings. This approach works fine, but the inspection process becomes much quicker when that data is assigned to a digital reference within the PCMM's software. Start by importing the 3D CAD model, and then assign the quality specifications from the drawings to the digital model. This allows the software to prompt where

PCMMs, FYI

Portable coordinate measurement machines (PCMMs) add portability to the capabilities of the traditional, stationery coordinate measurement machine (CMM). Like the stationery devices, PCMMs capture 3D measurements that are used to inspect and qualify parts, products or objects. Using 6 degrees of freedom (DOF) probing technology, the PCMM returns X, Y and Z coordinates of points on the surface of an object from any angle. However, to gain portability, the touch probe is mounted on the end of a lightweight, articulated arm.

Articulated arms have joints that provide six or seven rotary axes vs. the three linear axes of motion commonly used on CMMs. Spanning 4 to 12 ft., these arms allow an operator to position the touch probe in any orientation to capture most, if not all, measurements in a single set-up. Like CMMs, PCMMs can also be outfitted with laser scanners to capture dense point clouds of measurement data.

Articulated arms have 6 DOF and positive contact probing that allows for real-time inspection without triggering points. With an articulated arm, the probe approaches the part at any angle without slowing down as it nears the surface. This eliminates probe angle calibration and custom holding fixtures.

For large items and structures, PCMMs take on other forms. Using lasers and infrared light, long-range PCMMs can capture measurements to distances of several hundred feet. In industrial applications, laser trackers are the most common form of long-range PCMMs.

measurements are to be taken, and immediately report a pass/fail condition.

For the fortunate shops whose clients have adopted MBD, the process becomes even faster. Because the model contains all the quality specifications, it is simply imported—and a few moments later, inspections can be performed. This eliminates all the manual effort to interpret drawings, document measurements and report against the prints.

With these three components—PCMM, software and quality specifications—everything that is needed to determine go/no go is bundled in a rapid shop floor inspection tool that travels to the work piece.

The Process

The PCMM goes to the source of the inspection, which can be on the loading dock, manufacturing floor, machine shop or tool room. All that is needed is a little space and a stable work surface to mount the arm and place the part.

With battery operations and optional wireless communications, truly portable systems do not even require a wall outlet or a cabled connection. After a calibration routine, the system is ready for operation.

In three steps—align, inspect and report—the inspection process is complete.

Step 1, align: Start by placing the part within range of the arm. No fixturing is needed as long as the part does not move while measurements

Defining Model Based Definition

With model-based definition (MBD), a 3D CAD model is the sole reference object for all details and specifications regarding a part, sub-assembly, product or tool. In its purest form, no other documentation is referenced when describing the characteristics and qualities of an object. So, MBD is an approach where the CAD file provides much more than a description of the design intent.

In the realm of inspection-related activities, MBDs supply all of the dimensional and tolerance information. There are no drawings. The CAD model contains all of the specifications, including the geometric dimensioning and tolerancing (GD&T) callouts. The dimensional specifications may be either annotations within the model file or digital specifications linked to a feature. With the latter approach, inspections are completed simply by referencing the CAD model and picking the appropriate points on the object. This eliminates all manual documentation and data entry and expedites the inspection process.

An advanced concept linked to MBD is minimum dimensioning. With this approach, a global profile tolerance is applied to the CAD model and only those features that are critical to function are explicitly defined through GD&T callouts.

are taken. Next, probe the reference surfaces (e.g., datums) that align the physical part to the digital CAD model. Now, the part is ready for inspection.

Step 2, inspect: Take the desired measurements by touching the probe to the part, and click the record button. Just touch and go on to the next measurement. Alternatively, drag the probe along a surface to pick up a continuous stream of measurements. With each measurement that is made, the system gives immediate, on-screen feedback. The dimensions and deviations are annotated in green when within the specified tolerance band, and in red when the dimension fails.

Step 3, report: When the inspection is complete, output the results in an inspection report that presents the information in the traditional tabular format augmented with any desired reference images.

When describing his rapid shop floor inspection process, one tooling inspector stated, "The beauty is that we simply align the model and start checking it. We get immediate reporting and feedback."

This is in stark contrast to the time, effort and talents needed when using traditional measurement tools.

The Advantages

Rapid shop floor inspection provides the capabilities of a stationary, programmable CMM while offering the flexibility of hand tools and hard gauges.

Measurement results are produced quickly with little effort, which is what the small- to mid-sized shop needs. But how quick is it? One aerospace supplier stated that when inspecting with a measurement arm against a CAD reference model, the process took just 10 minutes. Without a PCMM and the CAD reference model, the same part took 12 hours to inspect. That company also offered an example comparing an arm to a CMM. Inspecting to prints, the arm was 75% faster than a manually operated CMM.

The bottom line is that rapid shop floor inspection makes it quick, easy and painless to measure parts and assemblies often and thoroughly. This lessens the likelihood of running "at-risk;" minimizes scrap and production delays; and maximizes product quality. ■

Ron Branch *is a manufacturing engineer for V&M Precision Machining and Grinding. Branch has 20 years experience as a machinist and more than 15 years of CNC programming. Contact him at rbranch@vm-machining.com.*

FOR MORE INFO:

> V&M Precision Maching and Grinding

Streamlining Intelligent Control Valve Design

>Simulink, xPC Target, and MATHLAB used to speed up HUSCO's electrohydraulic valve design process for excavators.

BY PETER VARHOL

HUSCO International was able to capitalize on its INCOVA technology for excavators by getting the design to market quickly.

Fuel prices and growing sensitivity to environmental issues are forcing some off-highway equipment manufacturers to re-evaluate their product's architecture as well as the technology they use. To stay competitive, manufacturers of excavators, earth-moving machines and other heavy-duty industrial equipment are constantly seeking new ways to improve efficiency and reliability, while continuing to meet safety standards and reduce costs.

Electronic control of hydraulic systems has been touted as one way to improve vehicle efficiency and controllability, but there are design tradeoffs to consider.

HUSCO International, which develops and manufactures hydraulic and electrohydraulic valves and controls, recognized this need and developed the Intelligent Control Valve (INCOVA) technology. Instead of controlling flow with traditional spool-and-sleeve valves, INCOVA incorporates independently controlled electrohydraulic poppet valves with an electronic controller and built-in transducers to measure cylinder workport pressures. The INCOVA technology provides electronic load sensing and pressure compensation, quickly opening and closing valves as the load varies to maintain a constant velocity. This increases overall fuel efficiency and productivity, and improves uptime and diagnostics.

HUSCO realized it was only a matter of time before other manufacturers would introduce similar products to stay competitive. To answer that, the company needed a faster, more efficient design process—with shorter design iterations and development time to speed time to market.

> Get the complete application story at deskeng.com/fastapps.

