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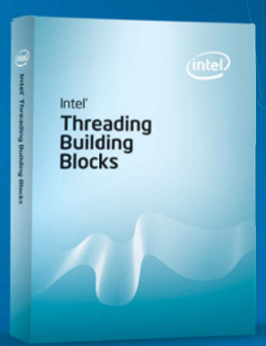

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It's a Mistake to Deny CAD Future Engineers

STEVE ROBBINS
steverobbins@deskeng.com

I received a call the other day from a professor at a well-known Midwestern university. I often get calls or e-mails from engineers who have a problem and are looking for a solution, and some of them are pretty strange. This call was no exception, but somewhat surprising.

The professor, a mechanical engineer, was up against the leadership at his engineering school. The other professors believed that all engineering students should learn drafting using mechanical pen and board before any introduction to CAD. The professor also said that some of the teachers believed that students shouldn't bother learning 3D CAD as it would never be useful to them. On top of that, he said some engineering students, having been taught this, believed it was the truth. The professor was desperate for data that showed hand-drawing mechanical designs was not going to help students and that they should be allowed to start their careers using modern engineering tools.

> Student engineers need to learn on tools that will help them compete.

What's going on? This couldn't be happening, I thought. I mean, just look around us. A recent news article reported that a new school superintendent in Torrington, CT thought that students use of i-Pods and media players in school was distracting, so he proposed a policy that allowed the devices on school grounds, but they "may not be used, heard or displayed during the school day." According to Torrington-based Bill Dunn, a freelance writer, these kids "have never known a time when people did not have personal electronic devices." The students' parents didn't agree with the superintendent and threatened a lawsuit, so now the superintendent is looking for a new job.

Talk about the two extreme ends of the spectrum.

When I attended school there were no computers, i-Pods, cell phones or any of the electronic devices that we have all come to depend on.

The first computer I used was a terminal in my local college that was connected to Dartmouth College's mainframe. Programming had just changed from punch cards to actual programming languages. The hot program was a bio-rhythm generator. For years I struggled with the writing of papers for class. I would research and write and make mistakes and correct and then worry and struggle, and then type on a manual typewriter using correction tape for the mistakes.

In 1983, I went to work for a publishing company that gave me my first personal computer, a Tandy Model 100 laptop, and I quickly had an epiphany. I realized that the reason I struggled all those years with writing was that my brain moved much faster than I could manually write. Thanks to my mother, I had taken typing in high school, so I was quickly typing on my Tandy at about 65 words a minute. I was writing what I was thinking without worrying about mistakes. Just hit the back button and fix the problem. My life was changed dramatically; by a tool.

So, do future engineers need to learn mechanical drafting with paper and pencil? What do you think? I know I would have been better off with better tools at a younger age. Anyone today can get CAD. There are low-cost and free versions out there. They are easy to learn and there is plenty of help, both online and with user groups. The CAD companies are competing with each other to get their software into school systems. And our future engineers need to learn to use the tools that will help them compete in the global workplace they are poised to enter. It's time to move to the new millennium. ■

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

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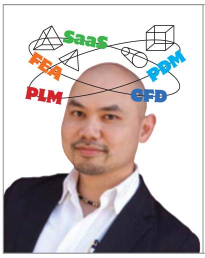
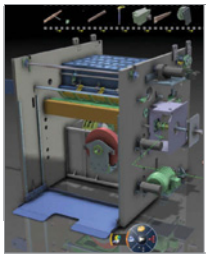
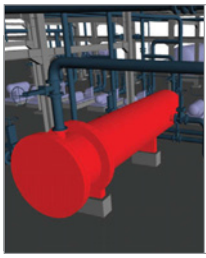
"I think computer viruses should count as life. I think it says something about human nature that the only form of life we have created so far is purely destructive. We've created life in our own image."

> Stephen Hawking

COVER STORY







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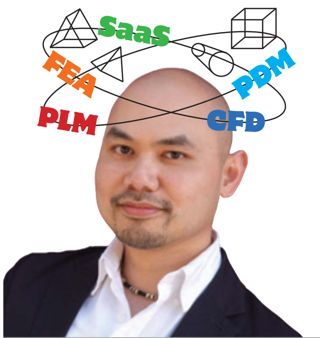
ON THE COVER >

Widescreen is standard as TFT active matrix LCDs are nearly ubiquitous, but the 16:10 aspect ratio might be completely eliminated by a standard 24-in. 16:9 ratio soon. Read Mark Clarkson's article on the latest in monitor technology beginning on page 32.

Heavy Metal, Light Metal: Solid Edge with Synchronous Technology 2

> Solid Edge with ST2 offers sheet metal options, cloud computing's effect on resellers, Alias tackles curves, and Autodesk Vault renews data management.



KENNETH WONG
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Sheet metal work is quite unlike traditional part modeling. Instead of features and blocks, you work mostly with plates, flanges, and tabs. Compared to part modeling, sheet-metal workflow is much more predictable. You spend a lot of time drawing rectangles and turning them into tabs; you repeatedly select edges to add flanges.

In 2008, when Solid Edge with Synchronous Technology (SE with ST) made its debut, it did so with one glaring omission: no dedicated sheet-metal operations. The second release of SE with ST fixed that. But sheet metal modeling in SE with ST2 is not simply a standard set of menu items. I find that SE with ST2 anticipates many of the steps in the standard workflow.

If I sketch a rectangle on the surface of an existing plate, the software deduces (correctly) that I want to turn that into a tab with the same thickness, to be connected to the existing plate. So once I click on the extrusion handle, it automatically converts the sketch into a tab.

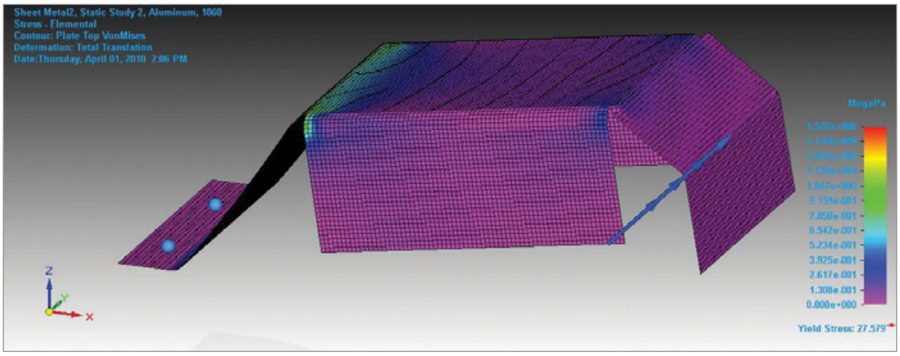
After selecting an edge, I don't need to bother telling SE with ST2 I want to create a flange. I can simply drag the extrusion handle to create the flange. In fact, I don't even need to specify the direction of the flange. The direction to which I drag the handle sets the direction of my flange. Along the way, whenever I pick a menu item, a floating toolbar appears to let me customize the operations (bend radius, offset distance, whether to create the bend from outside surface or inside, and so on).

With history-based modelers, the user has a tendency to create sketches or features in precision from the beginning. For instance, if you're about to create a tab, you begin by drawing a rectangle with the exact width you want, positioned at a precise distance from an outer edge. You could, of course, still do that in SE with ST2, but I find

that I can forgo such rigid ways of working.

Taking advantage of the ease with which I can modify dimensions and parameters (and doing so without worrying about regeneration failure), I might just draw a rough profile for a tab, place it at random on a surface, then adjust its size and position after the fact.

Quite often, sheet metal parts are analyzed not as solids but as a collection of 2D surfaces. With SE with ST2, I can use the mid-plane surface creation command and dialog box to automatically turn a 3D sheet metal piece into 2D planes. Other commands—for creating contour flanges, punching dimples, and closing two bended corners—make sheet metal creation in SE with ST2 much easier. For a video demonstration of the features discussed here, visit: http://deexchange.ning.com/video/solid-edge-with-synchronous.



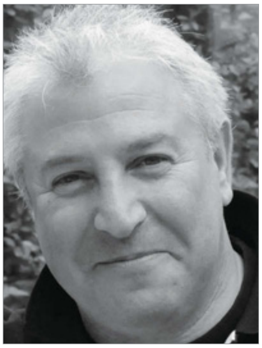
With Solid Edge with Synchronous Technology 2, you can analyze a sheet-metal part as a composite of 2D mid-planes.

Cloud Computing Shadow Over Resellers

Traditionally, professional software publishers like Autodesk, Dassault, PTC, and Siemens distribute their CAD and PLM (product lifecycle management) software suites through resellers. They're not just there to take your purchase orders and process them. They often bundle the transaction with consultation, services, training, technical support, and other complementary offerings. Hence, the term Value-Added Resellers (VARs).

What's to become of these resellers when cloud computing gains mass adoption? Would breaking up current software packages into a bunch of browser-accessible services make resellers unnecessary? What values can they offer if vendors choose to transform complicated modeling packages into simpler modules, delivered over the web? These questions—and many more—force resellers to scan the horizon in search of cloud computing's silver lining.

At the Congress on the Future of Engineering Software (COFES) 2010, Allan Behrens, an analyst from Taxal, led a discussion on this topic. The following is a sampling of the conversation that took place:



Allan Behrens, an analyst from Taxal, led a discussion on the fate of resellers in the dawn of cloud computing.

Martyn Day (DEVELOP3D): This is the worst recession I've ever seen. Yet, only a couple of dealers have gone bust. That's amazing. In the previous [recession], dealers were against the wall. They were lucky if they've got three months' cash. Now, this is the worst time, yet no large dealers have gone bust, because they're guaranteed the subscription revenues; they're selling it forward.…

Unknown: ***The other side of the issue is, can a vendor afford to not have a [reseller] channel? They've all tried direct sales before; they haven't been successful. Is being in the cloud going to change that?***

Behrens: The thing about the cloud is, if you don't have a channel for products that are sub-$5,000, who's gonna sell to the customers? Customers still need to be sold. They don't buy products, unless they're sold to. You still need face-to-face, desk-to-desk sales from people …

Unknown: ***Are you describing a PLM system that's more like Salesforce.com?***

Behrens: Well, I'm trying not to describe anything, because I don't think any of us know actually what the outcome will be. But there are solutions that are out there, being prototyped by SolidWorks … and Autodesk … And there are PLM solutions that are practically made available over the web. I don't think we know yet, but we make the assumption — certainly, I made the assumption — that it will happen, because the cost-benefit [ratio] of going to a thin client or some sort of thin platform at the office is there, so it's going to happen one day. The challenge is, how soon, how will it be delivered, how will it be serviced?

Martyn Day: But that means more componentalization of software …

Ping Fu: I do believe the change is pretty sweeping … we all love Apple apps, not just because they're cheap, but because they're so easy to use. … How many things we offer today in our software could be broken down [into] little apps?

**Arnold van der Weide (Open Design

Alliance): The trick of being a reseller is, you need to add value. In the past, it was delivering a CD. In the future, it might be breaking [the software] up into apps …

Ping Fu: With this new way of [delivering software], we could actually do it smarter. Instead of customizing [the software] for each industry, we could have apps for different industries that run on the same complex, powerful code.

Behrens: Is that going to happen with an established player, or is that coming from a start-up business? Is that a new company coming out of the left field?

Unknown: My prediction is, it's going to be a new player. You've got these ships— the channels, R&D, everything, this is the way they do it. To change direction, it's going to take somebody new with a different idea.…

What do you think will happen to reseller channels when cloud computing goes mainstream? Share your thoughts by leaving a comment for the original blog post: http://www.deskeng.com/virtual_desktop/?p=1594.

Alias for Inventor 2011: Curves Ahead!

Curves, curves, curves—from the mouse in your grip to the furniture you're sitting on, pretty much everything is made up of them. Generally speaking, complex shapes and surfaces made of rolling, sweeping curves aren't the forte of mechanical CAD programs. That's the reason some designers routinely turn to a NURBS-modeler like Rhino to sculpt out the shape they want, then export it back into their favorite CAD programs.

Alias Design 2011 is Autodesk's headlong charge against the Rhino herd. Along with the software comes a plug-in, dubbed Alias Design for Inventor. Upon installing Alias Design, the Alias plug-in gets installed in your copy of Inventor (of course, you must already have Inventor installed in your machine).

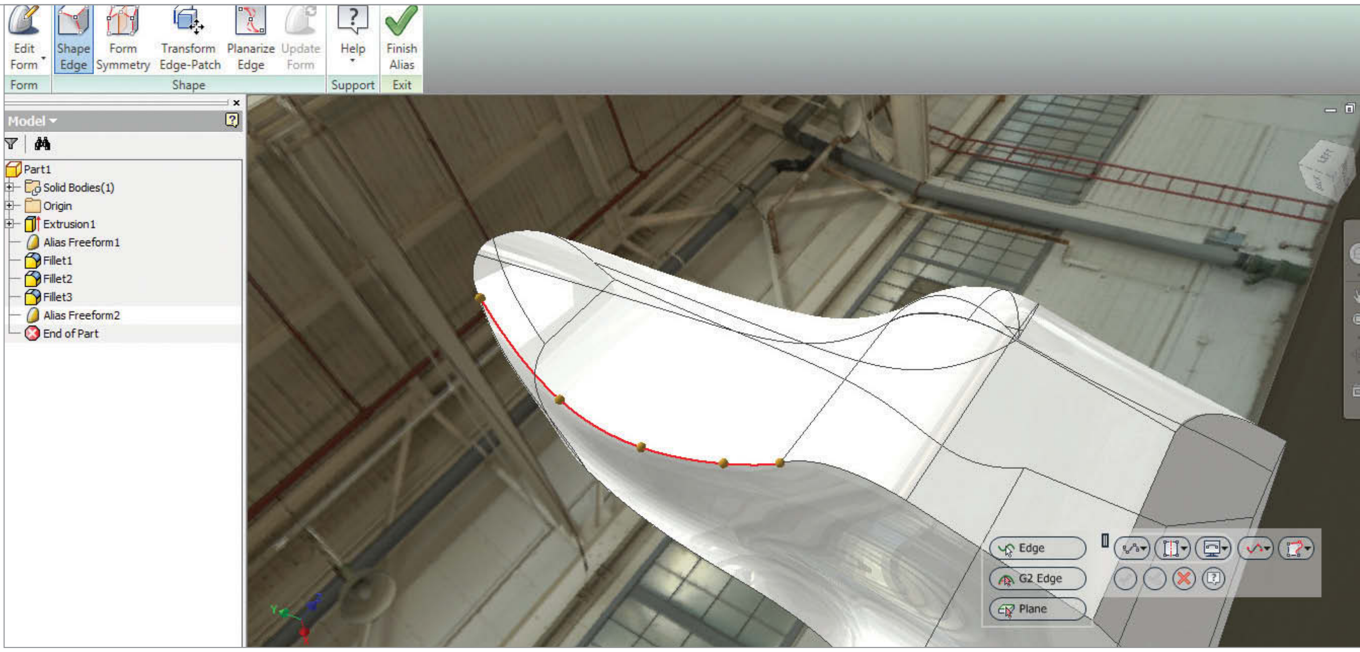
This gives you access to Alias-style NURBS-editing tools, right from within Inventor. You can now select the edges on your model and deform them by pushing and pulling on control points. This method allows you to create the type of free-flowing shapes that don't come easily in mechanical CAD programs.

The Alias tab also gives you the Symmetry command, which functions like a Mirror command that remains active throughout your modeling session. You invoke the command, specify the imaginary center plane, and then you go to work. As you do, the deformations and edits you make on one side are automatically replicated on the opposite side. This makes it easy to create complex features with uniformity on both sides. If satisfied, you can move right back into Inventor modeling mode to continue working with traditional mechanical tools.

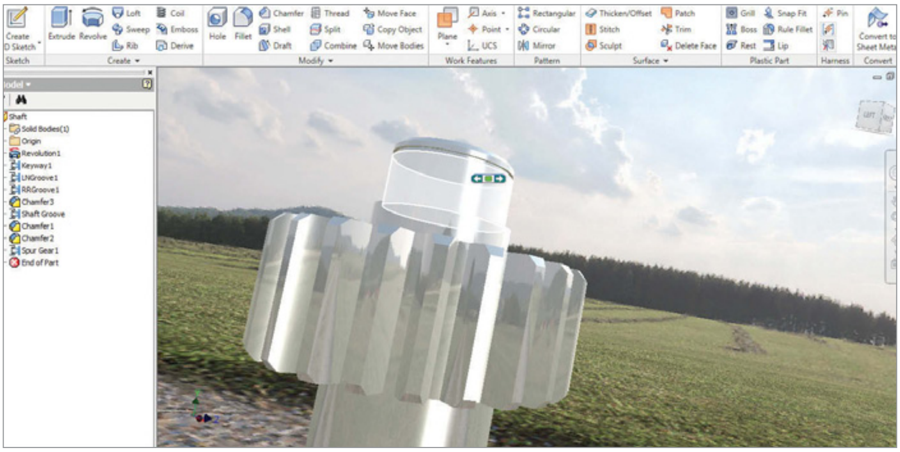
Autodesk Inventor 2011 remains a parametric modeler, but many operations—such as extrusions, rounds, and holes—can easily be adjusted by push-pull methods, as you might in direct modeling programs like SpaceClaim or CoCreate. (Inventor Fusion, currently available as a free technology preview from Autodesk Labs, may offer clues on how Inventor will look in the future.)

