DE
Desktop Engineering®
TECHNOLOGY FOR DESIGN ENGINEERING

March 2011 / deskeng.com

PLM for SMBs P. 22

Engineering the 3D-Printed Car P. 34

Visualization's TRUE COLORS

How to defend your finite element stress data results. P. 16

INCORPORATE POWER HARVESTING SENSORS P. 37

KNOWLEDGE-BASED ENGINEERING P. 46

REVIEWS OF DELL AND EUROCOM WORKSTATIONS P. 26

The new technologies in Creo **UNLOCK CREATIVITY!** and promise a new era in CAD. Innovations like AnyRole Apps™ will deliver the right tool for the job. While AnyMode Modeling™ promises the first truly multi-paradigm design system. Advances like these unlock the potential for products. And designers.

creo™
A PTC Product

creo.ptc.com

Where Do I Go for Data Acquisition Products?

omega.com, of Course!

Your single source for process measurement and control products!

Ideal for Monitoring Fluid Level in a Tank or the Status of a Pipeline

Long Range Wireless Remote Switch System Monitor and Control 4 Switches or Valves Up to 8 Miles Away

HPWS Series Starts at $1950

Rugged, Weatherproof NEMA 4X (IP66) Enclosure

Visit omega.com/hpws

FREE! *Dilbert™ CONTROLCAT™ New Horizons® in Temperature, Pressure, Flow and More!*

Visit omega.com to order your FREE copy of Dilbert™ CONTROLCAT™ New Horizons® in Temperature, Pressure, Flow and More! Version No. 28 Featuring 105 DILBERT Cartoons!

Transition Joint Thermocouple Probe Features USB Interface

TJ-USB Series Starts at $95

MADE IN USA

Visit omega.com/tj-usb

Laptop not included.

Multi-Function I/O USB Data Acquisition Modules

Visit omega.com/omb-daq-2416

OMB-DAQ-2416 Series Starts at $1100

Portable Data Loggers with Display, NOMAD®

OM-74 $179

Visit omega.com/om-70_series

Automatic Temperature Alarm Dialer OMEGAPHONE®

OMA-VM500-3 $260

MADE IN USA

Visit omega.com/oma-vm500-3

Portable Handheld Data Logger

OM-DAQPRO Starts at $995

Visit omega.com/om-daqpro-5300

High Temperature Data Logger with USB Interface

OM-EL-USB-1-PRO $150

Visit omega.com/om-el-usb-1-pro

For Sales and Service, Call TOLL FREE

1-888-82-66342®

1-888-TC-OMEGA

VISA MasterCard

Shop Online at

omega.com®

OMEGA

Dilbert © United Feature Syndicate, Inc.

by Steve Robbins

Brewing Up Your Own Automobile

Local Motors' Rally Fighter is an open source production vehicle.

Building and modifying automobiles has been a national pastime since the Duryea brothers set up the first American car manufacturing company. For some, the hobby becomes an obsession. Watch the movie La Mission (lamissionthemovie.com), which is about a group of low-rider enthusiasts whose automotive design creations are really works of art, or check out Houston's Art Car Parade (artcars.com/php/blogs/index.php/ACW2009) to see how far these car enthusiasts can take a project.

For decades, these automotive design projects started with an existing automobile or motorcycle and then, let the modifications begin. What began in the 1940s and '50s as hot rods, jalopies and roadsters, with modified engines and cut up bodies, became dune buggies, muscle cars and low riders of the '60s, '70s and '80s. Our fascination with the automobile has never ended. But our tools have changed.

Innovation Enabled by Technology

In this issue, Susan Smith is covering KOR EcoLogics. Its Urbee is the first vehicle prototype to have its entire body 3D printed. The Urbee gets around 150 mpg. While I don't think I would drive that car down my 3.5-mile dirt road in mud season, I sure wouldn't mind driving the Local Motors Rally Fighter car home.

What a concept Local Motors has: car design by crowdsourcing. You join the membership of Local Motors, then you present your design. The membership consists of people in all walks of life, from car enthusiasts to interested engineers, to people in the automobile industry. You can submit your concepts in 3D CAD models or 2D drawings, or even artistic renderings. With the help of the crowd, your design can be completed. If your concept is voted to one of the top positions, then you can invite a few of your friends over on a weekend and build it — kind of like one of those brew-your-own beer places, except on steroids. Check out the video at local-motors.com/rallyFighter.php. And let's not forget Tesla Motors, the up and coming success in the electric vehicle market. I mean *wow*, who wouldn't want to at least rent one of their roadsters for a week?

DE's Art Director, Darlene Sweeney (left), poses on her 1964 Thunderbird with her friend Debbie Davidson.

Big Ideas Start Small

There are a lot of people who are thinking small when it comes to automotive manufacturing. And I believe this will create some new, innovative designs in the near future. Startup automotive businesses don't have the problems the industry giants have. First, major automotive has to design to sell to the mass market. The design that sells 50,000 units a year would be a flop. Tesla or KOR EcoLogics would be ecstatic with those sales numbers.

Also, with a small automotive startup, the consumer isn't paying for all the overhead major automotive has acquired over the years. Small means designs can be innovative in the extreme. While Local Motors uses readily available parts, from engines to wheels, the vehicle is custom built to a unique design. The frame body and suspension are custom built. But, more importantly, the complete car is built to its purpose.

Will all cars be locally built? I doubt it. But I think this is a great idea and will grow. I also think, with the technology we have now and with future advances, it will make more sense to manufacture some products locally, restoring parts of our manufacturing base.

No, the big auto companies aren't going away, but my bet is on innovation and passion. The day is coming when you will be able to design your own furniture, or cell phone, and have it manufactured for yourself. Anheuser Busch might have laughed at the idea of someone becoming their own brewmaster, but the personal statement your label on a bottle of beer makes has created a booming business.

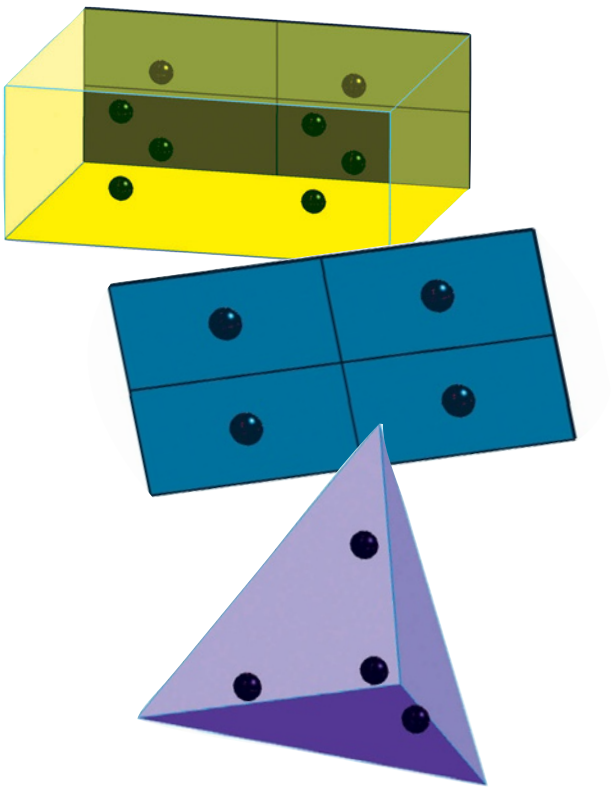
I have an idea what my perfect car might be. Who knows? The old Volvo has 130k on its odometer. DE

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

>> Find out how LabVIEW can make you better at **ni.com/labview/better** **800 453 6202**

NATIONAL INSTRUMENTS™

DE March 2011 VOLUME 16/ISSUE 7



COVER STORY

See Data Analysis' True Colors

ON THE COVER: Stress is never jumpy. It should always vary smoothly, so if your stress results don't appear right, then most likely they are not. *Image courtesy of Predictive Engineering.*

ANALYSIS & SIMULATION

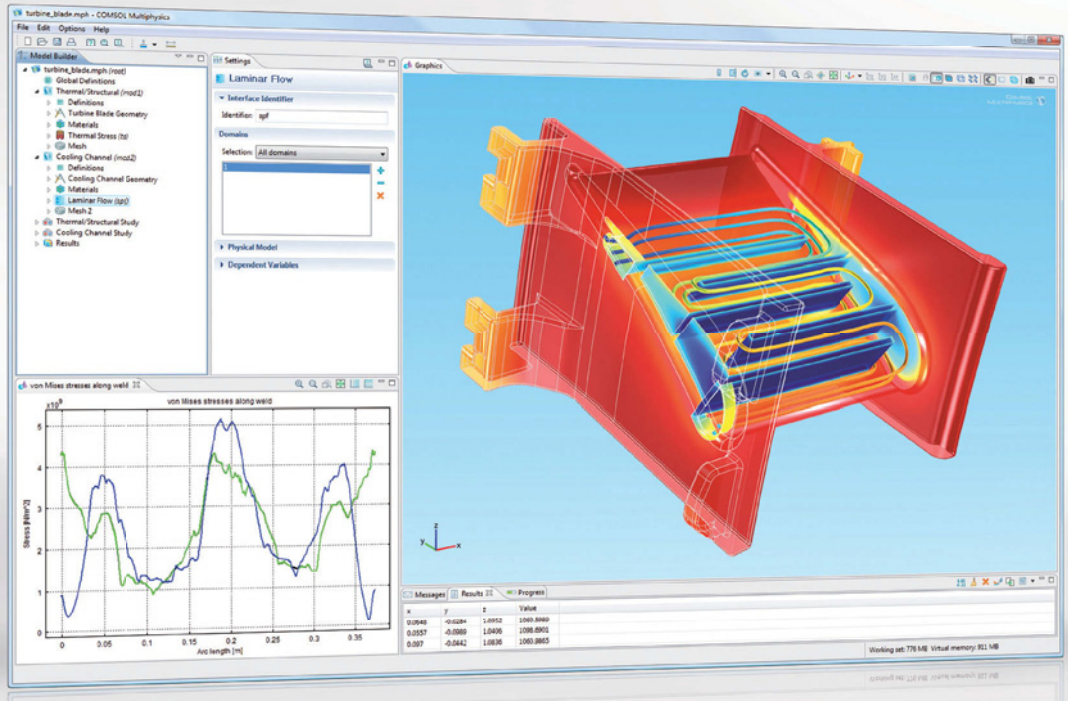
MCAD

HIGH-PERFORMANCE COMPUTING

RAPID TECH

MECHATRONICS

COMSOL MULTIPHYSICS®



A stator blade in the turbine stage of a jet engine is heated by the combustion gases. To prevent the stator from melting, air is passed through a cooling duct in the blade.

Capture the Concept.

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

Watch tutorial

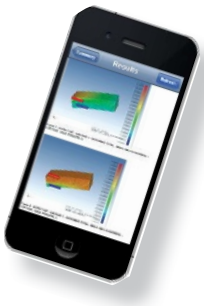
www.comsol.com/showcase

COMSOL

March 2011

VOLUME 16/ISSUE 7

DEPARTMENTS



deskeng.com

VIRTUAL DESKTOP BLOG
Read Kenneth Wong @ deskeng.com/virtual_desktop for a closer look at lifecycle components via articles, podcasts and video reports.

NEWSLETTER REGISTRATION
Newslink; Editor's Pick of the Week; Check It Out; Virtual Desktop; Focus on Analysis and Simulation; Focus on Engineering IT & Computing; Focus on MCAD; and Focus on Rapid Technologies.

DE MOBILE BETA
Check out our mobile app for Android and iOS by visiting wbxapp.com/de-mobile on your mobile device, or scan the QR code to the right.

***DE* EXCHANGE**
Join *DE*'s online community @ DEexchange.com

***DE* ON TWITTER**
Follow us @ DEeditor

LIKE *DE* ON FACEBOOK
Visit *DE* @ deskeng.com/facebook

DE
Desktop Engineering®

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

CONTRIBUTING EDITORS
Mark Clarkson, David S. Cohn, Barbara Goode, Mike Hudspeth, Susan Smith, Peter Varhol, Pamela J. Waterman, Kenneth Wong

PUBLISHER
Thomas Conlon

Advertising Sales
603-563-1631 • Fax 603-563-8192
Jeanne DuVal | Account Manager (x274)

ART & PRODUCTION
Darlene Sweeney | Director (x257)

A LEVEL 5 COMMUNICATIONS PUBLICATION
Steve Robbins | Chief Executive Officer
Thomas Conlon | President

ADVERTISING, BUSINESS, & EDITORIAL OFFICES
***Desktop Engineering*® magazine**
Level 5 Communications, Inc.
1283D Main St., PO Box 1039 • Dublin, NH 03444
603-563-1631 • Fax 603-563-8192
E-mail: DE-Editors@deskeng.com
www.deskeng.com

SUBSCRIBER CUSTOMER SERVICE
***Desktop Engineering*® magazine**
PO Box 677 • Northbrook, IL 60065-0677
847-559-7581 • Fax 847-564-9453
E-mail: den@omeda.com

***Desktop Engineering*®** (ISSN 1085-0422) is published monthly by Level 5 Communications, Inc., 1283D Main Street, P.O. Box 1039, Dublin, NH 03444, 603-563-1631. Periodicals postage paid at Dublin, NH, and at additional mailing offices. Desktop Engineering® is distributed free to qualified U.S. subscribers.

SUBSCRIPTION RATES: for non-qualified; U.S. $108 one year; Canada and Mexico $126 one year; all other countries $195 one year.

LIST RENTALS: For information on list rentals, contact Statlistics, Danbury, CT: 203-778-8700.

POSTMASTER: Send all address changes to ***Desktop Engineering***, P.O. Box 677, Northbrook, IL 60065-0677.

Address all editorial correspondence to the Editor, Desktop Engineering. Opinions expressed by the authors are not necessarily those of *Desktop Engineering*. Unaccepted manuscripts will be returned if accompanied by a self-addressed envelope with sufficient first-class postage. Not responsible for lost manuscripts or photos.

BPA WORLDWIDE

A CAD system that makes innovation easier?

Get inspired. Get NX for design.

Product design organizations face serious challenges: they need to create innovative new products—and get them to market faster than ever before. At the same time, they face constant pressure to take costs out of their development process. NX™ for design from Siemens PLM Software gives your designers everything they need for distinctive styling, design and analysis. The benefits: faster design, greater productivity, and more product innovations. Find out more at **www.siemens.com/nx.**

Answers for industry.

SIEMENS

by Kenneth Wong

Bertrand Sicot To Write a New Chapter in SolidWorks

It was a well-kept secret, revealed with impeccable timing. In early January, SolidWorks announced that Jeff Ray, who has been the company's face and voice since he took over as CEO in July 2007, is stepping aside for a new man, Bertrand Sicot.

The first thing Sicot did as the new chief when he stepped up to the stage at SolidWorks World 2011 (San Antonio, Jan. 23-26) was to put to rest, once and for all, speculations about the future of its desktop CAD software. "It will never be an either/or choice for you," he said. "We will always offer locally installed desktop CAD. In the end, the market will tell us [what it wants] … the market is you."

The comment drew a burst of applause, perhaps prompted by relief as well as delight. Last year, when the company revealed its plans to investigate—and eventually develop—online services and cloud-hosted software, it unintentionally set in motion a series of reactions among some desktop loyalists. SolidWorks subsequently clarified that R&D works in cloud-hosted software didn't mean the end of installed software.

"Now you're probably asking: Is 3D CAD going to become an online application tomorrow? I don't think so. I don't think tomorrow, or anytime soon, you're going to do everything you do in SolidWorks online. I just don't think that's going to happen," said John Hirschtick, the company's co-founder, during a virtual event called SolidWorks Innovation Day 2010. More recently, when Sicot officially took the reins, he wrote in his debut blog post, "We'll have three platforms: desktop, mobile, and online."

His latest public pledge to preserve SolidWorks on desktop, made before the recent assembly at SolidWorks World in San Antonio, was one more in a series of measures the company had taken to stem the tide of anxiety among desktop fans. In other words, a eulogy for the desktop version of SolidWorks is entirely unnecessary; the company isn't planning to kill it any time soon.

Sicot's first challenge may be to secure the trust of some SolidWorks users who are under the impression that a French invasion is imminent. As parent company Dassault Systèmes, headquartered in the Paris suburb Vélizy-Villacoublay, began to show a greater interest in the SolidWorks franchise, some SolidWorks factions voiced concerns that the takeover might change the character of their beloved engineering software. The fact that the new CEO, who succeeded Texas native Ray, happened to be French was bound to raise more red flags.

Longtime SolidWorks executive Bertrand Sicot took over the role of CEO in January.

But the truth is, Sicot wasn't a hand-picked Dassault Systèmes insider. He was originally hired by SolidWorks, one of a handful of Europeans recruited by the company's founders in 1997. In other words, Sicot, like early adopters of SolidWorks, took a chance on a fledgling American CAD company with his career. He is a SolidWorks loyalist. This revelation hopefully stops conspiracy theorists preparing to resist the advances of Napoleon's Grand Army. DE

INFO → Dassault Systèmes: SolidWorks.com

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

Mini-PDM for the Smallest Teams

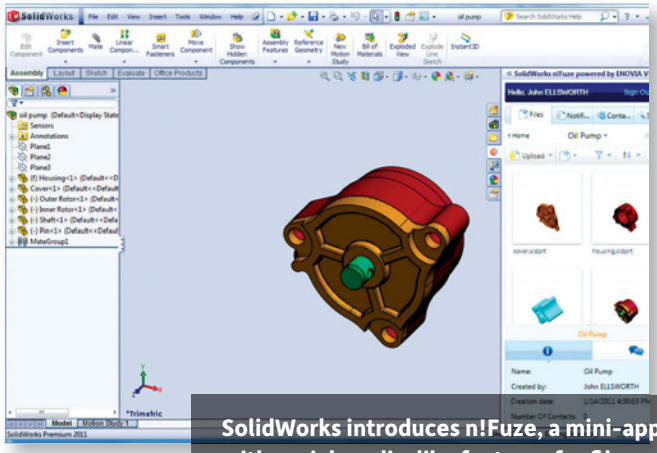
Until recently, SolidWorks' data-management offerings had two flavors: SolidWorks Workgroup product data management (PDM), for small teams and SolidWorks Enterprise PDM, for company-wide adoption. They're both on-premise (or installed) bundles.

In January, at SolidWorks World 2011, the company revealed the third addition to the family, to be deployed online. Its original name, as conceived and announced a year ago at SolidWorks World 2010, was SolidWorks Product Data Sharing. It was later renamed SolidWorks Connect. Eventually, it settled on n!Fuze.

The lowercase n followed by an exclamation point "is a way to say 'mini,'" said Bernard Charles, CEO of SolidWorks' parent company, Dassault Systèmes. It also suggests web-enabled architecture. Charles said: "We want to use n to express that there is something specific to a product—it's just online."

The official description, as it appears in SolidWorks Blog, states, "It's an improvement on traditional approaches for sharing files, such as email and FTP sites, because it integrates with your design tools to facilitate the way you work, uses familiar social networking concepts to engage with others, and avoids costly IT infrastructure and administration. It's also quick and easy to get started with, simple to use, and accessible from anywhere."

n!Fuze will most likely be licensed as a subscription, suitable for as small a team as two, with real-time chat and visualization features. It's currently in closed beta, so you may not be able to download and try it out yet (unless you're one of the invited beta testers). Once installed, it shows up as a tab in your SolidWorks pane. The n!Fuze window gives you the ability to upload a file to a remote server, create a personal workspace, invite others to share the space with you, and make comments on files.