SpaceClaim and Tools4Design 3D Model Golf Ball Tool

>> BallLogic's BL3 ballometeris a handheld device designed to optimize on-course ball fitting.

BY BLAKE COURTER

Ask any avid golfer, and he or she will tell you the most important aspect of the game is the golf ball. It is, in fact, in play on every shot. And golf, by rule—unlike any other sport—allows each player to play a different ball.

There are hundreds of golf balls from which to choose. However, a ball manufacturer recently determined that half of all golfers play the wrong one—a ball that is not best fit for their club head speed.

At a higher defined swing speed, a harder-core ball travels further than a softer one. At a slower speed swing, a lower-compression ball will achieve greater distance. This direct correlation among swing speed, ball compression and distance can also be mapped out for a ball's other major characteristic, its "feel." Thus, determining the right ball for each player starts with understanding compression.

With hundreds of different ball types on the market today, one can see the challenges golfers face in finding the right ball. A best-fit ball could enhance the experience and enjoyment of playing golf by giving golfers the opportunity to lower their scores.

The second ballometer prototype took a cylindrical approach to the tool.

BallLogic LLC, a privately held company headquartered in Portland, OR, identified this market opportunity and developed the idea for a handheld golf ball tool. The company's goal was to accurately and easily measure compression against a uniform scale. Rather than being deflection-based, this new product—coined a "ballometer" by its founder—would be based on a force protocol. The tool's key differentiator is that it eliminates variances of compression-testing a ball. Additionally, knowing that golf balls are sensitive to temperature changes, the BallLogic team wanted a product that would include a built-in thermostat—which can also factor into choosing a best-fit ball.

> Get the complete application story at deskeng.com/fastapps.

Astronics AES test lab builds better equipment with less work

Dewey Colvin is an electrical engineer with over 20 years of experience in avionics. He runs the System Integration Lab at Astronics AES, a Redmond, Washington based subsidiary of Astronics Corporation. Astronics AES is a leader in custom rugged and reliable electrical power systems for commercial and military aircraft, as well as missiles. Mr. Colvin's lab provides an environment that simulates the conditions found on real aircraft, in order to check out and test the company's products. As one might expect, rigorous testing is especially important for aircraft power systems, as electrical power is essential for keeping aircraft flying and keeping passengers and crew safe. Like most testing laboratories, they heavily depend on custom built test equipment, and as a result, designing and building this gear (and the enclosures in which it is housed) forms an important part of their work. The devices they build are almost exclusively low –volume, and often unique one-offs. Before working with Protocase, Mr. Colvin and his staff relied on local sheet metal shops to build their custom enclosures. But these shops were usually less than enthusiastic about such small jobs, and had cumbersome coordination of drawings and information from his electronics-oriented staff. Their lead times varied dramatically, and they also lacked finishing touch capabilities, such as silkscreening and painting.. As a result, Mr. Colvin's staff found themselves doing more work to get less-than optimal results.

For example, staff usually ended up doing things like hand-applying adhesive labels on front panels, giving results which, although functional, were somewhat home-made looking. Recently, Mr. Colvin and his staff began to use Protocase Designer® 3D custom enclosure design software. This free CAD software allows users to quickly and easily design custom enclosures (including cutouts, fasteners, and silkscreens), get instant online price quotations, and then have their design manufactured in 2-3 days. According to Mr. Colvin, "Protocase Designer is a simple tool that is very easy to use. We have plenty of access to full-featured CAD software like Solidworks, but my staff is trained in electronics, and these fully featured mechanical design packages have steep learning curves. Protocase Designer is so easy to use that my staff can be up and designing electronics enclosures right away. Its speed of design, and online price quotations allow us to work through design iterations, and optimize for cost, in a way that we never could before." Mr. Colvin says that working with Protocase has had a positive impact on his lab. "We now have easy access to fully finished enclosures, with quality powdercoat and silkscreen, even at one-off quantities. As a result, our equipment racks look more professional. This has a positive impact during customer visits, both in the way customers view us, and in the confidence that they have in our capabilities. And the best part is, we spend fewer man-hours getting there."

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KNOWLEDGE TO SUCCEED
NOW AND TOMORROW

elements of HPC®

The Dell Precision M6500 mobile workstation is targeted to 3D designers. It supports 16GB of memory, and can come equipped with an NVIDIA Quadro FX 3800M graphics accelerator.

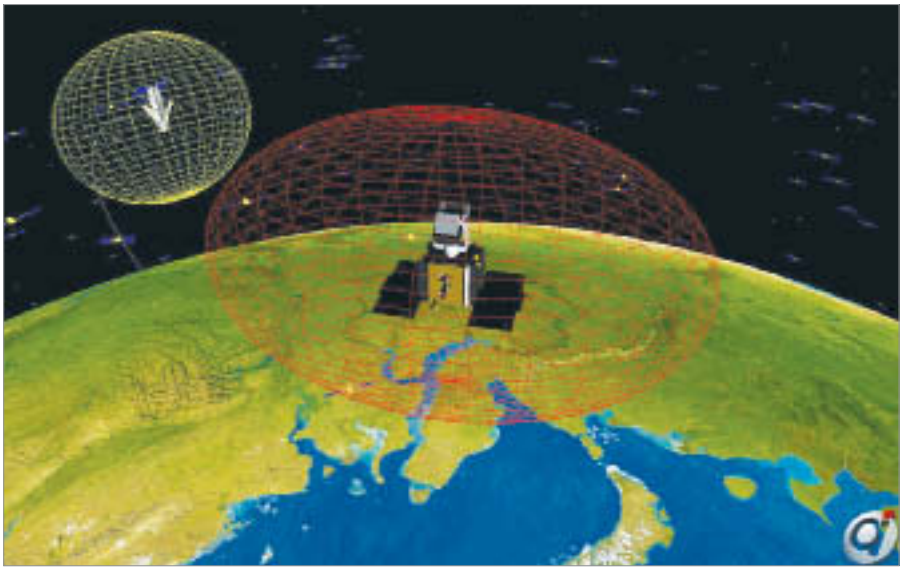
Photo by David Cohn

By David Graff

With HPC, We Have Liftoff

> Aerospace engineering firm, a.i. solutions cuts data analysis time from months to days with Microsoft's high-performance computing server.

Aerospace engineering firm a.i. solutions is responsible for the mission design and orbital dynamics analysis at the heart of successful NASA space missions. Planning a space mission is an intensive task—requiring precise analysis through which optimal launch times and navigation courses are determined. A single inaccuracy could cause catastrophic failure, and potentially result in the loss of millions of dollars.