The visual display in Inventor 2011 is much more robust than in previous versions. Along with the usual wireframe, rendered, and shaded modes, you can now apply the watercolor mode too. In addition, you can turn on environment maps and reflections. This lets you work in, for example, the 360-degree environment of a used warehouse or a lab (to name but two preloaded environments).

This means interacting with your model in a



▲ **Alias Design for Inventor, a plug-in that comes with Alias Design 2011, lets you apply NURBS editing to your Inventor model.**



▶ **With reflections, ground shadows, and environment maps turned on, you can work in a fully rendered, interactive environment in Inventor 2011.**

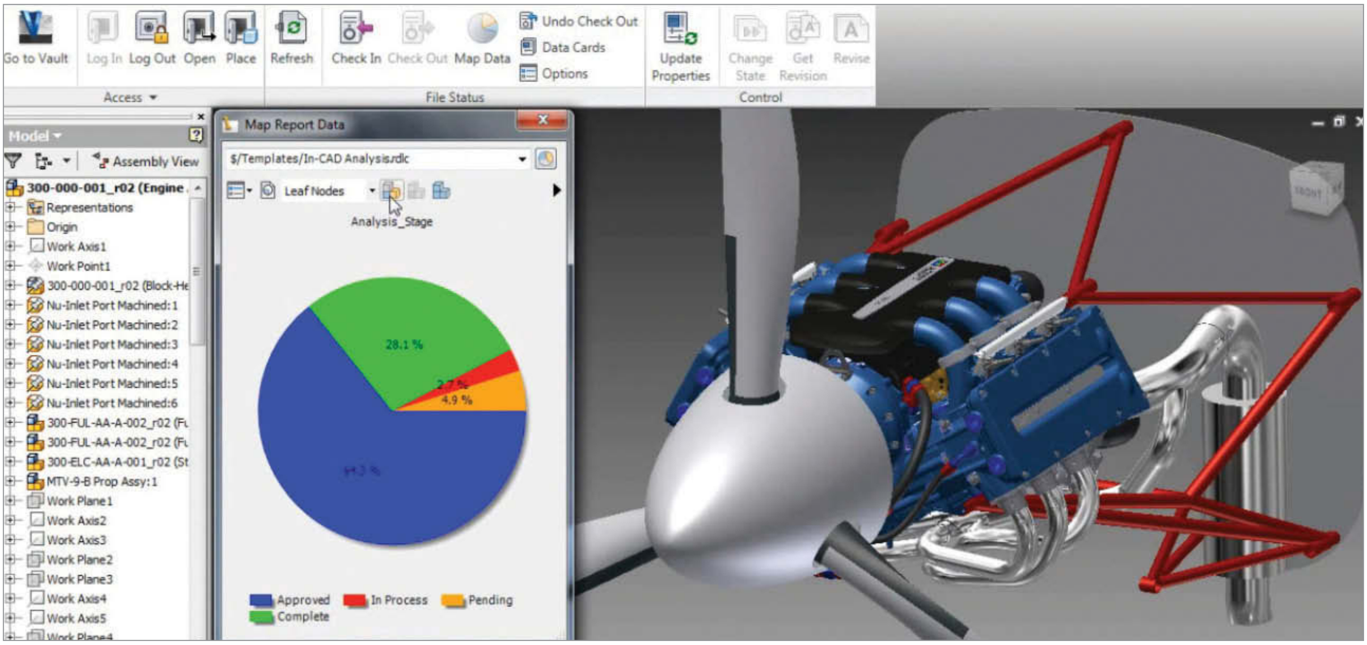
fully rendered environment, with ground plane shadows and all. In fact, if you assign a highly reflective material to your design (such as polished steel), you can zoom in close to see the roof of the warehouse reflected on its faces.

But harnessing all these display settings also means putting a heavy burden on your CPU, so you should strike a balance between what you need to do and your preferred visual setup. If all you're doing is adjusting the radius of a steering wheel, why bother with reflections? On the other hand, if you're designing a chrome part that's meant to sit on the hood of an all-terrain vehicle, maybe you do want to turn on reflections to see whether it'll be a distraction to the driver or an aesthetic compliment to the overall design.

Alias Design gives you surfaces with G2 continuity, constructed to ensure smoothness and curvature consistency. The tools in the Inspect tab in Inventor enable you to check the quality of your geometry by applying zebra stripes and colored contour lines.

Several years ago, anticipating the incorporation of Autodesk media and entertainment division's technologies into manufacturing products, the company's senior VP of manufacturing solutions, Buzz Kross, cheekily remarked on the arrival of "the pony-tailed crowd." With Alias Design for Inventor, you may actually get to design something with swirls and curves that mimic a ponytail.

Listed price for Alias Design 2011 is $4,590 with subscription or $3,995 without subscription. In



addition to Alias Design, Autodesk also offers Alias Surface and Alias Automotive, two higher end versions. For a video demonstration of the features discussed here, go to: http://deexchange.ning.com/video/autodesk-2011-and-alias-design.

Vault 2011: Data Management Has a New Face

Brian Roepke, Autodesk's senior product manager for the Vault product line, believes he can make data management "sexy" (his word, during a briefing with industry reporters and bloggers in April, 2010). In Autodesk Vault 2011, data management gets a new face. It isn't exactly the face of a supermodel, but it's a model—your 3D CAD model. Gone is the usual, uninspiring Excel-like interface so common among data management systems. With Autodesk Vault 2011, Workgroup Edition, your Inventor 3D model is your data management interface.

Suppose you need to get a snapshot of your project, to scan the parts that are released to production, those that are behind deadline, and those

In Autodesk Vault 2011's visual environment, you may isolate certain subassemblies and parts to probe further or perform edits.

that are in revision. You won't need to squint at a series of columns and cells populated with check marks and dates to get the information. Instead, you can launch your 3D assembly and get the status reports, right from within Autodesk Inventor. Your model will become a color-coded assembly, with all the revisions, released parts, and delayed parts highlighted in different shades. You'll still get pie charts, but they now work as legends that tell you what each color represents.

Dassault, makers of SolidWorks and a competitor to Autodesk in mid-range CAD, also advocates the use of a 3D assembly to inspect and view product lifecycle management (PLM) repositories. It calls its solution 3DLive Product Information. Late last year, Siemens PLM Software took a similar approach with NX with HD3D, described as "a simple and intuitive way to collect, collate, and present information" (see "NX7 with HD3D: Where CAD Geometry and Lifecycle Mingle," Virtual Desktop blog, November

4, 2009). However, Roepke pointed out Autodesk Vault's visual data-management environment had been in development for roughly 18 months, so it wasn't a reaction to Siemens' HD3D.

The visual environment is driven by meta data you maintain using Inventor and Vault (part numbers, suppliers, check-in, check-out, and so on). The new approach may yield insights into your project that weren't easy to obtain before. For instance, by displaying parts that are delayed or overdue by geographical distribution, you may be able to detect certain bottlenecks and hiccups in your supply chain or subcontractors who are under-performing.

According to Roepke, Autodesk Vault Workgroup (despite its name) may be used as an enterprise-class PDM platform. Basic Autodesk Vault comes free of charge with purchase of most major Autodesk products (such as Autodesk Inventor), but upgrade to more robust editions requires a fee. ■

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/.*

FOR MORE INFO:

> Autodesk, Inc.

> Siemens PLM Software

> Taxal

NAG Library for SMP and Multicore Released: New algorithms for designers

The new NAG Library for SMP Multicore from Numerical Algorithms Group is designed enable engineers to better use the processing power of multicore computer systems and migrate existing applications to multi processor architectures.

The NAG Library for SMP and Multicore contains more than 1,600 routines, including more than 100 that are new for the latest release, according to NAG.

"Most current processors are multicore, and can provide benefits when programmed with parallel techniques," says David Cassell, NAG product marketing manager. "In fact, if you do not use routines tuned for multicore architectures applications are now likely to execute more slowly. The NAG library for SMP and Multicore also has been designed to make it easy to move those applications that currently call serial routines into the parallel world, by the use of common calls and common documentation. This means users can quickly gain the benefits of parallel performance."

FOR MORE INFO & REGISTRATION:

> Numerical Algorithms Group

New Version of Cray Linux Environment Released

At the recent 2010 High Performance Computing (HPC) User Forum in Dearborn, MI, Cray Inc. announced the release of the latest version of its Cray Linux Environment—the production petascale operating system for the company's line of Cray XT supercomputers. This third generation of the Cray Linux Environment includes the introduction of Cluster Compatibility Mode, allowing Cray XT supercomputers to run applications from independent software vendors (ISVs) without modifications.

Shipping with the Cray XT6 and Cray XT6m systems, with availability planned for the Cray XT5 and Cray XT5m systems later this year, the third generation of the Cray Linux Environment is an adaptive operating system. Cray Linux Environment scales to more than 500,000 cores, according to the company. It includes Cray's NodeKARE diagnostic functionality to help ensure compute jobs are run on healthy nodes.

The introduction of the new Cluster Compatibility Mode provides users with a full-featured cluster environment. Cluster Compatibility Mode is a fully standard x86 Linux environment that allows out-of-the-box installation and running of parallel ISV applications without porting, relinking, or recompilation, according to Cray.

FOR MORE INFO:

> Cray, Inc.

Cost-Savings Strategies for Engineers

A recent Aberdeen study has found that as the economy begins a recovery, returning to profitability is driving companies to look for additional ways to reduce costs. The study further suggests engineering design decisions have a significant impact on the final cost of a product. When armed with the right resources, engineers are empowered to make better decisions that help cut costs from products without sacrificing quality, thus improving profitability.

Aberdeen used the following five key performance criteria to distinguish Best-in-Class companies and found that such companies achieve the following results: a 6% decrease in product cost and 14.8% increase in profit margins for products less than two years old; as 86% of products meet product cost targets and launch on time while 91% meet quality targets at design release.

When compared to competitors, firms enjoying Best-in-Class performance shared several product-design characteristics. These include a tendency to use virtual and digital prototypes to evaluate performance and the likelihood of evaluating different materials to optimize products.

In addition to the specific report recommendations, to achieve Best-in-Class performance, companies must leverage virtual prototypes, provide management with real-time visibility into the status of product performance, and continuously track failures missed in simulations. aberdeen.com/link/sponsor.asp?spid=30410733&cid=6009.

FOR MORE INFO:

> Aberdeen Group

COST SAVING BENEFITS OF SIMULATION

Performance Change over Last 2 Years	Best-in-Class	Industry Average	Laggards
Change in Development Cost	3% Decrease	7% Increase	11% Increase
Change in Warranty Costs	7% Decrease	1% Decrease	6% Increase
Change in Number of Physical Prototypes	3% Decrease	No Change	7% Increase
Change in Number of Change Orders after Design Release	4% Decrease	3% Increase	6% Increase

Source: Aberdeen Group, April 2010

Correction

On March 19, DE's Elements of Analysis & Simulation e-newsletter contained a link to the Blue Ridge Numerics' website and a comparison chart that contained errors on the performance of the CFD software represented in the chart. DE regrets this error. DE has strengthened its review process to prevent such an error from occurring again.

DE welcomes comments and suggestions, or complaints about errors that warrant correction. Messages on editorial coverage can be e-mailed to de-editors@deskeng.com.

Sinomatech Selects VISTAGY's FiberSIM Software

VISTAGY, Inc. has announced that Sinomatech Wind Power Blade Co., LTD has purchased FiberSIM composites engineering software to help streamline its design-to-manufacturing process so it can meet its goal of producing 500 sets of wind blades annually and continue to keep pace with market demand.

The Sinomatech design team was faced with multiple challenges, including increasing the speed of blade design and production and improving the quality and repeatability of manufactured blades.

Designers selected FiberSIM because it enables a number of criteria, including:

- Faster design cycles, enabling more trade off studies for improved blade configuration and reduced weight
- More accurate and detailed composite part and assembly definition
- Support for rapid iterations between design and analysis for earlier and better blade optimization
- Enhanced composites producibility simulation for early detection of manufacturing issues and rapid feedback to design
- Seamless linking from design to production with support for automated cutting, laser positioning, and electronic documentation.

"We're pleased to have the opportunity to work with one of the premier wind turbine blade manufacturers in China to help them meet their goals," says Olivier Guillermin, VISTAGY's director of product and market strategy. "With the extraordinary expansion taking place in wind, suppliers recognize the need to get to market as soon as possible, and Sinomatech's commitment validates the idea that FiberSIM helps composite wind turbine manufacturers do just that."

FOR MORE INFO:

> VISTAGY

3Dconnexion's 3D Mice Support Three New Applications

3Dconnexion's full line of 3D mice now support three new applications: CadFaster|QuickStep, a viewer tool for 3D professionals; Bluebeam PDF Revu, a PDF editor for design pros; and TrueGage TrueMap v5 surface topography and analytic software.

3Dconnexion's 3D mice provide users with a range of design performance and productivity benefits, including: simultaneous panning, zooming, and rotating models or sims without stopping to select commands; customizable programmable buttons that provide quick access to commonly used commands; help detecting design flaws and enhancing design review, verification, and presentation; and reduced mouse clicks by up to 50 percent.

FOR MORE INFO:

> 3Dconnexion

Integrating Windows 7 Workstations into High-Performance Computing

After releasing Windows HPC Server 2008 R2 Beta 1 in November, the Microsoft High Performance Computing Group has been working on improving integration with existing technology. Now Beta 2 is available for download.

According to a blog post by Ryan Waite, product unit manager at Microsoft High Performance Computing Group, Beta 2 includes a number of improvements in scalability, performance, parallelism, integration and interoperability.

Beta 2 now integrates with workstations running Windows 7, allowing organizations to use them as cluster compute nodes, says Waite.

Windows HPC Server 2008 R2 also provides a platform for traditional batch-based and service-oriented interactive HPC applications, Waite says. He says developers can use Visual Studio 2010, which launches next week, to create, debug, and trace HPC applications. Additionally, HPC Services for Excel 2010 can be used to help scale Excel computations to run in parallel on a cluster.

"We have started collaborating with industry-leading HPC management companies like Adaptive Computing, Clustercorp, and Platform Computing to enable hybrid options where Windows HPC Server and Linux work together," says Waite. "Whether it's a dual boot or dynamic cluster, hybrid options help organizations get more out of HPC investments and provide broader access to HPC resources."

Waite says the final HPC Server 2008 R2 will be shipped later this year.

"It's an exciting time for high performance computing at Microsoft as we work to put supercomputing power in the hands of those who need it most," he says.

FOR MORE INFO:

> Microsoft

Autodesk Certifies Parallels Desktop 5 for Mac

Parallels has announced that Autodesk, Inc. has certified Parallels Desktop 5 for Mac for customers who want to run Autodesk's 2011 applications on the Mac and receive product support from Autodesk.

Parallels Desktop 5 gives Mac customers fully supported use of their 2011 versions of Autodesk's AutoCAD, AutoCAD LT, Autodesk Inventor, Autodesk Inventor LT, Autodesk 3ds Max Design software, and the Autodesk Revit software platform for building information modeling (BIM).

For students, Autodesk provides free educational versions of its software, and Parallels offers a special student price for Parallels Desktop 5 for Mac of $39.99 instead of the regular $79.99 price.

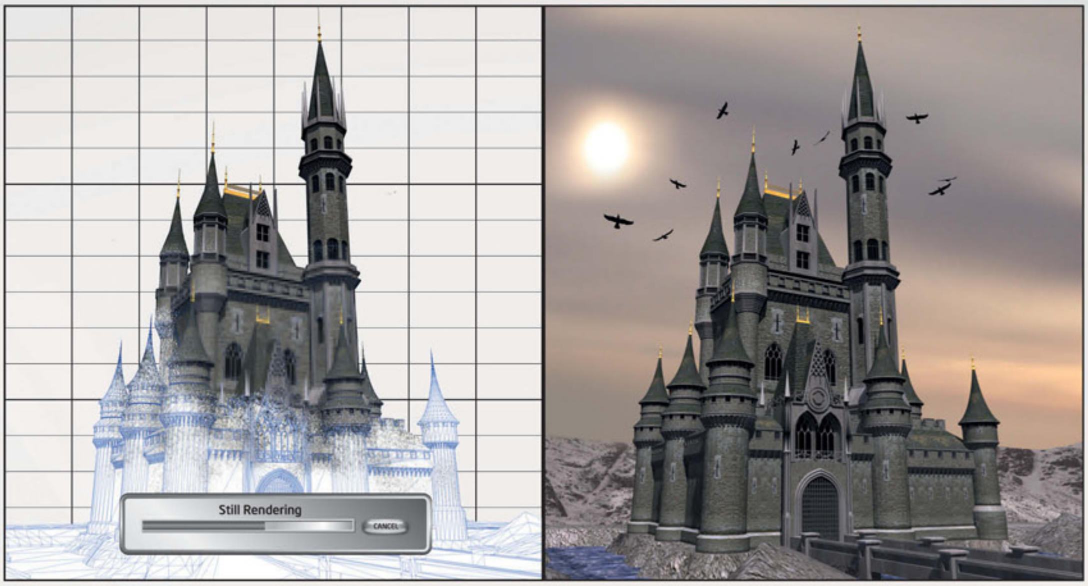
FOR MORE INFO:

> Autodesk, Inc.