SolidWorks introduces n!Fuze, a mini-app with social media-like features for file sharing, chat, comment and collaboration.

In addition to the desktop client, you can also access n!Fuze features from a smart phone or an iPad. (If you can imagine a CAD plug-in that resembles an instant messenger window with social functions, linked to a web-based FTP system, you get some idea how n!Fuze works.)

For what it's worth, the product is powered by Dassault Systèmes' ENOVIA V6, but its interface and architecture are targeted at teams and organizations that are much smaller than typical ENOVIA buyers, so you would hardly recognize its ENOVIA roots in n!Fuze.

So, is it a product lifecycle management (PLM) system for SolidWorks users, just as ENOVIA is the recommended PLM system for CATIA users?

"I think we can bring new functions to SolidWorks users without scaring them with big acronyms," observed Charles. "What we have to avoid is offering something too complex to someone who wants something simple."

For more, read "In Search of Plug-and-Play PLM" on page 22. DE

INFO → Dassault Systèmes: 3DS.com

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

by Kenneth Wong

Altair Snatched Up ACUSIM to Fill CFD Void

Mike Kidder, vice president of marketing at Altair Engineering, recently described computational fluid dynamics (CFD) as "the one component that has been missing" in the company's technology portfolio.

"We've been kind of on the lookout for a really high-end technology for a CFD solution," he said.

Altair has tried its hand at developing a CFD solver in-house, but ultimately, Kidder said, "acquisition made more sense than development." Altair found what it wanted in ACUSIM, based in Mountain View, CA. Founded by Dr. Farzin Shakib, ACUSIM is best known for its CFD solver named AcuSolve.

Shakib has 26 years of CFD software development experience under his belt, along with a few years of work at NASA Ames Research Center in Mountain View. AcuSolve's customer list includes Bechtel, Chevron, John Deere, Procter & Gamble, Toyota and Whirlpool.

Early this year, Altair snatched up ACUSIM.

"I think it was the right partner, the right technology, and the right time to do it," noted Kidder. Altair's culture, he said, "is all technologists, from the CEO down." And in ACUSIM's corporate makeup, Kidder saw a firm "very reminiscent of Altair's culture when we were that size."

Shakib agrees.

"The acquisition by Altair is a perfect complement to our CFD product offerings and vision," he said. "Altair's strength as a leader in pre- and post-processing CAE solvers and optimization technologies opens new opportunities to apply AcuSolve to a broader class of problems and markets."

So what's to become of ACUSIM? As a company, it becomes part of Altair, but the brand, Kidder acknowledged, "is highly regarded among its client base, and quite honestly [it's] a very strong brand in the CFD community. So the brands [AcuSolve and AcuConsole] will remain as part of Altair's HyperWorks Suite." AcuSolve and AcuConsole were added to Altair's HyperWorks lineup in May 2009 through a partnership.

ACUSIM, a CFD technology developer, filled the void for Altair Engineering's product portfolio.

Altair plans to deliver ACUSIM products on Altair's HyperWorks simulation platform, a unit-based licensing model. Explaining the model, Altair states, "HyperWorks users can run multiple applications for a flat rate, rather than paying for each license in use. HyperWorks also provides access at no extra cost to other Altair products."

Kidder said the primary reason for the acquisition was Altair's focus on multi-physics simulation, adding "We're going to heavily integrate [ACUSIM products] into our multi-body dynamics, into our RADIOSS structure solvers, as well as our optimization technology." DE

INFO ➜ **ACUSIM Software:** Acusim.com

➜ **Altair Engineering:** Altair.com

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

WEBINAR, MARCH 16, 2011: HOW MERCURY MARINE USES TEAMCENTER AS ITS ENGINE OF CHANGE

From adding a new robot in the manufacturing floor to correcting a typo in an engineering drawing; from new suppliers to new machine-control programs, Mercury Marine uses Siemens PLM Software's Teamcenter to monitor all classes of change and ensure that its business divisions are working on a single source of product data. Similarly, the company uses Teamcenter to encourage part reuse, preventing designers and engineers from spending unnecessary efforts recreating common engine components. The results of this disciplined approach can be seen in Mercury Marine Outboards, known for reliability, fuel efficiency, and performance.

On March 16, in a webinar hosted by *DE* contributing editor and MCAD blogger Kenneth Wong, Mercury Marine will explain how it:

- transforms many home-grown engineering change management systems into a single global engineering change system; and
- increases part reuse.

To join, register at goo.gl/w1foS.

Rock-Solid Innovation.

Get the Workstation Advantage

The Intel® Xeon® processor-based workstation family delivers rock-solid dependable performance for entry, essential, and expert workbench needs:

- **Reliability –** Workstations let you know your time investment in design will not be met with a blue screen.
- **Stability –** Workstations are certified for select software applications, and validated to ensure they deliver the optimum experience you need.
- **Performance –** Workstations deliver the performance you demand to get the job done, whether you need fast rendering, processing power for compute-intense applications, or memory capacity for large workloads.

Matching Your Needs to the Right Workstation

	ENTRY WORKSTATION Intel® Xeon® Processor 3400 Series	ESSENTIAL WORKSTATION Intel® Xeon® Processor 3600 Series	EXPERT WORKBENCH Intel® Xeon® Processor 5600 Series
Key Features	Integrated graphics for optimum performance and energy-efficient solutions. Support for ECC memory.	Increased compute, ECC memory, and system bandwidth capacity to support larger models.	The maximum compute and ECC memory, capacity you need for high-speed digital prototyping, simulation, and rendering.
3D CAD only	●	●●	●●
3D CAD + Rendering	○	●	●●
3D CAD + Rendering & Simulation	○	○	●●

●● Performance headroom for growth and innovation ● Ideal system ○ Not recommended

Get the Intel® Xeon® processor-based workstation advantage today.
For more information, visit **intel.com/go/workstation**

by Kenneth Wong

SketchBook O, Made for Oprah Winfrey

You don't normally expect an Autodesk design product to be part of a fashion and lifestyle magazine featuring beauty tips and celebrity interviews. But thanks to talkshow diva Oprah Winfrey, Autodesk's lines and arcs met the circle of *O*, the magazine co-published by Winfrey's Harpo Print, LLC.

Autodesk and Winfrey's publication staff teamed up to develop SketchBook O, especially developed for the Creativity Challenge. It appeared in February issue of *O*. Led by writer and filmmaker Miranda July, the challenge encourages readers to express themselves in a series of exercises. If you want to take up the "Draw Their Hair" challenge, for example, you may "think about the people who stirred you up last year—the ones who enraged you, made you feel lustful, brought out your tenderness, and so on. Now think of their hair. Using the SketchBook O app or a piece of white paper, draw just the hair of each of these people. Draw carefully, using a picture as a reference if you have one, and notice the details."

SketchBook O is free. At the end of the magazine's challenge (March 11, 2011), you can no longer submit drawings to Oprah's site, but the drawing tools continue to work. Autodesk also plans to release an update to turn SketchBook O into SketchBook Express, also free.

SketchBook Mobile, another app from Autodesk, costs $2.99—a negligible price tag compared to the cost of other Autodesk software titles. Nevertheless, the success of this easy-to-learn, consumer-friendly app for iPad and iPhone is "beyond our wildest dream," according to Autodesk Labs' vice president, Brian Matthews.

Autodesk and Oprah Winfrey's *O* magazine teamed up to create SketchBook O, a version of SketchBook Mobile for the creativity challenge in February 2011 issue of *O*.

Sales of SketchBook Mobile and other lightweight apps from the iTunes app store (such as AutoCAD WS and Inventor Publisher Mobile Viewer) may account for just a small fraction of Autodesk's profit margin. At least for the foreseeable future, professional design software suites remain Autodesk's core business. But the popularity of its mobile apps gives the company a foothold in the consumer market and Mac community, both fresh markets for the CAD giant. DE

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

INFO ➜ **Autodesk:** USA.Autodesk.com

➜ ***O*, The Oprah Magazine:** Oprah.com/omagazine.html

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

Considering uPrint?

Consider this...

Objet24 Personal 3D Printer

Objet24 Personal 3D Printer **for only $19,900*!**

- **True-to-life models that perfectly match your design**
- **Fine details with spot-on accuracy**
- **Ideal for office and desktop**

OBJET

Go Ahead. Print Reality.

*International pricing may vary. Price excludes VAT, options, installation, shipping, local taxes and duties.

1-877-489 9449
info@objet.com
www.objet.com

New Efficiency Mandates for Motors

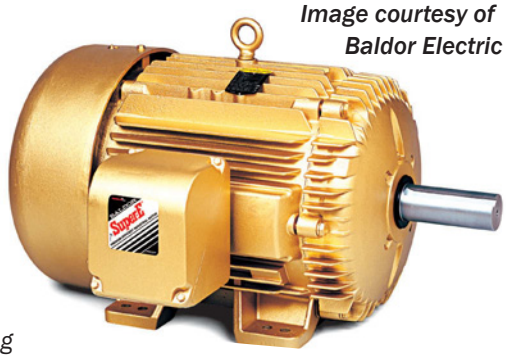


Image courtesy of Baldor Electric Co.

Design engineers who specify motors need to be aware of mandated energy efficiency standards that the federal Energy Independence and Security Act (EISA) put into effect in December 2010. The information below is courtesy of Baldor Electric Co., a manufacturer of electric motors, mechanical power transmission products, drives and generators.

Q. What is EISA?

A. *The Energy Independence and Security Act of 2007 (EISA) was passed by Congress and signed into law on Dec. 19, 2007. EISA builds upon the previous EPAct (Energy Policy Act of 1992) updating mandated efficiency standards for general purpose, three-phase AC industrial motors from 1 to 500 horsepower (HP) which are manufactured for sale in the United States. The U.S. Department of Energy (DOE) is responsible for establishing the rules to implement and enforce EISA.*

Q. When is the effective date for EISA?

A. *EISA applies to motors manufactured after Dec. 19, 2010. The Canadian version was scheduled to begin Jan. 1, 2011, but has not been signed yet.*

Q. What are the efficiency standards under EISA?

A. *For each general-purpose rating (Subtype I) from 1 to 200 HP that was previously covered by the EPAct, the law specifies a nominal full-load efficiency level based on NEMA Premium efficiency. All 230 or 460 volt (and 575 volts for Canada) motors currently under the EPAct, manufactured after Dec. 19, 2010, must meet or exceed this efficiency level. General Purpose Electric Motors (Subtype II) not previously covered by the EPAct will be required to comply with Energy Efficient efficiencies (NEMA MG1, table 12-11). The term 'general purpose electric motor (Subtype II)' means motors incorporating the design elements of a general purpose electric motor (subtype I) that are configured as one of the following:*

- *U-Frame motor*
- *Design C motor*
- *Close-coupled pump motor*
- *Footless motor*
- *Vertical solid shaft normal thrust motor (as tested in a horizontal configuration)*
- *An 8-pole motor (900 rpm)*
- *A poly-phase motor with voltage of not more than 600 volts (other than 230 or 460 volts*
- *Fire pump motors 1-200 HP*
- *201 – 500 HP motors not previously covered by the EPAct will be required to comply with Energy Efficient efficiencies as defined by NEMA MG 1, table 12-11.*

Q. Are fractional HP and 48 or 56 frame motors included in EISA?

A. *Only 1 to 500 HP motors with three-digit frame NEMA numbers (143T-up) are included in EISA. This also includes equivalent IEC frame designations (IEC 90 frame-up excluding 100 frame).*

Q. What motors aren't covered by EISA?

A. *The following motors are not covered:*

- *Design D with high slip*
- *Adjustable speed with optimized windings*
- *Customized OEM mounting*
- *Intermittent duty*
- *Integral with gearing or brake where motor cannot be used separately*
- *Submersible motors*
- *Single Phase motors*
- *DC motors*
- *Two-digit frames (48-56)*
- *Multi-speed motors*
- *Medium voltage motors*
- *TENV and TEAO enclosures*

Q. Does EISA apply to every three-phase electric motor from 1 to 500 HP?

A. *Not every configuration, but almost all motors except some special OEM designs with proprietary mounting configurations. The following configurations are exempt from EISA:*

- *Integral gearmotors*
- *Integral brake motors*
- *Inverter duty motors with windings optimized for ASD use that cannot be line-started*
- *Design D high-slip motors*

Q. Does EISA apply to both stock and custom motors?

A. *Yes. The determining factor under EISA is whether a particular motor meets the law's definition of "electric motor." Stock and custom motors should be treated the same and follow EISA guidelines.*

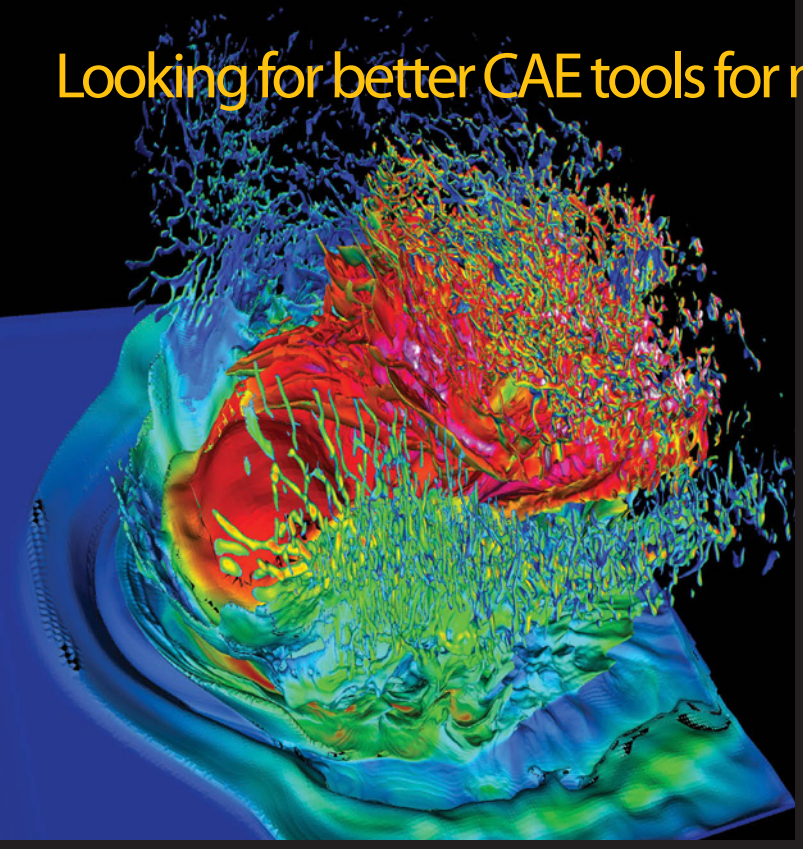
Q. Does EISA apply to motors manufactured outside of the United States and imported for use?

A. Yes. The requirements of EISA include imported electric motors. This also includes the electric motors "as a component of another piece of equipment".

Q. How about electric motors for export outside of the United States?

A. *EISA does not apply to motors exported outside the United States, including motors mounted on equipment. The DOE will require these motors or their boxes to be specifically marked "Intended for Export."* DE

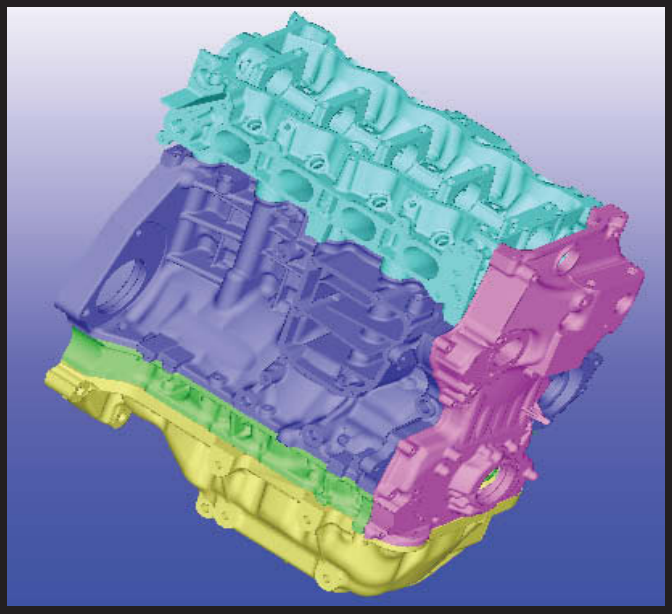
Looking for better CAE tools for meshing and visualization?



TSV-Pre

Powerful FEA Preprocessing

Fast and Robust Assembly Meshing
5 Million DOF Engine Model in < 2 hours

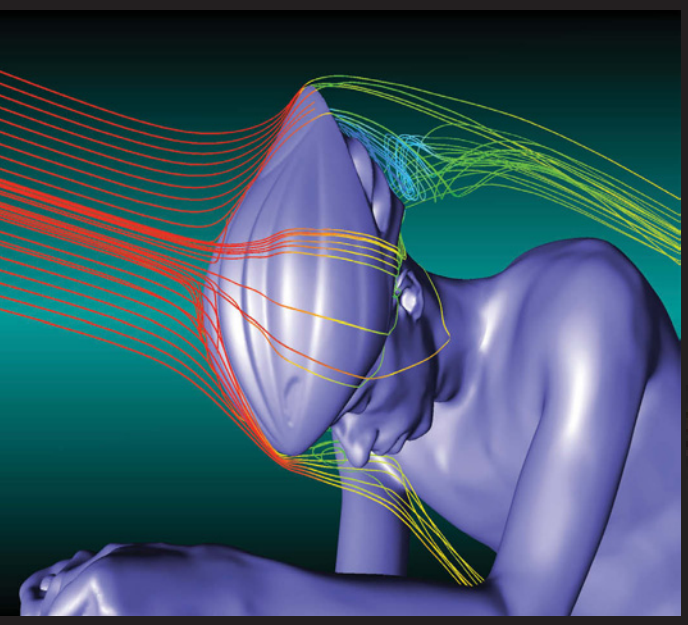


EnSight

Multiphysics Post-processor

EnSight CFD

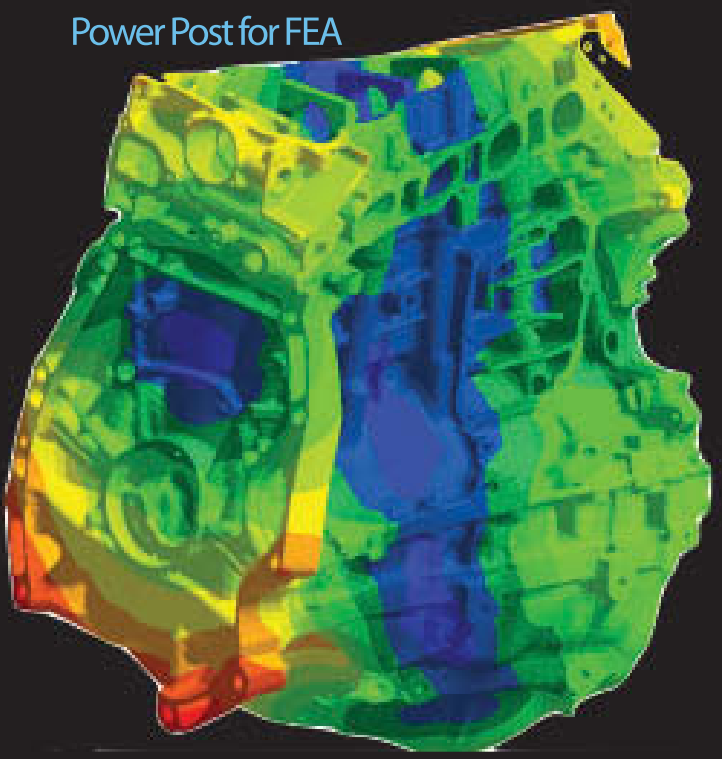
CFD Post -processing



Free Version Available

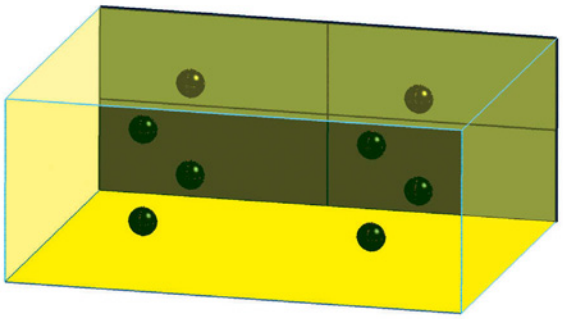
TSV-Post

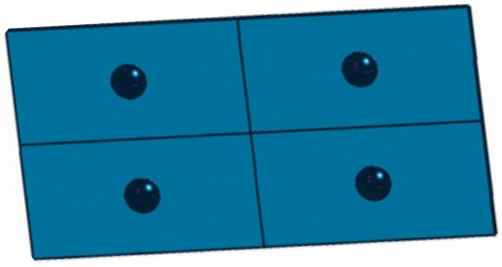
Power Post for FEA



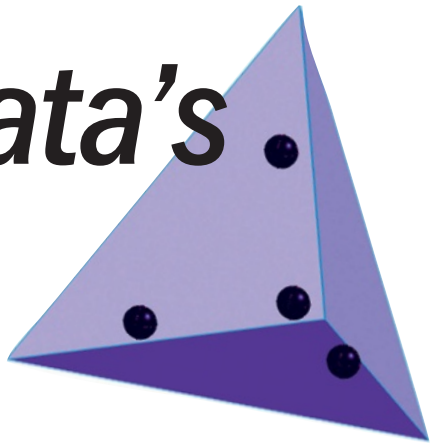
Visualize, Plot, Report, and Export to 3D

www.ceisoftware.com





See Analysis Data's True Colors



Why you don't always get what you want—and how to get what you need.