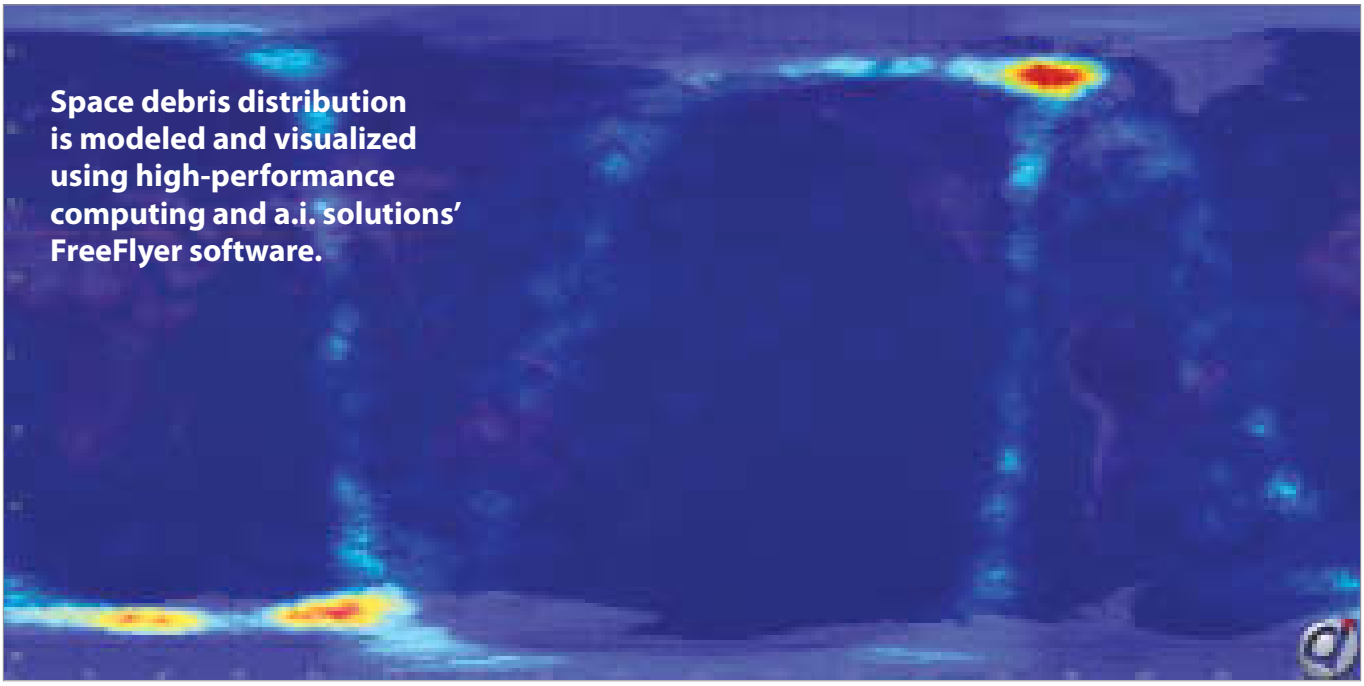
The FreeFlyer software, once used only on single desktops, can now be used in conjunction with HPC Server 2008 to run multiple simulations simultaneously.

Part of a.i solutions' business is based on the analysis capabilities of its FreeFlyer software, which is used in-house to service customer requests, but also sold direct. The FreeFlyer program had been more than adequate for customers' analytic needs for almost a decade, but recently demand increased—both in volume and complexity.

The Analytic Challenge

a.i solutions' customers, specifically NASA, began to present analysis problems on a new scale—to the point at which running the FreeFlyer program on a single desktop, as had traditionally been the approach, was no longer an efficient or viable option.

This challenge became impossible to ignore when NASA issued a request for a.i solutions to



Space debris distribution is modeled and visualized using high-performance computing and a.i. solutions' FreeFlyer software.

analyze several thousand pieces of debris from a Chinese anti-satellite test, and their potential impact on NASA satellites within the same orbit, over a period of 20 years. The existing single computer system would have taken months to deliver the results, and NASA couldn't afford to wait, given that its astronomically expensive satellite equipment hung in the balance.

The HPC Solution

With the need for greater computing power evident, the natural step was for a.i solutions to explore a transition to high-performance computing (HPC), which uses multiple PCs to perform tasks that require intense computing power. The company considered a Linux set-up, but ultimately felt more comfortable with Windows HPC Server 2008.

"Our in-house team and our customers both have a long history with Windows, so we certainly felt the transition would be simplest if we selected the familiar Windows environment, rather than struggling to learn an entirely new set-up," explains David Rand, systems engineer with a.i solutions. "When we reviewed the Linux system, we felt the accompanying documentation wasn't sufficient to ensure success."

It took a.i solutions three hours—using information on the Microsoft website—to get FreeFlyer running on the new solution.

Now, rather than working on an analysis problem on a single desktop, the a.i solutions team develops analysis solutions on their local Windows-based computers, and then uses Remote Desktop Connection to push the solutions to the Windows HPC Server head node for processing.

"Our analysts didn't need any formal training to work with Windows HPC Server," says Rand. "They saw pretty quickly what they could do with it, and have embraced the new capabilities ever since."

Simulation Speed Boost

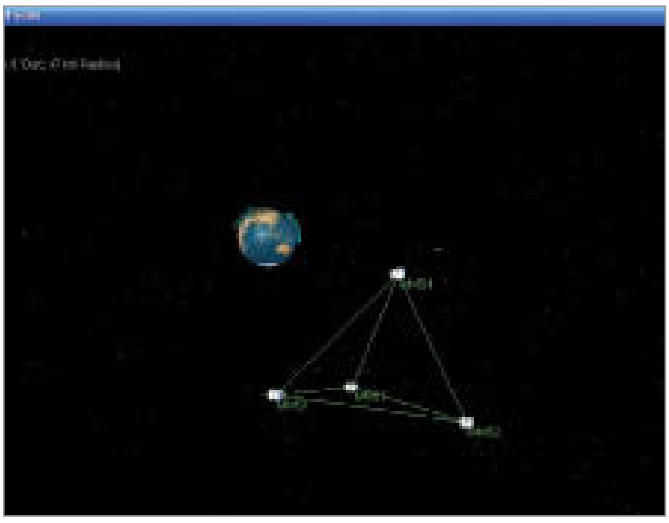
a.i solutions says its engineering simulations run up to eight times faster using the Windows HPC Server 2008. The NASA anti-satellite test analysis, for example, took less than three days to complete—rather than the 30-plus days the previous technical arrangement would have required.

Being able to handle even more complex data has enabled a.i solutions' involvement in some fascinating projects.

For examples, the research project under way at a.i solutions tracking space debris distribution, the path it followed, the predicted trajectory for future movement and, most importantly, where it could potentially interfere with planned missions, requires explanation to budget holders responsible for signing off on new mission expenses and to project managers involved in the success of a mission. With that in mind, a.i solutions is now developing a tool, powered by Windows HPC Server, that visualizes space debris, making its mass and movement clear to non-technically minded people.