> Parallels

BEST PERFORMING PROCESSOR FOR DESKTOPS[1]

PROCESSOR PERFORMANCE



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EDITOR'S PICK OF THE WEEK

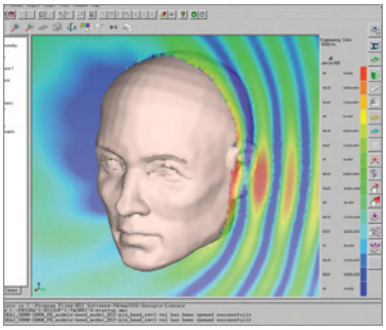
FROM THE DESK OF **ANTHONY J. LOCKWOOD**, EDITOR AT LARGE, *DESKTOP ENGINEERING*

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.

ESI Announces VA One V2009

> Latest release of noise and vibration software includes advanced models of foam and fibers.

The first car I owned was a beat up 1968 Plymouth Fury. It had the 426 "Street Wedge" V8 engine and something like a 121-in. wheelbase. When I was booking it, the PF Flier was so loud and rattly that you would have thunk it was approaching lift-off speed. Unlike my 68 love machine, you can't get away with designing a car with ambient noise levels on par with a fireworks display. That's where a simulation environment such as VA One from the ESI Group proves invaluable.



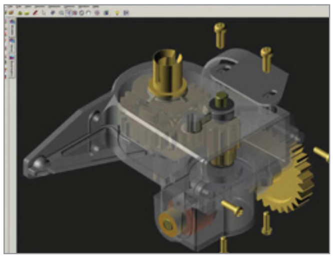
VA One might not be the first product you think of when you hear the name ESI. It's the quieter sibling of the widely deployed PAM analysis products. VA One, recently released in version 2009, focuses on vibro-acoustics. VA One integrates with your existing CAE tools and adds the vibro-acoustics functionality these tools don't have.

READ MY COMPLETE REVIEW:

>ESI

Document Management and Workflow Solution Enhanced

> Adept New version of Adept supports Windows 7 and enhances security.



Synergis Software started out, if memory serves me, as an independent software provider. What happened was that they were responsive to their client's needs and began, organically and almost by accident, building an engineering document management and workflow system that answered their clients' everyday problems. That is an attribute that makes Adept a bit different from the rest of the pack.

The short description of Adept is that it helps you control, manage, find, and share engineering, CAD, and business documents throughout their lifecycle. It integrates with such widely deployed CAD systems as AutoCAD, Autodesk Inventor, SolidWorks, and MicroStation. It has automated functionality to handle workflows and bills of materials.

Synergis Software just rolled out version 8.2 of Adept and, as you'd expect, it has a number of enhancements that clients have asked for.

READ MY COMPLETE REVIEW:

>Synergis Software

Cray CX1000 Supercomputer Supports New 7500 Processor

> Rack-mounted HPCs available in three compute configurations.

Many moons ago, all you had to say was "Cray" and, like saying Xerox for photocopy, you had defined mainframe computing, which roughly meant what we call a data center these days. Today, when you say "Cray," you're still talking about supercomputers. Only now, you could mean a personal supercomputer residing at your deskside and powering a workgroup or a supercomputer that is the nerve center for a engineering company. Cray's new Cray CX1000 series adds two new definitions supercomputing: hybrid supercomputing architecture and next generation.

The rack-mounted Cray CX1000 line of high-performance computing (HPC) systems start with what Cray calls a hybrid supercomputing architecture. That kind of means it has "multi-purpose" architecture. But forget what you know about multi-purpose being a code word for general purpose. What they're talking about is an architecture that lets you move-in components so that you have a supercomputer for your unique compute-intensive workflows. So, there's a core version that's tailored for cluster environments and another for graphics-intensive work.

READ MY COMPLETE REVIEW:

>Cray CX1000

Entry-Level Workstation for CAD Professionals

> Lenovo's ThinkStation E20 powerful enough for demanding applications.

My parents, born before World War I, spent their lives squeezing the full worth out of every penny spent because they were prepared for the next Great Depression. So we kids had fried SPAM and pepper sandwiches on white bread for dinner (called it Italian), and I, the youngest of five, had bags of out-of-date clothing to wear.

My parents, however, were not cheap. They were just highly attuned to their budget. A lot of engineers have made the decision that if it ain't broke, don't fix it and thus slave away on an old workstation because a new one is too expensive. This, of course, skips by the unpleasantness of wasting time and earning potential waiting for out-of-date technology to do modern work. Today's Pick of the Week on the recently announced Lenovo ThinkStation E20 workstation disposes of the too-expensive excuse.

The ThinkStation E20 is a real engineering enchilada: An entry-class workstation for budget-conscious and budget-constrained design engineers. Starting at less than $600, you can own a workstation that's certified to handle software from Autodesk, Dassault, and Siemens.

READ MY COMPLETE REVIEW:

>Lenovo ThinkStation E20

FASTApps

> FOR COMPLETE APPLICATION STORIES CLICK HERE

CFdesign Aids Development of Next-Gen Flow Sensors

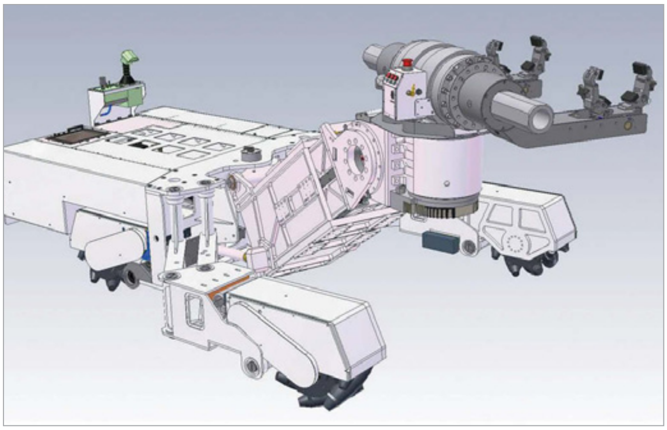
> Fluidnet, an innovator in the area IV systems, set out to revolutionize the market with a light, small, full-featured infusion pump. IV therapy must deliver fluids at rates from 0.1 mlph to 6,000 mlph, an large dynamic range for a mechanical system. Fluidnet needed to find a means of adjusting fluidic resistance within the pump's flow path by four orders of magnitude.

After extensive searching, the company could not find stock resistive valves that provided proportional control over the entire range. Then Fluidnet came up with a concept for a custom flow resistor and sensor that would provide proportional control over the full range of flow rates.

Fluidnet chose Blue Ridge Numerics' CFdesign software, so its engineers could perform CFD analysis early in the design cycle. The software enabled them to quickly iterate designs to obtain the desired performance. Compared to actual prototypes afterward, predicted results were almost an exact match.

> More info

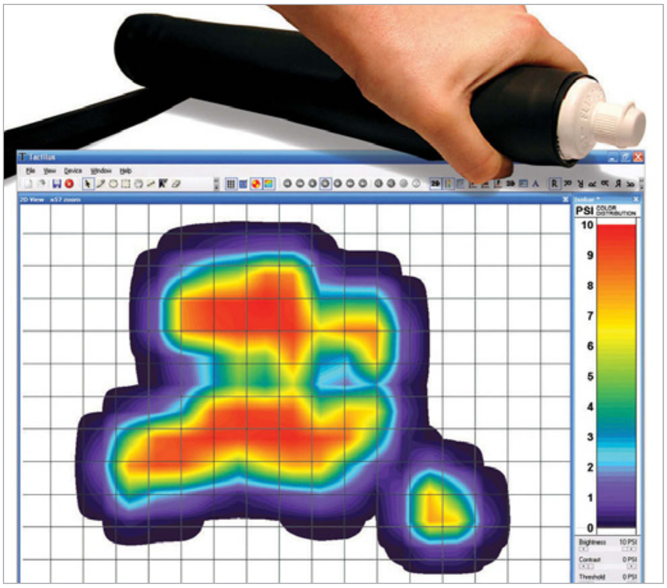
Synergis Software's Engineering Document Management System Helps Foster-Miller Gain Greater Control over Complex Projects and Achieve Industry Certifications



> In the midst of managing a large project for the military and trying to qualify for multiple industry certifications, engineering firm Foster-Miller turned to Synergis Software for help. The company now uses Synergis Software's Adept engineering document management system to manage its documents, review and release processes, design histories, standards compliance, and centralized SOP repository.

Adept has optimized the company's processes and workflow, and fewer people have to manage paper documents. As a result, more resources can be focused on creating world-class design solutions for its customers. With Adept, Foster-Miller has achieved greater control over its data, enhanced its collaboration, eliminated costly human errors, and reduced its costs.

> More info



Tactilus Sensor System Enables Body Mapping for Ergonomic/ Efficient Products

> Pressure body mapping is helping engineers develop products that are not only more ergonomic but also less expensive to produce. In these applications, sensors measure the force exerted by the human body as it touches another surface. The data is converted into color-coded body maps that correspond to different degrees of pressure. Armed with this knowledge, designers modify products for even distributions of pressure on the human body.

Sensor Products' Tactilus body-mapping system is essentially an "electronic skin." The system consists of a sensing element, signal conditioning electronics, and analysis software.

A major consumer toothpaste manufacturer enlisted Sensor Products to help develop tubes that dispensed toothpaste within certain force parameters, with less costly material construction. The manufacturer assembled a focus group to test different types of prototype packaging with Tactilus. The project established a baseline that packaging engineers could use in the future.

> More info

Geomagic Studio Puts R-Design on the Fast Track to Improved Part Design

> In a recent project, R-Design was called on to redesign the suspension arm for its Nimrod-Racing subsidiary's Traxxas Slayer, a radio-controlled, one-eighth-scale car model. The design team sidestepped initial modeling in CAD and instead scanned the model car's suspension arm with a GOM ATOS white-light scanner. Scan data was then brought into Geomagic Studio to extract design intent.

To further hasten the redesign process, the engineers used Geomagic's Parametric Exchange to directly transfer geometry from Geomagic Studio to SolidWorks. The beauty of using Parametric Exchange is that it speeds the design process by eliminating the need for intermediate neutral CAD transfer files, such as IGES or STEP. After further refining the parametric model in Solidworks, R-Design optimized the geometry and completed the redesign of the suspension arm, using the CAD software's built-in finite element analysis functions.

> More info

Functional Prototyping of Embedded Devices

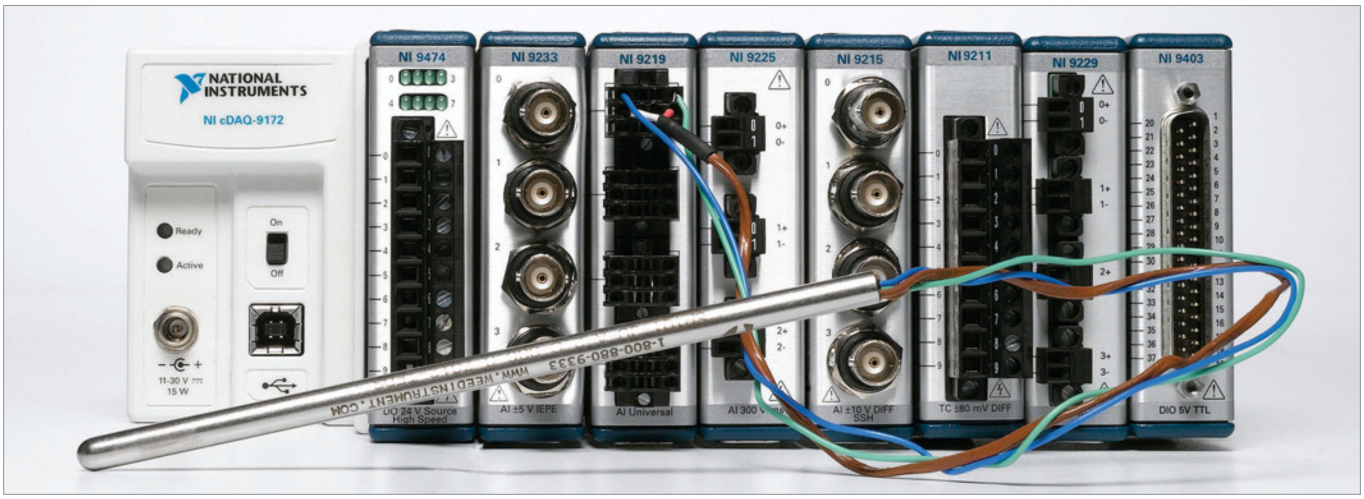
> Virtual simulations are certainly valuable, but you are basically operating on the conceptual level. Ultimately, you have to test designs in the real world.

BY TOM KEVAN

Anxious to be the first to market with innovative products, many device and machine makers cut corners and minimize prototyping before going to production. All too often, this results in less than desirable functionality or robustness, and high development costs.

The challenges are compounded when working on embedded systems that incorporate sophisticated sensing and control components. While these components can increase product performance, they can also increase the risk of poor product reliability. Without some form of system characterization and design validation, the chance of creating an inferior product increases significantly. "On the electrical side, you would be amazed at how many people go right into schematic capture tools and start laying out boards," says Matt Spexarth, embedded product manager at National Instruments.

A better approach leverages functional prototyping, which simulates the final design's materials and functionality to the greatest extent practical. Functional prototyping of embedded devices enables the selection of correct components.



The CompactDAQ I/O platform enables PC-based prototypes that need to connect to to real-world sensors. The hot-swappable C Series I/O modules feature integrated signal conditioning.

SENSOR OFFERINGS

NI CompactRIO Control and Acquisition System

National Instruments' CompactRIO programmable automation controller enables engineers and embedded developers to use COTS hardware to build custom embedded systems. The controller gives engineers the ability to design, program, and customize the embedded system with graphical programming tools.

CompactRIO combines an embedded real-time processor, an FPGA, and hot-swappable I/O modules. Each I/O module is connected directly to the FPGA, providing low-level customization of timing and I/O signal processing. The FPGA is connected to the embedded real-time processor via a high-speed PCI bus. CompactRIO is powered by LabVIEW, which has data transfer mechanisms to pass data from the I/O modules to the FPGA, and also from the FPGA to the embedded processor for real-time analysis, post-processing, data logging, and communication with a networked host computer.

Features:

- –40°F to 158°F operating temperature
- Up to 2,300 Vrms isolation (withstand)
- 50 g shock rating
- International safety, EMC, and environmental certifications
- Class I, Division 2, rating for hazardous locations
- Dual 9–35 VDC supply inputs, low power consumption (7–10 W typical)

– More Sensor Offerings on page 31

Sensing, Control, and I/O

Including sensing and control elements also means adding input and output to your prototype, which can be a challenge. It is, however, necessary to ensure that the final design will deliver a reliable solution.

By adding sensor inputs and control outputs, engineers can prove that the design works. Data derived from functional prototyping also helps you refine functional requirements and validate performance.

Choosing between analog and digital sensors is a series of tradeoffs. Each comes with its own advantages and disadvantages. This is where functional prototyping helps you make intelligent choices and simplifies iterative evaluations.

Analog sensor signals must be conditioned and digitized, so they require more components (e.g., converter, signal conditioning, and connectors) to complete the data acquisition process. This type of sensor usually has greater resolution and is less expensive than digital sensors.

Signal processing components are tailored for specific sensors, so as you evaluate different sensors during prototyping, you must adjust and reconfigure the processing components in the data acquisition chain.

On the other hand, because digital sensors incorporate signal conditioning and digitization at the chip level, fewer components must be added for data acquisition. This simplifies both the prototyping and the final system. Digital sensors also offer cost and development advantages.

"Embedded digital sensor technology has lowered the cost and simplified the inclusion of measurement into an embedded system," says Spexarth. "The proliferation of these new sensors is evident in everything from automobiles to handheld devices."

The downside of using digital sensors is that they introduce additional complexity. Specifically, they require unique driver interfaces to enable communications.

The Final Analysis

Functional prototyping is essential to characterize and validate sensors and prove an embedded device will perform reliably, meet design requirements, and have market value. Therefore, it's important to select a prototyping platform than can connect to a wide variety of sensors, ranging from traditional analog sensors to more complex MEMs digital sensors.

"The fastest thing you can do to prove your concept is to build a functional prototype," says Spexarth. "You can prove the concept of a device when speaking with investors or venture capitalists to demonstrate that your device has technical or market merit."

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

FOR MORE INFO:

> Analog Devices

> The MathWorks

> National Instruments

SENSOR OFFERINGS

MathWorks Simulink 7.5

Simulink is an environment for multidomain simulation and model-based design for dynamic and embedded systems. It provides an interactive graphical environment and a customizable set of block libraries that let you design, simulate, implement, and test a variety of time-varying systems, including communications, controls, signal processing, video processing, and image processing.

Add-on products extend Simulink software to multiple modeling domains, as well as provide tools for design, implementation, and verification and validation tasks.

Simulink is integrated with MATLAB, providing access to tools that let you develop algorithms, analyze and visualize simulations, create batch processing scripts, customize the modeling environment, and define signal, parameter, and test data.

Features:

> Ability to manage complex designs by segmenting models into hierarchies of design components

> Model Explorer to navigate, create, configure, and search all signals, parameters, properties, and generated code associated with your model

> Graphical debugger and profiler to examine simulation results and then diagnose performance and unexpected behavior in your design

Analog Devices ADIS16223 iSensor Accelerometer

The ADIS16223 iSensor accelerometer is a tri-axis, embedded digital vibration sensor system that combines iMEMS technology with signal processing, data capture, and a serial peripheral interface (SPI). The sensor's SPI and data buffer structure provide access to wide-bandwidth sensor data. The 22kHz sensor resonance and 72.9Ksps sample rate are ideal for machine-health applications and allow a system operator to identify failing equipment long before costly damage is sustained.