BY GEORGE LAIRD AND PAMELA J. WATERMAN

FIGURE 1: Gaussian integration points are shown for common finite element shapes: plate, brick and tetrahedral. *Images courtesy of Predictive Engineering*

"Whenever you see a stress contour plot, just assume that it is wrong," says Mark Sherman, head of the Femap Development Team for Siemens PLM Software Solutions. Although Sherman's comment sounds a bit dramatic, it's par for the course in computer modeling, where a common saying is "garbage in, gospel out (GIGO)." The questions that these comments raise are simple to pose, but are somewhat vexing to answer, even for the specialists.

How does a user quickly check finite element (FE) stress data validity or accuracy? How can one astutely defend these colorful, high-resolution results against the casual interloper who is throwing darts? Is the data gospel or garbage? This article will give you the background and ammunition to defend your results.

How Stresses are Calculated in FEA

Let's look behind the scenes at the general approach to FE analysis. Once you have prepped and launched your FE model, the software analysis engine kicks into action, taking each element and breaking it down into a series of simple stiffness equations. Whether linear or non-linear, the equations are assembled into a massive matrix, solved by one of several intensely mathematical methods and evaluated for the given constraints and loads.

With a quick menu-click and perhaps some rotations, you have a colored contour graph showing … *what exactly?*

Time to back up. What is glossed over in most explanations is how the analysis engine generates stiffness equations from oddly shaped elements defined in two or three dimensions. It is an amazingly beautiful process of simplification done over several stages.

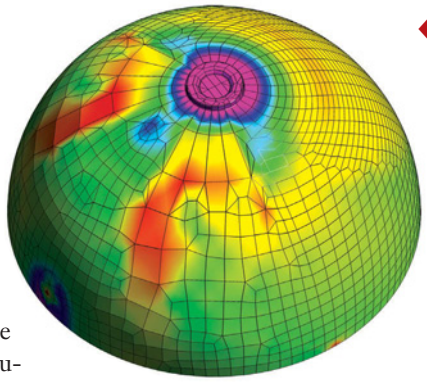
First, each element is broken down into quadrants. A weighting formula is used to calculate the approximate volume of each element using simple polynomials. Known as Gaussian integration, this step is the cornerstone of all FEA technology. Without this simplification, FEA would not exist.

Second, the software generates stiffness equations and the analysis engine applies the given constraints and loads. Then, the engine calculates all of the displacements at the element's corner points or nodes, leading to the next question: How does it generate stresses from displacements away from the element's corners?

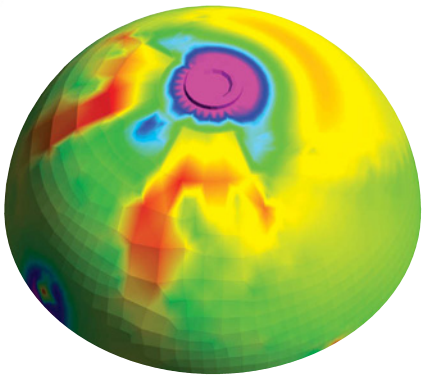
The answer lies in another great trick of the FEA process. Theoreticians have determined that the best place to calculate stresses in finite elements lies at the Gaussian integration points (the center of the quadrants). The software then takes these displacements and uses Gaussian integration to calculate first the strain and then stress within each "Gaussian volume." Most finite elements are analyzed using four Gaussian integration points, and thus the analysis engine generates stresses at four discrete

points within the element. (See Figure 1.)

But how do these Gaussian integration points relate to what we see on our real-world contour plots? Because most users have no use for raw element data, one final processing step is done. Values for the Gaussian point stresses are interpolated into the element's center, and also extrapolated out to the corner points or nodal points. At this stage, the analysis engine has done its work—and the visualization process starts.



← **FIGURE 2A: Stress is never jumpy. It should always vary smoothly, so if your stress results don't appear right, then most likely they are not. Here, warning lights should come on when you see the "spots" of high stress repeatedly popping up along the curved edge of this part.**



→ **FIGURE 2B: These stress results are 20% higher than those in Figure 2a. The values reflect smooth transitions across the geometry. Visual inspection will tell you that the higher stresses reflect results much closer to reality.**

De-bugging Jagged Stress Contours

You are more knowledgeable now than many stress analysts about how element stresses are computed, but what exactly are you seeing? These millions of extrapolated points have been loaded into the software's graphic display system and presented as a dazzling, yet smoothed spectrum of colors. Smoothed is a key word here.

In the default mode, FEA programs average the corner point stresses from each element and only present the averaged value to the user. This little smoothing technique has its good and bad points. Overall, it is a good thing because it smoothes out the stresses into a cleaner pattern. Numerically, this process adjusts for the non-physical variations in stresses that stem from minor variations in the element's shape.

Because physical stress is not a step-function (it wants to flow smoothly), numerically smoothed results display the more accurate solution. If they don't, you should definitely worry! This is the garbage part. Alarm bells should ring, which brings us to the task of developing your FEA eyes.

When contours look jagged, with lots of red spots (see Figure 2a) or have extremely irregular shapes, three causes are likely:

- poorly applied loads and constraints (likely);
- complicated or bad CAD geometry (tricky); or
- poor mesh quality. (See "Judging Good and Bad FE Shapes" to the right.)

Because we are using finite elements to approximate a continuum, sometimes it's best just to accept a few discrepancies when they can be easily explained as a reality of the modeling process. For example, one could quote Saint-Venant's principle and say that stress and displacement contours away from load application points, and do not depend on how the load was applied (concentrated or distributed) because forces and moments are always conserved. In other words, if the region of interest is far away from the load application point, you can ignore the less-than-smooth stresses around the load and constraint points.

From a geometric point of view, designers hand over CAD files that include every manufacturing detail down to 0.005-in. sharp edge-breaks or small diameter oil-feed passageways. Typically, we can (and should) ignore these small regions by invoking another useful relationship from Jean Claude Barré Saint-Venant. (See "Saint-Venant's Principle of Decreasing Load Effects," page 18.) He discovered that small features only create localized disturbances in the stress field. The extent of this disturbance is no more than three times the characteristic dimension of this small feature. For example, for holes of radius R, this size is 3*R. Thus, if your objective is to determine the overall stress of the structure, localized excursions in the stress field will not affect your final answer. This can be

Judging Good and Bad FE Shapes

Gaussian integration is an exact method only for elements that have near-perfect shapes—side-to-side ratios of 1x1 for plates or 1x1x1 for solids (bricks and tetrahedrals, for example). Once the element shape starts to degrade, so does the quality of your results.

A standard rule of thumb is that the element shape should be "pleasing to the eye" and maintain this regularity across the model. Although it's a subjective approach, if the mesh appears to be close to having 1x1x1 proportions, you are good to go.

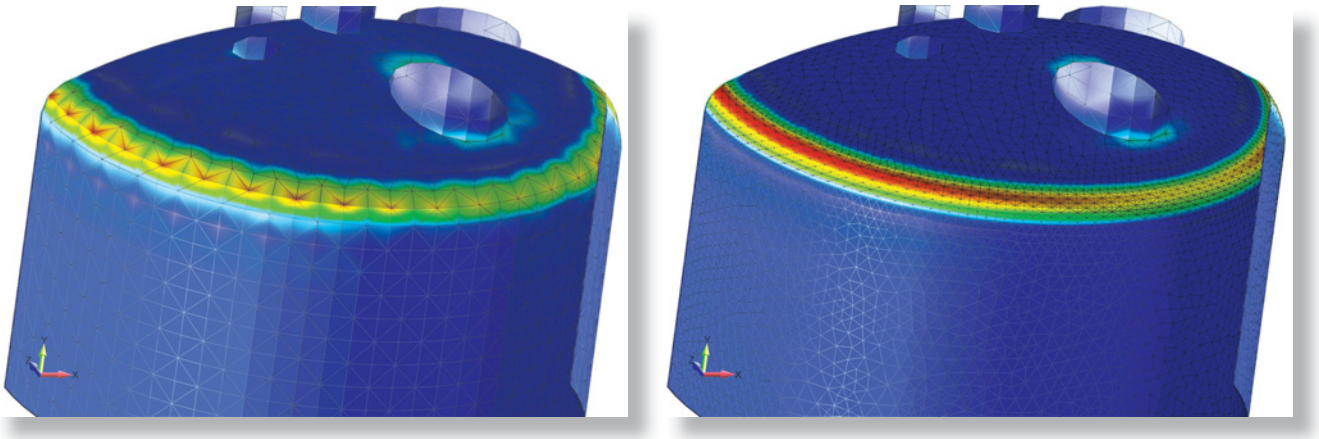


FIGURE 3A (LEFT): A poor meshing job. Judging good and bad elements is as easy as looking at the mesh. If areas of the mesh look angular, sharp and irregular, then most likely your stress results will be inaccurate. This part is a completely symmetric hemisphere (with the addition of one small hole at the lower left). The mesh should be virtually uniform across the part—but clearly is not, nor are the resulting stresses. The problem comes from an artifact of the meshing algorithm, and can be solved by dividing the part into subsections before meshing.

FIGURE 3B (RIGHT): Another trick to help you identify bogus meshing regions is that you should be able to turn off the mesh outline and not tell where the elements start or stop. See the pronounced variations in stress levels on the left side of this same hemispherical part, in spite of the part's physical symmetry.

easily proved by running two analyses on a part, both with and without a few holes and verifying that the results will be essentially identical.

If the small features are truly relevant and cannot be simplified away, then you will have to set the mesh density to be increased so that the resulting stress field looks smooth and realistic. (See Figure 2b.) Your existing software may handle this with no problems, or you may find you need to divide the geometry into subsections for the mesher to properly deal with the peculiarities of your part. (See Figures 3a and 3b.)

Saint-Venant's Principle of Decreasing Load Effects

In 1855, French elasticity theorist Jean Claude Barré de Saint-Venant concluded that mechanical load effects on a body rapidly diminish as you go away from the point of application—at distances that are large compared to the dimensions of the part. In 1945, Richard Edler von Mises put a mathematical description to this effect using partial differential equations.

The principle allows FE algorithms to replace complicated stress distributions with simpler ones as long as the boundaries are small. You can compare this situation to electrostatic field effects, where the field decays as 1/(ri+2), where i relates to the number of poles.

Interpreting Stress Results

One more back-to-basics reminder: Stress is force divided by area. This basic tenet of stress analysis sounds simplistic, but it's extremely useful. For example, if you have two bars with the same cross-sectional area—one aluminum and the other steel—and the same force is applied to each bar, then each bar will undergo the same stress. In the age before computers, this is why stress guys could build scale models of complicated structures in plastic and get useful information.

In other words, if you are applying force or pressure to a structure, the resultant stress will only be a function of the geometry of the structure and not its material. One can then do material selection on the fly, since the model's maximum stress value is valid whether the material is plastic, aluminum or steel. The only thing that would change is the deflection of the structure, which scales with the elastic modulus.

A common occurrence in the interpretation of stress results is when the model returns a very high stress value—say, 500 megapascals (MPa)—when the user knows that the material of choice for this structure (low-grade steel, for example) has an actual yield stress of 300 MPa.

How does this happen? Because the FE calculation is linear, it has no idea that the material would plastically deform or break above the material's yield stress; it just makes the calculation based on the load and the geometry. This is where the user must interpret the result. Perhaps the load is unrealistically high and in reality, the load is half this value.

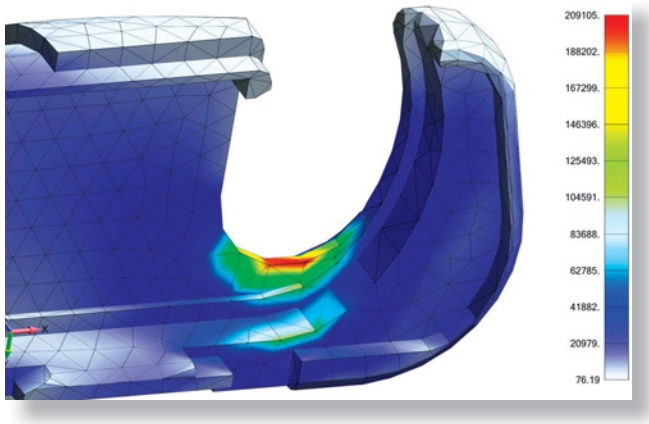


FIGURE 4: Sometimes, results seem to make no sense but are good enough if interpreted correctly. This surgical anvil has a yield strength of around 100,000 psi. With a calculated stress of more than 200,000 psi, the part has already broken. This shows the power of visualization knowledge—you know when "good enough is good enough," and remeshing would be just a waste of time.

In this case, because the stress results are linear, they would scale with the load. The stress result should be 250 MPa and the structure would survive. (See Figure 4.)

Visualizing Beyond FEA

Many other analysis techniques (computational fluid dynamics, for example) use finite element grids to lay down spatial domains. In all cases, the numerical solver is trying to capture a smoothly varying field, whether fluid velocity or electromagnetism, and if the grids are smoothly arrayed, then a better solution will naturally result. The human eye is a powerful tool for recognizing regularity, since non-regularity can often indicate danger or a predator lurking in the grass. In short, keep your grids smooth and regular, let your eyes be a critical judge, and you'll be far safer in your numerical analysis work. DE

George Laird, *Ph.D., P.E. is a mechanical engineer with Predictive Engineering and can be reached at FEA@PredictiveEngineering.com. Contributing Editor Pamela Waterman, DE's simulation expert, is an electrical engineer and freelance technical writer based in Arizona. You can send her e-mail to DE-Editors@deskeng.com.*

INFO ➜ Predictive Engineering: PredictiveEngineering.com
➜ Siemens: Femap.com

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

Imagine This

LMS introduces Revision 10 of LMS Imagine.Lab AMESim.

BY VINCE ADAMS

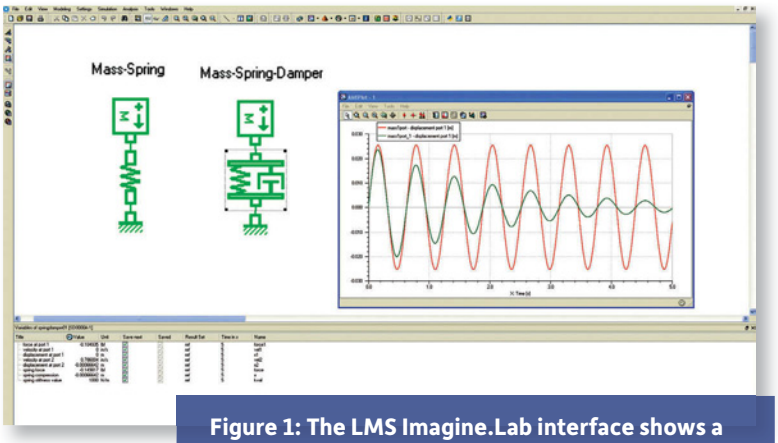


Figure 1: The LMS Imagine.Lab interface shows a simple mechanical model and overlayed responses.

While system simulation tools have been available to the engineering community for more than 25 years, general engineering awareness and usage has lagged behind the more popular finite-element-based simulation technologies. This "one dimensional" world, or 1D simulation, so termed because of the flow chart or path-dependent nature of the interface logic, was relegated primarily to researchers or specialists.

In its most basic form, equation blocks, or components, are graphically connected with varying degrees of logic to convert one form of input, typically a form of energy in a mechanical system, to another or a more problem-specific output. In the example shown in Figure 1, an initial displacement is imposed on otherwise equivalent mass-spring and mass-spring-damper systems to plot decay and, potentially, to optimize for critical damping.

This seemingly trivial example still highlights the key components of a 1D simulation. Components ground, spring, damper and mass are physically attached to one another. Component parameters mass, spring stiffness and damping are assigned to each component. An input signal or initial state is defined, and the simulation is run for a specified "model time." A problem of this size can be computed in several seconds of model time, which translates to a fraction of a CPU second. More complicated models still typically run in seconds to minutes—a small fraction of the computation time required by a finite element-based equivalent.

Today's Technology

LMS Imagine.Lab AMESim, first released in 1995, is a multi-domain system simulation environment for industries as diverse as hybrid vehicles, internal combustion engines, hydraulic valves, pneumatic tools and lawn care products, to name a few. Revision 10 was released in November 2010. LMS Imagine.Lab uses a graphically intuitive interface of more than 3,500 pre-defined components from 30 libraries. These libraries include mechanical and control entities, engine and powertrain components for vehicle development, hydraulic and pneumatic components, and refrigerant HVAC-based components. A system model can include any component from any library for multi-domain simulation.

A more advanced example, shown in Figure 2, models all the energy use in an automobile. It includes hydraulics for steering and braking, passenger air conditioning systems, engine performance and cooling, as well as wind resistance over a variety of representative drive cycles. The potential for exploration and optimization, using one of several built-in optimization algorithms, are nearly endless.

