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by Steve Robbins

Spaced Out by Costs

As I sit at my desk writing this editorial, the newswire has just informed us that the remaining three space shuttles have been auctioned off to the Smithsonian Institution in Washington, DC, the Kennedy Space Center Visitor Complex in Cape Canaveral, FL and the California Science Center in Los Angeles. It's a defining moment for the space program, as the last shuttle launch will happen this summer and then the United States will be without an operating vehicle to service the International Space Station or perform other scientific duties in space.

As engineers, we have tools that would have been considered astounding 50 years ago.

I grew up before we had put a man in space. The Russians went first with Yuri Alekseyevich Gagarin. When Alan Shepard, in his Mercury spacecraft, was sitting on top of a Redstone rocket, I was enthralled. Being nine years old, my best friend and I decided to write NASA about joining the space program. Unbelievably, someone at NASA actually wrote us back and included a lot of pamphlets about the program and becoming an astronaut. In 1961 the Mercury spacecraft had 120 controls, including 55 electrical switches and 35 mechanical levers.

About 25 years later *Mobile Computing Magazine* published a story on the back up computer for the space shuttle. It was a GRiD laptop that was attached via hook-and-loop to the main instrument panel. It had exponentially more compute power than the multiple redundant computers in the shuttle's main computer system. Today, the same basic design is running the computer systems of the original shuttle. It has been upgraded over time but, by today's standards, it's a dinosaur.

More Tech, Less Motivation

It's sad to see the space shuttle being retired. It's even more amazing that we don't have a replacement for this spacecraft. But we live in different times. Back in the '60s, it was competition with a threatening (real or imagined) power that drove us. We had to be there first. Now, no one wants to spend the money.

The innovation resulting from our research and designs from the space industry has been commercialized, changing everything from medical devices to the safety systems in our automobiles. Yet now we are paying the Russians millions of dollars per flight to send our astronauts to the International Space Station.

Private enterprise is making progress in space flight, but real movement forward allowing us to break the bonds of gravity will have to come from that inventiveness and ingenuity that was an obsession in the early days of space flight.

Limitless Possibilities

As engineers, we have tools that would have been considered astounding 50 years ago. We have developed components, sensors, computers and materials that were not just unheard of, but impossible to acquire when the space shuttle was designed in the '70s. With the skill, knowledge, and resources we have today, imagine what is possible. And think of the knowledge gained if we could succeed in visiting another planet or asteroid.

I know we will eventually move in this direction, and we will be covering these advances in *Desktop Engineering*. And who knows, maybe we won't need government funding, maybe it will happen organically. Maybe something will provide the passion and drive to excel in creating new space technology, like the Rocket Racing League (rocketracingleague.com).

I am still enamored with spaceflight and am looking forward to the future. I am also sure that as technology moves forward, computers get faster, and the motivation for exploring new frontiers increases, we will have extraordinary space vehicles that we can't imagine today. 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.*

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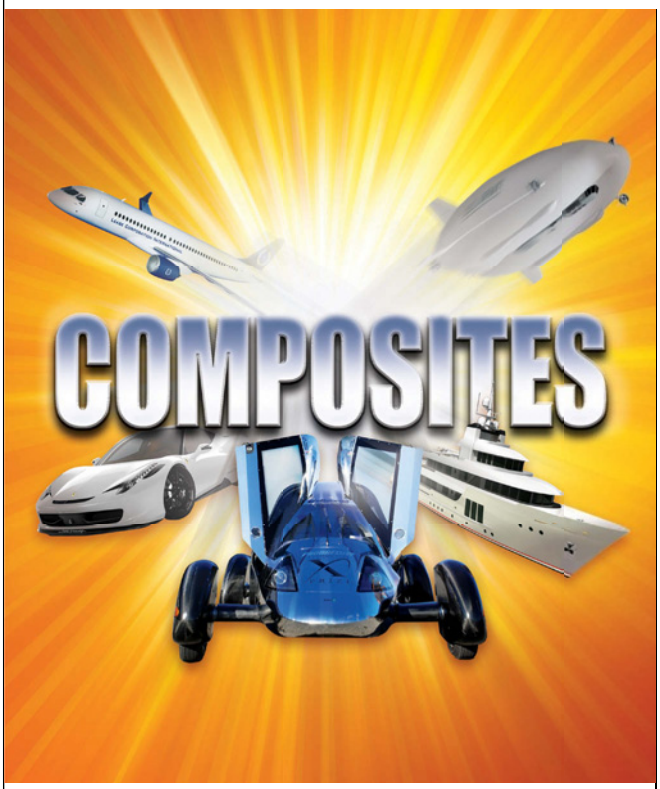


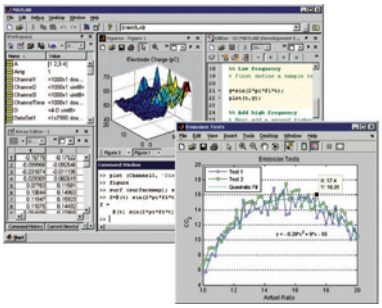
COVER STORY

Composite Cooperation

 Fiber-reinforced technology is seeing extensive use for its low weight-to-strength ratios. But if ever there was a need for close cooperation among designers, structural analysts and manufacturing engineers, this is the time, and optimization plays a key role across the board. With dozens of software packages addressing these challenges, Pamela Waterman takes a look at what's new, what's critical and what challenges remain.

ON THE COVER: Composites are commonplace in cutting-edge planes, trains and automobiles, including X prize contenders like the Edison2, which won in 2010.