The ADIS16223 is available in a +/- 70g dynamic range, across three axes. The 22kHz sensor resonance and 72.9 Ksps sample rate provide a flat frequency response from DC to 10kHz, which is desirable for most machine-health applications. With the SPI interface, configuration options include condition monitoring/alarm settings, capture buffers configuration control, and embedded self-test control. The data capture function has three different trigger modes, allowing in-system adaptation of the sensor to the end-systems product lifecycle.

Features:

> RMS noise, and elimination of false alarms.

> Configurable embedded data capture saves system power, while allowing device tuning to multiple applications, as well as in-system adapting to end-equipment lifecycle changes.

State of the Art: LCD Desktop Monitors

> > Widescreen is standard as TFT active matrix LCDs are nearly ubiquitous, but the 16:10 aspect ratio might be completely eliminated by a standard 24-in. 16:9 ratio soon.

BY MARK CLARKSON

Six months, or even a year ago, nearly every computer monitor sold used a TFT active matrix LCD. It's the same now. It'll be the same in six months.

But underneath, things are evolving at a furious pace.

The Dell UltraSharp U2711 is a 27 in. screen with a 16:9 aspect ratio with in-plane switching.

No Longer Hip to be Square

One change is apparent on the outside: 'square' 4:3 monitors have all but disappeared from the marketplace, replaced by 16:10 widescreen monitors.

The 16:9 aspect ratio—a better fit for movies—is becoming more common and may, ultimately, replace its slightly taller brethren. You and I might prefer the bit of extra real estate 16:10 affords, but that's ultimately secondary to screen size and resolution.

LCD monitors have also, on average, grown. The mainstream commercial form factor is now 24 in.; five years ago it was 19 in.

Monitor resolution, which has been stuck at around 100 pixels per inch (ppi) for years, may be on the way up. Dell's new 27 in. U2711 16:9 monitor, for example, squeezes in 2560 horizontal pixels, for about 108 ppi. There have been high-resolution monitors before, and they haven't sold very well, but the resolution independence of Vista and Windows 7 make higher resolutions more attractive.

The latest in HP's engineering monitors range in size from 24 in. to 42 in.

120Hz monitors are becoming common. While driven in large part by the demands of PC gamers, faster monitors are essential to support upcoming 3D schemes, which require twice the data rate. For most of us, right now, 60Hz is still quite comfortable.

You're also finding more and more ancillary features—USB hubs, card readers, built-in invisible speakers and web cams—a sure sign of the maturity of the technology.

TN—Granddaddy Of Them All

More important by far than the webcams and other tchotchkes, though, is the underlying panel technology. And there's a problem; few monitor specs even tell what the underlying technology is. All you get is: "LCD display/TFT active matrix." This means exactly nothing, as every single LCD monitor on the market uses some form TFT active matrix technology. But which form, exactly? That turns out to be rather important. Let's look at the most popular varieties.

Twisted nematic (TN) is the oldest LCD panel technology in wide deployment today. (The name refers to underlying physics and the twisted arrangement of the liquid crystal cells. You can learn more about the twisted nematic effect, here: hwikipedia.org/wiki/Twisted_nematic)

TN panels completely dominate the consumer market. They're fast and cheap, but there's an old saying: "Fast, cheap, and good—pick any two."

That's not entirely fair, though; TN panels are good and, in some cases, very good, but they're not great. Their biggest problem is their limited viewing angle. You've seen it; the farther away from perpendicular your eyes get—especially vertically—the worse the display looks. Contrast fades, colors shift, and even invert.

TN technology has come a long way, and current TN monitors are greatly improved, but this problem, though ameliorated, persists.

Or Not TN

In-plane switching (IPS), on the other hand, provides very wide viewing angles, and the best color reproduction. It is very popular in color-critical applications including design and medical imaging. IPS panels originally had trouble with response time and contrast but, like TN, they have improved markedly over time.

Patterned vertical alignment (PVA) offers excellent contrast, and viewing angles and color reproduction nearly as good as IPS.

Each of these technologies is available in many flavors; you'll find Super-PVA, Super-IPS, and even Advanced Super-IPS. And while my characterizations of them are couched in the most general terms, as a rule of thumb, PVA and IPS are at the high end, and TN is at the low. While TN panels are generally limited to 6-bit color, for example, most IPS and PVA panels support 8-bit color or more.

In many applications, such as large displays for conference rooms or factory floors, PVA and IPS are seen as more-or-less comparable technology as they both offer good off-angle viewing and color reproduction. TN panels, on the other hand, are rarely used in such applications, if ever.

None of these panel types is especially new, but IPS and PVA panel technologies are increasingly available in the professional and consumer marketplaces.

Backlight

Behind the crystal, the backlight is changing too, as cold cathode fluorescent lamps (CCFLs) are phased out in favor of LEDs.

LEDs bring two big advantages: they're "green," and they're thin. Unlike CCFLs, LEDs contain no toxic mercury. Their thinner form factor allows for smaller, lighter displays. LEDs are also easier to tweak via software and firmware to compensate for environment, power usage, and wear.

White LED backlights (actually blue LED plus a yellow phosphor) are the most common, but RGB LED backlights, which produce the widest color gamut—wider than the best CCFLs—are increasingly available in high-end desktop monitors and notebooks.

State Of The Art

What does today's state-of-the-art monitor look like? It's probably a 30-in., 2560 x 1600 LCD display, with an RGB LED backlight and an IPS or PVA panel. It runs at 60Hz; for now at least, you'll only find 120Hz matched to RGB LED backlights in televisions.

LaCie's 30-in. Super-PVA-powered 730 is a good example. Its street price—$3,400—bespeaks its nearness to the cutting edge.

HP's smaller 24-in. DreamColor LP2480zx, built on a 10-bit IPS panel and RGB backlight, weighs in at half the price ($1,700) and delivers an impressive billion-color gamut.

If your budget is . . . somewhat smaller, $350 will buy you a nice 22-in. S-PVA. And you might be surprised at how good the latest TN panels are.

Technology advances in a kind of punctuated equilibrium. A new technology bursts onto the scene, displaces an existing technology, and then settles in until it is replaced in turn. When it comes to monitors, this is the LCD's time to shine. There isn't even a new technology on the horizon; the best contenders—OLED and electronic ink—are years away from mounting a credible threat. ■

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

FOR MORE INFO:

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- > NEC
- > Panasonic
- > Samsung
- > ViewSonic

Reconnecting Design & Manufacturing

> By formally restructuring and enabling the symbiotic relationship between design and manufacturing, manufacturing process management tools enhance productivity.

BY TOM KEVAN

The universe of product lifecycle management (PLM) continues to expand and incorporate more phases of the lifecycle as interdependencies and mutually beneficial interactions dictate. The concurrence of design and manufacturing is proving to be an area in which enhanced collaboration can deliver greater innovation, productivity, and competitiveness in product development.

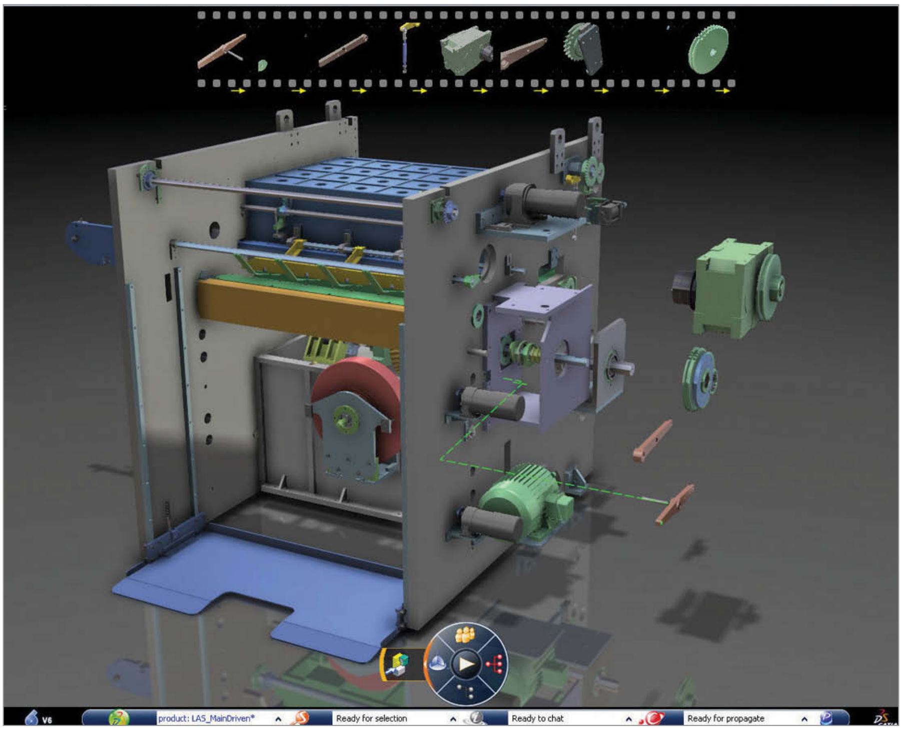


Figure 1: MPM process simulation enables engineers to optimize the assembly manufacturing plant/cell layouts using 3D tools. The software lets the engineer work with the spatial organization and components of the plant to plan the downstream evolution of the shop floor layout.
(Image courtesy of Dassault Systèmes Delmia Corp)

In a parallel trend, traditional approaches to managing manufacturing processes increasingly fail to reduce costs and improve productivity. As a result, companies need a different approach that will help them survive and excel in a marketplace that is increasingly unforgiving in terms of development costs and product delivery schedules.

The answer to both trends is the rise of a set of tools within the PLM suite that bind design and manufacturing more closely together. The payoff from this migration is significant. To see its true value, you only have to follow the data trail.

Figure 2: MPM enables concurrent product and manufacturing process definition. *(Image courtesy of PTC)*

Managing Manufacturing Processes

The toolset in question is known by many names, including Manufacturing Process Management (MPM), Digital Manufacturing, and Collaborative Manufacturing Process Management. Nomenclature aside, a good definition of the approach can be found in the CIMdata white paper titled "Digital Manufacturing in PLM Environments." The PLM consulting firm says that when manufacturing process management is combined with PLM's data management and CAD capabilities, the resulting toolset integrates the definitions of products, processes, practices, plants, tools, and resources into a consistent manufacturing system. Integrating product design and manufacturing provides a system that supports processes from concept to disposal.

"In digital manufacturing, we are looking at the definition of the product and configuration management," says Peter Schmitt, Vice President of business development for Dassault Systèmes' DELMIA. "We are articulating the sequence, dependencies, and precedents of the processes. We define a schematic layout on how and where those processes can be executed (see Figure 1). We further describe those processes from assembly simulation to time measurement. We define robotic, manufacturing, quality, and inspection processes. We describe the layout of the factory, lines, and cells, where the product is manufactured or assembled. We look at the material flow and the creation of programs for robots, PLCs, controllers, and master control machines that are downloaded to the shop floor."

A Single Source of Data

Engineers started in the CAD arena, and they were generally concerned with products. They needed a place to manage their revisions and configurations of product data. The natural progression was for them to adopt product data management (PDM). With it, they could manage the workflow associated with the multiple groups in design engineering responsible for different functional areas of a particular product.

PDM has become the core of PLM, which derives its importance from the interactions of all the phases in its environment (e.g., design, manufacturing, maintenance). PLM's core value is the fact that it is the single source of the highest quality product data, upon which everything in the lifecycle depends. Having all the areas of PLM draw from and align their data with this single source ensures the accuracy and consistency required to compete and survive in the marketplace.

MPM is a part of PLM, and it is natural to start migrating process data into the mix. The hope is to give design engineers access to this data so they can determine why products come back with requests for changes. There is a need for increased collaboration not only among the manufacturing engineers but also with the design engineers.

"The single source contains more than the MPM," says Tom Hoffman, a director of Tecnomatix for Siemens PLM Software. "The single source is really the core for everything. MPM happens to be a layer that is tied to that single source of data. Manufacturing process management bridges the gap and ties product data to process data. So you are looking at product, process, plants, and resources and the interactions among them. They are all linked to the single source of data."

The Design-Manufacturing Connection

The link between design and manufacturing hasn't always been recognized. All too often, what little collaboration occurred between the two has been a case of too little, too late. Overcoming the disassociation between the two phases of product development has physical and organizational obstacles.

In the past, manufacturing engineers were often not brought into the process until the design was completed. This precluded them from providing valuable input early enough in the cycle to optimize the design for manufacturing and prevent the incorporation of design elements that would diminish the effectiveness of or outright impede the production processes. Using the manufacturing process management approach, manufacturing engineers are involved early in the design cycle, when the models are being put together. This means that by the time the design is ready for production it can be efficiently manufactured and rework is nearly eliminated.

"We see manufacturing process management as the link between design and manufacturing," says Mike Distler, director of product marketing at PTC. "In some cases, the manufacturing folks are in another building or on the other side of the world, and their connection to the design process can be difficult. This type of software can really bridge that gap. Now they are part of the overall product development process. It's important for manufacturing to be involved at that stage and get their input upfront."

Manufacturing process management, or digital manufacturing, formalizes the collaborative workflow between design and manufacturing. "On the design side, you define the product's requirements—the functions the product should perform and the market requirements it should meet," says Dassault's Schmitt. "Based on that, you start your design and validate key features through a CAE-type analysis. Then you validate that the product can be manufactured by determining the sequence, number of people needed, and manufacturing cost. You want to make sure the processes you deploy are repeatable and can produce a quality product. At the end of the day, a good product is only a good product if it has the right qualities and manufacturing cost and is available to the customers at the right time."

A key part of the manufacturing process management approach is the virtual build scenario, in which CAE tools are used to determine how well a design can be translated into manufacturing and assembly processes. "There have been instances where 200 to 250 issues have been found in a design that has gone through the virtual build process," says Schmitt. "These would not have been found without the virtual build until a physical prototype was built. So this is one reason why the connection between design and manufacturing must be very close."

Collaborative Development

The interaction between design and manufacturing, facilitated by MPM, covers the entire development process, from the early stages of the design cycle, through the feedback loop, to the change and approval process. The scale of this collaboration can be seen—again—by looking at the data trail.

Collaboration in the early stages of design combines the insight of the design team with that of the manufacturing engineers. This ensures that the design meets the functional and market requirements and is optimized for manufacturing. The result is the engineering bill of materials. The data derived from this process is used to define resources, tooling, work instructions, and staffing. This process generates the manufacturing bill of materials.

There is, however, another part of MPM. Design and manufacturing engineers not only work together early in the design phase but also during the implementation of changes later in the development cycle.

"Manufacturing process management helps when feedback on the initial design comes back from the shop floor or when design realizes it has to make a change," says PTC's Distler. "At this point, MPM helps by coordinating change management between design and manufacturing."

"Design engineers have the ability to say, 'I want to make this change. What will it affect?'" says Tecnomatix' Hoffman. "Then manufacturing comes back and indicates that if the part is changed it will affect these particular plants and processes, and maybe this particular tool that holds the part. The interaction between design and manufacturing enables the group to consider the proposed change and make more intelligent decisions. It goes back to the increasing collaboration between design and manufacturing. There is no more 'throw it over the wall.' It is almost like the design engineer and the manufacturing engineer are sitting at workstations right next to each other."

Many leading PLM technology providers include MPM modules in their environments that enable companies to create, validate, and optimize manufacturing processes. The idea is to leverage information interrelationships and enable collaboration among all engineering disciplines in the design and manufacturing segments.

Toolsets

Dassault Systèmes' DELMIA Digital Manufacturing & Production software enables companies to define, plan, create, monitor, and control all processes, from early planning, assembly simulation, modeling welding lines, and robot and cell programming to the definition of the production facility and equipment. The software suite's modules allow manufacturers to model in 3D and validate production cell setup; simulate and program robotic workcells; perform ergonomic simulation to optimize work space and worker efficiency; simulate parts and assemblies to validate manufacturing processes; and create and validate mechanical, kinematical, and logical device behavior for PLC and robot programs.

The application enables manufacturing engineers to create and compare process alternatives to determine the best way to optimize the manufacturing processes.

Siemens' MPM functions are implemented by two applications: the manufacturing process planner and the parts planner. Both operate within the Teamcenter environment. The MPM functionality is enhanced with the Process Simulate and FactoryCAD programs.

Process Simulate allows manufacturers to verify the feasibility of operations through the simulation of product assembly processes. Tools such as sections, measurements, and collision detection enable detailed verification and optimization of assembly situations.

FactoryCAD allows engineers to work with "smart objects" that represent factory resources, from floor and overhead conveyors and mezzanines and cranes to material handling containers and operators. This specialized software allows manufacturers to gain insight into their factory layout and installation processes.

PTC's Windchill MPMLink provides for the step-by-step optimization of manufacturing operations. The software enables manufacturing engineers to evaluate design requirements in relationship with the company's manufacturing capabilities. The application allows design and manufacturing to work concurrently, early in the development cycle (see Figure 2). Together the two groups create preliminary manufacturing bills of material and process plans, initiate tooling requests, and establish time and cost estimates.