The term "system modeling" may also be a little restrictive for this product. For example, a hydraulic valve or a pneumatic tool—components in a macro sense—also represent systems of springs, masses, orifices, impellers and slides that can be simulated within LMS Imagine.Lab. A unique feature of the product is the ability to develop models with scalable levels of fidelity or resolution so that an engineer can focus his or her time on the most critical design aspects.

In the example shown in Figure 3, a hydraulic component manufacturer might lay out a network for a skid steer or excavator using a simple model (termed "functional model") of a limit valve to formulate a design envelope.

When the valve requirements are known in the context of the total system performance, a more detailed component model (termed "Technological model" in the figure) can be substituted for further development. System masses, orifice size and spring stiffnesses that produce the transient response called for in the system model can be synthesized in LMS Imagine.Lab. A component designed outside the full system, or under the assumption that a static configuration would suffice, could lead to erroneous conclusions or last-minute redesigns.

New Updates

LMS Imagine.Lab is designed as a platform for innovation-centric workflows. With more than 3,500 components available to users, model organization is an important aspect of the user experience. LMS Imagine.Lab previously allowed users to change commonly used icons to even more recognizable images, and define multi-domain libraries for faster component access. In Revision 10, a Favorites library has been implemented to streamline the process of sorting out components. Dockable and tabbed library windows make screen layout, especially in multi-monitor environments, more efficient. Power Sensors have been implemented in most domains to better track and optimized energy consumption for "green" design.

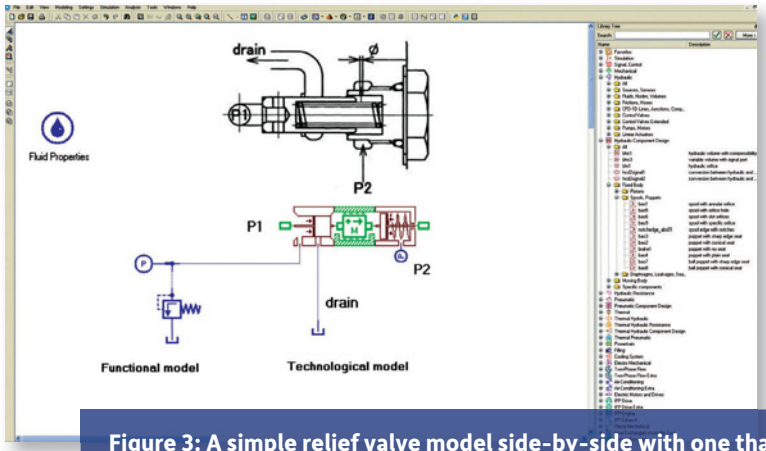


Figure 3: A simple relief valve model side-by-side with one that captures all the relevant physics to synthesize the right valve.

Because computation time is fast, multiple design iterations on a given model are commonplace. Revision 10 includes enhanced Batch Run & Result Set Managers that allow users to create, and then navigate the massive amount of output data being generated. Similarly, when engineers have nearly unlimited design iteration options, the alternate configurations can take on many forms over a short period of time. The Experiment Manager tracks model changes in the background so that engineers can explore improvements across complicated design changes without worrying about in-process documentation.

In addition, LMS Imagine.Lab remembers what components and/or parameters were used in any given study. Users can jump back and forth to images of past configurations to explore alternatives. This is a critical capability to answer the question "Why?" when examining everything from the various component options or the best design choice to meet the latest eco-trends.

LMS Imagine.Lab includes a help and demo model library that are cornerstones of the hands-on tutorial system. The help system in LMS Imagine.Lab includes an explanation of the underlying equations and parameters for all of the components. A library of demo models, or templates, is included—as well as providing a fully documented starting point for most applications. These have both been enhanced in Revision 10 with more engine, powertrain, and vehicle dynamics models. Additionally, application "assistants" have been added to Revision 10 to guide users through model construction in a number of domains.

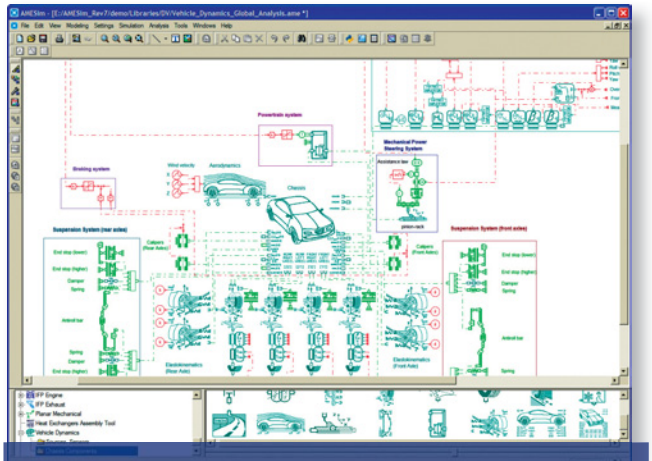


Figure 2: A complete model of an automobile energy system showing multiple libraries (differentiated by color.)

One exciting technology enabled by LMS Imagine.Lab is model-based system engineering (MBSE), which allows co-simulation of models, control software (C-code), and/or actual hardware. LMS has further improved the real-time simulation capabilities in LMS Imagine.Lab for hardware-in-Loop (HiL), software-in-loop (SiL) and model-in-loop (MiL). Additionally, in 2010, LMS acquired Emmeskay, a global MSBE provider with offices in Michigan, India and Japan.

LMS offers LMS Imagine.Lab AMESim products in "à la carte" libraries for specific needs, or in bundled application-oriented solutions. In Revision 10, LMS expanded its token-based licensing to the LMS Imagine.Lab product line so engineers can access the potential of multi-domain and system simulation. With tokens, users don't need to try to find all their innovative ideas at once—or go to their boss for more funding to explore a new concept or check out the actual viability of the products they imagine.

As with most CAE technologies, such as finite element analysis (FEA) and computational fluid dynamics (CFD), 1D simulation was developed primarily for the automotive and aerospace industries. Now, as with FEA and CFD, it is accessible to all industries. DE

Vince Adams, *currently an account manager for LMS, is a longtime simulation educator, consultant and speaker. He has authored three books on finite element analysis and numerous magazine articles.*

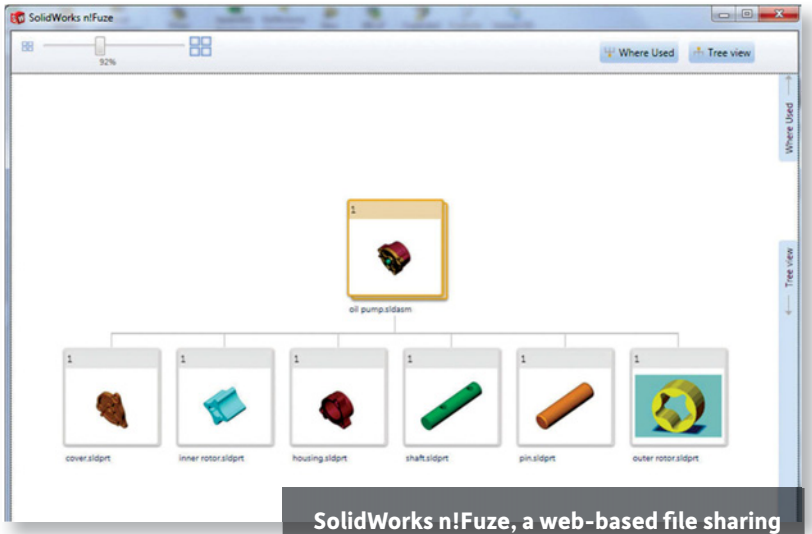
INFO → LMS: LMSintl.com

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

Plug-and-Play PLM

The state of the art for tools designed for small and mid-size businesses.

BY KENNETH WONG



SolidWorks n!Fuze, a web-based file sharing and collaboration function from Dassault Systèmes, is aimed at teams as small as two.

Asking a small business to adopt a product lifecycle management (PLM) system is like asking a neighborhood baker to install an industrial oven, complete with conveyor belts, control knobs, and a walk-in heat chamber. What he needs is a countertop oven, small enough to fit on the oak table in his kitchen, large enough to churn out several batches of breads and pastries to keep up with morning and lunch rushes. He refuses to read a 2-in.-thick installation manual just to get started. He believes the equipment should be ready once plugged in. As for configurations, he asks for but four settings: On, Off, Temperature and Timer.

WHAT IS PLM?

Ever since its creation in the late 1980s, product lifecycle management (PLM) has had to go through a series of identity crises. Preached by many, yet understood by few, the concept grew more abstract over time. According to CIMdata, an analyst firm, PLM is a strategic business approach that:

- applies a consistent set of business solutions that support the collaborative creation, management, dissemination and use of product definition information;
- supports the extended enterprise (customers, design and supply partners, etc.);
- spans from concept to end of life for a product or plant; and
- integrates people, processes, business systems and information.

The same analyst firm warns that "PLM is not a definition of a piece, or pieces, of technology. It is a definition of a business approach to solving the problem of managing the complete set of product definition information—creating that information, managing it through its life, and disseminating and using it throughout the lifecycle of the product."

In the late 1980s and early '90s, PLM projects were often data consolidation initiatives undertaken by the GMs and Boeings of the world. It was assumed—correctly, I might add—that only manufacturing titans of such size and magnitude would engage in parallel product development (subcomponents that must eventually fit together and were in development in different places, overseen by different teams). Only they would need to tackle the complex data-management issues arising from this practice.

Thus, for a time, most PLM technologies were the software equivalent of industrial ovens. Like its equally intimidating cousin enterprise resource planning (ERP), early PLM came with a 2-in.-thick manual, a team of consultants and a hefty price tag.

But today, in what *New York Times* columnist Thomas Friedman calls the "Flat World," small and midsize businesses (SMBs) can compete with large enterprises in a playing field already leveled by technology. In the era of digitized, wired communication, small manufacturers from Taipei, Pune or Minnesota can bid for the same jobs on which their larger counterparts are bidding.

With lower overhead, smaller firms can—and often do—underbid the larger ones. The opportunities once confined to bigger firms are now within their reach. Consequently, so are the product-development complexities once limited solely to bigger firms. The question among progressive SMBs is this: Is there a countertop oven version of PLM?

Getting Your Data House in Order

By its very nature, PLM is an ambitious undertaking, involving concept development, design creation, data management, collaboration, simulation, manufacturing, compliance and—if you choose to extend the lifecycle beyond manufacturing—post-sale maintenance.

With the exception of certain tier-one companies, there aren't many manufacturers sufficiently resourceful in finance, time and manpower to adopt a series of technologies that address all aspects of PLM in a single shot. Most likely, companies tackle these issues one at a time, or a few at a time, depending on priority and affordable downtime.

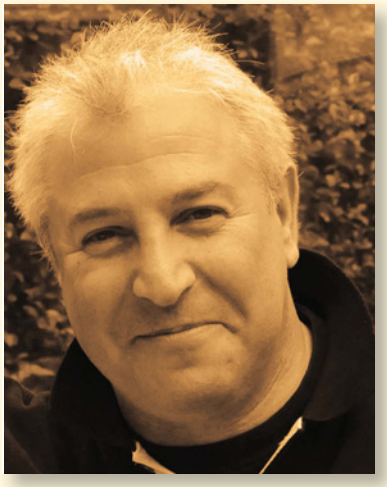
"I think that many large enterprises have additional requirements for a PLM system that are needed just due to the size of the company," says Michael Distler, director of solutions marketing for PLM tool manufacturer PTC. "For example, requirements management for an SMB may be easily managed by one person using a simple vault tool, since there are a fairly finite number of requirements to keep track of. But the large enterprise may have thousands of requirements that would be unwieldy or impossible to effectively manage and cross-reference without a PLM system. Because these additional capabilities result in a larger system that needs to be configured and maintained, the SMB may not have the resources to manage such a large system."

Many vendors offer software suites—a collection of interoperable, associative software programs—to manage different aspects of the product lifecycle. For PLM beginners, the best place to start may be data management and collaboration.

"I think simply having a single, secure, accessible place to store all product-related files is probably the most important capability for an SMB," Distler says. "After that, I would say simple change and configuration management, such as keeping track of the latest version, etc. Collaboration would be next, given that many SMBs work with independent contractors for a particular job."

SaaS-sy PLM

In the last five years, as people have begun to feel more comfortable with the idea of remote software, often called Software-as-a-Service (SaaS), certain PLM programs have sprung up on the same platform. If what you need



A CONVERSATION WITH ALLAN BEHRENS

In January, at SolidWorks World 2011, I had a chance to sit down with Allan Behrens, an analyst from Taxal, about how product lifecycle management (PLM) systems can benefit small and mid-size businesses (SMBs).

"PLM solutions have historically been notoriously difficult to implement," he says. "They're not short-term solutions, not very malleable, so you can't change them easily. An SMB has limited bandwidth for software maintenance, IT maintenance and customization. So a solution for the SMB has to be easy and practical, with immediate return on investment and a low entry barrier."

It doesn't necessarily mean low cost, he adds, just that they have to start paying back the investment quickly.

Because of their low costs (around $100 per seat per month) and low overhead (little or no IT investment), Software-as-a-Service (SaaS) or web-hosted PLM solutions often strike SMBs as attractive alternatives. Behrens advises buyers to consider certain factors:

- How do you get your information in and out?
- How do you use it or train new people?
- Do you have to change your work processes to suit the application? Or can the application be changed to match your business?

"SaaS gets rid of the IT maintenance burden, but it also brings with it another problem: Transferring information [in and out of the program] can be quite costly," he says.

Whether delivered online or on the premises, if the PLM software forces you to significantly recalibrate your workflow and practices, it could be an inhibitor to adoption, he cautions.

to manage is the most basic of your manufacturing documents—your bills of materials (BOM)—you could do it for as little as $99 a month. Arena Solutions, founded in 1994, specializes in delivering SaaS BOM management functions. The product, called Arena, was an outcome of the co-founders' own frustration with their homegrown data-management efforts in Excel spreadsheets in their previous career as manufacturers.

Arena includes features for BOM management, change management and supplier collaboration. SaaS deployment means you don't need to keep and maintain an IT infrastructure. You access Arena features and your uploaded data from a standard browser.

Arena's look and feel still reflects its original point of departure, Excel. Rows and columns, an approach that does a fine job managing textual and numeric data, may be sufficient for many, but the new model-driven data-management approach, as exemplified by Siemens HD PLM and Autodesk Vault, shows that a greater integration between product data (part numbers, BOMs, release dates, and so on) and product design (CAD files) could yield PLM insights otherwise unavailable.

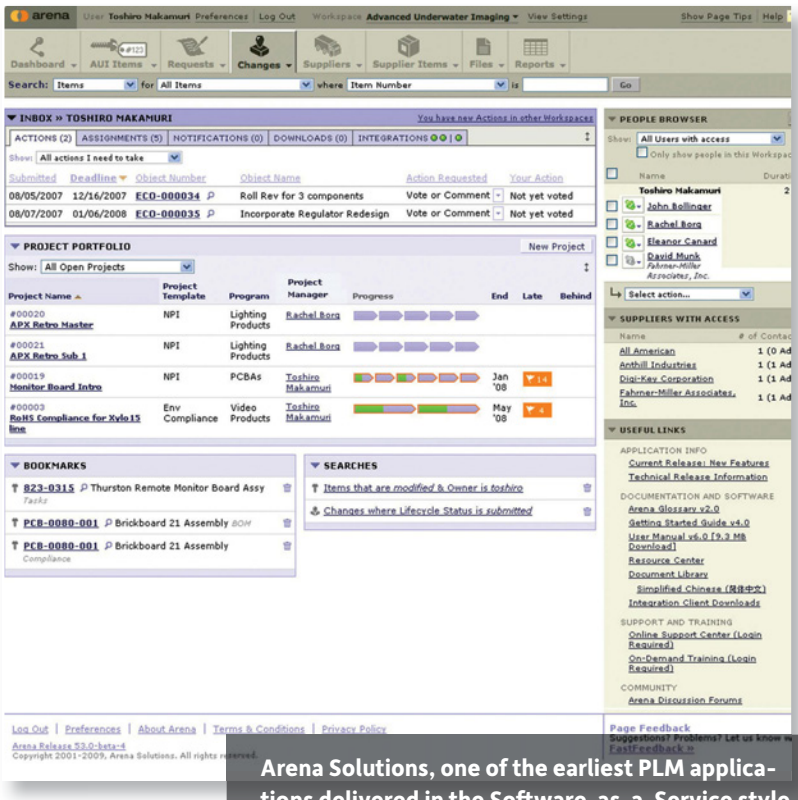
Playing Well with Others

"We understand that we're not going to be the only tool that our customers use," Chuck Cimalore, CTO of Omnify Software, states. "Where we excel, in addition to the breadth of our functionality, is in our ability to turn around

the system—get customers up and running quickly in a very cost-effective package."

Omnify concentrates on SMBs, from startups to those with $500 million in annual revenues. Its PLM software suite includes BOM management, change management, quality assurance, project management, compliance and more. Omnify's CAD integration lets you access your product data directly from within your modeling environment in partner products like SolidWorks and PTC's Creo Elements/Pro (formerly known as Pro/ENGINEER).

Cimalore reveals it often takes new customers only three to four days to be up and running.



Arena Solutions, one of the earliest PLM applications delivered in the Software-as-a-Service style, lets you monitor your project status in a dashboard.

The Big Three

The holy trinity of PLM—Dassault Systèmes, PTC and Siemens PLM Software—used to focus on industry titans, with comprehensive software suites like ENVOVIA (Dassault Systèmes), Windchill (PTC), and Teamcenter (Siemens). But the allure of the SMB market beyond tier-one manufacturers proved irresistible.

Dassault Systèmes tackled this segment with SolidWorks Workgroup PDM, offered alongside its midrange CAD program SolidWorks. PTC recently made the decision to reshuffle its products, breaking up Pro/ENGINEER, Windchill and other titles into a series of applications with smaller footprints. Siemens put together its midrange PLM bundle called Velocity Series. At the heart of it was Teamcenter Express, a lighter version of Teamcenter.

Recently, Dassault Systèmes moved further down the SMB market, attempting to capture the smallest of PLM users—teams as small as two—with a web-based file sharing and collaboration plug-in called n!Fuze (see Virtual Desktop, page 9). Though the product is based on its enterprise PLM system ENOVIA, the user interface looks more like an instant messenger window, reinforced by social media-inspired chat-and-comment functions. The plug-in, which appears as an unobtrusive tab in SolidWorks, lets you create a personal workspace where you can upload a design in progress, invite a collaborator, then start a discussion.

"What designers and engineers don't like," notes Omnify's Cimalore, "is for someone to come to them and say, 'Hey, we've implemented this new PLM system, so you're gonna have to use it.'"

That, perhaps, is a challenge shared by all PLM providers, large and small. The ghost of enterprise software still haunts many. Only a new breed of lightweight, pain-free PLM products can wipe away the memory of implementation horror. DE

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

INFO

- **Arena Solutions:** ArenaSolutions.com
- **CIMdata:** CIMdata.com
- **Dassault Systèmes:** 3DS.com
- **Omnify:** OmnifySoft.com
- **PTC:** PTC.com
- **Siemens PLM Software:** PLM.automation.Siemens.com
- **Taxal:** Taxal.com

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

A Pricey, Power-packed Tower

The dual-six-core Dell Precision T5500 workstation turns in impressive results—with a price to match.