HIGH-PERFORMANCE COMPUTING



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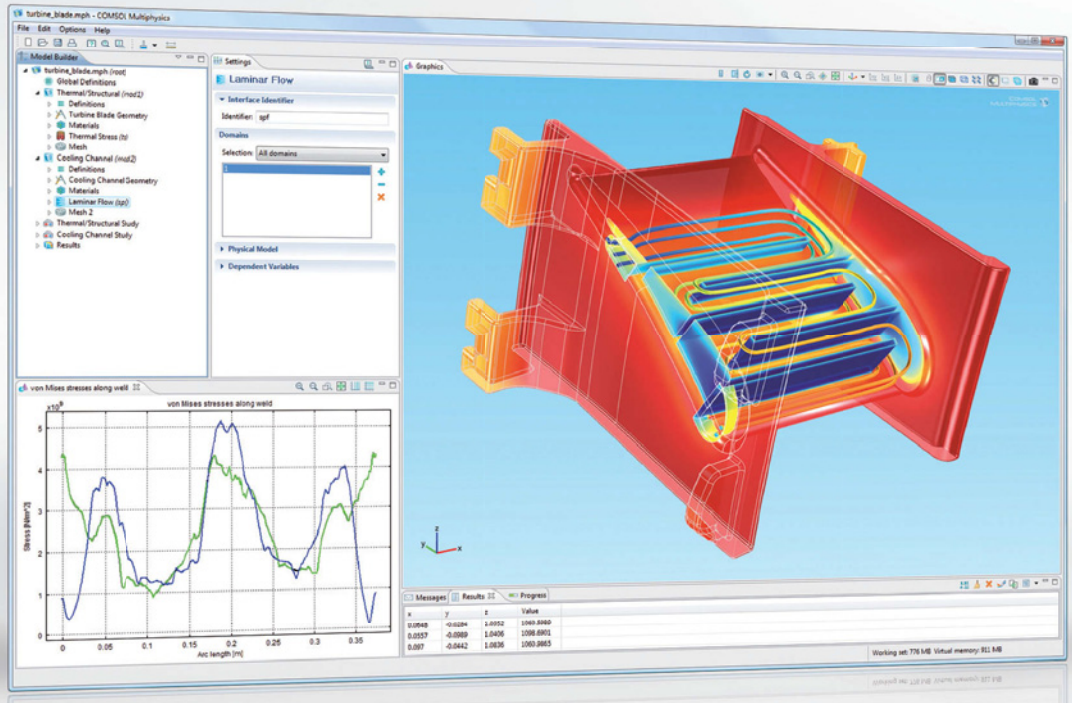

A stator blade in the turbine stage of a jet engine is heated by the combustion gases. To prevent the stator from melting, air is passed through a cooling duct in the blade.

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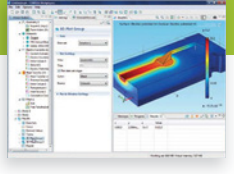

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NATIONAL INSTRUMENTS™

by Kenneth Wong

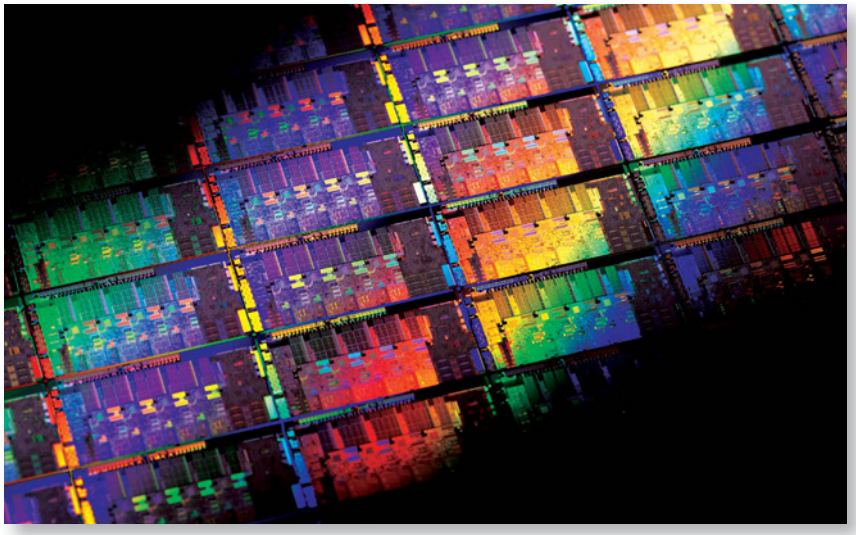
Intel's New Carrot: HD Graphics for Entry-level Workstations

For years, price-conscious buyers have been creating their own unauthorized workhorses. Often, they do it by purchasing a high-end home or business machine, adding a GPU, and bolstering its RAM. The downside of that, of course, is that they end up with configurations that aren't supported by professional software makers, particularly those who publish 3D design and engineering software.

Hardware makers like HP and Dell have been taking note—and they have decided to enable what they couldn't stop, by creating the entry-level workstation category. The new machines coming out this season will most likely be powered by Intel Xeon E3-1200, the chipset series.

According to an Intel news release, "these processors power entry-level workstations that merge the traditional strengths of the professional workstation with a new processor-based Intel HD graphics technology to tackle entry-level data analysis, CAD, digital animation, and 3D imaging challenges."

Thor Sewell, director of Intel's workstation business strategy, explains: "The new Intel Xeon processor's greatest innovation is how it integrates—for the first time in an entry workstation product—the CPU and graphics engines on the same die. That means visual and 3D graphics capabilities that were once only available to entry workstation users with discrete graphics cards will now be accessible to anyone with an entry workstation with Intel HD Graphics P3000. It changes the definition of the workstation, and it may potentially change the form factors it is delivered in."



Intel Xeon E3-1200, which features general processor and graphics processor units on the same die, is based on the Sandy Bridge technology Intel announced in January at CES. This close up shows a Sandy Bridge wafer.

Sewell points out that HD Graphics P3000 in Intel Xeon is not to be confused with the Intel HD graphics 3000 on Intel Core i7. "The P3000 is only available on Intel Xeon E3-based workstations, and it delivers some amazing graphics performance for professional applications from SolidWorks, Autodesk and Adobe," he says.

Intel argues that putting the general processing unit and graphics processing unit on the same die—as it is the case with Xeon E3-1200—is a better approach than using a discrete graphics card, because the shorter passage (physical distance) between the two processing units cuts down on data travel, thus improving throughput.

Cross Licensing

Intel recently signed an agreement with NVIDIA for a significant sum. "Under the transaction, Intel receives a license to NVIDIA's patents subject to the terms of the agreement," the announcement reads. "NVIDIA receives a license to Intel's patents subject to the terms of the agreement, including that x86 and certain other products are not licensed to NVIDIA under the agreement. Intel and NVIDIA have also exchanged broad releases for all legal claims, including any claims of breach of their previous license agreement. Intel will pay NVIDIA $1.5 billion over the next 5 years." The agreement also ends a legal battle between the two.