In addition, the Windows HPC technology is supporting the analysis central to a space mission planned for 2014. The mission, designed to collate 3D data regarding the magnetosphere, requires four spacecraft to fly in a tetrahedron formation, at close range with no margin for error. It is a complicated mission to route, requiring intense computing power to do so in a useful timeframe.

The mission is in the thrust of its design stage. As small changes are made to the make-up and design of the crafts and the project objectives, a.i solutions must run new analyses.



a.i. solutions' FreeFlyer software models the complex MMS mission: four spacecraft flying in a tetrahedron formation.

"One such change that we've dealt with recently," Rand says, "is that spacecraft location will be determined using GPS, and the route-mapping computations change according to the specific GPS technology built on board each craft. So as the design team finalizes the craft technology, our analysis follows to ensure the route remains accurate.

"Without the computing power made available to a.i solutions through Windows HPC Server 2008, the complex analysis required to support this, and other critical projects, would not be possible," Rand says. ■

David Graff *is director of U.S. Automotive and Industrial Equipment Industry Solutions, Microsoft.*

FOR MORE INFO:

> a.i. solutions

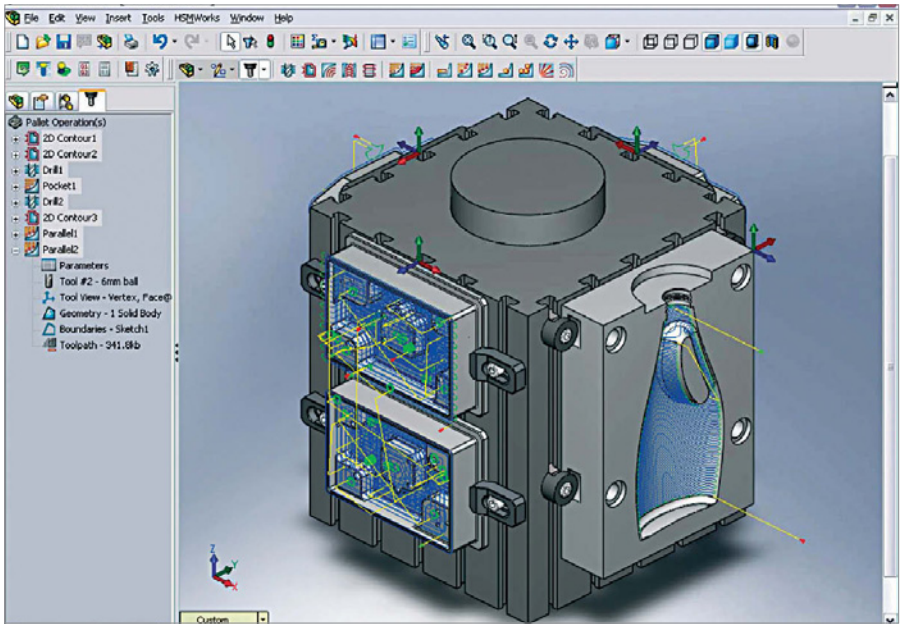
> Microsoft

By Kenneth Wong

Put Your Idle Cores to Work

> Use distributed computing for faster machining.

A few weeks before he flew out to Anaheim, CA, for SolidWorks World 2010, Anthony Graves, marketing director of HSMWorks, was mulling over a crazy idea. He wanted to find out how long it would take to generate tool paths for a part that was the size of the city of Anaheim—roughly 50 sq. mi.



HSMWorks, a SolidWorks CAM package, comes with a distributed computing setup to process tool paths faster.

No manufacturer would ever need to process computer numeric controlled (CNC) tool paths for such a part. No machine would be large enough for the job, for that matter. On a single computer—even the most powerful workstation you could find—the operation would take days, if not weeks. But, Graves wondered, what if you could assemble a computing cluster out of 50 workstations—say, from the University of San Diego?

Generating tool paths for a city-size part is an unlikely scenario to come across in the real world. Nevertheless, in theory, if you have a supercomputer, or a computing cluster with enough memory and cores to load and process the part, you'll get your tool paths sooner or later—preferably sooner. Most computer-aided manufacturing (CAM) packages on the market today aren't hyper-threaded. They aren't designed to take advantage of distributed computing. So even with the most powerful high-end workstation, the mammoth task cannot be completed on a reasonable schedule.

However, HSMWorks, a Gold-certified CAM program for SolidWorks users, can work in a distributed computing environment. That doesn't mean you need a supercomputer to run the software. HSMWorks can identify and call upon the idle computing cores in your networked computers. Essentially, it assembles a virtual supercomputer from these unused cores, giving you enough horsepower and bravado to think you might be able to machine Anaheim.

Building Your Own Cluster

If your workstation is a recent purchase (say, two to three years old), you're probably running a multicore workstation. But the bulk of your daily operations—composing Word documents, replying to emails, and correcting CAD geometry—doesn't demand more horsepower than a single core provides, so the additional cores in your dual- or quad-core machine sit idle, literally awaiting instructions.

This is not confined to you alone; it's the same with pretty much all your colleagues with workstations. So at any given moment, your business may have enough unused computing cores to make up a high-performance computing cluster.

With HSMWorks, you can choose to install a service in each machine within your company's network. Think of it as an agreement to contribute your unused computing power to a pool from which HSMWorks can draw. When the workstation that's running HSMWorks needs more horsepower, it can call upon other service machines to "borrow" their idle cores. Because it uses your existing workstations, it doesn't require additional hardware purchases.

"If the computer is on, the service is on," explains Graves. "[The service computers] broadcast to the HSMWorks-installed machine the available resources [cores unoccupied by any tasks]."

In other words, no complex IT setup is needed to turn your workstations into a distributed computing environment. You can simply launch and work in HSMWorks without any attention to the workload distribution. In the back, HSMWorks' task manager deals with delegating operations to the machines with available services.