BY DAVID COHN

After having not reviewed a Dell workstation for quite some time, we were pleased to receive a second Precision workstation in less than a year. This time around, the Texas-based company sent us the latest version of its Precision T5500, a dual-socket system that packs a lot of power into a relatively compact tower.

The Dell Precision T5500 bears a striking resemblance to the T3500 we reviewed last year (see *DE*, March 2009), housed in a gray and black case measuring 6.73 x 17.64 x 18.54 in. (W x H x D) and weighing in at 41.5 lbs. And like the T3500, although configured as a tower, the T5500 can also be reoriented as a desktop system.

Quirky Interior

Like other workstations in the Dell Precision series, the T5500 case opens on the right. Inside, we again found an unusual hard drive mounting system. Up to two drives can be mounted on a special cage that hinges at the bottom of the case. When latched in place, the cage covers more than a quarter of the case. Drives simply snap into the cage and cables are properly routed for easy manual connection.

Swinging the drive cage out of the way exposes one of the CPUs. We could then remove the blue plastic memory shroud to expose a bank of six memory sockets, three of which were filled with 1GB dual in-line memory modules (DIMMs). Because we knew the system had two CPUs and a total of 6GB of memory, however, we wondered where Dell had hidden the additional memory and the second CPU.

We soon solved the mystery. The second processor mounts on a separate dual processor riser. Located toward the rear of the hinged drive cage, this riser slides into a special slot and is held in place with a quick-release lever. The dual processor riser has its own heat sink and cooling fan, and also includes three more memory sockets. So, the second of the two 3.33GHz Intel Xeon X5680 six-core processors was mounted on this unique riser, along with three more 1GB memory modules.

The system supports up to 72GB of RAM if you install 8GB DIMMs into all nine memory sockets. While 1GB

DELL PRECISION T5500

- **Price:** $9,242 as tested ($1,299 base price)
- **Size:** 6.73 x 17.64 x 18.54 in. (W x D x H) tower
- **Weight:** 41.5 lbs.
- **CPU:** two 3.33GHz Intel Xeon 6-core with 12MB L3 cache
- **Memory:** 6GB 1,333MHz DDR3 SDRAM (72GB max)
- **Graphics:** NVIDIA Quadro 5000 with 2.5GB memory
- **Hard disk:** two 500GB Seagate Constellation ES SATA 7,200 rpm drive
- **Optical:** one 16X DVD +/-RW
- **Audio:** onboard integrated high-definition audio (microphone, headphone, line-in and line-out)
- **Network:** integrated Broadcom 5761 Gigabit Ethernet LAN
- **Modem:** none
- **Keyboard:** 104-key Dell QuietKey USB
- **Pointing device:** three-button USB optical mouse
- **Other:** One 9-pin serial, one 25-pin parallel, eight USB 2.0 plus three internal USB, 19-in-1 media card reader

Design Engineering Workstations Compared

		Dell T5500 workstation (two 3.33GHz Intel Xeon X5680 six-core CPUs, NVIDIA Quadro 5000, 6GB RAM)		**Digital Storm PROTUS 226060** workstation (one 3.33GHz Intel i7-X980 six-core CPU, NVIDIA Quadro FX 3800, 12GB RAM)		**BOXX 3DBOXX 4860 Extreme** workstation (one 3.33GHz Intel i7-X980 six-core CPU (over-clocked to 4.15GHz), NVIDIA Quadro 5000, 12GB RAM)		**Lenovo E20** workstation (one 3.19GHz Intel i5650 dual core CPUs. NVIDIA Quadro FX 580 4GB RAM)		**HP Z200** workstation (one3.47GHzIntel i5-670 dual core CPUs, NVIDIA Quadro FX 1800, 4GB RAM)		**Lenovo D20** workstation (two 2.66GHz Intel Xeon X5550 quad core CPUs, NVIDIA Quadro FX 4800, 8GB RAM)	
Price as tested		$9,240		$6,545		$6,325		$1,224		$2,089		$5,943	
Date tested		1/14/11		12/13/10		11/14/10		9/15/10		8/7/10		1/11/10	
Operating System		Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7	Windows XP	Windows 7	Windows XP	Windows Vista
SPECviewperf	higher												
3dsmax-04		76.05	78.72	88.15	87.07	n/a	**90.25**	66.73	64.98	60.87	60.65	**50.38**	51.21
catia-02		98.48	100.25	74.35	84.85	n/a	**115.36**	68.28	63.79	68.13	66.87	**61.79**	62.01
ensight-03		118.29	121.70	62.22	58.33	n/a	**120.41**	45.79	**43.40**	53.85	53.06	55.26	53.51
maya-02		**490.95**	435.44	174.45	218.33	n/a	458.21	185.81	**157.57**	238.59	208.40	250.41	223.73
proe-04		92.19	90.61	83.16	77.29	n/a	**114.34**	64.08	**59.17**	68.03	65.74	64.83	63.66
SW-01		180.49	169.75	174.74	157.70	n/a	**233.03**	97.07	**89.67**	138.22	137.48	144.17	145.19
tcvis-01		93.99	90.34	40.16	37.36	n/a	**95.26**	23.66	**23.00**	35.60	34.81	40.55	39.51
ugnx-01		**89.31**	87.95	37.46	35.49	n/a	88.75	23.15	**16.93**	30.91	31.23	34.93	34.52
SPECapc SolidWorks	lower												
Score	seconds	146.86	n/a	**106.51**[1]	n/a	n/a	n/a	**153.29**	n/a	148.72	n/a	141.59	n/a
Graphics	seconds	58.42	n/a	**32.17**[1]	n/a	n/a	n/a	**58.71**	n/a	56.83	n/a	41.48	n/a
CPU	seconds	32.27	n/a	**25.87**[1]	n/a	n/a	31.63	**33.67**	n/a	32.81	n/a	33.00	n/a
I/O	seconds	60.76	n/a	**47.99**[1]	n/a	n/a	54.68	65.44	n/a	63.10	n/a	**67.73**	n/a
SPECapc SolidWorks	higher												
Score	ratio	5.32	n/a	**8.04**[1]	n/a	n/a	n/a	**5.21**	n/a	5.27	n/a	6.28	n/a
Graphics	ratio	**3.23**	n/a	**6.07**[1]	n/a	n/a	n/a	3.25	n/a	**3.23**	n/a	4.68	n/a
CPU	ratio	10.00	n/a	**12.01**[1]	n/a	n/a	10.20	**9.58**	n/a	9.83	n/a	9.78	n/a
I/O	ratio	5.21	n/a	**6.60**[1]	n/a	n/a	5.79	4.84	n/a	5.02	n/a	**4.67**	n/a
Autodesk Render Test	lower												
Time	seconds	0:42[1]	**0:28**[1]	53.5[1]	46.3[1]	n/a	39.6[1]	**222.3**[1]	203.0[1]	137.4[1]	135.2[1]	64.00[1]	63.60[1]

Numbers in **blue** indicate best recorded results. Numbers in **red** indicate worst recorded results. 1. Hyper-threading enabled.

The Dell Precision T5500 workstation packs incredible power and dual CPUs into a compact tower case.

modules are certainly less expensive, they limit future expansion because only three memory sockets remain unpopulated. But the Dell website doesn't offer a 6GB configuration option using larger memory modules.

Dell equipped our evaluation unit with a pair of 500GB Seagate Constellation ES SATA hard drives, configured in a redundant array of independent disks (RAID) 0 (striped) array, so that the drives appeared as a single 1TB drive. While this arrangement improves performance, it puts data more at risk—the failure of either drive would result in complete data loss.

Hidden beneath the hinged drive cage and the dual processor riser is a Dell motherboard based on an Intel 5520 chipset, with a total of six expansion slots: two PCIe x16 graphics slots, two PCIe x16 slots wired as x8, one PCIx slot and one PCI slot. There are also three more USB connections on the motherboard.

The PCI slot contained a FireWire card, while our evaluation unit also came with a single NVIDIA Quadro 5000 graphics accelerator installed in one of the PCIe x16 graphics slots. The Quadro 5000's 152-watt power consumption means that an auxiliary power connector from the 875-watt power supply is required. In addition, it is a dual-slot board, blocking access to the adjacent PCIe slot.

All told, Dell offers 15 graphics card choices, including entry-level and mid-range workstation cards from NVIDIA and ATI, and the even more powerful NVIDIA Quadro 6000.

In spite of two large fans behind the front panel—one on the dual processor riser assembly, one in the power supply—and yet another on the graphics board, the Precision T5500 was virtually silent after startup.

Great Performance , Premium Price

The Dell Precision T5500 marks the first workstation we've tested with dual six-core CPUs, so we had high expectations when we began our benchmark testing. We certainly weren't disappointed. On the SPECviewperf test, which looks solely at graphics performance, the speedy CPU and ultra high-end graphics accelerator combined to produce some of the highest scores we've ever recorded. The only system to surpass the Dell's performance was the over-clocked 3DBOXX 4860 Extreme (see *DE*, January 2011, page 14), which was equipped with an identical Quadro 5000 graphics card.

When we turned our attention to the SolidWorks benchmark, which is more of a real-world test and additionally breaks out graphics, CPU and I/O performance from the overall scores, the T5500 turned in excellent, but not record-setting results.

But when we ran our AutoCAD rendering test, which clearly shows the benefits of multiple cores, the results were nothing short of spectacular. With hyper-threading enabled, giving the equivalent of 24 processor cores, the Dell Precision T5500 completed our presentation quality rendering in just 28 seconds.

The Dell Precision T5500 is backed by a basic 3-year warranty, with next-business-day, on-site service. Pro support with 24x7x365 service is available. So are 4- and 5-year service terms, accidental damage protection, data recovery protection and even a prepaid recycling service.

Prices for the Dell Precision T5500 start at $1,719, and with current promotions, that price drops to an even more attractive $1,299. But that figure won't even begin to purchase the system we received. As configured, our evaluation unit priced out at $9,712. Even after instant online savings, the system would still cost $9,242. It's a lofty sum, but it buys you an incredibly powerful Dell Precision T5500, capable of handling the most demanding engineering applications. DE

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

INFO ➜ **Dell:** Dell.com

➜ **Advanced Micro Devices:** AMD.com

➜ **Broadcom:** Broadcom.com

➜ **Intel Corp.:** Intel.com

➜ **NVIDIA:** NVIDIA.com

➜ **Seagate:** Seagate.com

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

Experiment to *Accelerate the Innovation Cycle*

What is in your innovation tool box?

BY PETER VARHOL

Theodore Levitt, an American economist and professor at Harvard Business School, is credited with saying "Creativity is thinking up new things. Innovation is doing new things." Of course, we all know this saying from Albert Einstein: "The definition of insanity is doing the same thing over and over again, expecting different results."

But one of the greatest challenges heard recently came from Hollywood, where an industry leader suggested to his artist, animators and technologist that we need to revolutionize the way we work to exploit all the technologies we have around us. They did, and now they produce more full-length animations with amazing special effects faster than ever before.

No doubt you have some really bright engineers and scientists, an assortment of single- and dual-processor Intel®Xeon® based workstations, and potentially some investments in high-performance computing clusters. Combined together, these investments represent your innovation sandbox.

But, are you making the most of these investments? If you are still using workflows from 20 or 30 years ago, then your innovation assets are probably not being used to their fullest potential.

Let's Experiment

Your most important investment is your engineer or scientist. They possess the capacity to create new ideas or refine existing products. They also possess the skills to innovate — that is to create, test, modify, and redefine their ideas. When you give them the right tools, they can do it faster than ever.

In the past they have been confined to serial thinking — they created and tested one idea at time. However, with the advent of multi-core Intel Xeon processors and dual-processor workstations, like the HP Z800, Dell T7500 or Lenovo ThinkStation D20, these professionals now have the opportunity to not only create a new idea; they can also test it and modify it in a very tight loop. With new workstation technologies combined with new workflows, your engineer and scientist can move from serial thinking to parallel thinking to quickly arrive at an innovative idea that best meets form, fit and function product requirements.

The experiment is about adopting and testing new workflows that are made possible by the new breed of rock solid, dual-processor based Intel® Xeon® multi-core workstations. These workstations enable your engineers and scientist to think parallel.

What You Need to Try the Experiment

The most important component is access to engineers who will innovate around new workflows that will revolutionize they way your organization works so you can leverage available technology.

The experiment:

- Is not intended to be disruptive or slow down the critical projects they are heads down in.
- Is intended to optimize how they use the tools they already have in order to accelerate access to results that are needed to make time critical decisions with.
- Requires no special programs or software rewriting.

You will also need access to one to four dual-processor workstations powered by two Intel Xeon 5600 series processors; either 24 or 48GB of memory; two 10 GB network cards; preferably access to a 160GB solid state drive and a large hard disk drive; Microsoft® Windows® 7; a single copy of Windows® HPC Server; and Parallels Workstation 4.0 Extreme.

What to Expect

Once these powerful Intel Xeon processor-based workstations are up on your network, you will see that parallel thinking presents an interesting opportunity to explore "what ifs." Your engineers will experiment with more ideas in the same time as they explored a single idea. And just one of those ideas could turn into the innovation that separates you from your competition.

The outcome of the experiment is that your innovation assets will be more productive. Your engineers can explore more what ifs. Your-dual processor workstation is using all its resources to process small and medium simulations. Your HPC investment can now be fully applied to solving large problems really fast.

Your call to action: Start a parallel thinking experiment. DE

INFO → Intel Corp: intel.com/go/workstation

Blowing the Doors Off

The expensive Eurocom D900F Panther notebook outperforms most desktop workstations.

BY DAVID COHN

While not a household name, Eurocom has been building some of the world's most powerful portable computers for more than 20 years. The company offers lightweight notebooks and tablets, all-in-one portable desktop replacement notebooks, mobile workstations and mobile servers. When we first looked at one of the Canadian company's systems five years ago, we were duly impressed. But the firm's newest offering, its top-of-the-line Eurocom D900F Panther mobile workstation, blew us away. In fact, it delivers performance that beats most desktop workstations.

That may be because the Eurocom D900F Panther uses many components heretofore found only in true workstations—a blazingly fast 6-core Intel Xeon CPU, redundant array of independent disks (RAID) support, and triple-channel memory, all industry firsts.

Power comes at a price, however. This Panther may be fast, but it's also big, heavy and very expensive.

The D900F measures 15.6x11.7x2.4 in., and tips the scales at 11.5 lbs., plus another 2.25 lbs. for its power supply.

Raising the lid reveals a 17.1-in. LCD with a native WUXGA resolution of 1920x1200 and a full-size keyboard with a separate numeric keypad. The touch pad, centered below the keyboard in the large wrist rest, seems a bit small in comparison, and has just a pair of buttons in addition to its dedicated scroll zone. Speakers are located to either side of the keyboard, and a pair of game keys below the left speaker can be assigned macros.

The round power button glows blue when the system is running, while three poorly labeled buttons to its immediate left activate email, a web browser and a user-specified application. LEDs arrayed above the keyboard indicate card reader and hard drive activity, number lock, caps lock and scroll lock status. Three more LEDs in the bezel below the display indicate power, battery and wireless status. The microphone is to the left of these, while an optional 3-megapixel camera is centered above the display.

Lots of Expansion Options

The right side of the case is rather sparse, with just four USB 2.0 ports and a security lock slot. The left side is packed with an HDMI-out port, eSATA connector, a cable antenna jack, RJ-11

EUROCOM D900F PANTHER

- **Price:** $7,467 as tested ($2,977 base price)
- **Size:** 15.6 x 11.7 x 2.4 in. (W x D x H) notebook
- **Weight:** 11.5 lbs. as tested, plus 2.25-lb. power supply
- **CPU:** 3.33GHz Intel Xeon X5680 6-core with 12MB L3 cache
- **Memory:** 12GB 1,333MHz DDR3 SDRAM (24GB max)
- **Graphics:** NVIDIA Quadro FX 3800M with 1GB memory
- **LCD:** 17.1-in. diagonal WUXGA LED (1920x1200)
- **Hard disk:** 128GB SSD and 500GB 7,200 rpm Seagate Momentus hybrid drive
- **Optical:** Multi DVD+/-RW dual layer
- **Audio:** microphone, headphone, line-in, S/PDIF out, built-in microphone and speakers
- **Network:** integrated Gigabit Ethernet (10/100/1000 NIC); Intel 802.11 a/b/g/n wireless LAN; optional integrated Bluetooth 2.0
- **Modem:** 56K V.92
- **Keyboard:** integrated 109-key keyboard with numeric keypad
- **Pointing device:** integrated two-button touchpad
- **Other:** four USB 2.0, one mini IEEE 1394 FireWire, eSATA, Express Card slot, 7-in-1 card reader, DVI-out, HDMI-out, 3MP webcam

Mobile Engineering Workstations Compared

		Eurocom D900F Panther mobile workstation (3.3GHz Intel Xeon X5680 six-core CPU, NVIDIA Quadro FX 3800M, 12GB RAM)		**HP Elitebook 8540w** mobile workstation with DreamColor display (1.60GHz Intel Core i7 QM720 quadcore CPU, NVIDIA Quadro FX 1800M, 8GB RAM)		**Dell Precision M6500** mobile workstation (2.00GHz Intel Core i7 X920 CPU, NVIDIA Quadro FX 380M, 4GB RAM)		**HP EliteBook 8530w** mobile workstation (2.53GHz Intel Core 2 Duo T9400 CPU, NVIDIA Quadro FX770M, 4GB RAM)		**Lenovo ThinkPad W700** mobile workstation (2.53GHz Intel Core 2 Quad Core Q9300 CPU, NVIDIA Quadro FX3700M, 4GB RAM)	**Alienware Area-51 m15x** mobile workstation (2.8GHz Intel Core 2 Extreme CPU, NVIDIA Ge-Force 8800M, 4GB RAM)
Price as tested		$7,467		$3,657		$4,430		$2,822		$3,524	$4,549
Date tested		1/14/11		12/13/10		4/23/10		12/18/8		12/22/08	10/22/08
Operating System		Windows XP	Windows 7	Windows XP	Windows 7	Windows XP	Windows 7	Windows XP	Windows Vista	Windows XP	Windows Vista
SPECviewperf	higher										
3dsmax-04		75.97	**79.11**	43.31	56.10	49.56	52.35	33.38	32.21	34.23	**12.12**
catia-02		**85.23**	82.83	53.08	59.43	64.31	61.72	42.41	39.75	45.01	**13.64**
ensight-03		**66.02**	60.10	41.52	41.05	58.28	47.75	37.42	34.24	43.31	15.03
maya-02		**290.35**	236.55	204.12	159.95	283.64	212.05	149.21	108.33	165.87	25.37
proe-04		**84.84**	77.09	57.51	57.06	70.91	61.96	42.92	39.33	45.67	10.28
SW-01		**178.01**	163.34	109.6	102.93	152.41	132.68	67.98	59.75	90.01	17.19
tcvis-01		47.36	42.28	29.84	27.15	**47.71**	39.44	21.42	19.19	28.34	4.48
ugnx-01		**43.18**	39.34	27.75	28.10	39.60	33.64	19.85	18.11	30.91	4.18
SPECapc SolidWorks	lower										
Score	seconds	**135.63**	n/a	**198.16**	n/a	175.72	n/a	182.63	n/a	187.27	n/a
Graphics	seconds	**51.94**	n/a	**67.55**	n/a	58.99	n/a	62.16	n/a	60.87	n/a
CPU	seconds	**29.22**	n/a	**45.42**	n/a	37.62	n/a	39.99	n/a	44.40	n/a
I/O	seconds	**58.76**	n/a	89.8	n/a	83.48	n/a	83.69	n/a	**96.66**	n/a
SPECapc SolidWorks	higher										
Score	ratio	**5.66**	n/a	**4.08**	n/a	4.75	n/a	4.75	n/a	4.47	n/a
Graphics	ratio	**3.61**	n/a	**2.69**	n/a	3.09	n/a	3.26	n/a	3.15	n/a
CPU	ratio	**10.19**	n/a	**7.1**	n/a	8.58	n/a	8.07	n/a	7.27	n/a
I/O	ratio	**5.14**	n/a	**3.53**	n/a	3.79	n/a	3.78	n/a	3.65	n/a
Autodesk Render Test	lower										
Time	seconds	57.16	**51.83**	188.5	46.3[1]	168.33	180.16	318.4	**324.60**	162.00	291.60
Battery Test	higher										
Time	hours:min	n/a	**1:17**	1:28	1:21	2:06	2:05	**3:21**	3:00	2:15	1:20

Numbers in **blue** indicate best recorded results. Numbers in **red** indicate worst recorded results.

phone jack for the built-in modem, RJ-45 LAN jack for the built-in Gigabit Ethernet LAN, a mini-IEEE 1394 (FireWire) port, an ExpressCard slot, a 7-in-1 card reader, and the optical drive bay. Our evaluation unit came with an 8X dual-layer DVD +/-RW burner, but Eurocom also offers other drives with Blu-ray Disc read-and-write capabilities. Two more speakers occupy the front, along with an infrared transceiver and four audio jacks (line-in, S/PDIF-out, microphone and headphone), while the rear houses the power jack and a dual-link DVI-I port.