The application enables manufacturing engineers to create and compare process alternatives to determine the best way to optimize the manufacturing processes. Once the final plan is decided, manufacturing can detail and document the final manufacturing process. ■

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

FOR MORE INFO:

> CIMdata

> Dassault Systemes

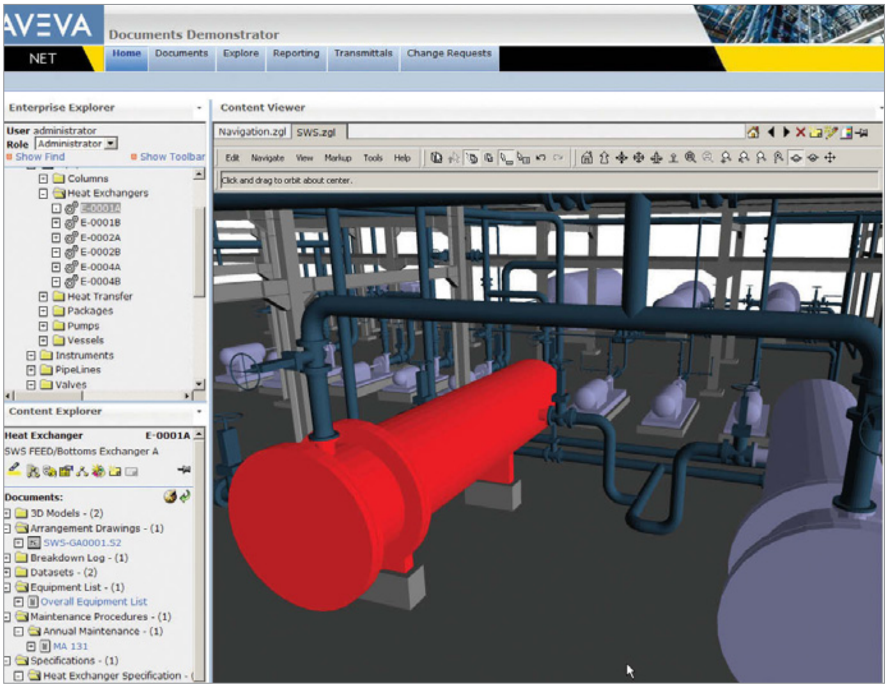
> Parametric Technology Corp.

> Siemens PLM Software

AVEVA.NET Simplifies Asset Management Tasks

> Woodside Energy consolidates project data in AVEVA NET and retires more than 250 disparate applications.

BY KENNETH WONG



AVEVA.NET enabled Woodside to consolidate schematics and all engineering data in one, easily accessible PLM system that takes new employees about an hour and a half to learn.

Woodside Energy, one of the largest publicly traded oil and gas companies headquartered in Australia, traces its origins back to 1953, the year after the first oil was discovered Down Under. That proud industrial history also comes with a burdensome legacy known as engineering legacy data.

Company archives, amounting to decades of project data, comprise paper documents, microfilm, Microstation files, AutoCAD files, piping and instrumentation schematics, and maintenance records scattered across several repositories in both corporate and outside (service providers') document management systems. At one point, Woodside's engineering data management team supported more than 250 applications, many homegrown, that required new hires an estimated 20 hours to learn.

In 2004, after an extensive evaluation process, Woodside chose AVEVA.NET, an ISO15926-compliant PLM system, as a single source. Today, new employees get trained in a limited number of core applications (AVEVA's VNET and SAP among them), reducing the training time to 1.5 hours. All Woodside assets are now accessible via a standard VNET portal, allowing Woodside to train its employees once.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Second Time Around

Dave Coppin, AVEVA's executive VP for AVEVA.NET solutions, was among those who first went to Woodside Energy to bid on the project.

"That was actually Woodside's second attempt at [consolidation]," said Coppin. "A similar undertaking was made in 2001. It was an IT-led initiative, meant to change everything overnight—the Big Bang approach." That project fizzled out at the end of the dot-com boom and by the end of 2003, Woodside ws ready for another crack at information management. According to Coppin, "[Woodside's] engineering group was having difficulty controlling the large number of applications that wouldn't talk to one another."

This time, Woodside and AVEVA implemented the changes in various phases, not all at once. The project was to be led by engineering, not IT as in previous attempts. Coppin recalled, "It was not just about putting in an information backbone but about installing an integrated engineering solution based on modern technologies."

Fewer Errors

With electronic data, more data doesn't necessarily mean better data. "Data quality was a major issue," recalled Richard Harris, Woodside's engineering data management technical authority and team leader.

Typically, Woodside collects process maps, engineering libraries, and metadata: facility codes, system codes, document types, relevant disciplines, and so on, all reduced to a series of alphanumeric codes.

"But it's difficult to associate intelligence with numbers," said Bill Van Butzelaar, Woodside's business improvement manager. "We want to put intelligence back into metadata."

Employees used to juggle nine different metadata profiles, most of them comprising noncritical engineering information. AVEVA.NET helped drive Woodside toward a single metadata profile.

With the introduction to VNET, Woodside began its transition from traditional 2D data paradigm to digital archival system. Not only did it result in substantial savings, but it also enabled reuse of engineering data in new projects and in repurposing assets.

In the oil and gas industry, plant components—pipes, valves, cables, machinery, and plant areas, to name but a few—are marked with tags, or unique identifiers that explain their locations, maintenance records, purposes, and functions. The more complex the site, the greater the number of tags. There's a direct correlation between the volume of tags involved in a new plant and the price Woodside must pay to fix inaccurate and inconsistent data when an EPC (engineering, procurement, and construction) firm hands over the finished facility.

"We knew that, historically, the cost of a post-handover data manipulation and cleansing team would cost about eight times more than having the project source that required data prior to handover," said van Butzelaar. Typically, each capital project handover cost Woodside about $3 million, depending on the project scope.

But the streamlined data structure imposed by AVEVA.NET changed that. Recently, a new facility (dubbed Woodside Angel Project, constructed in

Product Lifecycle vs. Asset Lifecycle

Though AVEVA sometimes refers to its technologies as product lifecycle management, using the same three-letter acronym employed by Dassult Systemes, PTC, and Siemens PLM Software, AVEVA's specialty may more accurately be described as asset lifecycle management.

"With product lifecycle management, you're dealing with a product during its manufacturing stages," clarified Dave Coppin, AVEVA's executive VP for AVEVA.NET solutions. "Asset lifecycle management is the control and management of all the data in an operating facility. Not many [asset lifecycles] start from inception, but it could start from there, all the way to decommissioning." For AVEVA, "asset" primarily means data from power plants, marine facilities, and oil and gas refineries.

—KW

Singapore) was completed. It was used as benchmark for the success of the EDM project handover strategy. The cost to Woodside was $250,000, a significant drop from the previous bills.

More to Come

Looking ahead to 2012, Woodside plans to use its media gallery to monitor its sites, to photographically keep track of sections and machinery that are shut down, in repair, or operating as normal.

These site photos may even let contractors issue quotes without costly site visits. They also reduce time in the field. "Some of these are high-risk areas, so we don't really want crews to be there if they don't have to," noted van Butzelaar.

As part of the project, AVEVA helped Woodside migrate its existing data into the AVEVA.NET environment. "If the data is electronic—3D models, AutoCAD files, intelligent PDFs, databases, Excel, Word, those types of documents—then it's very easy to do," said AVEVA's Coppin.

When dealing with unintelligent documents—paper documents that have been scanned and converted to PDF, for example—AVEVA uses optical character recognition features, then compares the text to 3D models and master data repositories. ■

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:

> AVEVA

> Woodside Energy

Not Just Your Typical Workstation Anymore

> Today's engineering workstation is an intelligent workbench that enables engineers to potentially design, analyze and modify their ideas faster than ever before.

BY PETER VARHOL

FEA SPECIAL REPORT

Design engineers and consultant engineers today have the opportunity to dramatically change the way that they work. This opportunity is driven by the emergence of the Solver Ready Workstations from HP. This is an HP Z800 workstation that is sized and configured to run complex analysis with software from ANSYS and other CAE suppliers without passing the information off to a server. This allows engineers to start driving their designs based upon simulation and analysis, in other words Analysis-Driven Design —radically improving and accelerating the design process.

The Solver Ready HP Z800 Workstation brings two critical capabilities to engineers. First, it enables them to do work on their workstation that often had to be done in data centers, or not at all. Additional computational power, memory, and overall system performance makes it possible to do the usual design activities more quickly, and also makes it possible for the engineer to engage in a greater number of design iterations and complex analysis.

Second, by doing design activities more quickly, the Solver Ready Workstation brings with it the ability to improve the design in the process. Engineers aren't only producing a design, they are iterating through multiple designs and design approaches in order to come up with the best design. They can design, analyze, simulate, adjust, and repeat until the design is optimized. All at their desk, done without delay using modern engineering software on today's high-performance dual processor workstations.

Technologies Driving the Solver Ready Workstation

Engineering-driven organizations now have access to inexpensive workstations and workgroup clusters based on the new 64-bit Intel® Xeon® 5600-series processor, with six cores and two threads per core, and two of these high-powered processors in a single HP Z800 workstation. All totaled that's 12 cores and with hyper-threading they can run 24 threads simultaneously. These workstations and work group clusters deliver the compute capacity of high-performance computers that was only available in the data center just a few years ago.

Further, advances in engineering software are taking better advantage of the ability of hardware to deliver substantially higher performance at lower costs. Software from ISVs such as ANSYS, have improved capability in utilizing multiple cores and threads to quickly analyze and simulate those designs, ultimately producing a better product. Engineers can do more at their desktops, and do it more quickly. And those designs will be of higher quality, with a faster time to market

There is a better way. And with today's high-performance HP Z workstations, design engineers are finding it. ■

FOR MORE INFO:

> HP and ANSYS Solution

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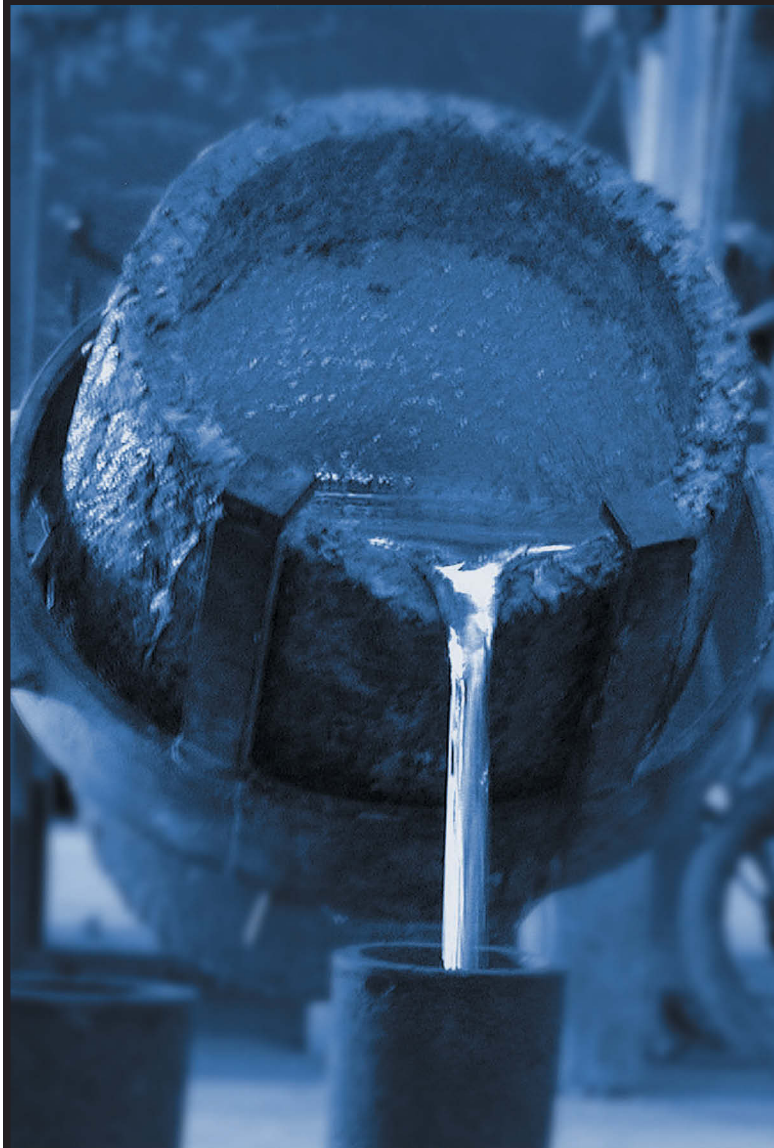

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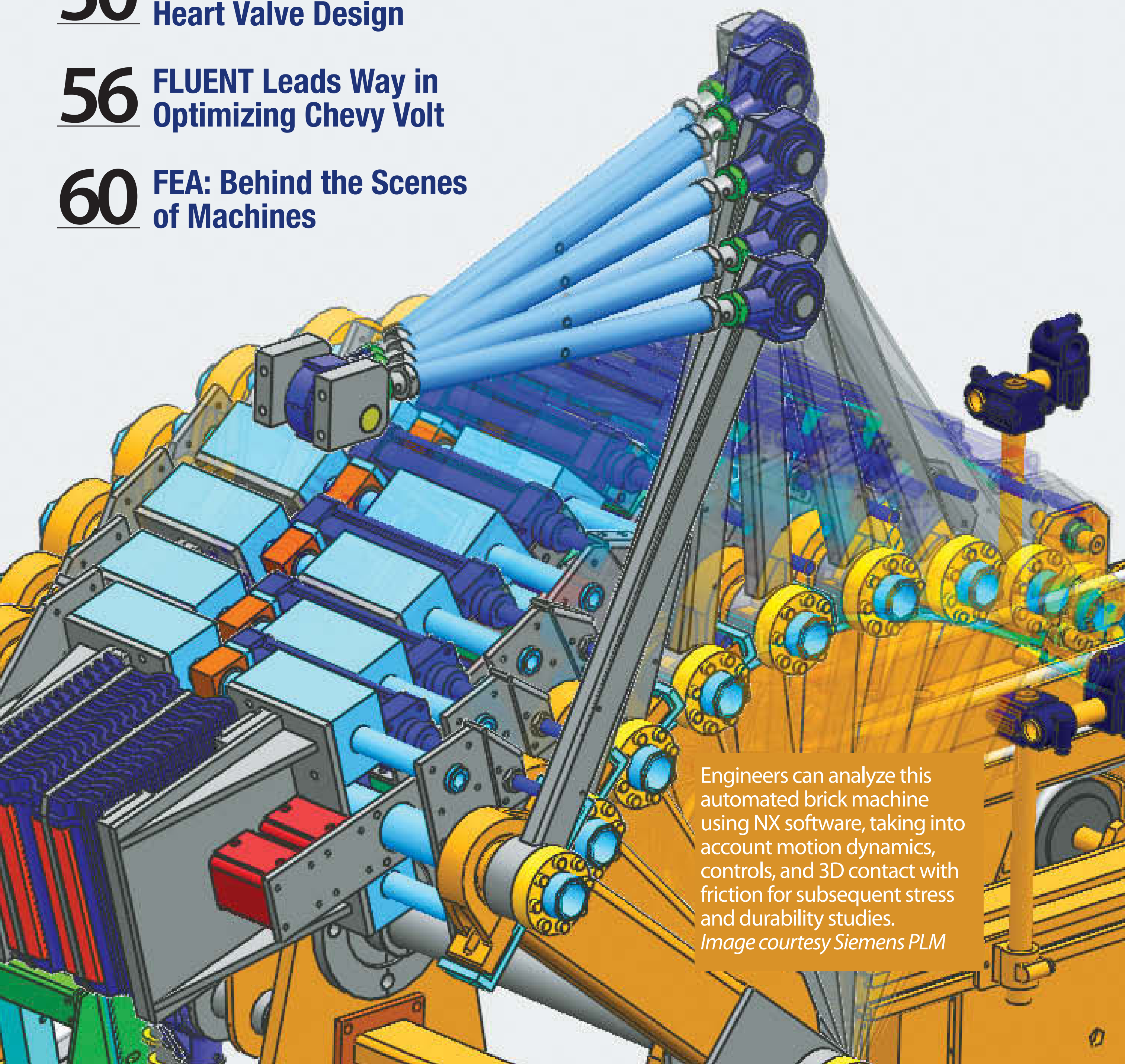


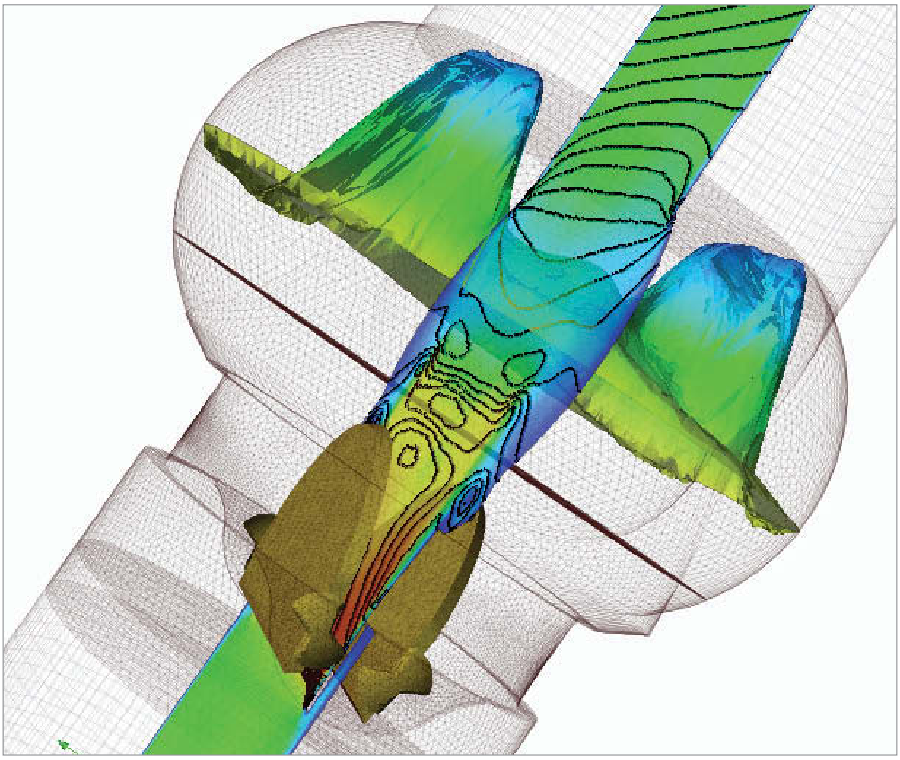
Engineers can analyze this automated brick machine using NX software, taking into account motion dynamics, controls, and 3D contact with friction for subsequent stress and durability studies.
Image courtesy Siemens PLM

By David Essex

Analysis Aids in Heart Valve Design

> Simulation of prosthetic heart valves has become so essential that researchers have invented a Latin phrase for it: *in silico*.