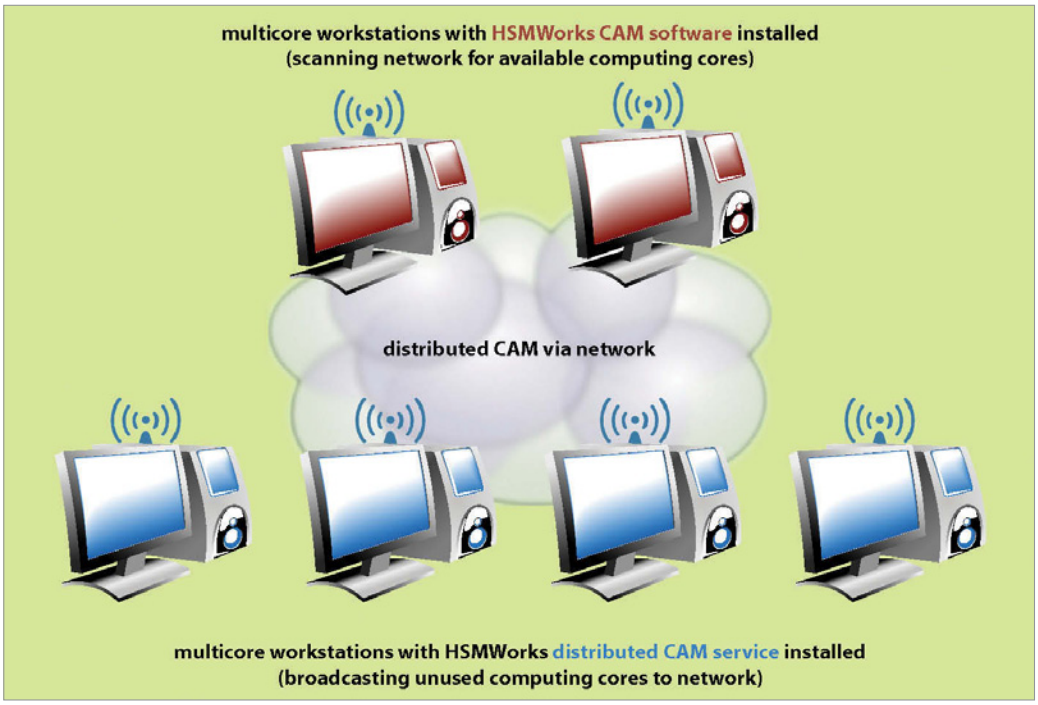
"If you're running HSMWorks, the way that [the operation] looks to you is as if you're using a single computer," says Graves.

What if your workstation happens to be one of the service machines, and you suddenly are in need of its full force for a mechanical simulation or stress test? "In that case, the core on that machine is released," says Graves. "HSMWorks won't call on it again until it's available again."

You don't necessarily need to load the service component on every workstation in your network. If you'd rather reserve certain units for calculation-intense operations unrelated to CAM, you may exclude them from the distributed computing setup by leaving them out of the service installation.

Distributed CAM

Distributed CAM works within a single machine as well as a computing cluster, so even if you don't plan to delegate tool path generation to any other workstations, you should see performance gains in a single workstation with multicores, Graves says.



A schematic of how distributed CAM works with HSMWorks.

"The size of the part dictates the time needed," he explains. "If you increase the surface area that [the software] needs to analyze, say from 2 x 2 x 2 in. to 4 x 4 x 4 in., it quadruples the calculation time.

"Most jobs consist of 20 to 60 operations," he continues, defining an "operation" as a series of tool travels required to generate a mechanical feature, such as a boss or a bridge. Problems often arise, Graves says, when there are design changes. Whereas a CAD modeler can swiftly regenerate the modified 3D model with 15 to 20 changes with a single mouse click, the CNC programmer would need to regenerate the tool paths to accommodate all these changes—a much more time-consuming and complicated process that involves changing surfacing and roughing paths.

In developing and testing HSMWorks' multicore architecture, the company has determined that the processing time is invariably cut in half when the number of CPU cores the software can harness doubles. "We go from two to four CPUs, we cut [the time] in half. We go from four to eight, we cut it in half again," says Graves.

In visualization tasks (rendering and animation, for example), adding a graphics processing unit (GPU)—a dedicated graphics processor—to the machine has been shown to provide dramatic performance gains, but in CAM operations, because of the nature of the calculations that the software must perform, additional CPUs will more likely deliver greater performance boost than GPUs.

HP is Impressed

HSMWorks is certified for HP Z-series workstations (Z400, Z600, Z800), among others. HSMWorks has tested its distributed CAM workflow only on Intel CPUs, but the software should provide similar benefits on workstations equipped with other multicore CPU brands.

"I think HSMWorks' model is the way of the future,"

says Tom Solomon, HP's marketing manager for workstations. "It requires no effort. The simplicity is what shocked me."

In fact, HP was sufficiently impressed that it invited HSMWorks to give a presentation at one of its investor and press gatherings in March.

The latest generation of Intel's multicore CPU, the Intel Core i7 processor, is designed to render across six cores using 12 threads. Aside from video games and animation, it's difficult to imagine many other software applications developed to fully harness its horsepower. Making distributed computing a painless process may be one way to allow ordinary CAD users to tap into the idle cores. ■

Kenneth Wong *writes about technology, its innovative use, and its implications. One of DE's MCAD/PLM experts, he writes DE's Virtual Desktop blog at deskeng.com/virtual_desktop.*

FOR MORE INFO:

> HSMWorks
> Intel
> HP

By David Cohn

Workstation Performance on the Go

> The Dell Precision M6500 mobile workstation packs power in a heavy, but portable package.

Dell is targeting the M6500 mobile workstation squarely at engineers. The 17-in. display has a native resolution of 1920-x-1200 pixels.

It's been nearly two years since we last reviewed a Dell mobile workstation. A lot has changed since then—most notably, a shift to quad-core CPUs with much better power management technologies. So it was with considerable excitement that we received a Dell Precision M6500 for hands-on evaluation.

The M6500 is Dell's top-of-the-line mobile workstation, heralded at its release several months ago as a new class of mobile workstation aimed at users of 3D design, animation and engineering software. The M6500 supports up to 16GB of memory, including DDR3 1600MHz memory, and can come equipped with an NVIDIA Quadro FX 3800M graphics accelerator.

Housed in an attractive brushed aluminum case, the Dell Precision M6500 is similar in size to the M6300 we previously reviewed (see DE, November 2008). In other words, it's big, measuring 15.5 x 11.125 x 1.75 in. and weighing 8.75 lbs., plus nearly two more pounds for its 210-watt power supply and cables, which is also quite large (7.87 x 3.94 x 1 in.).

More Than Skin Deep

Raising the lid reveals a 17-in. display and a 101-key backlit keyboard, which includes a separate numeric keypad and an integrated track stick. An ambient light sensor can adjust both the screen and keyboard backlighting. Additional buttons above the keypad open the Windows calculator app, and control volume or mute the internal speakers. Above these are a power button, Precision on button, and optional fingerprint reader. A multi-touch enabled touchpad with two sets of buttons is located below the keyboard. The touch-