Like most Eurocom systems, configuring the D900F Panther is all about choices. The LCD is available with or without a non-glare coating, and you can also save a bit by going with a WSXGA+ (1680x1050) resolution display. Either way, the display can be driven by a choice of 10 different GPUs, ranging from an AMD Radeon or NVIDIA GeForce, up to a 2GB NVIDIA Quadro FX 5000M, which would add $1,711 to the base price. Our evaluation unit came with the excellent NVIDIA Quadro FX 3800M with 1GB of dedicated GDDR3 video memory, which was also able to power an external 30-in. monitor at up to 2560x1600.

You can also equip the Panther with any one of 24 different Intel processors. In our case, we pushed it to the limit: a 3.33GHz Intel Xeon X5680 CPU with 6 cores and 12MB of L3 cache. The system accommodates up to 24GB of memory in three 204-pin Small Outline Dual In-Line (SO-DIMM) memory sockets, two hidden behind the bottom panel (after removing no fewer than 26 screws, disconnecting several cables, and removing a cooling fan) and a third located beneath the keyboard. Our system came equipped with 12GB of memory using three 4GB DDR3 1333MHz memory modules.

Our evaluation also came with a 128GB Crucial Solid-state hard drive, which added $912 to the price, as well as a 500GB Seagate Momentus solid state hybrid 7,200rpm SATA drive with 32MB cache and 4GB flash memory. Eurocom offers solid state drives of up to 512GB and the D900F Panther can accommodate up to three internal hard drives, two in the primary drive bay and a third behind the 12-cell Li-Ion battery (which can be removed after loosening three captive screws).

That battery didn't last long, powering the system for a bit more than 75 minutes in our battery rundown test. That's actually more than we expected, but still useful as little more than an uninterruptible power supply (UPS). Don't expect to venture too far from an A/C outlet.

Paying the Price for Performance

With all of the power packed into the Panther, we expected great performance, but we weren't prepared for the results.

On the SPECviewperf test, which looks solely at graphics performance, the Eurocom D900F Panther outshined every other mobile workstation we've ever tested by a wide mar-

wide margin, sometimes as much as 40%. As if that wasn't enough, its viewperf numbers also matched or beat *every desktop workstation we've tested to date*, with the exception of the over-clocked BOXX 3DBOXX 4860 Extreme (see *DE*, January 2011, page 14).

When we turned our attention to the SolidWorks benchmark, which is more of a real-world test and breaks out graphics, CPU and I/O performance separately, the Eurocom D900F Panther again beat out every other mobile workstation—and equaled or beat most of the towers we've tested.

With hyper-threading enabled, the equivalent of 12 CPU cores enabled the Panther to complete our AutoCAD rendering in less than 52 seconds. That's nearly three times faster than the next-fastest mobile workstation, and faster than all but the most tricked-out desktop systems.

Of course, all of the Panther's power comes with a staggering price tag attached. The standard D900F configuration sells for $2,977, although you can drop the price a bit by downgrading several components. Our evaluation unit was certainly not downgraded, however. As configured, the Eurocom D900F Panther we received would cost $7,467.

If that price isn't daunting enough, the standard Eurocom warranty only covers the system for a year, and requires owners to ship the system back to a factory depot for repairs. Extending the warranty for a second year adds $145 to the cost, while adding a third year adds $259. But Eurocom does offer lifetime upgradability, as well as credits of up to 20% if you trade in an older system when purchasing a new Panther.

But if you're an engineer, designer or graphic professional on the go who needs the ultimate performance in a portable package, the Eurocom D900F Panther can't be beat. DE

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

INFO
- **Eurocom Corp.:** Eurocom.com
- **Advanced Micro Devices:** AMD.com
- **Autodesk:** USA.Autodesk.com
- **Dassault Systèmes:** SolidWorks.com
- **Intel Corp.:** Intel.com
- **NVIDIA:** NVIDIA.com
- **Seagate:** Seagate.com

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

Accelerating into the Future

This hybrid car is the first prototype to have its entire body 3D printed by additive manufacturing.

BY SUSAN SMITH

What if the car you drive was made with a sustainable design process, and saved you a bundle at the gas pump? Or maybe, you're no longer going to the gas pump at all?

Both of those scenarios would be a benefit for our planet, as there is a finite resource of 1.258 trillion barrels of proven resources of oil in the world—and 20 million barrels of oil are currently being consumed daily in the U.S.

While several vehicle manufacturers are addressing this issue, KOR EcoLogic is among the leaders of the pack. Jim Kor, president and senior design engineer for the Winnipeg-based company, reports that his team's low-energy, hybrid car is considered to be the first prototype ever to have its entire body 3D printed by additive manufacturing processes. All exterior components of the vehicle—including the glass panel prototypes—were created using Dimension 3D printers and Fortus 3D Production Systems at Stratasys' digital manufacturing service, RedEye on Demand.

Team Urbee poses at the recent SEMA show in Las Vegas.

Blaine McFarlane, KOR EcoLogic's senior design engineer, says the electric/liquid-fuel hybrid reaches more than 200 mpg, highway, and 100 mpg, city, in U.S. gallons with either gasoline or ethanol. That means the Urbee costs only 2 cents per mile for combined city and highway use, according to its creators. This is only about 10% of the fuel consumed by a typical sports utility vehicle (SUV). On the highway, the Urbee costs about 1 cent per mile, or 95% less than a typical SUV.

In terms of electrical energy, the car is charged overnight from any standard home electrical outlet. It can also be charged by renewable energy from a windmill or a solar-panel array that is small enough to fit on top of a single-car garage.

Design Specifics

There are 10 panels in the body of the car, and it takes three weeks to build the parts. At press time, Kor and McFarlane had the door, the side, the nose and the back end of the body finished.

The car body panels are made of plastic and are 3D printed. These go on the car directly. However, the glass or windows of the car are also 3D printed out of solid plastic. These opaque windows are used as templates only, while Toronto-based Accura Glass Bending, Inc. makes the glass windows by hand. The glass windows then go onto the car, glued to the plastic body panels in the traditional way.

"We designed the parts to be low-energy; we designed an aerodynamic body," says Kor. "We have two industrial designers on the project who are car stylists, and they were worried it would be too ugly with the aerodynamic body—the eye can't follow the shape, etc. So they took all the aerodynamic specs and then made it look appealing without sacrificing aerodynamics."

This was done by making a sculpted clay model of the car at 60% scale and then having it scanned into the computer. With the body in the computer, CD-adapco software was used for aerodynamic simulation, from which they derived a drag coefficient (Cd) of 0.15. The lower the number, the less horsepower needed to push the car through the air. By comparison, the Toyota Prius has a Cd of about 0.26.

After the aerodynamic simulation, the next step was to cut

GORDON MURRAY DESIGN TAKES PROTOTYPING IN-HOUSE

Another company making significant strides with prototyping cars that are cheaper to run, ecologically friendly and reduce emissions is Gordon Murray Design, led by McLaren Formula One veteran Gordon Murray, of Surrey, UK. The company has been in the thick of designing, automotive intellectual property, prototyping and developing since 2007, and its first prototype, the T.25 City Car, made its debut in June 2010.

At press time, the company was working on its T.27, an all-electric three-seater city car, made possible through an approximately $7 million investment from the government-backed Technology Strategy Board.

Gordon Murray Design uses Stratasys FDM Fortus 400mc as its in-house machine because the team wanted to manage the entire design and prototyping process in-house. They use Fortus 400mc in the Prototype Workshop to build multiple components for tooling and design. According to Murray, FDM technology was primarily used for component design rather than body design, using ABSM30 as the material.

Murray says the Stratasys FDM technology enables the team to embrace traditional CAD design processes in four ways:

1. 3D validation of a component.
2. A pattern representing the component, which could be used to cast in alloy.
3. Jigging fixtures and templates.
4. Trim substrates.

The design software Gordon Murray Design used was Catia V5 Revision 17.

Stratasys' Fortus 3D Production System came into the picture as Gordon Murray Design sought to protect its intellectual property, have control over the overall design process and save on outsourcing costs.

"We were initially using the machine (Fortus 400mc) as a design tool, but soon discovered that we could use it more and more for structural parts," says Murray. "In fact, we've designed the entire of the T.25 interior using the Stratasys machine—including the instrument panel, sun visor, internal mirrors and internal trim. We expect to be able to do the same with our next project, the T.27."

"The lightweight philosophy of T.25 meant it achieved 96 mpg during the inaugural Brighton to London Future Car Challenge," says Murray. "Had it been powered by diesel, it could have recorded 131 mpg."

The T.25 with Gordon Murray.


Urbee rendering

URBEE HONORS

The Urbee has already earned tremendous accolades: It competed in the 2010 X-Prize Competition, and is the topic of an upcoming episode of the Discovery Channel's Daily Planet. The team was encouraged to take the design to SEMA, where people thought the body was machined. In addition, CNN News interviewed Jeff Hanson of Stratasys and Jim Kor, viewable online at goo.gl/08nkU.

the computer model into body and glass panels, and verify the fit with the scale model. To accomplish this, the body panels were printed full-scale and the window templates were 3D printed full-scale to make glass windows.

The Urbee's chassis is made of stainless steel for longevity. It is made of sheet metal and welded, which is like a traditional chassis used for vehicles, according to Kor. "We had the chassis moving to verify certain things, and then the body is fit over the metal chassis," he says.

Kor says they were familiar with other processes before choosing rapid manufacturing. They had done fiberglass for other projects on buses and tractors, but they wanted the car to look like a real car with sharp edges.

"We wanted to adhere to a perfect shape that was aerodynamic," he adds. "The other process requires months of labor, but this is pretty rapid for the designer. Those pieces are all done with minimal handwork at all in Minneapolis."

Project History

Kor says the project itself is quite old. They have been working on it for about 15 years. KOR EcoLogic designers wrote their own software for designing the Urbee.

"The formulas are simple," Kor says. "We did a typical city trip where you accelerate, you cruise, you decelerate, you stop. We made 100 trips and scenarios to make this faster or that a little heavier, and we got a deeper understanding of how that went."

The Urbee project began with trip simulations, and the team did not have any preconceived ideas about what the car would look like, says Kor: "We followed the energy, just wanting to use the least energy to go get that liter of milk we are always running out of—whether the convenience store is a mile or 100 miles away from your home."

KOR EcoLogic used Autodesk Inventor to design some of the parts, and Alias for most of the parts on the first prototyping.

Physical Prototyping

Rather than allowing the parts to be shipped, Kor says the team picks them up at RedEye in Minneapolis. "The first body panels are a little thicker than we expect in later panels," he admits. "Also, we are just focused on body skin right now, and getting that correct. Later, body panels will have depth and likely include interior finishes as well."

As a group, Kor adds, "we're just learning the process ourselves. We're learning how to make the panels very efficiently."

In terms of continuing to manufacture with the Stratasys Fortus system, Kor says, "When I first talked to Stratasys, it seemed this process was perfect for prototyping. But as we move forward, production pieces are becoming more feasible—especially with advances in technology and as we all learn how to use this technology specifically for production parts."

For a milling process, Kor says, the company would have to tool up, "but with this process we don't have to tool up. 3D printing is completely flexible. If we had made fiberglass molds, change to the body would have been traumatic."

"FDM is certainly suitable for limited production manufactured parts that will be installed to an automobile," says Joe Hiemenz of Stratasys. "This is currently going on with a few high-end custom automobiles in Europe."

This car may start out in limited production, which would mean additive manufacturing would be an excellent fit, Hiemenz says. "However, when the car goes into mass production, additive manufacturing will no longer make sense."

Green from the Get Go

"Other hybrids on the road today were developed by applying 'green' standards to traditional vehicle formats," says Kor. "Urbee was designed with environmentally sustainable principles dictating every step of its design. Urbee is the only practical car we're aware of that can run solely on renewable energy."

The team's goal in designing the Urbee was to be as green as possible throughout the design and manufacturing processes, Kor says, and Stratasys' FDM technology has been central to meeting that objective.

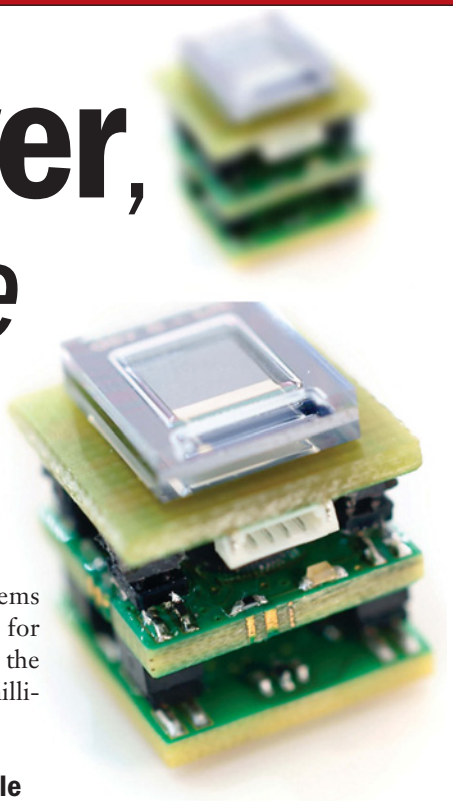
"FDM lets us eliminate tooling, machining and handwork, and it brings incredible efficiency when a design change is needed," he adds. "If you can get to a pilot run without any tooling, you have advantages." DE

Contributing Editor **Susan Smith** *has written and edited for various publications in the tech industry for more than 17 years. Send e-mail about this article to DE-Editors@deskeng.com.*

INFO ➜ **Accura Glass Bending, Inc.:** Accuraglass.com
➜ **Gordon Murray Design:** GordonMurrayDesign.com
➜ **KOR EcoLogic:** Urbee.net
➜ **RedEyeOnDemand:** RedEyeOnDemand.com
➜ **Stratasys:** Stratasys.com

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

Perpetual **Power**, *Maintenance Free*



For design engineers, success with micro-energy harvesting requires equal parts knowledge and willingness to experiment.

BY BARBARA G. GOODE

Energy harvesting is a still-new concept—embodied by a range of technologies—that lets design engineers create versatile, autonomous systems and products that operate free from power maintenance. A well-known example is Seiko's Kinetic line of watches, which are powered by the movement of the wearer's body. Less well known, but increasing in number, are installations such as the one devised by Leviton Manufacturing, a supplier of lighting energy management systems. Leviton's engineering team has paired miniature solar cells with low-power consumption devices and designs to produce an effective, self-powered wireless occupancy sensor and lighting control system able to "keep the lights on when there is occupancy and allow the lights to go off after 2 to 30 minutes with no occupancy," according to Dan Wright, lead electrical engineer, and Paul Maddox, director of engineering.

"There's certainly a growing interest in energy harvesting, and it's becoming widespread over a number of industries," says Harry Ostaffe, vice president, marketing and business development for Powercast Corp., maker of products that convert radio frequency (RF) energy into DC power. Also called power scavenging, the approach involves collecting ambient energy that is normally overlooked, untapped and wasted—for instance, vibration energy from machines and rail cars, thermal energy from industrial processes, or radiant energy from lighting. The harvesters convert the power for use by devices able to operate on miserly amounts of power. Such devices include radio frequency identification (RFID) tags, which is used for location tracking, security, etc. Others examples include switches, sensors (especially wireless sensors, designed to send their data by way of radio waves), low-power displays and more.

"Energy harvesting is generally divided into two camps," explains Keith J. Abate Sr., director of business development for Perpetuum, which designs and manufactures vibration energy harvesters: Macro systems generate > 1ma of power output (think solar arrays and windmills) and micro systems generate < 1ma. Generally, though, the term "energy harvesting" refers to systems that deliver power for devices operating in the microwatt to low-milliwatt range.

Why it's Worthwhile

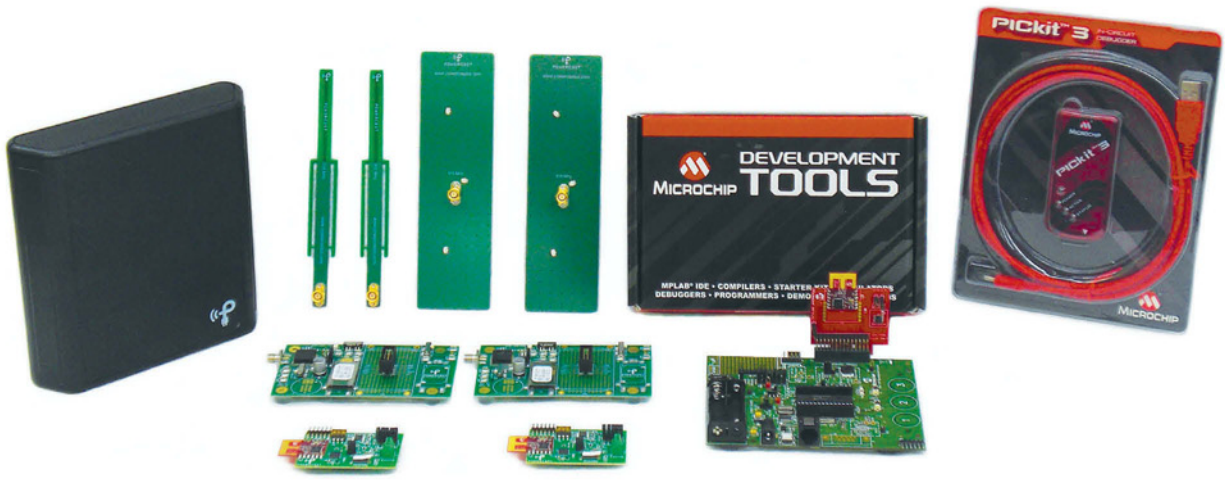
Design engineers who have already embraced the idea have done so for a few reasons. One is to facilitate maintenance-free operation of systems that would otherwise be powered by batteries, which need to be replaced on a regular basis. The approach is especially appealing for systems involving components in remote, hazardous or difficult-to-reach places—as well as for those involving many battery-operated devices.