It's unclear how exactly Intel plans to use chunks of NVIDIA technologies to which it now has access. Intel is rather tight-lipped about it. And the end of their legal feud hardly means the end of their market rivalry. If anything, this might be a case of "coopetition:" competitors working together for mutual gain in an area where their interests happen to merge. In this case, that coveted area is graphics acceleration. DE

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by Kenneth Wong

FRC 233: The Pink Team Builds SWAT Robot

When Detective Christopher Cochie from Florida's Rockledge Police Department first approached FIRST Robotic Competition (FRC) Team 233, also known as the Pink Team, to help build a robot for his SWAT team, he had something fairly simple in mind, like a remote-controlled miniature car with a camera mounted on the hood. The team took his ideas, added some of their own, and came back to him instead with a state-of-the-art robot that could climb up steps, trudge through mud, toss a phone, launch flash bangs, and do much more.

Its creators, a group of students from FRC Team 233, were well versed in the mechanics of robotics, thanks to the competitions in which they'd participated. Given the chance to help their local police officers, they jumped at the opportunity, enlisting the help of their teacher and FIRST mentor Marian Passmore and their FIRST sponsor NASA. (Team members were mostly from the Cocoa Beach area, roughly 15 miles away from Cape Canaveral and the Kennedy Space Center.)

Though it weighs approximately 100 lbs., PDBot is designed so a single person can transport it. It has pneumatic canister launchers, for both short- and long-range targets. It's equipped with a camera, capable of video recording. Its chassis can withstand heat and moisture; its tank-style wheels can move along inclines and vegetation. In field tests, the robot proved strong enough to drag a human with little or no effort. Using its microphone, it can literally talk to a suspect.

Officers may deploy it in crisis situations—for instance, to open up a communication line for hostage negotiation or to distract a hostile suspect. With PDBot providing sight and sound, officers can remotely inspect and assess dangerous environments without compromising their safety. Most likely, PDBot will ride alongside SWAT officers when they respond to calls.

Charlie Stankie, one of the students responsible for producing CAD designs for the team, recalls how the police department was "even thinking about going to Walmart and buying a remote-controlled car to tow the throw-phone out to the target," which is a common approach in hostage negotiation scenarios. But over time, he adds, "Imagination led to something substantially more complicated, and quite a bit bigger."

PDBot, a SWAT robot designed and built by FIRST Robotic Competition students from The Pink Team for their local police department.

Stankie and his team used PTC's Pro/ENGINEER CAD software (recently renamed Creo Elements/Pro) to design their competition robots. Naturally, they relied on the same package to develop the PDBot.

"We built the entire model with all the parts, down to the bolts," he says. "Mainly, we did it for spacing, to figure out how we'd have to arrange everything so they would all fit, because it's a relatively compact package."

The students also used Pro/E to verify clearance among the robot's moving parts, using the software's basic mechanical simulation tools.

"There's nothing like it out there," Kaitlin Lostroscio, the pit crew chief for the team, says of PDBot. "Many other robots would just have a camera. With our long design process, we were able to actually figure out everything beforehand. Now it's just a matter of working out a few [system] communication issues here and there so that they can get the best distance with it. We don't want them to have any interference."

Though her post-high school aspirations are still up in the air, Lostroscio says she is certain she wants to be involved in robotics in one way or another. "Biomedical engineering, something like the PDBot—that's a field of its own, when you think of it—or a Mars robot," she says.

Cochie, who has been on the force for six years and a SWAT officer for four, says, "This project is the best thing I've ever been involved in in my career so far. It's given me pride for my job, pride in my community. The students gave us something that will eventually save the life of one of us."

More information about the team's SWAT robot can be found at Roccobotics.com.

To see PDBot in action, check out the video clip at deskeng.com/virtual_desktop/?p=3469. DE

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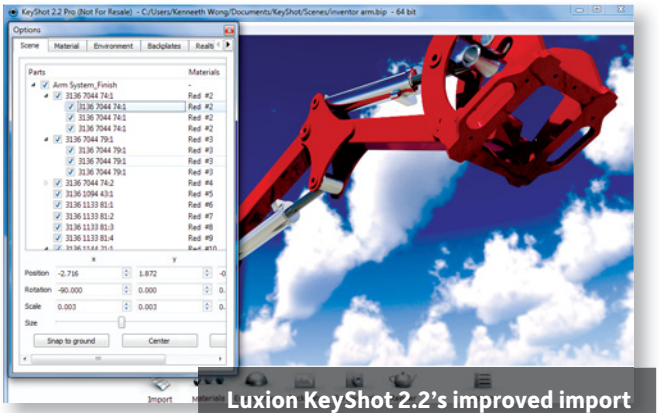
SIMULIA

by Kenneth Wong

Luxion KeyShot 2.2 Features Improved Import Functions

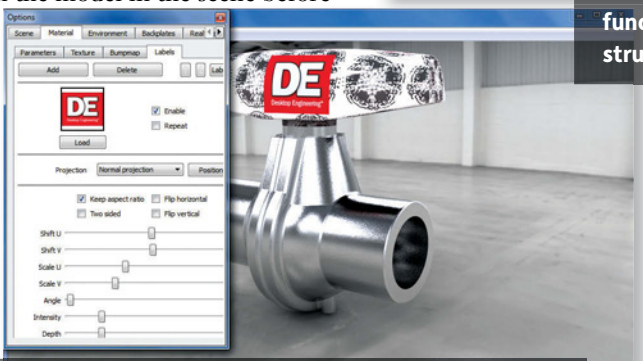
Luxion KeyShot, one of the offshoots of HyperShot, is now in its second incarnation. In fact, it's in Version 2.2, with incremental upgrades sprinkled over the past few months to bring it to where it is now.