Mobile Workstations

		Dell Precision M6500 mobile workstation (2.00GHz Intel Core i7 X920 CPU, NVIDIA Quadro FX 380M, 4GB RAM)		**HP EliteBook 8530w** mobile workstation (2.53GHz Intel Core 2 Duo T9400 CPU, NVIDIA Quadro FX770M, 4GB RAM)		**Lenovo ThinkPad W700** mobile workstation (2.53GHz Intel Core 2 Quad Core Q9300 CPU, NVIDIA Quadro FX3700M, 4GB RAM)	**Alienware Area-51** m15x mobile workstation (2.8GHz Intel Core 2 Extreme CPU, NVIDIA GeForce 8800M, 4GB RAM)	**Dell Precision M6300** mobile workstation (2.60GHz Intel Core 2 Duo T9500 CPU, NVIDIA Quadro FX 3600M, 2GB RAM)	**HP Compaq 8710w** mobile workstation (2.60GHz Intel Core 2 Duo T9500 CPU, NVIDIA Quadro FX 3600M, 2GB RAM)
Price as tested		$4,430		$2,822		$3,524	$4,549	$3.051	$3,726
Date tested		4/23/10		12/18/08		10/22/08	10/22/08	8/28/08	7/31/08
Operating System		Windows XP	Windows 7	Windows XP	Windows Vista	Windows XP	Windows Vista	Windows XP	Windows XP
SPECviewperf	higher								
3dsmax-04		49.56	**52.35**	33.38	32.21	34.23	**12.12**	33.25	34.22
catia-02		**64.31**	61.72	42.41	39.75	45.01	**13.64**	41.85	42.57
ensight-03		**58.28**	47.75	37.42	34.24	43.31	**15.03**	39.91	40.40
maya-02		**283.64**	212.05	149.21	108.33	165.87	**25.37**	168.00	166.70
proe-04		**70.91**	61.96	42.92	39.33	45.67	**10.28**	40.98	41.04
SW-01		152.41	132.68	67.98	59.75	90.01	**17.19**	81.50	82.03
tcvis-01		**47.71**	39.44	21.42	19.19	28.34	**4.48**	23.93	23.91
ugnx-01		**39.60**	33.64	19.85	18.11	30.91	**4.18**	24.34	24.34
SPECapc SolidWorks	lower								
Score	seconds	**175.72**	n/a	182.63	n/a	187.27	n/a	192.92	**194.23**
Graphics	seconds	**58.99**	n/a	62.16	n/a	60.87	n/a	68.10	**69.82**
CPU	seconds	**37.62**	n/a	39.99	n/a	**44.40**	n/a	43.81	43.21
I/O	seconds	**83.48**	n/a	83.69	n/a	**96.66**	n/a	85.57	86.14
SPECapc SolidWorks	higher								
Score	ratio	**4.75**	n/a	**4.75**	n/a	4.47	n/a	4.29	**4.24**
Graphics	ratio	3.09	n/a	**3.26**	n/a	3.15	n/a	2.86	**2.78**
CPU	ratio	**8.58**	n/a	**8.07**	n/a	**7.27**	n/a	7.37	7.47
I/O	ratio	**3.79**	n/a	**3.78**	n/a	**3.65**	n/a	3.70	3.67
Autodesk Render Test	lower								
Time	seconds	168.33	180.16	318.40	**324.60**	**162.00**	291.60	319.40	317.60

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

The left side of the M6500 features a slot-load optical drive, dual-slot smart card and PC card reader, an 8-in-1 card reader, two USB ports, headphone and microphone jacks, and a FireWire port.

The right side houses a network plug, DisplayPort, VGA port, an ExpressCard slot, and two USB, one of which doubles as an eSATA connector. There's also a switch to disable its wireless radios.

pad supports single- and multi-finger gestures, as well as a jog shuttle mode with pre-configured profiles for three dozen applications. Status lights are located to the upper-left of the keyboard.

Our evaluation unit came equipped with a stunning UXGA RGB LED backlit display with a native resolution of 1920-x-1200 pixels, with 16.7 million colors and a rated luminance of 300 cd/m2, powered by the aforementioned NVIDIA Quadro FX 3800M graphics card with 1GB of GDDR3 graphics memory. Dell also offers the NVIDIA Quadro FX 2800M and ATI FirePro M7740 as lesser-priced GPU options, as well as lower-cost displays that could cut as much as $1,000 from the total price. Our evaluation unit was also equipped with an integrated 2-megapixel camera and LED light and a microphone, all centered above the display.

Dell offers various hard drive choices, and here we actually received the lowest-cost option, a single 250GB, 7200rpm drive manufactured by Hitachi. Drives of up to 500GB are available, and the Precision M6500 can accommodate a second internal drive. Other options include RAID support and solid-state drives of up to 256GB. Our evaluation unit also came with an 8X DVD+/-RW slot load optical drive. A Blu-ray drive is a $435 option.

The system's nine-cell, 93.2 amp hour lithium-ion battery fits into a bay on the bottom of the computer. There, you'll also find a port for a docking station (a $200 option) and a panel to access memory modules, internal cards and hard drives. A button on the battery quickly displays the charge status via five small LEDs. Our evaluation unit lasted two hours and five minutes in our battery rundown test.

Dell offers several different CPUs, ranging from Intel i5 Dual Core processors at 2.4GHz to 2.66GHz and i7 Quad Core processors at 1.66GHz to the Intel i7 920XM Extreme Edition 2.0GHz CPU with 8MB L2 cache provided in our evaluation unit. Opting for the fastest available dual core processor would reduce the cost by $658.

Our evaluation unit also came equipped with 4GB of RAM, installed as four 1GB 1333MHz DIMMs, which filled the four available memory sockets. The system supports up to 16GB using 4GB DIMMs (either 1066MHz or 1333MHz memory). Although

the M6500 supports 1600MHz memory, it can only accommodate 8GB of the faster memory.

Workstation Performance

We tested the Dell system running the 64-bit version of Windows 7 Ultimate as well as a 32-bit Windows XP configuration.

On the SPEC Viewperf tests, the Dell Precision M6500 turned in the fastest results we've ever recorded for a mobile workstation, attesting to the performance of the NVIDIA graphics card. The graphics performance achieved by the M6500 rival those of full-blown desktop workstations.

The SolidWorks results were also impressive, although not quite up to the levels of a desktop workstation. On our AutoCAD rendering test, the Dell Precision M6500 took less than three minutes to render our test image at 1280 x 1024.

Balancing Price and Performance

The Dell Precision M6500 as tested would cost $4,430, based on the latest data from Dell's website. But prices for the M6500 start at $1,799—and a nicely equipped system delivering nearly the same level of performance could be configured for less than $3,000.

Dell backs the Precision M6500 with a three-year limited warranty, with next-business-day on-site service after remote diagnosis. Additional warranty options and services are also available. Operating system options include versions of Windows 7, as well as Vista, XP and Red Hat Enterprise Linux. Like previous Precision mobile workstations, the M6500 is fully certified for most CAD and DCC applications.