While the artificial heart holds sway over the imagination as the penultimate component to perfect for saving lives, the less romantic—but no less amazing—reality consists of small prosthetic devices intended to replace failing sections of the heart and surrounding vascular system. With scaffold-like, artery-clearing stents now commonplace, the new vanguard is replacement heart valves.



This CFD velocity profile of the middle plane of an ANSYS FLUENT model shows the downstream blood-flow velocity (with iso-lines in black) of a prosthetic aortic heart valve. Abaqus was also used to model the valve itself. The superficial tetrahedral grid is shown with the valve's two leaflets in gold.

Open-heart surgery, often risky, can now often be avoided with minimally invasive "percutaneous" procedures that deliver valves via catheters inserted through an artery, typically in the groin. The latter technique is standard for stents.

In a 2006 study, Millennium Research Group predicted the U.S. heart valve market would grow to $700 million, thanks to exploding development of mitral and aortic percutaneous valves and increased incidence of heart disease among the elderly.

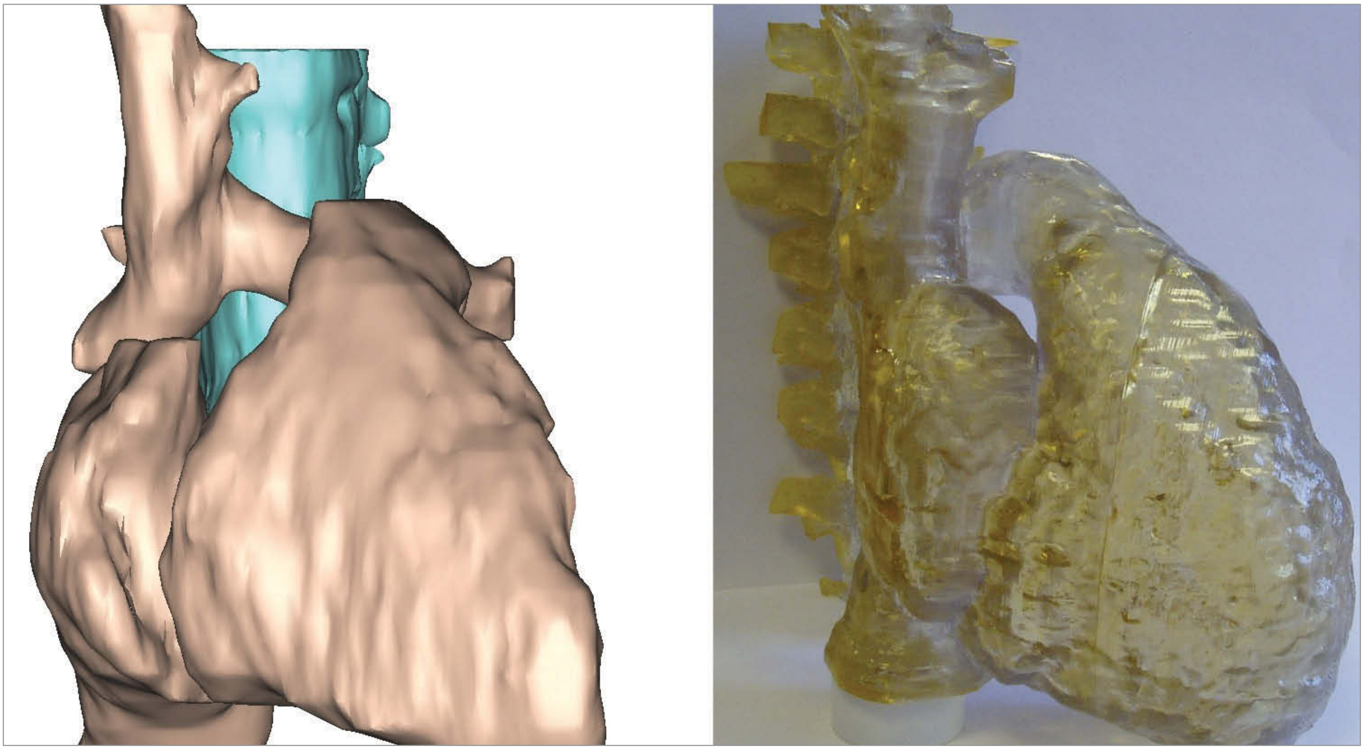
Medical devices usually go through in vivo testing on live animals or in humans participating in clinical trials, and in vitro in the controlled environment of a test tube or petri dish. But increased use of desktop design tools has given birth to a new Latin phrase: in silico.

That's because computer design, simulation, and modeling tools enable speedier introduction of safer, more durable valves.

Planned Interventions

Academic researchers and leading valve makers, including Edwards Lifesciences and Medtronic, have focused much of their computer work on designing the devices and simulating their operation. But imaging technology is also playing a prominent role in the ancillary efforts of marketing and training.

For example, the University of Colorado Denver used soft-tissue imaging such as computer tomography (CT) and magnetic resonance imaging (MRI) to develop 3D models of individual patients' hearts and cardiovascular systems. The files are then converted to physical models on a Z Corporation 3D printer at the nearby Protogenic division of Spectrum Plastics Group. Doctors then use the model to plan and practice the procedure. "We can mimic very realistic patient cases, so we can train surgeons on complicated cases," says James Chen, a UC Denver associate professor of medicine who helped develop the technology. One manufacturer, ValveXchange, has licensed



Rapid prototyping is commonly used to create physical models of the heart to aid in valve implantation. Researchers used medical imagery to create the 3D model of a pediatric patient's heart (pink) and spine (blue) at left, which they then used to build the polymer model at right.

the technology, and Chen says others are using patient data sets created by the university to test their devices.

Nearby Medical Simulation Corp., whose medical director is Dr. John Carroll, a co-inventor of the UC technology, makes simulated models that it claims are used by 95 percent of valve makers.

"What we do for companies like Edwards is design simulations around their products," says Sammy Peppers, the company's director of business development. "Operators actually experience the forces—the haptics—of what they will be doing." Peppers says the company uses Adobe Photoshop and Autodesk Maya along with custom software for its simulations, while making the physical models from valve prototypes. It doesn't need the level of detail that designers do, but takes information from the valve development process, as well as CT scans and other medical images from actual patients, to write programs that simulate live procedures. The method purportedly trims time to market and training expenses.

"With the physical model, you can really practice the intervention," Carroll says. "A lot of this is done in fluoroscopy—they're basically looking at live X-rays. What [surgeons are] looking at is what they would actually see in the cath lab."

Hagop Kaneboughazian, animation director at Viscira, uses Luxology's modo software to make 3D models that manufacturers use to market their devices to doctors and investors. "We show how the model works inside the heart," Kaneboughazian says. "It also has to fit within the anatomy. It has to be believable." Still, the animation can't be so blood-and-guts realistic that it might turn off non-physicians, he says.

To get the animations right, Kaneboughazian typically meets with the manufacturer's chief science officer. "Half the time we start from sketches or conceptual drawings," he says, though sometimes CAD files are available.

Kaneboughazian says modo is the initial modeling tool, while the animation is done in either NewTek's LightWave or Autodesk Softimage. Then he brings the project back into modo for texturing, lighting, and rendering.

CFD: The Vital Flow of Life

Benchtop tests use physical models to simulate a valve's behavior in fluid. Developers and academics supplement them with computer simulations. Chen says UC mostly uses ANSYS FLUENT and Simulia's Abaqus to perform computational fluid dynamics (CFD) and finite element analysis (FEA). They use Autodesk Maya for smoothing of boundary information and assurance that boundaries don't intrude on each other. Files are converted to stereolithography (STL) format for export to the Z Corp printer. McNeel Rhino software is also used for 3D modeling, according to Chen, while modo smoothes surfaces where sparse data points create over- or under-segmentation, a serious error that can confuse chambers of the heart. The university also employs several CAD programs.

Keith Perrin, Autodesk's industry principal, describes a "hive" of valve development centering on his company's platforms, principally Maya, which he says is especially suited for modeling organic material. Inventor is preferred for valve design, and Algor Simulation for analysis, or to translate CFD into FEA. Perrin says some companies also use Autodesk software to create Method of Application (MOA) animations for training, typically by exporting Inventor designs back into Maya.

One of the main areas of study involves using CFD to predict how valves will interact with, and sometimes injure, the body's soft tissue. Perrin says turbulent flow is important to model because it can show where blood flow might be affeccted by the valve. Developers also study laminar flow, which some designs deliberately harness to open and close a valve's leaflets or flaps. "You can actually model where that boundary layer is going to break down," Perrin says. "In order to understand the flow going across the valve, you need the complexity of the body immediately around it. You can't just simulate the valve in isolation."

Researchers are also studying how impact with prosthetic valves can damage the blood's platelets or cause clots, according to Thierry Marchal, industry director for healthcare and consumer products at ANSYS. "The flow rate can be too small, and it can cause the platelets to stick," Marchal says. "It can lead to death." So researchers have done much work in FLUENT to study the phenomenon.

"A detailed description of the local hemodynamics is necessary," explains Raffaele Ponzini, an engineer at CILEA HPC, an Italian research consortium for high-performance computing. For three years, Ponzini, who also does CFD analysis for yacht design, has worked on a team performing vendor-independent in vitro and in silico tests of St. Jude Medical's Hemodynamic Plus valve (See sidebar).

FEA of Stress on Hearts

The flow of blood and pressure from soft tissue can cause a device to fracture, with obviously dire consequences. FEA is often the tool that pinpoints stress points before a bad design reaches patients.

Engineers are keenly interested in the devices' lifespans, an important issue in medical decisions. A device with a 20-year life expectancy might never need replacing in elderly patients, but would in children.

Subham Sett, life sciences industry lead at Simulia, says valves "are under constant cyclic load. That leads to a lot of fatigue issues because of the opening and closing of the valves." Maximum and

Simulating Heart Valves on CILEA's High-Performance Computers

To simulate the hemodynamic (blood flow) characteristics of St. Jude Medical's Hemodynamic Plus valve, the Italian high-performance computing consortium, CILEA HPC, used an impressive array of raw CPU power and off-the-shelf software.

According to engineer Raffaele Ponzini, CILEA's computer cluster was ranked 135th-fastest in the world in 2008. It is composed of 208 two-way Intel Xeon 3.16GHz QuadCores with 16GB of RAM per node and a total disk capacity of 13TB. The operating system is Red Hat Enterprise Linux Server Release 5.1, and James River Technical's PBS Professional is used to manage workloads.

Ponzini says the team used an ultra-fast cinematographic technique to acquire patient data to build a CFD model with realistic fluid dynamics that took into account heartbeats per minute, cardiac output, and the geometry of the valve housing and hinges. CILEA also studied the valve's effect on blood platelets. "The CFD model, already equipped with the FSI algorithm, has been enriched with a particle-tracking algorithm to provide fluid-dynamics data of passive tracers," which Ponzini says played the role of platelets.

"We ran several simulations performing 4,000 time steps per heart cycle," Ponzini says. "The CFD model was fully developed to be deployable on a parallel machine architecture, and thanks to the scalability properties of the problem, we achieved our results on a single heart cycle in about two days, performing the computations on up to 16 cores."

Ponzini says modeling and mesh generation were done in ANSYS GAMBIT software, and simulations were performed in ANSYS FLUENT by adopting a control-volume-based technique to solve the Navier–Stokes equations.

— DE

alternating stresses are the most critical points in predicting when a valve might break, he says.

University of Connecticut and University of Pittsburgh researchers use Abaqus extensively to study soft-tissue behavior, especially valve leaflets to see if they close completely, according to Sett. "What we have within Abaqus is tools which let people solve flow problems in which there is a lot of structural influence." He notes that Abaqus doesn't do full-fledged CFD, but has multi-physics integrations to other third-party tools that do, such as ANSYS FLUENT and CD-adapco's STAR-CD.

Like stents, the percutaneous soft-tissue valves are rolled up into tight cylinders that can fit inside the vein or artery, then expanded at the implant site. Shape memory alloys, which can "remember" the device's previous shape, are increasingly popular materials. Many simulation studies have focused on the stress placed on valves when they're rolled up.

The Next Frontier: Live Procedures

There is emerging interest in using some of the same computer imaging that was used in development to guide doctors while delivering the valves by catheter.

Chen says the UC hospital cath lab is already outfitted with the necessary imaging equipment, but it's up to surgeons to use it. The main challenge is integrating the different imaging formats that are needed to present the complete picture in real time. Fluoroscopy is the only way to see the catheter, but it is 2D and can't adequately show soft tissue. One promising approach is to combine it with images from 3D echocardiography.

Marchal agrees that unifying the images is a major research challenge. "The CT scan can export some geometry into STL format," he says, "but it t usually needs quite a lot of repair." ANSYS has begun a three-year venture with Medtronic's Invatec division and an Italian university to speed up simulations so doctors can see the effects of interventions as they happen. "When the patient is lying on the table, you can't wait for a simulation," he says. ■

*Freelance writer **David Essex** has covered information technology for 24 years. He was a BYTE editor and has written for Computerworld, PC World, and numerous other publications. Send e-mail about this article to DE-Editors@deskeng.com.*

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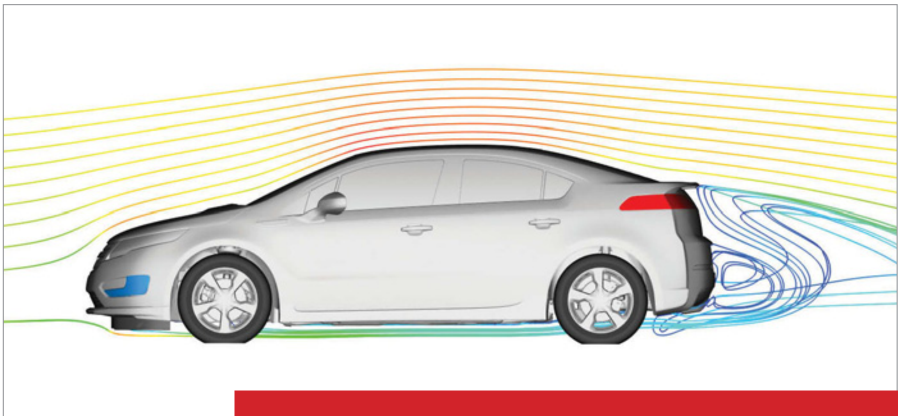
By Russell Shuba

FLUENT Leads Way in Optimizing Chevy Volt

> Computational fluid dynamics simulation helps reduce drag and improve acoustic performance of GM's electric vehicle.



The Chevy Volt's external aerodynamics simulation was accomplished using ANSYS FLUENT CFD.

In designing its new rechargeable electrical vehicle, the Chevy Volt, General Motors (GM) decided a combination of wind tunnel and computational fluid dynamics (CFD) simulation would reduce the time needed to obtain accurate vehicle drag and cooling airflow analysis results. The process meant the engineering team could use more geometric detail than is practical with a clay model, which enhanced flow visualization capacity around the vehicle for diagnostic purposes. The combination of the wind tunnel testing and ANSYS FLUENT made it feasible to achieve aggressive range and fuel economy targets.