A major improvement in the latest version is the smoother, faster import function. Now, when you import a CAD assembly, you'll see a model tree with the same assembly structure inside KeyShot. During import, the program gives you options to place the model at the center of the scene (or not), snap the model to the ground (or not), and orient the model by a certain axis (X up, Y up, or Z up). This eliminates the work you would otherwise need to do to position and align the model in the scene before applying aesthetic treatments.



Luxion KeyShot 2.2's improved import functions let you retain your assembly structures from common CAD files.

KeyShot continues its ease of use tradition, dating back to its origin as a rendering program for those with little or no experience. With robust support for common CAD file formats, KeyShot remains one of the most accessible rendering packages for those who regularly work with mechanical modeling programs.



With the new Label function in KeyShot 2.2, you can project 2D images on your 3D models easily. Afterward, you may also apply texture to your material.

The program retains its drag-and-drop simplicity, allowing you to apply materials, environment and backdrops, then render the visible scene in the program window into a photo-realistic image. There's no need to understand ray-tracing, Gama adjustment and other technical setups. The simple slider bars and real-time feedback let you work intuitively by experimentation to compose the scene with the right brightness, camera angle and materials.

In Version 2.2, the hierarchical assembly structure imported along with the model gives you a simpler way to sort, identify and apply attributes to different parts of your model. Furthermore, items selected in the model tree are encircled by a yellow outline in the program window, which makes isolating them much easier. If you often deal with complex assemblies and you're used to identifying items by name (part number, for instance), you'll find this enhancement to be a huge help.

In Version 2.2, you'll find that the Move and Scale commands are much more responsive. You'll also notice some interface improvements—among them, an easy way to select standard camera views (Front, Left, Right, Top, Back and so on) from a drop-down menu; and a single-click button to center your geometry.

Though not highly publicized, it's worth noting that KeyShot gives you the option to select a small region for test-rendering. Under Render > Render Settings > Region, if you place a checkmark in the Enable box, you'll be able to drag a selection window to define the region you want to render. If you're concerned about the details in a certain region in your scene, and you don't want to wait till the entire scene has been rendered to inspect the area, the regional rendering option works well as a way to test-render the chosen area.

Previously, to project a 2D image on the model's 3D surface, you had to load the image as a texture in the material editing window. Though it gave you the result you wanted, the method also left you without a way to apply texture once the slot was occupied by the projected 2D image. In Version 2.2, KeyShot gives you the ability to apply labels—more than one, if you want—to your material. Not only is the operation simpler, it also gives you the option to apply texture to your material in addition to labels.

For a video demonstration of KeyShot 2.2, visit deskeng.com/virtual_desktop/?p=3492. DE

Pay-per-Core FEA Licensing: **Fair or Unfair?** Altair Weighs In

One of the consequences of multi-core computing is the introduction of per-core licensing. This is true especially in the analysis market, where the number of cores you designate to a problem can dramatically shorten the turnaround time or increase the quality of the results. Software makers judge—correctly, I might add—that the benefits are significant enough to entice users to pay more for the right to use additional cores. Hence, the birth of pay-per-core licensing.

I've heard grumblings among finite element analysis (FEA) and computational fluid dynamics (CFD) users. They believe the gain comes from the additional hardware they are paying for (by adding more processors to the server or by upgrading their dual-core workstations to quad-core ones). So they ask: Why should we shell out more for using the same software on the more powerful hardware we acquired?

Software developers counter that it takes considerable time and effort to enable parallel processing in the software, so users who want that added boost should pay more.

One Developer's Perspective

Jeff Brennan, Altair Engineering's chief marketing officer, acknowledged some users' dissatisfaction with this licensing model, but points out, "There is some effort required in software development to not just architect [the product] for scalability … but [doing so] without sacrificing accuracy."

In 2007, Altair launched an on-demand licensing model for its PBS Professional suite. It was described by the company as "a single on-demand computing environment" where users "only pay for what they use, where customers can enable their entire infrastructure but only pay for concurrent usage of licenses" and they can "dynamically float [licenses] across enterprise computing resources, even geographically separate systems …"

"With our licensing model, the added cost for multiple cores is by no means linear," says Brennan, defining linear as a licensing cost multiplied by the number of cores used. "It decays quite rapidly as you increase the number of cores."

In Altair's licensing model, Brannan explains, "You draw licenses, or tokens, from a central pool only when you're using the product. You deposit them back when you're done."

In 2003, Altair Engineering acquired Veridian's PBS technology (which stands for portable batch system). The product lives on as Altair's PBS Works, a job scheduling system for submitting, tracking and monitoring computing tasks. The company plans to launch a service called HyperWorks On Demand, which lets its users remotely borrow Altair's hardware resources (in other words, additional computing cores, available via cloud-hosted setup) for jobs that demand more than what's available internally.

To share your thoughts on licensing, or to listen to my interview with Brannan, please visit deskeng.com/virtual_desktop/?p=3438. 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.*

RAPID 2011
Focuses on Revolutionizing Product Creation

Additive manufacturing show includes 3D Imaging Conference.

RAPID 2011, a conference and exposition showcasing how additive manufacturing is used to create almost any solid product while reducing production costs, will be held in Minneapolis, May 24–26, 2011. It is presented by the Society of Manufacturing Engineers (SME).

RAPID 2011 includes displays of equipment, software and service providers, as well as technical sessions with experts in additive manufacturing.

The RAPID Conference, including 3D IMAGING, will offer more than 70 technical sessions, keynotes and panels, allowing professionals in design, engineering and production as well as artists to evaluate the latest materials and machinery for creating 3D products using 3D imaging and additive manufacturing.