"Once a lot of sensors are applied, changing the battery is not economical anymore," says Ruud Vullers of the Holst Centre, which works with clients to create wireless sensor networks incorporating vibration, thermal, photovoltaic (PV) and RF harvesting schemes.

In situations where power would otherwise be provided by a standard electrical system, energy harvesting technology enables reduction of energy and cabling costs, and provides flexibility. For instance, explains Wolfgang Heller, product line manager for EnOcean, the wireless technology allows you to erect or take down walls—to expand or reduce room sizes—without additional cost.

While the initial outlay for energy harvesting is often greater—as much as 1,000% than for battery-based systems, says Abate—that investment pays off over time in multiple ways, because while batteries are relatively inexpensive from a price perspective, "the real value is in the overall cost factor."

"What many people do not take into account when it comes to batteries is the additional costs and issues beyond the initial price," he adds, referring to costs involved in replacing and changing, disposal, skilled maintenance labor availability, safety, stocking and inventory maintenance. Abate notes that once these factors are considered for the life of the system, the equation favors the "fit-and-forget, perpetual harvesting solu-



Powercast's Lifetime Power Energy Harvesting Development Kit for Wireless Sensors, created with development support from Microchip, enables wireless, RF-based battery-free operation of sensor nodes (each detects temperature, humidity and light, and an additional parameter via an external port) at a distance of 40 to 45 ft.

tion." The scale of the project is another factor, because the components are less expensive in quantity. And for companies concerned with earth-friendly operation, Abates says, hazardous material content is an important consideration; energy harvesting is definitely "green."

Capacity

Vendors of energy harvesting products take various approaches to increasing reliability in case of power source loss. A video by Powercast (see deskeng.com/articles/aababc.htm) demonstrates how RF energy emitted by an iPhone can power a sensor, but when no iPhones or other RF energy sources are within range, a dedicated transmitter can step in.

Powercast offers two versions of its original transmitter (1W and 3W), but according to Ostaffe, the company is planning another transmitter designed to conveniently plug into the wall like a nightlight and generate .5W.

In addition, vendors supply storage devices such as capacitors to cache power. This approach enables Seiko's watch, for example, to accumulate approximately one day of power reserve per 12 hours of wearing time, for up to three months of operation, in its Electricity Storage Unit (ESU). Similarly, Wright and Maddox explain, Leviton designed its WSC04/WSC15 wireless occupancy sensors, which require a minimum of 40 lux to operate, to store enough energy to operate up to 48 hours in darkness when fully charged.

Design Considerations

How can a designer determine whether his or her application is appropriate for energy harvesting? In this nascent area, direct communication with suppliers can provide critical information. Most companies billing themselves as power harvesting companies supply to original equipment manufacturers and work closely with customers to achieve their goals.

One thing to keep in mind is that while technologies can often apply across a broad range of applications, young companies target particular markets. According to Heller, EnOcean chose to launch with a focus on building automation because the design cycle is shorter than, say, automotive. That's why EnOcean's website is dominated by examples of building automation—even though its products are suited to other applications as well.

A good place to start, then, is by considering what sources of power exist in your operating area. From there, develop an understanding of how technologies that tap those sources operate.

"The next step is to determine the power requirements of what you want the energy harvester to power," says Abate.

Indeed, Wright and Maddox recommend that designers considering energy harvesting "consider power consumption very carefully." Of course, power consumption depends on the device itself, and the frequency with which it needs to operate—that is, the duty cycle.

"You must then rely on the product data/performance information to determine whether the harvester is even capable of providing the power that will be required," Abate says, noting it's also important to "ensure that the time between duty cycles is sufficient enough to allow the harvester to replenish the energy storage mechanism."

In addition, Abate says, you will need to consider your energy storage methodology.

Finally, "one needs to determine the area or volume that the harvester needs to occupy," says Vullers. Where space is a key consideration, he notes, the Holst Centre fabricates miniature, microsystems technology-based devices.

To help design engineers understand their needs and plan their designs, Powercast provides a wireless power calculator on its website. In addition, Powercast's evaluation kits allow designers to experiment with RF energy technology, and development kits facilitate integration of power harvesting into designs. Ostaffe

notes that creative antenna design is a key factor in making an installation work. A document on the Perpetuum website, "Getting Started with Vibration Energy Harvesting," provides useful tips.

It's in your future

Vullers says that he and his colleagues at the Holst Centre "see more and more ultra low-power devices, which will increase possible energy-harvested applications."

Likewise, Abate sees a chain of events leading to an eventual explosion in the adoption of energy harvesting: The continued evolution of power-efficient embedded systems and low-power electronics and sensor technologies will facilitate further development of energy harvesting.

As energy harvesting devices continue to proliferate and volumes increase, manufacturing processes will improve. Supply chain and bills of material efficiencies will drive down the investment needed, "and therefore make an even more compelling cost justification for these technologies," Abate predicts.

Wright and Maddox, too, see the cost issue as important. They anticipate energy harvesting and wireless technology to expand, especially when the cost of these solutions come down. In the meantime, they say the protocol needs to open to allow universal commands for increased flexibility of product types.

EnOcean is pursuing its own version of this vision through the EnOcean Alliance, which Heller says exists to "standardize and internationalize EnOcean wireless technology," and enable "interoperability between the products of OEM partners."

Many vendors are continuing their technology and market development plans. Perpetuum, says Abate, is working to ease the processes of evaluating, installing and using the technology—for both end users and OEM partners—and will eventually target applications beyond industrial condition monitoring and rail transportation. DE

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

INFO ➜ **EnOcean:** EnOcean.com/en/home

➜ **Holst Centre:** HolstCentre.com

➜ **Leviton Manufacturing:** Leviton.com

➜ **Perpetuum:** Perpetuum.com

➜ **Powercast:** PowercastCo.com

➜ **Seiko:** SeikoWatches.com/technology/kinetic/index.html

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

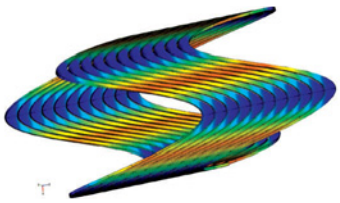
New Magnet Technology: A Multiphysics Challenge

AML's 3D coil-design software and automated construction processes enable rapid deployment of complex magnets.

Recently, Palm Bay, FL-based AML developed a new magnet topology—Direct Double-Helix (DDH) magnets—that allow for a significant increase in power density, performance in field generation, and field quality. The characteristics of the DDH magnets, part of the Double-Helix (DH) magnet family invented by AML's founder, Dr. Rainer Meinke, could lead to more affordable systems and potentially portable devices.

The Technology

Unlike conventional magnets based on saddle or racetrack coil configurations, AML's processes and designs enable magnets of any multi-pole fields with field homogeneity. Specifically, the DH and DDH magnets are composed of modulated tilted helices that produce magnetic fields



with pure multi-pole content. However, while DH magnets are based on accurate positioning of wire in machined grooves, DDH technology enables the design and manufacturing of magnet coils in one step, without conventional conductor and winding processes.

According to Dr. Philippe Masson, an AML senior research scientist., when DDH was invented, the advantages were clear in concept. But to really understand the physics behind the measurements, a detailed numerical analysis was required.

MORE ➜ deskeng.com/articles/aabaam.htm

Motorola Gets Greener with Windchill Product Analytics from PTC

Electronics manufacturer controls high-risk substances and complies with environmental regulations.

Motorola, a Fortune 100 tele–communications company, designs and manufactures tens of thousands of products, ranging from cell phones and cable set-top boxes to police radios and wireless network equipment. The company operates under three separate business units: Mobile Devices, Home and Networks Mobility, and Enterprise Mobility Solutions.

The Challenge: Global Environmental Compliance

As a global manufacturer, Motorola must ensure that its products comply with hundreds of environmental standards, including Europe's Restriction on Hazardous Substances (RoHS) directive, the End of Life Vehicles (ELV) directive and Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). Outside of Europe, Motorola's products must comply with many other derivatives of these laws, such as China's own version of the RoHS regulation. All these regulations seek to restrict toxic substances in products, and can block the sale of non-compliant products. For Motorola, millions of dollars in revenues are at stake.

To comply with these regulations, Motorola must track and control restricted substances in its more than 50,000 products across a global supply chain.

MORE ➜ deskeng.com/articles/aabaan.htm

Faster Modeling Accelerates Powerwing Redesign

Solid Edge with synchronous technology speeds the conversion of a steel assembly to a molded plastic part.

In eight years, Razor USA, LLC has grown from an upstart company with a single product (the original Razor kick scooter) to an established earner with a line-up of more than 30 human- and electric-powered toys. The company's successful diversification can be seen in its revenues: Sales in 2001 were $20 million; sales in 2007 were $200 million.

"The struggle for our company in the early years was to capitalize on the popularity of the original scooter while expanding the product line so there was less reliance on a single item," explains Bob Hadley, the company's product development manager. "We accomplished that, but our challenge now is to continually upgrade the product line with more items to maintain growth."

Bringing a new product to market at Razor is a process of considering as many as 100 ideas annually, then narrowing that list down to 15 to 20 to develop more fully. Of those, one to three might actually make it to market.

"In our industry it's important to be able to vet out design ideas as quickly as possible," Hadley says. Today, the company has even more advanced technology for doing that: Solid Edge software with synchronous technology.

Working with Complex Parts

Razor is not new to Solid Edge, having migrated to it in the early 2000s. This was driven by the need for better communication with manufacturers in China.

MORE ➜ deskeng.com/articles/aabaap.htm

➜ For the complete application stories visit deskeng.com/fastapps

-TOM BURBAGE
EXECUTIVE VICE PRESIDENT & GENERAL MANAGER,
JOINT STRIKE FIGHTER PROGRAM
LOCKHEED MARTIN AERONAUTICS COMPANY

-MIKE VANDER WEL
MANUFACTURING DOMAIN LEADER,
ENTERPRISE TECHNOLOGY STRATEGY OFFICE
THE BOEING COMPANY

-STEVE LINDER
DIRECTOR OF MANUFACTURING TECHNOLOGY,
DDR&E RESEARCH DIRECTORATE
OFFICE OF THE SECRETARY OF DEFENSE

-DOUGLAS COMSTOCK
DIRECTOR FOR PARTNERSHIP,
INNOVATION AND COMMERCIAL SPACE,
OFFICE OF THE CHIEF TECHNOLOGIST
NASA HEADQUARTERS

-DR. JAMES K. SUTTER
SENIOR SCIENTIST,
POLYMER BRANCH, MATERIALS
& STRUCTURES DIVISION
NASA GLENN RESEARCH CENTER

THE BRIGHTEST MINDS IN AEROSPACE AND DEFENSE MANUFACTURING. ONE EVENT HORIZON.

AERODEF MANUFACTURING 2011 **IS PLEASED TO ANNOUNCE KEYNOTE ADDRESSES FEATURING THE INDUSTRY'S MOST IMPORTANT THOUGHT LEADERS.** Learn what new technologies and processes are influencing decisions, reducing costs and increasing productivity throughout the enterprise. Created in partnership with the largest OEMs, AeroDef allows you to experience the entire supply chain at one venue – from enabling technologies to the most advanced, integrated systems. A technical conference intent on changing the trajectory of the industry. An exposition floor arranged by seven Technology Zones and featuring advanced Innovation Centers. AeroDef Manufacturing 2011 is the one event you cannot miss. Visit us at www.aerodefevent.com/de.

AERODEF MANUFACTURING

EXPOSITION AND CONFERENCE
APRIL 5-7, 2011
ANAHEIM CONVENTION CENTER
ANAHEIM, CALIFORNIA
WWW.AERODEFEVENT.COM/ME

PRESENTED BY
SME Society of Manufacturing Engineers

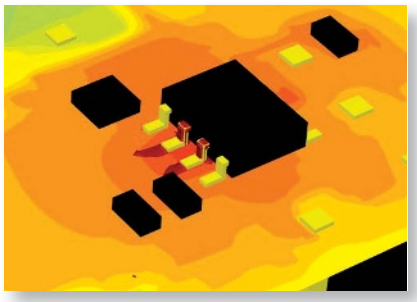
EXECUTIVE COMMITTEE

BOEING · LOCKHEED MARTIN · NORTHROP GRUMMAN · Raytheon · GENERAL DYNAMICS Ordnance and Tactical Systems · Bell Helicopter A Textron Company · NATIONAL CENTER FOR DEFENSE MANUFACTURING & MACHINING

Editor's Picks

by Anthony J. Lockwood

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



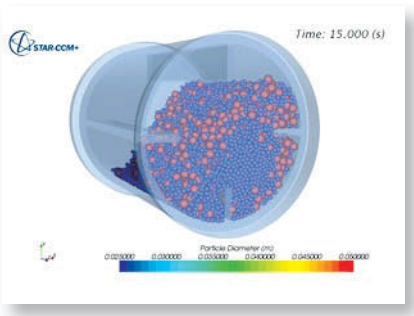
Mentor Graphics Enhances FloTHERM Software

Includes thermal analysis bottleneck and shortcut innovation.

FloTHERM CFD software predicts airflow and heat transfer in and around electronic equipment. You can use it for components, boards, and full systems. It has a long and well-regarded history.

Mentor Graphics has announced some enhancements to FloTHERM, two of which it describes as "patent-pending" technologies. First, FloTHERM 9 now provides what the company calls Bottleneck (Bn) fields. The second technology is what the company calls Shortcut (Sc) fields. These things work together and, from the sound of it, they'll make the designer's job easier and more efficient.

MORE ➜ deskeng.com/articles/aaayxd.htm



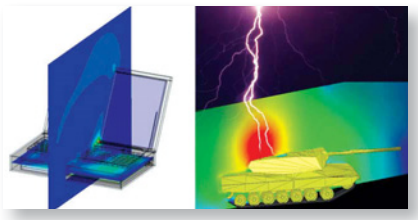
Multi-Disciplinary CAE Tool Upgraded with DEM

STAR-CCM+ v5.06 offers discrete element modeling.

CD-adapco has introduced a DEM (discrete element modeling) capability into version 5.06 of STAR-CCM+, its multi-disciplinary engineering system. This is interesting for a number of reasons.

First, STAR-CCM+ strives to give you the full CFD engineering simulation process in a single integrated software environment. In a nutshell, what that means is that from a single interface you do your CAD preparation, meshing, model set-up, and design studies. Its physics modeling capabilities range anywhere from time to turbulence and heat transfer to combustion and chemical reaction. And it has direct associativity with CAD applications.

MORE ➜ deskeng.com/articles/aaayzk.htm

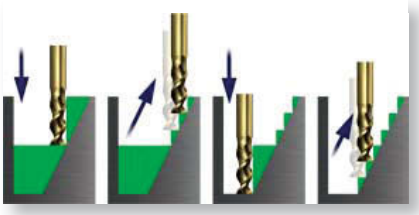


ANSYS 13.0 Engineering Simulation Suite Launched

Latest release focuses on time to market and development costs.

I've never bought that old paranoia about 13 being an unlucky number, and I can tell you that ANSYS Corporation certainly doesn't either. It has released version 13.0 of its ANSYS engineering simulation suite of products. Engineering efficiency — or productivity if you prefer — is the theme here, and it unfolds in three ways: a bunch of new solvers, better integration of multiple physics, and a handful of new technologies that improve performance. Having watched this analysis system evolve over the years, I'd say this sounds like a most interesting release.

MORE ➜ deskeng.com/articles/aaazbh.htm



CNC Software Unveils Mastercam X5

Mastercam Router X5 also released and enhanced.

CNC Software is one of the oldest companies in the PC-based CAD/CAM industry. Its flagship CAM system, Mastercam, has an installed based of more than 150,000 worldwide. The company has released it newest version, Mastercam X5, as well as the newest version of the complementary programming system Mastercam Router X5.

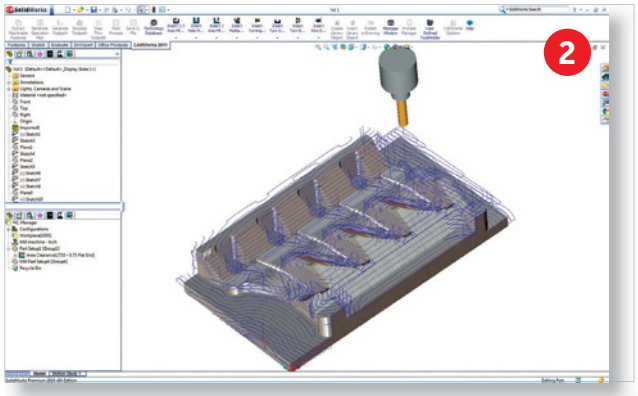
Mastercam X5 introduces new dynamic milling techniques, new multiaxis machining capabilities, and Smart Hybrid Finishing. The latter blends two cutting techniques in a single toolpath. That means your toolpath will evaluate your model's shape then switch between cutting and machining.

MORE ➜ deskeng.com/articles/aaazce.htm

SPOTLIGHT

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

To appear in the next SPOTLIGHT, contact Jeanne DuVal at 603-563-1631, ext. 274 or e-mail jduval@deskeng.com



1 NextComputing's All-In-One, Portable Workstation

NextComputing (nextcomputing.com) has announced its newest portable workstation, the Radius EX. Promising desktop-class computing performance in a transportable, all-in-one design, the Radius EX has a built-in 17-in. 1920x1200 display, single Intel Core i7 processor or dual Intel Xeon 5600 series processors, 48GB of RAM and more than 7TB of storage.

Omega Releases CS Series Process Control Modules

Omega Engineering's (omega.com) CS series of process control modules give users PID loop control of any process without using a PLC. The single- and dual-loop temperature modules also provide ramp-and-soak controls. Up to 16 of these modules can be attached to any CS series master (such as the CSMSTRV2) to provide up to 32 independent control loops. Choosing an advanced CS master (such as the CSMSTRSX) also gives users features such as a virtual HMI, data logging, and web server. Prices start at $227.

Opera Version 14 for Electromagnetic Simulation

The new release of Opera electromagnetic design software improves the speed and accuracy of simulation by extending the flexibility of finite element analysis meshing, according to the company. The software also includes other enhancements, including an integrated graphical circuit editor for defining associated electrical circuitry, such as motor drive components.

Opera, from the Vector Fields Software product line of Cobham Technical Services (cobham.com/technicalservices), provides a design-simulate-analyze-optimize toolchain. It is available in several variants with finite element analysis (FEA) solvers for static and time-varying electromagnetic fields, or with application-specific solvers for design work including rotating electrical machinery, superconducting magnets, particle beams, dielectric insulation, and magnetization/demagnetization processes.

2 Geometric Launches CAMWorks 2011

Geometric Technologies' (geometricglobal.com) CAMWorks 2011 introduces VoluMill, the toolpath plug-in engine for high-speed milling for 2.5-axis and 3-axis roughing operations. For the mold and die industry, Geometric has introduced an optional electrode design solution called ElectrodeWorks. It automates the calculation and design of EDM electrodes. Feature Recognition, which is used to automatically identify areas to be machined, has been upgraded to find more features while decreasing computation times by more than 50% over previous CAMWorks versions, according to the company.