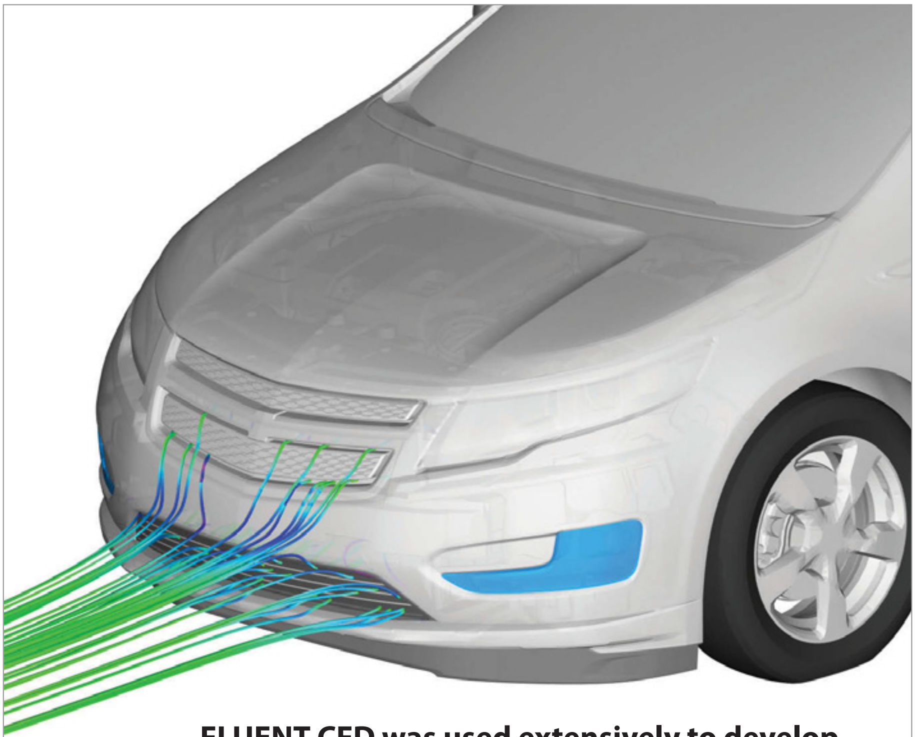
The aerodynamics team starts with concepts and ideas provided by the design studio. The process proceeds with a considerable amount of interaction between the studio and the aerodynamicists. The designers work to preserve the theme of the vehicle, and the aerodynamicists provide feedback on shape changes and modifications that could be used to reduce the vehicle's drag. The bulk of the wind tunnel testing is performed on a one-third-scale clay model that is continually modified to evaluate various design alternatives.

"While the wind tunnel plays the primary role in the aerodynamic design process, we find ourselves in situations in which wind tunnel testing does not make sense, either because there isn't enough time to perform tests or because we can't build a clay model of the geometry to the level of detail that we need," said Ken Karbon, staff engineer for GM. "In these situations and others, we use ANSYS FLUENT CFD software to simulate aerodynamic performance."

Karbon added that the team can easily set up an automatic batch run to evaluate several hundred different front-end airflow configurations over a weekend—unattended. Fluid dynamics simulation also provides the ability to model the underhood geometry to a much higher level of detail than is possible with a physical model, and in a reasonable period of time.

Efficient Simulation Process

To reduce the time required to analyze the large number of iterations needed to optimize a design, an efficient simulation process is used to automate a considerable portion of the model setup process and makes it possible to semi-automatically run many test points without user interaction. Engineers wrapped a workflow toolkit around the fluid dynamics software that guides the user through preprocessing, meshing, case preparation, job submission, postprocessing, and reporting. The models generally are submitted to a high-performance computing cluster built around IBM POWER6 blades. Engineers use these capabilities with design



FLUENT CFD was used extensively to develop the front end cooling airflow characteristics of the new Chevrolet Volt.

of experiments (DOE) or design for six sigma to explore large design spaces and identify the global optimum design.

In the case of the Chevy Volt, aerodynamics engineers obtained CAD data from the design studio in Siemens PLM NX format. The team used the CFD software's preprocessor capabilities to build a tetrahedral or hex-core mesh of the volume surrounding the vehicle's outer surface with a prism layer next to the body to capture boundary layer gradients. Volumetric refinement was used to capture gradients in other areas of interest, such as the wake and stagnation points. Boundary conditions were defined to match the wind tunnel.

"For the styling surfaces, we applied classic automotive aerodynamics best practices by ensuring smooth continuous airflow around the vehicle," Karbon said. "We entrained smoke in the wind tunnel to provide a high-level macroscopic picture of flow direction. CFD allows us to see much more than could ever be obtained from physical testing." Karbon noted examples such as pressure differentials both fore and aft of underbody components. The GM team also pays close attention to large separation points or vortex structures coming off the vehicle because of the potential for resulting in aerodynamic drag. Karbon added that engineers also target "very clean separation from the back of the vehicle."

Fluid dynamics analysis played the primary role in designing the grill, radiator, and related components to obtain the right amount of airflow through the grill, to direct the airflow to where it is needed, and to minimize cooling drag.

"We looked at the pressure and velocity profiles to understand how the air comes through the grille openings," said Karbon. "We needed to make sure we were getting enough volume of air to meet the most demanding engine cooling load cases, such as driving the car through the Death Valley desert."

To solve specific problems, engineers created large arrays consisting of hundreds of design variations and used parallel batch, scheme, and journal processing to quickly analyze all of them. This made it possible to quickly model various design details such as grill openings, grill texture, air dams, heat exchanger size and position, and sealing and baffling underneath the hood.

The engineering team also used FLUENT to mitigate and optimize wind noise associated with the Volt's wiper blades. Engineers first determined pressure and flow velocity generated by the wipers during the concept design phase. This information was used as input by software developed to predict acoustic performance. The evaluation of wind noise at an early stage of the design process helped avoid later-stage problems that would have been costly to correct.

Fluid dynamics analysis also predicts wind loads on vehicle components such as sunroofs and windows, especially under crosswind conditions. This information is fed into structural analysis programs used to ensure that all components meet high-speed requirements. CFD also estimates the temperature and quality of underhood airflow to the powertrain induction system.

"CFD plays a vital role in aerodynamic and acoustic design by highlighting the areas we need to work on and by providing diagnostic information that we cannot obtain in the wind tunnel," Karbon said. "The technology also makes it possible to quickly evaluate hundreds of designs in batch processes to explore the complete design space so that we knew we had the best possible design." ■

FOR MORE INFO:

> ANSYS

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

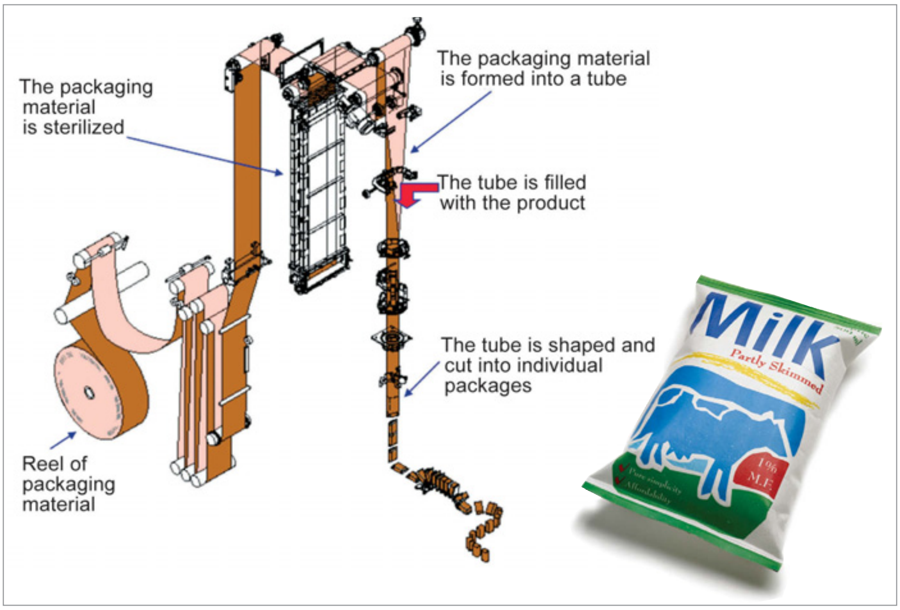
By Pamela J. Waterman

FEA: Behind the Scenes of Machines

> Multi-disciplinary analysis with Abaqus, ANSYS, Algor, NEi Nastran, NX, and SimXpert FEA smoothes design of manufacturing machinery.

The next time you handle a piece of paper, pick up a soda can, or turn on a lamp (meaning probably sometime in the next five minutes), think about the equipment that made that sheet, container, or fixture. Then think again about optimizing that machinery in terms of component strength, contact forces, part clearance, thermal expansion, and long-term durability. This is the world of manufacturing design for machinery.

Finite element analysis (FEA) software plays a key role in understanding the operation of machinery that contains hundreds to thousands of parts, many of them in constant motion. DE examines how several analysis packages accomplish this impressive task.



A system performance schematic (left) of a filling and packaging system for an aseptic liquid container, was simulated with Simulia Abaqus FEA software. The simulated consumer packaging for milk, formed from flat stock, filled and sealed with the automated system (right). *Image courtesy TetraPak*

Top Requirement: Accurate Handling of Critical Details

What do manufacturing users most often require in designing their complex equipment? Developers of NEi Nastran will tell you it's the capability to handle advanced surface contact, fatigue issues, and composite materials. Allan Hsu, an NEi Software application engineer, says that accurately modeling contact conditions is critical in evaluating the structural integrity of equipment ranging from scissor lifts to conveyor belts.

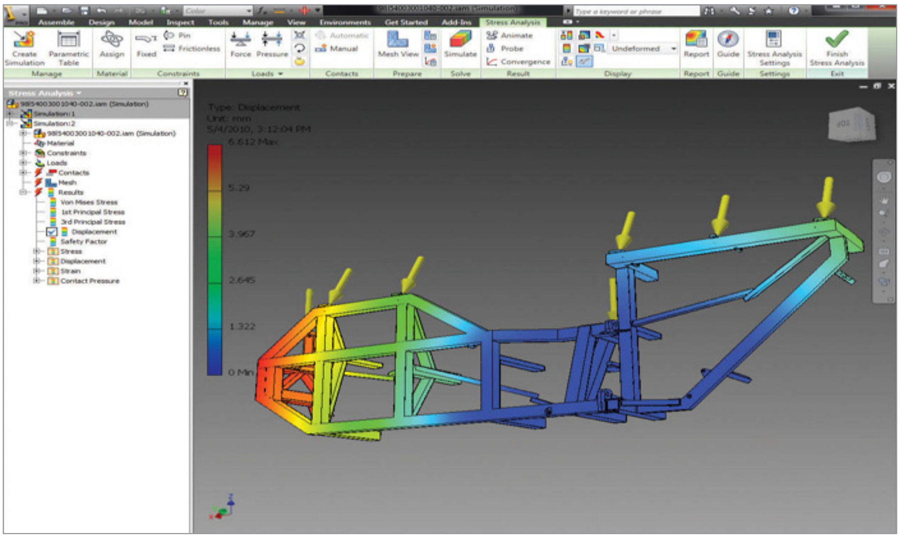
Hsu explains, "Assuming that parts are 'glued' at joints or that sliding is minimal between certain parts will tend to affect the load path of the structure, resulting in less accuracy of the FE analysis. Defining true surface contact, where parts can bear up against each other, separate, or slide against each other is the most accurate choice. A prospect in this industry looking for an FEA package should make sure they will have true surface-contact capability, not outdated contact approximations that define the stiffness between nodes."

Equipment manufacturers also need to know whether a certain design will meet desired service life expectations. With the NEi Nastran interface, users can take a structural analysis (for example, a linear static analysis) and, just by adding material fatigue properties and loading cycles, automatically evaluate fatigue damage and fatigue life (both high and low cycle).

A third aspect important to designers needing strong yet lightweight structures is that of analyzing composite material behavior. New FEA users should check to see if the software can perform such functions as predicting layer de-bonding and fiber failures.

Check out NEi Software's homepage to read useful discussions categorized for designers who are new to FEA, experienced with general FEA or accustomed to a different flavor of Nastran. The company's personalized customer service also gets high marks from users.

Nonlinear behavior is common in the materials processed by complex manufacturing equipment. SIMULIA's Abaqus FEA software takes direct aim at understanding and predicting all possible interactions; consequently, the machinery itself must be designed with this in mind. A common example involves the roll-fed paper or plastic used in equipment that simultaneously creates and fills an orange-juice carton.



Autodesk Inventor Professional software was used to perform structural simulation on a Techman-Head engine stand, used to support the engine of an aircraft during servicing. The simulation results helped to validate the predicted deformation of the stand under load. *Image courtesy of Techman-Head Group*

David Cadge, of SIMULIA's electronics and consumer products division, points out that when working with bottle- or container-handling machinery, simulations can quickly become complex. The analysis of how the packaging material moves through the system must incorporate not only the behavior the fluid involved, but also the changing fluid-structural interactions over time. Thus, every component of the machinery, whether metal or plastic, must be evaluated as to how it responds to those conditions: how much tension should you put on the material as it is folded, shaped, sealed, and cut? How quickly can you run the machine to do so? What are the thermal and mechanical limitations?

Users need robust, accurate, reliable solutions says Cadge. Abaqus offers this as well as direct geometry import and simple assembly setup. He adds, "This makes it easy to add parts or copies of parts into the model, for example when multiple, identical bottles are traveling along a conveyor belt. We also have fast, compatible solvers needed for the diverse simulation applications of this industry, some suited to implicit solutions, some explicit, and others requiring both for efficiency."

Integrated Analysis in the Big Picture

According to Richard Bush, marketing director for Siemens PLM Software Digital Lifecycle Simulation group, when looking at the manufacturing process from a higher level, speed ultimately drives every decision. Design engineers will tell you there are a huge number of changes made late in product design, which translate into last-minute changes to manufacturing machinery—and those changes must be precise. CAE software must therefore be integrated in the full process to be reliable and respond quickly. "Wait time is death time," observes Bush.

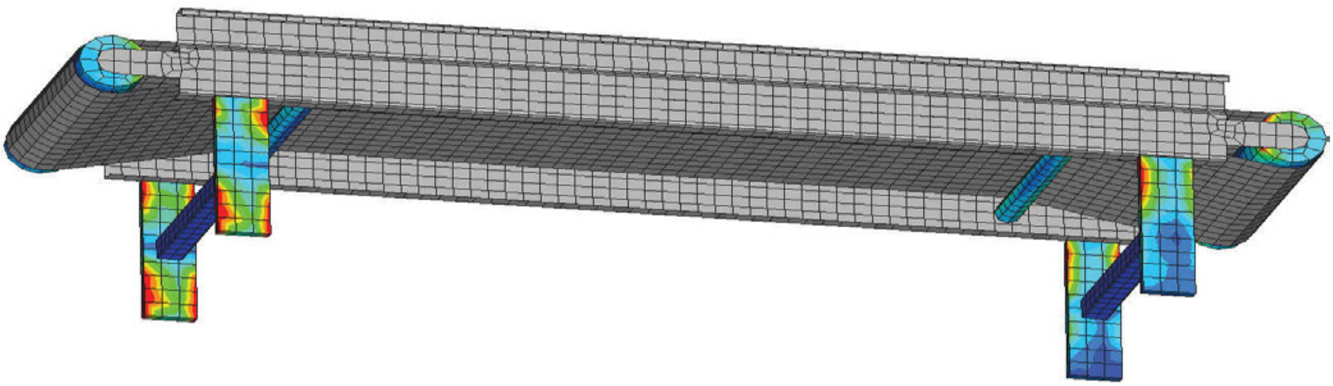
Many machine builders start by combining standard modules and making changes to suit the requirements for manufacturing a specific product. Siemen's Synchronous Technology supports this task across all stages, first offering feature-recognition, accelerating edits to 3D part files (some of them "dumb") created on different CAD platforms. Siemens PLM Software NX analysis software then gives mechanical designers access to advanced analysis tools by combining controls and motion behavior with FEA results.

Speed of actual operation is also critical. "A lot of companies are being challenged to make machines go faster," says Bush, "yet the materials they handle may not be simple, and the analyses must cover [the effects of] many different disciplines." He explains that to analyze moving parts FEA software may need to incorporate multi-body dynamics that go beyond simple rigid kinematics and clearance-checking, accounting for machinery parts flexing during use, thermal effects as moving parts heat up and expand, response of control electronics to heat, and even the behavior of the part or parts being manufactured. For example, analysis of a roll of paper moving at high speed through a printing press may actually need to include fluid effects.

Siemens PLM Software realizes that a customer may have one analyst per 50 designers, so the vision is to make complex simulation a part of the process at a level designers can use. It must capture and reuse existing designs, work with analysis codes from other vendors, be scalable to manage assemblies of thousands of parts, and ultimately be reliable.

FEA capabilities deeply embedded in a CAD environment are a key to success at Autodesk, too. The company's acquisition of Algor Simulation software expanded the possibilities for analysis across a spectrum of products and therefore users, including the upfront designers. Autodesk's Bob Williams, the company's Algor product manager, says that industrial machinery is the bread and butter of simulation, so it was important to offer solutions to fit all needs.

This is a simulation of general stress on parts during typical operational loading of a conveyor belt (125 lb object). *Image courtesy NEi Software*

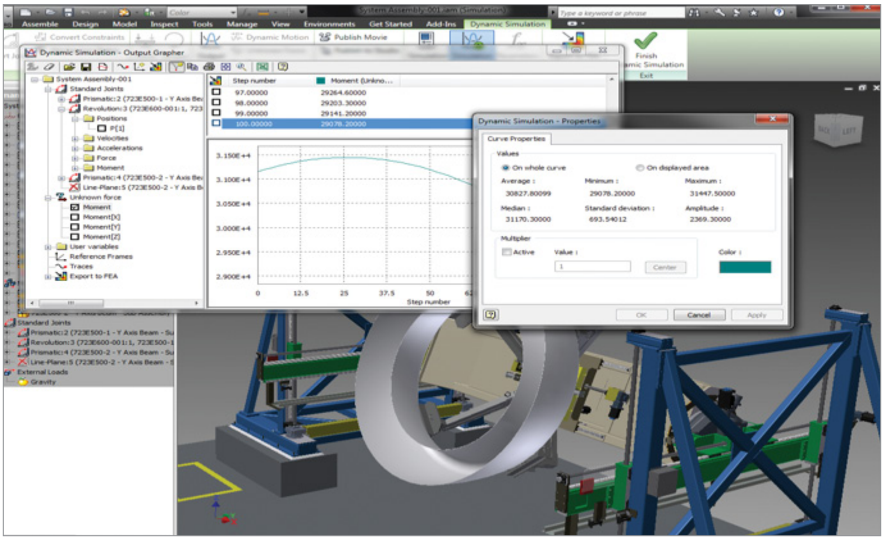


Autodesk's simulation technology is introduced in Inventor, where designers can investigate structural responses, kinematic behavior and basic vibration responses. From there, as needed, users can move up either to Algor CFD for fluid analysis or Algor Mechanical Event Simulation (MES), which includes flexible multi-body analysis and can analyze such details as rubber-gasket functions or long-term fatigue.