Exhibits, keynotes and presentations will illustrate applications for industries serving medical devices, aerospace and defense, automotive parts, architecture modeling, the arts and emerging applications for custom consumer products. Buyers and end-users of design, prototyping, tooling and direct manufacturing equipment will get a chance to compare products and processes and discuss new cost-cutting and time-saving uses for the technology. Presentations will cover the use of additive manufacturing in combination with 3D imaging for:

- Medical devices, bones and implants
- Custom consumer products
- Casting
- Parts inspection and verification
- Motor vehicles
- Aircraft, aerospace and defense parts
- Architecture modeling
- Sculpture, entertainment figurines and jewelry

Special programs and events include:

- The Rapid Implant Manufacturing Forum. SME is co ordinating with Materialise to present diverse uses of image processing and manufacturing from medical industry leaders.
- Industry-focused conference sessions.
- The Contemporary Art Gallery represents the use of additive manufacturing in a new industry, expanding the horizons and demand for these technologies.
- Additive manufacturing and 3D imaging technology briefings. These one-hour sessions provide an introductory overview of the technologies on the trade show floor.
- Show floor networking reception on Tuesday evening.
- Bright Minds Mentor Program. Members of the RTAM Education & Information Exchange Tech Group will hold the eighth annual mentoring program including students from Minneapolis area high schools.
- Design for DDM Student Competition 2011. This annual student-only competition encourages student designers to use their imaginations and design a product that use direct digital manufacturing (DDM) features.
- Technical Group Open Houses on 3D imaging, direct digital manufacturing, medical applications and nano-manufacturing.

Attendees also have the opportunity to register for one of four workshops, all of which take place on Monday morning.

The Fundamentals: Additive Manufacturing workshop, led

Simulation and Analysis at NAFEMS World Congress

If you're involved in simulation and analysis, check out the NAFEMS World Congress 2011: nafems.org/congress. Being held in Boston May 23-26, the Congress will provide delegates with:

- Keynotes from leading minds in the analysis community.
- Approximately 170 presentations in six technical tracks.
- A choice of free training courses to attend.
- Focus sessions on composites, stochastics, SDM, HPC and more.
- An exhibition featuring industry software vendors.
- Social and networking opportunities included as part of your registration.

Representatives from large corporations, delegates from academic institutions, consultancies, software vendors and others will share their experiences in engineering analysis, simulation, and associated technologies.

In addition to traditional conference sessions, the NAFEMS World Congress will play host to a number of short training courses on related topics, focus sessions on the cutting-edge concepts in engineering analysis, and an extensive exhibition area including representatives from all of the major analysis software vendors.

For more information, visit nafems.org/congress.

by Graham Tromans of Loughborough University, introduces participants to the world of rapid technologies with discussions on the most widely used additive technologies and how they are applied.

Another Fundamentals workshop will focus on Reverse Engineering & 3D Data Capture. Led by Giles Gaskell of Xspect Solutions, it will provide an introduction to 3D scanning technologies, software and processes, highlighting the differences between data capture technologies followed by a hands-on demonstration of some of the most popular scanning devices.

Brent Stucker, Ph.D., University of Louisville, will lead the Metal Parts Using Additive Technologies workshop. It will provide an overview of additive processes used for creating metal parts. Methods for metal part fabrication range from casting metal parts from rapid prototyped patterns to direct metal fabrication using lasers, electron beams or ultrasonic energy.

The American Foundry Society will present the Metalcasting Solutions workshop, which will provide attendees with an interactive overview of metalcasting processes and alloys.

After the workshops, attendees can elect to take one of two tour tracks that are being offered Monday afternoon.

One tour visits Starkey Laboratories & RedEye On Demand. Starkey Laboratories is a designer, developer and distributor of hearing solutions. It uses stereolithography to manufacture the hearing aid shell. A 3D scanner is used to digitize the ear impressions, which are then used to sculpt the outside and inside of the impressions, add virtual electronic components and other options, and then print the modeled shell. RedEye On Demand, a digital manufacturing service center, is a subsidiary of Stratasys, Inc. Attendees can observe FDM technology being used to produce concept models, functional prototypes and manufacture tool and end-use parts by experiencing the "factory of the future."

Tour 2 visits Invest Cast Inc. & Vista Technologies. Invest Cast Inc. specializes in production metal investment casting and production quality prototypes. The tour of Vista Technologies ventures through the Rapid Prototyping Division's multiple additive manufacturing technologies including FDM, SLA, Polyjet and Multi-Material Polyjet.

Concurrent conference sessions run from Tuesday through Thursday.

For more information on RAPID 2011 and the 3D IMAGING Conference & Exposition, or to register for the event, visit sme.org/rapid. DE

CALENDAR OF EVENTS

Below is a sampling of upcoming events for design engineers in 2011.

EASTEC 2011
Manufacturing Conference
May 17-19, West Springfield, MA
easteconline.com

NAFEMS World Congress
May 23-26, Boston
nafems.org/congress

RAPID 2011
May 24-26, Minneapolis, MN
sme.org/rapid

FLOW-3D European Users Conference
May 26-27, Monza, Italy
flow3d.com

Hexagon 2011
International Conference
June 6-9, Orlando
hexagonconference.com

Sensors Expo 2011
June 6-8, Rosemont, IL
sensorsmag.com/sensors-expo

International Forum on Design for Manufacture and Assembly (DFMA)
June 13-15, Providence-Warwick, RI
dfma.com

Solid Edge ST4 Global Launch Event
June 15-16, Huntsville, AL
seeuthere.com/solidedgest4reg

PlantePTC Live
June 21-15, Las Vegas
live.planetptc.com

Altair HyperWorks
Technology Conference
June 22-23, Orlando
altairhtc.com

STAR American Conference
June 28-29, Chicago
cd-adapco.com/minisites/us2011

Coordinate Metrology
Systems Conference
July 25-29, Phoenix
cmsc.org/cmsc-attendee-information

NIWeek 2011
Aug. 2-4, Austin, TX
ni.com/niweek

SIGGRAPH 2011
Aug. 7-11, Vancouver, BC, Canada
siggraph.org/s2011

GPU Technology Conference
Oct. 11-14, San Jose, CA
nvidia.com/object/gpu_technology_conference.html

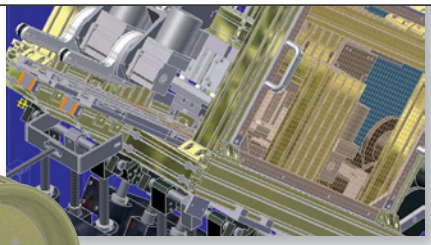
COMSOL Conference
Oct. 13-15, Boston
comsol.com/conference2011

SC11 Supercomputing Conference
Nov. 12-18, Seattle, WA
sc11.supercomputing.org

Autodesk University
Nov. 27-Dec. 1, Las Vegas, NV
au.autodesk.com

Make the Machine Go

BY JIM ROMEO



TOP: A machine that feeds two strips of rubber profile into an over-mold press machine.