Clearly, the M6500 delivers great performance, albeit at a price to match. We'd love it even more if it were a bit lighter and could run longer on battery power, but those are lesser issues when you consider that it delivers near-desktop workstation performance in a truly mobile package. ■

Dell Dell Precision M6300

- **Price:** $4,430 as tested ($1,799 base price)
- **Size:** 15.5 x 11.125 x1.75 in. (WxDxH) notebook
- **Weight:** 8.75 lbs., plus power supply (depending on configuration)
- **CPU:** 2GHz Intel i7 920XM Extreme Edition with 8MB L2 cache
- **Memory:** 4GB (16GB max)
- **Graphics:** NVIDIA Quadro FX 3800M with 1GB memory
- **LCD:** WUXGA 1920 x 1200 RGD LED backlit
- **Hard disk:** 250GB, 7200rpm
- **Optical:** 8X DVD+/-RW slot load
- **Audio:** microphone and headphone jacks
- **Network:** integrated Broadcom NetXtreme 10/100/1000 Ethernet, 102.11 b/g wireless LAN
- **Other:** Four USB (two with 3.0 support, one with eSATA support), one mini IEEE 1394 FireWire, SmartCard slot, ExpressCard slot, 15-pin VGA, DisplayPort, 8-in-1 card reader
- **Keyboard:** integrated 101-key backlit keyboard with numeric keypad
- **Pointing device:** integrated multi-touch enabled touchpad

David Cohn *is a computer consultant and technical writer based in Bellingham, WA. He has been benchmarking PCs since 1984. He's a contributing editor to Desktop Engineering, an applications engineer with The PPI Group, the former editor-in-chief of Engineering Automation Report and CADCAMNet, and the author of more than a dozen books. You can contact him at david@dscohn.com or visit DSCohn.com.*

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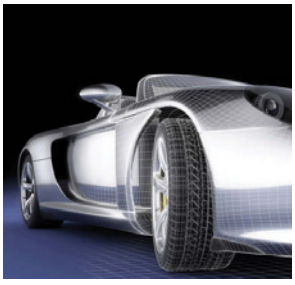

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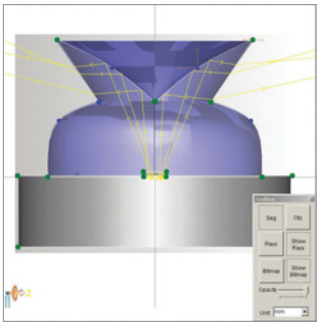

Lambda Research Corporation announces the latest release of its flagship opto-mechanical raytracing software program, TracePro 7.0. TracePro 7.0 features a new interactive optimizer, multi-threaded raytrace and rearrangeable system tree. The interactive optimizer is unique in its capability to sketch in an idea using its built-in digitizer, interactively raytrace it, specify variables, create a target output and optimize the design.

> Lambda Research Corp.

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Omega Releases wi-8 Wireless Meter Scanners and Controllers

>The wi-8 series of wireless monitoring and control systems from **Omega Engineering** is compatible with a range of Omega wireless sensors including the UWTC, UWRTD, and z series.

The compact device can monitor up to eight wireless sensors. Wireless inputs for this product include thermocouple, RTD, temperature, humidity, and barometric pressure.

The wi-8 series comes standard with a choice of either two Form C relays, or two solid state relays that can be used for control functions or alarms. Monitoring can be done locally or through an embedded Ethernet or Internet connection without any additional software other than a web browser.

Prices start at $395.

Dassault SystÈmes Releases Isight 4.5 from SIMULIA

>**Dassault Systèmes** has announced the release of Isight 4.5, the simulation process automation and design optimization solution from its SIMULIA (simulia.com) brand, as well as the SIMULIA Execution Engine (formerly Fiper) 4.5 for executing Isight simulation process flows across computing resources.

Isight provides designers, engineers, and researchers with a system for integrating design and simulation models, created with various CAD, CAE, and other software applications, to automate the execution of hundreds or even thousands of simulations. It allows designers to save time and

dSPACE Releases New MicroAutoBox

>The MicroAutoBox II is the next generation of **dSPACE's** Ωcompact rapid prototyping platform for in-vehicle use. It is used to perform fast function prototyping in fullpass and bypass scenarios.

MicroAutoBox II gives ECU function developers faster real-time computation of their controller models. This boost to processing power comes from a new processor board equipped with an IBM PowerPC processor running at 900 MHz.

In addition, MicroAutoBox II has a new host connection for direct connection to the host PC's Ethernet interface. Another Ethernet interface is for connecting MicroAutoBox II to external devices. This opens up potential uses in new application areas, such as driver assistance systems. To develop these systems, embedded PCs are often used for processing video data or controlling analog or digital displays.

Autodesk Releases New Design Suite Family

> **Autodesk, Inc.** has unveiled a family of software suites for visual, factory and plant design. The new suites are designed to offer increased functionality, interoperability and provide a simpler purchasing and deployment process.

"The design suites make it much easier for Autodesk customers to accelerate their design processes and benefit from the wide range of Autodesk design, visualization and simulation technologies," says Carl Bass, Autodesk president and CEO. "Customers will also benefit from increased interoperability and productivity through access to new features and web services that will only be available as part of the design suite family."

The suites for visual, plant and factory design are the first releases of the new family of design suites aimed to address industry workflows. The first three suites are:

- Autodesk Design Suite for architects and designers working with AutoCAD software.
- Autodesk Factory Design Suite is for machine and equipment builders, system integrators and manufacturers who design, visualize and simulate layouts of machine lines and entire manufacturing facilities. Autodesk Factory Design Suite promises to help manufacturers make better layout decisions by creating a digital prototype of the factory before equipment is installed and commissioned.
- Autodesk Plant Design Suite is for plant designers and engineers who need integrated plant design and whole-project review capabilities for plant design projects.

improve designs by optimizing against performance or cost variables through statistical methods such as Design of Experiments or Design for Six Sigma.

Users of SIMULIA's Abaqus Unified FEA will benefit from a new licensing policy that reduces the cost for using SIMULIA's Abaqus Unified FEA in automated design studies with Isight.

Siemens PLM Software Updates D-Cubed Components

>**Siemens PLM Software** has released the latest version of the D-Cubed 2D Dimensional Constraint Manager (2D DCM), a software component that controls 2D parametric sketches in 2D and 3D design environments.

Some of the new features specific to version 57.0 include a new driving dimension for constraining the distance along an arc between its end points; applications can now create copies of splines, parametric curves, and offset curves with reference to a parent curve and a transformation for each copy; and diagnostics, including whether a sketch has been fully constrained, or remains underdefined.

The company has also announced the latest release of the D-Cubed Profile Geometry Manager (PGM), a software component that adds productivity tools to the 2D environment in 2D or 3D design and manufacturing applications. Siemens PLM Software has also released version

42.0 of the 3D Dimensional Constraint Manager (3D DCM), Collision Detection Manager (CDM), Hidden Line manager (HLM), and Assembly Engineering Manager (AEM).