GstarCAD V2011 Released

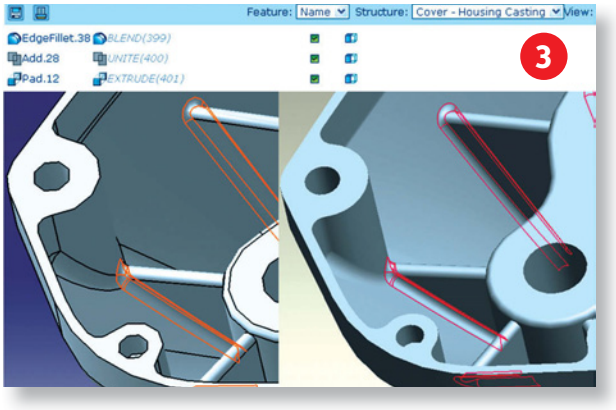
GstarCAD (en.gstarcad.com/) has released GstarCAD 2011. The computer-aided design solution has been improved to provide compatibility with Windows XP, Vista, Windows 7 and AutoCAD from R2.5 to 2010. The latest version offers a number of new features including transformation from 3D model to 2D drawings, advanced drawing compare, text fields and more. GstarCAD 2011 also has a new ribbon user interface.

nPower Releases New Power SubD-NURBS

nPower Software's (npowersoftware.com) Power SubD-NURBS converts Sub-D models into a NURBS-based format that can interface with CAD systems and CAD modeling operations. Power SubD-NURBS is based on IntegrityWare's (integrityware.com) SOLIDS++ geometric modeling Kernel, a hybrid modeling system that supports solids, surface and polygonal modeling. As a plug-in for Autodesk 3ds max, Power SubD-NURBS can convert Sub-D models into a precise NURBS representation that can be read into many CAD systems. Power SubD-NURBS sells for $295, and comes with 200 credits.

ANSYS Releases Engineering Knowledge Manager 13.0

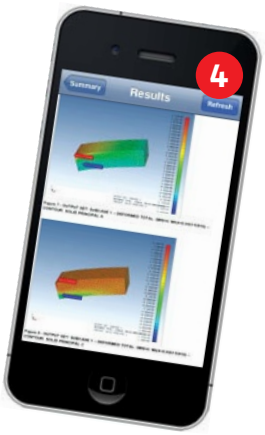
ANSYS (ansys.com) Engineering Knowledge Manager (ANSYS EKM) 13.0 is a simulation process and data management (SPDM) software product designed to provide solutions for engineers who are challenged with managing vast amounts of data and best practices. By managing simulation data and processes using ANSYS EKM technology, the company says users can more effectively leverage simulation and capture the expertise of analysts and engineers who contribute to the process. According to the company, the result is shortened time to market and safeguarding and reuse of the simulation's intellectual property.



Océ TDS750 Large Format Printer Launched
Océ (oceusa.com) has announced the Océ TDS750 large format printing system. The new Océ TDS750 printer features speeds of nine D-size prints per minute and no warm-up time. Users can load the system with six media rolls — up to 3,900 ft. of media capacity — for long uninterrupted printing. Users can also prioritize urgent jobs. The Océ TDS750's scan technology allows for the capture of color markups or as-builts.

3 Proficiency Collaboration Gateway Version 9.0 Released
ITI TranscenData (transcendata.com) has released Proficiency Collaboration Gateway 9.0, which enables the transfer of design information between CAD systems, such as geometry, features, sketches, manufacturing info, metadata, assembly information and drawings in the conversion process. Enhancements include use of the STEP format as the primary geometry exchange engine when features are not used, integration with CADfix and ITI's geometry repair tool, as well as support for CATIA V5 R20, Siemens NX 7.5, and Creo/Elements Pro 5.0 (formerly Pro/ENGINEER WF5).

AMD FirePro 2270 and ATI FirePro V5800 DVI Released
AMD (amd.com) has introduced the AMD FirePro 2270 and ATI FirePro V5800 DVI professional graphics cards. The AMD FirePro 2270 delivers multi-display capabilities for increased efficiency, longevity and compatibility. The ATI FirePro V5800 DVI delivers professionals the graphics performance needed to drive two high-resolution dual-link DVI displays while offering users the ability to stretch one image or application across both screens. The AMD FirePro 2270 starts at $149 and ATI FirePro V5800 DVI starts at $469.



4 Free Mobile FEA App
NEi Software (neisoftware.com) is introducing a free FEA mobile application, NEi Stratus. With the application, finite element analysts can explore how mobile technology can be used to perform basic analysis, viewing results on their iPhone and iPad. The company says it sees the potential of combining cloud technology with NEi Nastran solvers, and expects this initial exploration into the combination will allow for more complex analysis as the technology matures. DE

Advertising Index /// Publisher does not assume any liability for index errors or omissions.

Perspective by Bhushan Patwardhan

Riding the KBE Rollercoaster

Knowledge-based engineering (KBE) means different things to different people. For purposes of this article, it refers to a practice of using the right knowledge at the right time in a design process to facilitate its automation, in part or whole.

The main motivation behind KBE is an integrated approach to product design, with the goal of optimizing a design and associated process by making it predictable, leaner, faster, repeatable and efficient. Apart from that, KBE tries to apply a set of techniques to a design process, enabling organizations to manage knowledge as an important asset. Once knowledge is properly managed, it can be harnessed effectively when needed. For example, a design process can be automated, a sales configurator can be created, and engineer-to-order (ETO) designs can be configured quickly.

Process-centric KBE belongs in the domain of PLM, and not as a part of a CAD model.

KBE problems are often categorized into parametric, configurational, generative, etc., with configurational problems further categorized into x to order (xTO), where x can be assemble, build, configure, manufacture, etc.

But a deeper examination of various categories reveals that the basic nature of the KBE problem involves product configuration and computer-aided technologies (CAx) modeling. However, from a KBE framework standpoint, it is important to differentiate between generative and configurational problems, because solving generative problems demands access to free-form geometry parameters inside the KBE environment. If we accept that generative KBE problems are special forms of configurational problems, then we also realize that it takes a specialized KBE environment to solve such problems.

Two KBE Problem Categories

Generative problems are associated with parts that cannot be "parameterized" and "templatized." It is associated with parts and assemblies that create, modify or build on free-form features. Typically, the design process for these products starts from free-form features like curves and surfaces, and proceeds with more features created to match the form of input geometry. For example, an aircraft leading edge rib is built from loft data. The design process demands several non-parametric, free-form features to be created to match the input loft surface. Ship structural elements and dies for automotive body panels are two more examples where generative KBE provides the most complete and effective method for automating design processes.

Configurational problems relate to products configured or created per order. A traditional configurational problem involves rule-driven configuration of parts from CAx templates, applying assembly conditions to build complete product models, driving downstream CAx model for analysis, etc. If a product configuration requires only the manipulation of part parameters, then a CAD-based assembly automation solution is sufficient. However, such an environment may be insufficient where product configuration rules also lead to situations where individual part quantity, location, type and/or design parameters change based on customer requirements.

To build a comprehensive KBE solution for a product design problem, it is critical to understand all possible product family variations and how a single product family may be divided into multiple knowledge models to make it suitable for process automation.

KBE History

The current state of uncertainty in KBE practice can be attributed to several reasons. After CAD underwent a parametric revolution in the 1990s, it started competing with KBE. There was confusion about where CAD ended and KBE began. A handful of KBE vendors, busy competing against one another, did not rise above the din and clearly communicate KBE differentiators. CAD vendors, because of their size and market penetration, won the battle for customers—and KBE vendors found it difficult to survive.

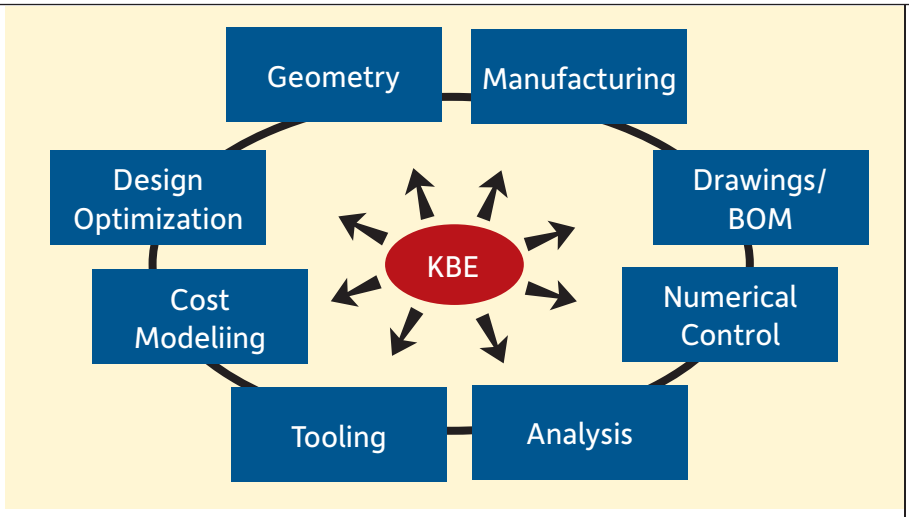
Product design organizations were reluctant to promote KBE for several reasons, including driving tough cultural change through an organization, organizational politics and conflicts between IT and engineering departments over KBE implementation. The reluctance of design organizations to bear costs associated with development, maintenance and complexity associated with a programmed solution, as well as the lack of standardization in process automation practice also contributed.

On the other hand, CAx vendors had their own reasons for failing to promote KBE. Some have argued that a CAD company promoting KBE could cannibalize their own CAD license sales because an automated design process with one KBE license could, potentially, replace several CAD licenses.

Because KBE deals with the creation/configuration of parts and assemblies, most CAD companies have tried to integrate their KBE acquisitions within CAD environments without realizing that a process-centric KBE technology may be better suited to be integrated with PLM.

This integration has not always been seamless. If CAD is a model output of KBE, then KBE should drive CAD output. However, most CAD companies have integrated KBE in ways where CAD environments drive KBE.

Most KBE frameworks in the market are not transparent because they lack an effective knowledge management component. In addition, the high cost of KBE software (in addition to CAD licenses) and specialized consulting have also deterred many design organizations.



Various factors increase the complexity of the product configuration problem, thus requiring a more demanding KBE framework.

The Future of KBE

Are there business drivers that demand better KBE tools, and are there technology enablers to fulfill them? From past, limited successes of KBE, it is evident that there is sufficient technology on hand to create a KBE environment to handle various configurational problems.

Over the years, organizational willingness has been a big hurdle in driving KBE projects forward. On the other hand, CAx vendors have not provided compelling KBE environments to overcome organizational inertia. A next-generation product configurator will require collecting best-in-class features from past experiences into a new, integrated product offering.

One important step in that direction will be to stop looking at KBE as a natural extension of CAD, and look at it from a process or product lifecycle management (PLM) perspective. This could be the single-most important paradigm change to put KBE (and product configuration) into the right perspective. Process-centric KBE belongs in the domain of PLM (or other process related product offering) and not as part of a CAD model. A subtle change in current relationship between CAx and KBE tools can lead to significant benefit in streamlining the KBE environment. It will let KBE integrate various modeling activities associated with product design by giving KBE process much-needed control over the modeling environment.

Three Essentials to a KBE Framework

1 The knowledge manager (KM) serves as a repository of knowledge. It is an application-independent, generic environment, capable of storing various forms of knowledge associated with a design organization. The KM not only includes discrete pieces of knowledge, information or databases, but also common, generic knowledge objects. Making the KM transparent through a web-based front-end will do wonders for any KBE tool.

2 The knowledge configurator (KC) serves as the KBE system development environment to build product-specific knowledge models (or knowledge templates) in the form of a product and process structure tree. It is a development environment with an editor and/or form-based user interface used to define product and process knowledge models. It accesses relevant knowledge from the KM, and applies it to a knowledge model. To facilitate an integrated product development approach, the KC should also provide exposure to various CAx modeling environments through a consistent set of syntax.

3 The knowledge browser (KB) serves as a testing as well as run-time, user access environment for knowledge models. Ideally, the KB should be the CAx modeler itself, with access to the product knowledge model.

It is also interesting to note that many large and small design organizations, frustrated with the escalating costs for CAx licensing, consulting and backward compatibility issues, may be eager to break free of proprietary shackles and seriously consider an open-source CAD and KBE framework.

From my perspective, it has been a rollercoaster ride for KBE over the last 20 years. Growth in the 1980s and 1990s, coupled with the decimation of independent KBE vendors through the 2000s, has been followed by recent signs of rejuvenation. Will the recent signs turn into an industry-wide trend, or will it be another bump in the rollercoaster? DE

Bhushan Patwardhan *is currently based in Puné, India. He has more than 20 years of experience implementing IT-enabled engineering for a variety of companies in the automotive, aerospace and manufacturing industries. He has implemented KBE projects for Fortune 500 companies, as well as medium and small companies, in North America, Europe and Asia. He can be reached via de-editors@deskeng.com.*

Large-format Printing

1 The 3.3-ft.-wide HP Designjet 111 allows users to print oversized projects up to D-size. It is available with a tray or roll-fed option.

Print Speeds

2 Depending on the selected quality mode, which ranges from an image printed in best mode to a color line drawing in draft mode, the HP Designjet 111 prints at speeds between 21.5 minutes per page and 90 seconds per page.

Paper Handling

3 The printer features a front manual single sheet feed and a rear manual path for thick media. Media types include bond and coated paper, technical, film, photo, and proofing paper. Usable media sizes range from 3 to 24.6-in. wide sheets, up to 24-in. rolls. The maximum roll length is 50 ft.

Print Technology

4 The HP Designjet 111 uses HP thermal inkjet Resolution technology with dye-based (color) and pigment-based (black) ink cartridges. It has a line accuracy of +/- 0.2%, according to the company, and resolutions up to 1200 x 600 dpi.

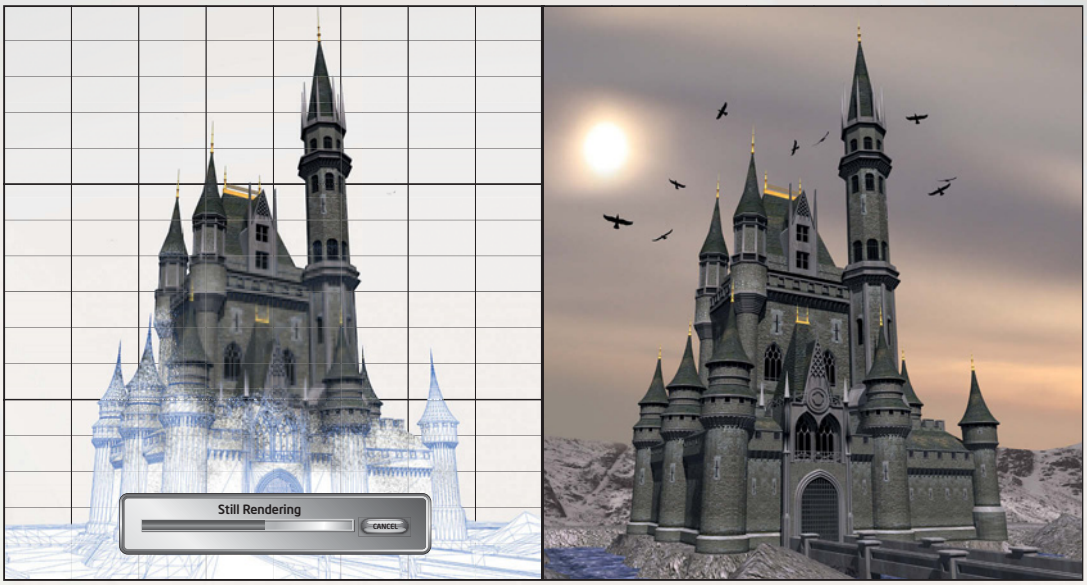
➜ DO YOU HAVE A COOL TOOL? *Desktop Engineering* editors are always on the hunt for great tools to share with our readers. Send us your ideas at de-editors@deskeng.com.

TECH SPECS

- *Dimensions: 41 x 19.5 x 8.7*
- *Weight: 50.7 lbs.*
- *Compatible operating systems: Microsoft Windows 7, Vista, XP, Server 2008, Server 2003; Novell NetWare 5.x, 6.x; Mac OS X v 10.4, v 10.5, v 10.6; Citrix XenApp; Citrix XenServer*
- *Connectivity: Full-speed USB 1.1, Centronics parallel IEEE-1284 (ECP compliant), EIO Jetdirect*
- *Print languages: PCL 3 GU*
- *Included drivers: HP PCL 3 GUI driver for Windows (optimized for AutoCAD 2000 and higher); HP PCL 3 GUI driver for Mac OS X; support for Citrix XenApp and Citrix XenServer environment*
- *Margins (top x bottom x left x right): roll, 0.2 x 0.2 x 0.2 x 0.2 in.; sheet: 0.2 x 0.47 x 0.2 x 0.2 in.*
- *Ink cartridge size: 69 ml (black), 28 ml (cyan, magenta, yellow).*
- *Operating temperature 41 to 104 °F*
- *MSRP: $895*

BEST PERFORMING PROCESSOR FOR DESKTOPS[1]

PROCESSOR PERFORMANCE



Previous Intel® Core™ Processor

Intel® Core™ i7 Processor

With faster, intelligent multi-core technology that automatically applies processing power where it's needed most, the new Intel® Core™ i7 Processor delivers an incredible breakthrough in PC performance.

GREAT DESKTOP COMPUTING STARTS WITH INTEL INSIDE.

3DBOXX SERIES

- Six-core Intel® Core™ i7 processor option
- World's fastest single-processor workstation
- Four dual-slot GPU option
- Performance enhanced to 4+ GHz

STARTING PRICE **$2,312**

GoBOXX SERIES

- Six-core Intel® Core™ i7 processor option
- World's fastest mobile workstation
- NVIDIA Quadro* FX3800M option

STARTING PRICE **$1,966**

BOXX

www.boxxtech.com
877-877-BOXX
512.835.0400

3DBOXX Series and GoBOXX Series are just two of the outstanding solutions from BOXX, the workstation and rendering leader, providing unparalleled, XTREME performance for 3D product design, engineering, VFX, and more.

Intel is not responsible for and has not verified any statements or computer system product-specific claims contained herein.

intel CORE i7 inside

Faster. Smarter.

1 Based on SPECint_rate_base2006* scores. Results have been estimated based on internal Intel analysis and are provided for informational purposes only.
Any difference in system hardware or software design or configuration may affect actual performance. See http://www.intel.com/performance for additional information.

STRATASYS
Make It Real

NOW THERE'S ROOM ON YOUR DESK AND IN YOUR BUDGET FOR BIGGER 3D PRINTING.

Modeling material available in nine colors with uPrint Plus.

Introducing the uPrint® Plus Personal 3D Printer. Turn big ideas into color 3D models right at your desk.

The uPrint Plus Personal 3D Printer gives you a 33% larger build envelope than the original uPrint Printer but in the same 25" x 26" footprint. uPrint Plus also gives you two layer resolutions and a choice of nine material colors. Both uPrint and uPrint Plus bring your ideas to life as durable plastic models you can use for proof of concept, functional testing, product mock-ups and much more.

Choose which uPrint is right for you at www.dimensionprinting.com/de3

STARTING AT

$19,900* USD

uPrint® plus
by dimension

*Manufacturer's worldwide list price. Additional options, shipping, applicable taxes/duties not included. ©2010 Stratasys, Inc.