LEFT: An example of how a motorcycle rim would look with fancy engraving.

3D prototyping is necessary to design, visualize and ultimately simulate conceptual designs for their customers. Design work such as this requires accuracy to design and subsequently fabricate products.

Michael Forkert is a specialized machine design engineer with Glaze Tool and Engineering in New Haven, IN. Part of his job, and his company's overall function, is to design and engineer machines for manufacturing and production.

To accomplish this, Glaze uses Autodesk's Inventor 2009. *DE* spoke to Forkert to get an assessment of how his company uses this product, and what it looks for in design engineering software to accomplish its goals:

Q. What can you tell us about Glaze's products?

A. *I use Inventor 2009 in the concept, design and detailing of specialized machinery. Here at Glaze, we don't really have a 'product,' per se. Our product is the design and building of machinery to produce, assemble or test our clients' products. One machine may be for a dryer or washer panel assembly; the next might be automotive related. Our machines may be a simple fixture for a manual operation, or may be as extensive as a complete robotic weld cell.*

Q. What are some of your more challenging aspects to working on a project for a customer?

A. *Communication is always the most critical aspect to any project. Whether via phone, email or drawing, the communication needs to be clear and understood from both sides. As far as drawing data is concerned, the ease and error-free conversions from one type of software-based data to another almost always is a challenge — let alone the different levels of release of the same software. It has vastly improved over the years.*

Q. What characteristics of the Inventor program were most beneficial?

A. *With the Inventor program, I will create ".dwfs" of my machine concepts. I always recommend to our clients to go to the Autodesk website and download the free design review. Some of our clients do not have any CAD software. Some companies have a type of CAD software, but our contacts don't have the access. But by using the viewer, they have the ability to review my concepts, and then they can communicate their concerns or questions in a more timely fashion.*

Q. Is designing your engineered projects different from designing other products?

A. In the specialized machine design field, I probably see or create a wider variety of designs than someone who just designs the same widget for various customers. Each machine or fixture is different, because our client base is so varied. Sometimes ideas will translate, but that just comes from experience.

And as in any design, cost is a factor. Even if our client says, "Money is not an issue, we need it now," we still try to design cost-effectively. The other issue, especially in a machine that handles production parts, is whether the products are within the design tolerance. Does the design handle out-of-tolerance parts? When I can, on highly tight, critical machines, I like to create three models of the same product: one at mean, one at max and one at min tolerances. Then I have something to check clearances and fits. The Analyze Interference tab is very helpful in checking close areas.

Q. Is breakthrough technology reliant on top quality design software? Why or why not?

A. *I believe it depends on what you are designing. I believe you use the right tool for the right job. Finding or knowing what the right tool is, however, does take a bit of experience or training. In the end, our special machines are to make products easier, faster and safer to produce.*

Q. In your view, what were the key economic and functional benefits that the Inventor program provided as a solution to existing problems?

A. *Years ago, I worked in a group of 20-plus engineers, designers and detailers. We even had a few checkers that reviewed our details and designs. Everyone had a drafting board, and we worked in a very large room. Now, I am the entire engineering department, and work at a desk in an office. With today's software, it has become the engineering source. Smaller companies can use a few talented designers and get by with someone who knows the engineering program.* DE

Jim Romeo *is a freelance writer based in Chesapeake, VA.*

INFO ➜ Autodesk: USA.autodesk.com

➜ Glaze Tool and Engineering: GlazeTool.com

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

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Clusters Fill the Compute Gap

Whether in a rack like this one or built with desktop workstations tied together via high-speed interconnects, compute clusters are an attractive option.

Engineers are increasingly turning to compute clusters for faster and less expensive analysis and simulation efforts.

BY PETER VARHOL

In the not-too-distant past, engineers who could not run analyses or simulations of their designs on desktop computers had little choice but to use an engineering mainframe or supercomputer, queuing up the job and hoping to get the results back within a few days. Further, many smaller engineering groups couldn't make the leap in investment necessary to acquire such "big iron," and either rented time on larger systems or simply did without a lot of analysis.

Today, there is an intermediate level of computation that is both more affordable and more flexible than the mainframe and supercomputer alternatives. It's the compute cluster — a group of connected computers, working together closely, which in many respects create a single computer for certain kinds of computations.

These connected computers are good for only certain kinds of problems — those that can be broken apart into independent execution paths, so that code can execute on multiple processors and cores. Independent execution is typically the realm of analysis and simulation problems, where the same code uses different data to come up with intermediate results independently.

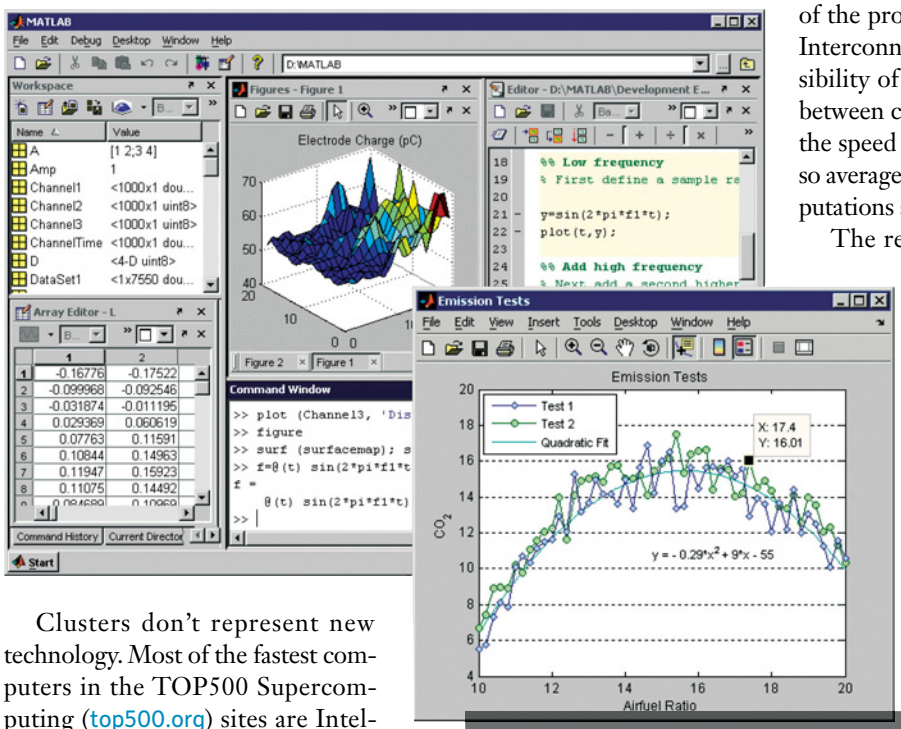
According to Silvina Grad-Frelich, manager at The MathWorks, one of the most common applications of cluster computation today is Monte Carlo simulations. "Within a given amount of time," she notes, "engineers can get a much finer level of detail over the possible strengths of their design." Multiple Monte Carlo runs can be done on different processors and cores simultaneously, making it possible to get better simulations faster than with individual workstations. But the speed of clusters also enables engineers to follow through with entire alternative designs, and to test those designs quickly and accurately.