Williams sees more non-experts and non-dedicated users involved in simulations, so a number of issues are critical for their success. To handle geometry coming in from different CAD packages, Inventor includes many translators while Algor MES works directly with multiple CAD formats.

Scalability is also important. Williams explains that with some packages, "Jumping from linear static stress and linear vibrations to full-blown motions may only be available through a different interface or workflow. Knowing that you can expand as your needs expand without having to learn a new workflow (or hire new people) —that's what supervisors want to hear to minimize costs."

Lastly, he says, prospective customers should consider ease of use—not just button clicks, but what other resources are available to help you get up and running and be productive. Since the actual simulation technology (i.e., linear static stress) itself is fairly similar between a lot of different tools, these factors become the important differentiators. Autodesk offers its Users Guide, tutorials, and white papers online with no user registration necessary.



The Dynamic Simulation tools included in Autodesk Inventor Professional software were used to study a GEMCOR nacelle system, a fastening system designed for the production of engine nacelle assemblies used in the aerospace industry. In addition to simulating the motion of the fan cowl during manufacturing, the "Unknown Force" functionality was used to determine specifications for the optimal motor size required to operate the system efficiently. *Model courtesy of GEMCOR.*

Software developers at ANSYS draw on their decades of experience to understand what users need today and will want tomorrow. Thierry Marchal, ANSYS' industry lead, says that designers want to move in the direction of simulating assemblies with thousands of parts but to model each part and its interaction with the environment is a complex, long-term project. What is generally done today is to model just the parts that would create bottlenecks in machinery operation, then add more parts as possible.

Beyond simplifying the complexities of the assembly, says Marchal, performing an accurate simulation depends first on making sure there is a good software environment for importing the CAD geometry plus a relatively automatic way to generate a quality mesh for each part. "Make sure that the interaction between the parts (such as) friction and sliding is in the model, then start with a relatively simple model and a simple load, rather than a complex non-linear material or load." He adds that the system and the path of motion are the most important considerations.

Given these starting points, Marchal says users should make sure the software in question can handle any necessary physics (such as the behavior of lubricating oil) as well as assemblies with a great many parts. With recent advances in computing power from such techniques as cloud computing, it would be a shame not to have software that can take advantage of this, both technically and in terms of licensing. Lastly, the package should include data management capabilities that let users get new results from making minor geometric changes without having to rerun a full simulation.

A Classic in the Field

Several years ago, Nastran FEA software from MSC. Software became part of the company's SimXpert integrated simulation environment, handling both multi-body designs and multi-discipline physics for linear and non-linear conditions. SimXpert capabilities that may be relevant to machinery designs include modeling and analysis of gears, bearings, pumps, seals, pneumatics, hydraulics, rotating machinery, and control systems.

A SimXpert analysis can incorporate flexible body representation, contact modeling and vibration and durability studies. Its Workspace structure lets users in different disciplines model and analyze just those parts that are relevant to their problems, and only brings up menus for the chosen task or tasks. For example, the Motion Workspace lets users define the allowable degrees of freedom between moving parts, the contacts between parts, and any forces applied to or between parts. Results are viewable in both chart and animation formats.

The Human Factor

The more flexible the FEA package, the greater the chance that users will have questions regarding specific applications. A fundamental requirement for efficient usage is therefore a fast, friendly, capable customer-support program. Sliding contacts and non-linear materials aside, the real deal-maker may just be the level of personal guidance you can expect from the FEA vendor. Quiz the current customers. Idle machinery loses money, so great support can be the deal maker. ■

*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

> MSC.Software

> NEi Software

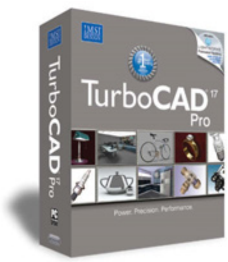
> Siemens PLM Software

> Simulia

EDITOR'S PICK OF THE WEEK SHOWCASE

> CLICK HERE FOR THE FULL WRITE-UP AND PREVIOUS EDITOR'S PICK OF THE WEEK.

TurboCAD® Pro and TurboCAD Pro Platinum



TurboCAD® Pro and TurboCAD Pro Platinum are comprehensive, professional architectural and mechanical CAD applications for drafting, detailing, and modeling. New version 17 offers more robust, powerful tools for greater control and flexibility, updated DWG 2010 compatibility, and takes advantage of GPU-based graphics cards, providing lightning-fast wireframe and 2D displays with performance up to 60x faster. To learn more and see about competitive pricing, visit www.turbocad.com.

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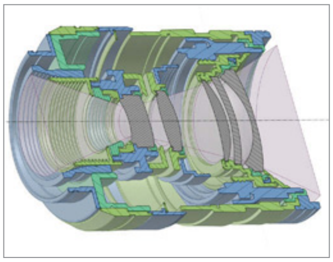

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- Hot Trends in Additive Manufacturing
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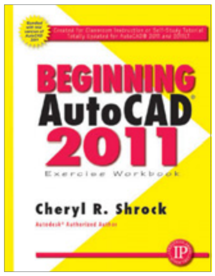

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INUS Releases Inspectworks 2.0 for SolidWorks Users

>**INUS Technology** has announced the release of Inspectworks 2.0, which provides verification tools for the SolidWorks user. InspectWorks 2.0 is an upgrade to the company's SolidWorks plug-in based on Rapidform XOV. Design engineers can use InspectWorks along with a 3D scanner to verify that parts are manufactured to specification from SolidWorks.

Anyone with SolidWorks and the InspectWorks add-in can open a part file and a 3D scan of the object, and see where the part is in or out of tolerance via a deviation color map. If there are dimensions or tolerances defined for the part, InspectWorks also provides measurements and pass/fail results automatically.

InspectWorks 2.0 now includes multi-core processor support on the current Windows operating systems (32 and 64 bit on Windows XP, Vista, and Windows 7).

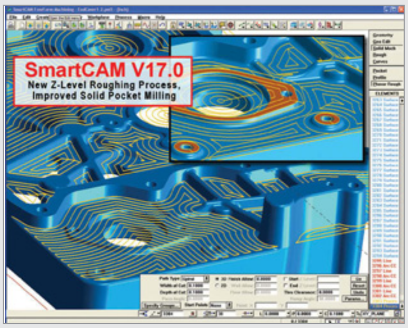
The MathWorks Introduces the Simulink PLC Coder

>**The MathWorks** has announced the Simulink PLC Coder, a new product that generates IEC 61131 structured text for programmable logic controller (PLC) and programmable automation controller (PAC) devices. It enables model-based design for manufacturing and power generation equipment controlled by PLCs and PACs.

With Simulink PLC Coder, engineers can automatically generate code for industrial control systems, including closed-loop and supervisory control applications. Automatic code generation helps eliminate errors associated with traditional

SmartCAMcnc Releases SmartCAM V17

>**SmartCAMcnc** has announced the field test release of SmartCAM V17.0. It features a new Z-level roughing process, enhancements to the solid pocketing process, and core enhancements to the SmartCAM suite of CAM system software.



The SmartCAM product family consists of applications for CNC milling, turning, fabrication, and wire EDM. Version 17.0 continues the solids-machining theme in many recent releases and provides benefits for users working with prismatic and freeform solid models.

The new Z-level rough process incorporates many features found in the solid pocket process introduced in v16, such as critical depth processing and multiple start points. It extends these to allow roughing strategies to be applied to many configurations consisting of cores, cavity, and open pockets, and profiles. It is found in SmartCAM Advanced Milling, Advanced Turning and FreeForm Machining.

Autocad 2011 Designers Can Use NVDIA Quadro Certified Graphics

> **NVIDIA** has announced that NVIDIA Quadro graphics processing units (GPUs) have been certified for AutoCAD 2011.

Autodesk and NVIDIA collectively spend more than 2,000 engineering hours annually certifying Quadro GPUs for AutoCAD, according to NVIDIA. In addition, NVIDIA has invested more than 10 years in application specific optimizations.

"Autodesk certifies and recommends NVIDIA Quadro for use with AutoCAD 2011," says Guri Stark, Autodesk vice president, AutoCAD and Platform Products. "By upgrading to a Quadro, millions of AutoCAD users worldwide can take full advantage of the application's newest 3D features, experience superior image quality, and realize true interactive performance."

Designers running AutoCAD 2011 on Quadro professional GPUs can also realize significant performance increases, according to NVIDIA. AutoCAD benchmarks show Quadro delivering:

- Up to 6x higher performance in '3D Hidden' visual style
- Up to 3x faster interactive manipulation of models in 'Conceptual' visual style
- Up to 2x gains in speed with the 'Realistic' and new 'Shades of Gray' visual styles.

In addition, Quadro users will be able to experience higher image quality using the "Smooth Lines" option (enabled by hardware anti-aliasing) in all of the visual styles in AutoCAD 2011. When zooming, panning, and spinning, Quadro GPUs maintain interactivity and deliver a visually accurate model.

NVIDIA Quadro Graphics received the most visitors for the month of April.

hand coding and reduces overall development and validation time.

Simulink PLC Coder is available immediately. U.S. list prices start at $10,000. For more information, visit mathworks.com/products/sl-plc-coder.

Omega Releases Wireless Communications Publication

>**Omega's** "New Horizons in Wireless Communications" contains 68 full-color pages showcasing the company's top-selling wireless sensors, transmitters and receivers, Ethernet web-based measurement and control devices for monitoring and recording data over the Internet.

Wireless solutions include temperature, pressure, pH, humidity, flow and process apps for test and measurement, automation, and industrial manufacturing.

Top-selling products include the OM-84 series of compact wireless RFID temperature data loggers, the OS530-W9 series of handheld infrared thermometers.

Mentor Graphics Announces FloVENT v8

>**Mentor Graphics Corporation** has announced the release of the FloVENT v8 solution with enhancements in heating, ventilation and air-

conditioning (HVAC) model creation, solution performance, and results visualization. These enhancements enable design engineers of built environments, data centers, and clean rooms to set up build scenarios and analyze them for proper cooling, heating, contamination control, and ventilation.

The FloVENT software is a computational fluid dynamics (CFD) product that predicts 3D airflow, heat transfer, and contamination distribution in buildings of all types and sizes. FloVENT menu system was created for engineers involved in the design and optimization of built environments and HVAC systems.

Third Wave Systems to Release Production Module 5.8

>**Third Wave Systems** will release Production Module version 5.8 in May. Production Module is process-analysis CAE software that integrates

workpiece material properties, CAD/CAM inputs, and machine dynamics to map forces, temperatures, and more.

By displaying results visually, Production Module allows users to better understand the machining process to avoid potential problems and identify opportunities for improvements, according to the company.

Production Module 5.8 3D will include a number of new features, including a new multi-constraint optimization feature, selective force computation, a new air-cut optimization safety check, and performance speedups.

New Magnacad JRIV Packages Released for IronCAD Users

>**Magnacad Design Inc.** (MDI) has released several new JRIV packages to address the needs of engineers, designers, and CAD users in general.

For existing IronCAD users, the JRIV-Express packages do not change current IronCAD Armor Advantage costs and they can upgrade to JRIV at a discount.

The base JRIV packages are using IronCAD as the core foundation. The "LT" versions use INOVATE as the core foundation.

INTEGRATED Engineering Software Launches Version 9.0 of its Simulation Software

>**INTEGRATED Engineering Software** has announced updates across its product range. Version 9.0 includes general enhancements to make the modeling software easier to use, faster and more accurate.

There have been upgrades across the range of INTEGRATED's simulation software in version 9.0. Visualization tools have had enhancements, including a new Predefined Output/Output Manager structure to improve the natural flow of the design/simulation process and enable better management of multiple plots and results generated by transient analysis. INTEGRATED has also enhanced the coils/windings feature in its magnetic programs.

Transient capabilities have been extended to INTEGRATED's 3D programs' electrostatic (COULOMB), eddy current (FARADAY), and heat transfer (CELSIUS) solvers. All packages also include an Enhanced Time Modeler to simulate various types of signals and sources in the time domain.

Hexagon Metrology Releases PC-DMIS 2010

>**Hexagon Metrology** has announced the release of PC-DMIS 2010, the latest version of its CAD-based metrology software. PC-DMIS is developed by Wilcox Associates, a Hexagon Metrology company.

PC-DMIS 2010 is a family of software products covering metrology hardware platforms and solutions sold under the banner of enterprise metrology solutions (EMS). PC-DMIS 2010 rolls out enhanced versions of PC-DMIS CMM, PC-DMIS Portable, and PC-DMIS Vision software. The release also introduces PC-DMIS Planner and DataPage+ suite of products.

The core product of the EMS suite is PC-DMIS CMM, which is used primarily on automated CMMs. A new feature allows users to select animation path lines and insert a safety move or jump to that command location in their part program

PC-DMIS 2010 offers enhanced support for the new Geometric Dimensioning & Tolerancing (GD&T) ANSI Y14.5 2009. New Comment functionality allows users to display pictures, videos, or text to aid operators.

Mellanox Releases 40Gb/s Cable Interconnect Products

>**Mellanox Technologies, Ltd.** has announced the availability of its family of 40Gb/s InfiniBand cable solutions that complements its portfolio of InfiniBand adapter cards and switch systems.

Mellanox 40Gb/s cables exceed the IBTA 1.2.1 and SFF-8436 QSFP connector standards, according to the company. Cables are available in a variety of options to suit the different needs of data centers.

Mellanox has also announced the availability of its IS5000 40Gb/s InfiniBand switch system family and FabricIT management suite. The IS5000 switch system family is designed to enable high-performance computing clusters and data centers to efficiently scale using switch building blocks from 36 to 648 ports in a single enclosure with a latency performance of 100ns. ■

One Size No Longer Fits All in Composites

STEVE LUBY
VISTAGY

When high-performance composites first emerged several decades ago in the aerospace industry, the question was, "Can we make it and, if so, will it break?" But as more industries have adopted composites successfully, the questions have become more sophisticated. Now manufacturers must ask, "Can we increase the manufacturing rate while lowering the weight of the part? Can we use new materials to optimize part performance while reducing costs?"

While the use of composites is growing rapidly, even during the current economic downturn, this growth represents a small percentage of the potential. And it is a fragmented potential because materials and processes; shapes, sizes, and tolerances; part definitions; and outputs are becoming more industry-specific. In fact, composite parts and assemblies can be as different in shape, size, and make up as a two-inch long guiding vane for a jet engine or a 200-foot wind turbine blade. Clearly, one approach no longer fits all.

> It's time to examine the potential for composites in your industry.

While there is overlap in engineering with composite materials among certain industries, the combination of unique business conditions and technical requirements means the optimal strategy and best methodologies will differ and must be taken into account.

Consider that the aerospace industry started with small, non-flight critical composite parts for fighter jets and helicopters, but now uses composites for everything from a commercial airliner's entire wing and fuselage to landing gear struts. This requires figuring out how to integrate the design and manufacture of composites with the complexity of managing the development of the airframe. It also requires consolidating a huge number of parts and assemblies as well as design in an increasingly automated manufacturing process. Further, an airplane can be in use for 30 or 50 years, so the stakeholders must manage repair, maintenance, and upgrade issues.

While composites have been used on racing cars for some time, their adoption by the automotive industry is relatively new. Of course, this brings new challenges such as the need to simulate and

The potential widespread adoption of composites by auto makers is also driven by multiple and conflicting environmental concerns, namely the quest for fuel efficiency and the viability of recycling huge amounts of materials.

pass crash tests in a high-volume production process. Additionally, it is critical that automotive firms use automated manufacturing to achieve optimum cost and rate goals as well as a reliable and repeatable process. The potential widespread adoption of composites by auto makers is also driven by multiple and conflicting environmental concerns, namely the quest for fuel efficiency and the viability of recycling huge amounts of materials.

Efficiency is also a concern in the wind turbine industry where blades are meant to last for 20 to 30 years under all kinds of weather conditions with minimum maintenance efforts and costs. As blade length grows, production efficiency increases. Unfortunately, blade weight grows even faster, and with turbine diameters currently topping out at about 400 feet, minimizing composite blade weight has become critical.

Other industries adopting or increasing use of high-performance composites are the marine, infrastructure, and consumer sectors for a variety of reasons. And while many industries are in the very early stages of using composites, this much is clear: As more designs are undertaken and more engineering software is used to understand these materials, the better the next effort will be. These successes will lead to cross-fertilization between industries and accelerate the continued expansion of composites.

Combine these factors with the availability of new materials, processes, and design and analytical tools, and perhaps it is time to examine the potential for composites in your industry. n

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