Contex Americas Unveils XD2490 MFP

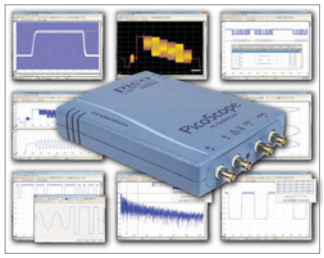
>**Contex's** new XD2490 MFP pairs the XD2490 wide format scanner and Nextimage software with a custom stand. The lightweight XD2490 MFP has a series of multi-use functions to scan, copy, and communicate. This single-footprint, multi-function solution retails for less than $5,200 and can be coupled with most 24-in. printers.

"The XD2490 24-in. scanner creates high-quality scans of drawings, sketches, renderings, and mark-ups," says Phil Magenheim, president and COO for Contex Americas, Inc.

It also provides users with the ability include paper drawings in their projects without having to redraw or extract data. Scanned images can be edited or enhanced from within CAD or GIS.

Saelig Introduces PS4227 Oscilloscope

>**Saelig Company, Inc.** has introduced PS4227, a 2-channel 100MHz USB scope with a real-time sampling rate of 250 MSa/s from Pico Technology. PS4227 has a 12-bit resolution—adjustable



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Technology for Design Engineering

up to 16 bits in enhanced resolution mode for repetitive signals. It can be used for noise, vibration and mechanical analysis.

PS4227 includes an integrated spectrum analyzer, function generator and arbitrary waveform generator. With two 12-bit input channels and a bandwidth of 100 MHz, waveforms can be captured for production testing, scientific analysis, electronic design and debug tasks. A third input is a dedicated external trigger, while a BNC connector is provided for the output of the signal generator. This signal source allows users to create an arbitrary test signal, draw waveforms using the graphical editor, or use one of the six preset waveform types.

High Performance Computing Roundup

EUROCOM LAUNCHES X8100 LEOPARD MOBILE WORKSTATION

> **Eurocom's** X8100 Leopard Mobile Workstation can run two ATI Radeon Mobility HD5870 graphics cards in CrossFireX, an NVIDIA GTX480M graphics card, or other cards. It has four physical SATA-300 hard drives and RAID 0/1/5/10, and the Intel i7 Extreme Processor.

To accommodate the 18.4-in. display, the X8100 measures 17.52x 11.2x2.56 in. and weights under 12 lbs. The display has a resolution of 1920x1080 pixels.

The X8100 has four USB ports, one of which is a combined eSATA/USB interface. In addition it has a DVI-port and two HDMI ports.

SCALABLE HPC SOLUTIONS WITH NVIDIA GPUDIRECT TECHNOLOGY

> **Mellanox Technologies, Ltd.** has announced the availability of NVIDIA GPUDirect technology with Mellanox ConnectX-2 40Gb/s InfiniBand adapters. The company says the adapters boost GPU-based cluster efficiency and increase performance.

Mellanox was a partner in the development of NVIDIA GPUDirect, a technology designed to reduce the involvement of the CPU. It helps reduce latency for GPU-to-InfiniBand communication by up to 30 percent, according to the company.

LENOVO RELEASES SMALL DUAL-CPU WORKSTATION

> **Lenovo** has announced the compact ThinkStation C20 dual-socket workstation, and the ThinkStation C20x, which offers extra memory and more powerful processors.

The ThinkStation C20 and C20x workstations' size allows for more of them to be installed in a rack. They can also run up to eight monitors.

The workstations offer choices of Intel Xeon 5600 Series processors, up to 96GB of DDR3 memory on the C20x with 12 available DIMM slots, up to two NVIDIA FX4800 class graphics, and native SAS support on the C20x.

DIGITAL STORM RELEASES PROTUS WORKSTATIONS

> **Digital Storm** PROTUS workstations are equipped with Intel's new i7 980X processor and NVIDIA's Quadro graphics card. They are designed to use NVIDIA's CUDA technology.

Each PROTUS workstation can be customized by the customer. Digital Storm's technicians and customer support staff are trained to explain how hardware maximizes software performance, according to the company. Digital Storm gives customers the option to have the processor overclocked, while still being backed by the company's four-year warranty.

Optimize Your Design Investments

WES SHIMANEK
Intel

Optimizing engineering assets plays a key role in gaining competitive advantages, growing revenues, increasing profits, and maximizing customer loyalty. It can reduce product development time and cost, improve quality, and move a company from delivering an adequate product to delivering an optimal one.

Let's look at three asset optimization areas.

1. Optimize Your Engineer's Talents

If you give engineers the right tools, you may be able to supercharge their talents to let them quickly play more "what ifs." The power of "what if" enables an engineer to design, test, simulate, and redefine an idea before an investment is made in the first physical prototype. "What if" helps reduce cost, without sacrificing quality or missing time-to-market demands.

> "There has to be a better way to do it—find it." —Thomas A. Edison

If you are not contemplating using tools that give engineers an opportunity to play "what if," you may be underutilizing your most prized asset.

2. Optimize the Engineer's Workstation

Many CAD applications, such as CATIA, Autodesk Inventor, SolidWorks, ProE, and Siemens PLM NX, are single-threaded applications. That means workstations with one or two Intel Xeon 5600 series processors may be underutilized. Why not buy down and reduce your investment?

You could, but doing so would remove any opportunity to incorpo-

rate modern workflows that allow your engineers to play "what if." You will miss the chance to leverage software advancements that are combining design and simulation into software suites. Worse yet, you may be protracting your product development time and cost.

Software and hardware technologies have changed considerably in the last few years. You can now design and simulate right at the workstation. You can create modern workflows that allow engineers to create optimal products in the same time they would have created adequate products.

3. Optimize Your HPC Investment

OK, you say already have a cluster that is used to do simulation. Imagine how much more productive it will be when you remove the small and medium jobs from its queue. Imagine how much faster you will get your large jobs returned when all available cycles can be applied to the enormous jobs.

Today's workstations from vendors such as Boxx, Dell, HP, and Lenovo are amazing. They pack high computing performance with amazing visualization technologies from companies such as ATI and NVIDIA.

Modern workstations give engineers the ability to rapidly test new ideas before submitting larger jobs to the remote center.

What's Next

Ask yourself if the power of "what if" can make a difference. If so:

> Prioritize technology investments to support an evaluation of "what if."

> Get your IT organization to give you an opportunity to test new ideas.

> Evaluate or measure the return of incorporating "what if" software and hardware technology investments.

Ask if your organization can:

> Increase its efficiency and obtain better results with the same resources, or obtain the same results with less by adopting "what if" product development strategies.

> Increase its effectiveness by increasing the quality or quantity of the desired outcome by adopting "what if" strategies.

> Use workstation-based "what if" product development strategies to provide a means to eliminate or reduce an opportunity for an otherwise unfeasible activity, or undesirable event.

If you would like to learn more about "what if" product development strategies or consider a pilot, please ask your workstation vendor to contact me. ■

Wes Shimanek *is Workstation Product Manager, Intel Corporation. Send e-mail about this commentary to DE-Editors@deskeng.com.*

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