The Practical Benefits of Clusters

Any 64-bit system today can be configured with enough memory and storage to eventually solve virtually any problem. But there are two practical reasons for using a cluster. First, it enables engineers to do an analysis within a reasonable time constraint. Even the fastest individual workstation lacks the horsepower to do some very complex problems in a set period of time. You can improve cost and time to market by performing these activities on a faster set of computers.

Second, even if time to market remains the same, the risk is reduced because engineers have more data upon which to make decisions. Because you can run more simulations and more detailed simulations, do a greater number of sensitivity analyses, or run more detailed dynamic analyses, you end up with a better design. Engineers say that the ability to consider more design alternatives usually results in a better design, as they can do more than simply meet specs within the same amount of time.

For high-end designs and detailed simulations, server clusters can be employed to speed up computations, or do more computations. The ability to break simulations and many types of analyses up into multiple independent parts makes it possible to solve some problems in a fraction of the time that they required on the desktop, and with higher fidelity.



MATLAB support different types of parallel operations with clusters, including NVIDIA GPU porting.

Clusters don't represent new technology. Most of the fastest computers in the TOP500 Supercomputing (top500.org) sites are Intel-based clusters. What has changed is their acceptance as alternatives to supercomputers, along with the ability of software vendors to break up computations into independent parts that can fully leverage dozens of processor cores found in a cluster.

Because many high-end servers employed in clusters use Intel Xeon processors, the chip maker has an interest in ensuring that vendor hardware scales up well, and works with both components and software. Developed in conjunction with hardware and software vendors, Intel Cluster Ready lets engineering groups match engineering design applications to the fastest computers and components. This includes servers from Appro, Dell, SGI, and Super Micro, among others.

System and component providers and system integrators use the Intel Cluster Ready architecture and specification to develop interoperable clusters. Software vendors test their applications running representative workloads on Intel Cluster Ready systems that have already received certification. By buying and using Intel Cluster Ready systems and components, engineering groups know that they have been tested together and can more easily be used in making a "do-it-yourself" cluster. It may be more work to design and set up your own cluster, but doing so gives engineers the ability to customize a cluster for specific types of applications and design tasks.

The Interconnect Is the Key

Most clusters are using Infiniband or similar high-speed interconnects, where the performance begins to approximate that of the proprietary busses on the motherboard. Interconnects make a big difference in the feasibility of a cluster. The speed of data transfer between computers is already slowed relative to the speed of memory and especially processors, so average interconnects simply slow down computations still further.

The result is that clusters are able to have inter-system communication at a rate fast enough to deliver the needed performance between memory and system processors on different systems. Typical enterprise 100 Mbit Ethernet simply doesn't provide the needed bandwidth and performance for cluster applications. Either gigabit Ethernet or fiber is essential in delivering on the promise of cluster computing. Gigabit Ethernet is often adequate for low-end clusters, and 10Gb Ethernet is becoming mainstream for more powerful configurations.

Further, it's also important that clusters be on their own network segment. While there's no reason that segment can't be connected to the rest of the organization, the extra traffic on a busy network is likely to slow cluster performance substantially. The extra traffic increases the likelihood of network packet collisions, which require that packets get resent.

GPU Clusters Set to Take Off

There are other alternatives for building clusters. An increasing number of engineering analysis and simulation applications offer the option to execute on graphics processing units (GPUs), delivering performance that is often substantially increased over industry-standard CPUs produced by Intel and AMD. GPUs from NVIDIA and AMD offer improved computational performance, thanks to a processor design optimized for the kinds of floating point computations that graphics require.

GPU clusters offer a combination of high performance for generally lower costs than CPU-only systems. Individual GPU systems of more than 900 cores can be purchased for $10,000, and clusters of such systems are formidable computational engines for certain kinds of applications.

Of course, engineering applications have to be ported to run on GPUs, which have a different instruction set from industry-standard processors. The porting

process for commercial applications seems to be gathering steam, with NVIDIA reporting that GPU-based applications for structural dynamics are fully in the mainstream, while those for fluid dynamics are well on their way to that point. It's important to note that the greatest benefit comes when a problem is highly numeric, and when the problem can be split up into multiple independent streams.

Are Workstation Clusters Feasible?

For groups using workstations for both engineering design and normal office work, there is often interest in collectively applying spare computational resources on these systems to larger engineering problems. In fact, most workstations have multiple processors and cores, and most application ignore anything more than a single core on the first processor. For most common uses, a good bit of workstation computational capability remains unused.

The bad news is that it's not a straightforward process to use extra computing horsepower for other problems. Perhaps the best-known technology in this area, SETI@HOME, doesn't work for engineering applications. You can't cycle-steal from in-use processors and cores without having it affect the performance of active work.

However, there is another way. It's possible to set up a virtual machine that uses Intel's Directed I/O technology along with unused processors and cores to create a high-performance shell on individual workstations. Parallels Workstation Extreme uses Intel's hardware virtualization technology, along with a separate dual-hosted network interface.

A fast interconnect is a critical part of the solution. Without the ability to get data and code to the workstations in the cluster, some workstation vendors, such as HP, provide gigabit Ethernet interfaces that can be employed in the virtual machine.

Granted, a workstation cluster won't perform as well as a traditional server cluster. The processing power is less, in part because it's not using all available processors and cores, and gigabit Ethernet can't take the place of fiber as a fast interconnect. Because it's running in a virtual machine, that can also slow down execution. But if you're looking for a way to run less-demanding jobs inexpensively, a workstation cluster may get the job done.

Software and Clusters

It goes without saying that the software you use has to be able to take advantage of the parallel processing capabilities of your cluster. In most cases, your computational work has to be able to be split into multiple independent

pathways, and then has to be re-coded to run that way.

The good news is that many commercial software vendors have already done this re-coding, enabling engineering users to get the most out of their computer clusters. MathWorks' MATLAB, used by many engineers for custom analysis and simulation, has supported different types of parallel operations with clusters for quite a while. Today, its goal is to provide the capability to utilize clusters at a high level of abstraction that requires as few code changes as possible.

MATLAB also supports easy NVIDIA GPU porting, either with high-level instructions directing specific code segments to run on GPUs, or with Accelereyes Jacket, which enables users to tag MATLAB code to send to an installed GPU.

Analysis applications such as computational fluid dynamics and many types of simulations have already been optimized for clusters, but if a cluster is a part of your future computing strategy, it's important to check with your software provider to make sure that the applications you use have been fully parallelized.

Thanks to the relatively low cost of lower-end clusters, along with the significant computational benefits, many engineers have come to count on them to deliver performance where it makes a difference to the design process. The cluster options have expanded to include both workstations and GPUs. Now that software is rapidly catching up, any engineering group can take advantage of clusters to create better designs faster. DE

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

INFO

- **Accelereyes:** accelereyes.com
- **MathWorks:** mathworks.com
- **Intel:** intel.com
- **AMD:** AMD.com
- **NVIDIA:** nvidia.com
- **Parallels:** parallels.com
- **Appro:** appro.com
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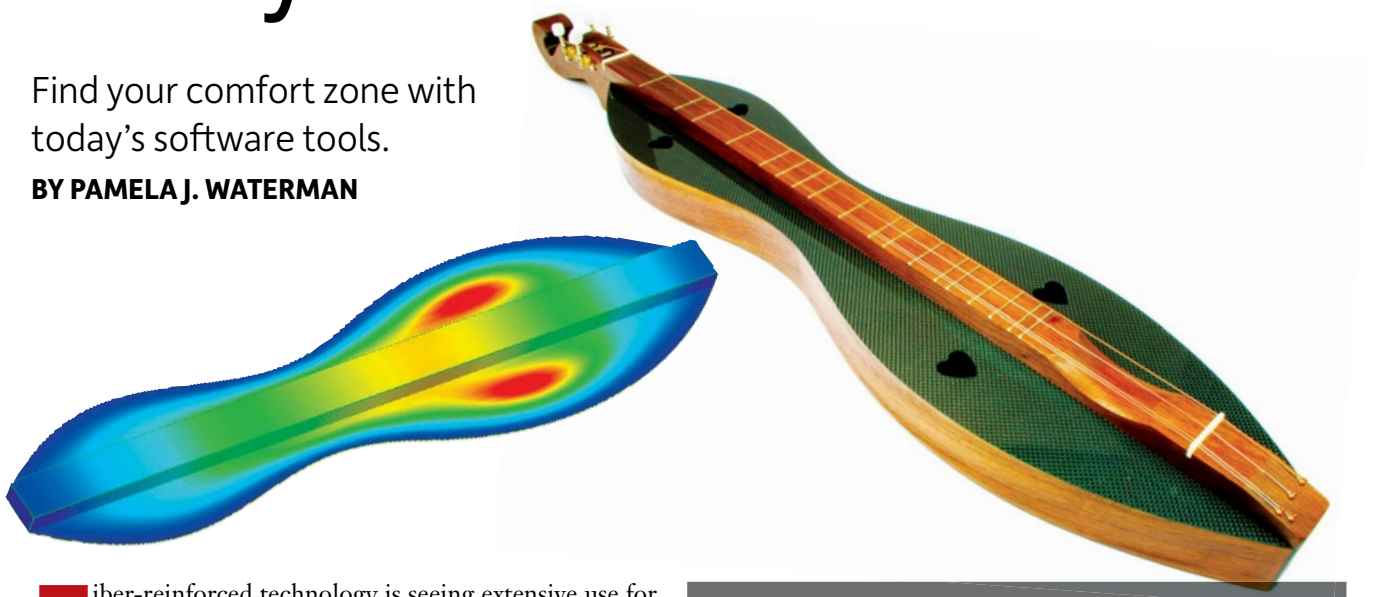
Options for Composites Analysis and Simulation

Find your comfort zone with today's software tools.

BY PAMELA J. WATERMAN



Modal analyses (left) of carbon-fiber sounding board for a dulcimer musical instrument (right), are performed with NEi Nastran software by consultants at ALLRed & Associates. *Image courtesy of ALLRed & Associates.*

Fiber-reinforced technology is seeing extensive use for its low weight-to-strength ratios—as well as other benefits. But working with composites is rarely a 1-2-3 process. If ever there was a need for close cooperation among designers, structural analysts and manufacturing engineers, this is the time, and optimization plays a key role across the board. With dozens of software packages addressing these challenges, *DE* takes a look at what's new, what's critical and what challenges remain.

Composites: Why now?

The term *composite* covers material compositions ranging from glass-filled liquid resins to "fabric" sheets with embedded carbon fibers. (See "The Life of Composite Materials," *DE* May 2007.) Just that difference helps explain the variety of software packages targeted to the field.

Depending on the exact formulation, composite materials display such positive attributes as easy formability, strength with light weight, excellent long-term weathering and resistance to corrosion and chemicals. These advantages, in turn, may make it easier to integrate multiple parts. Plus, properties such as good thermal stability and high thermal conductivity are increasingly useful in special applications.

However, achieving these desirable properties is a challenge at every step—from initial design to hand-done or automated part creation.

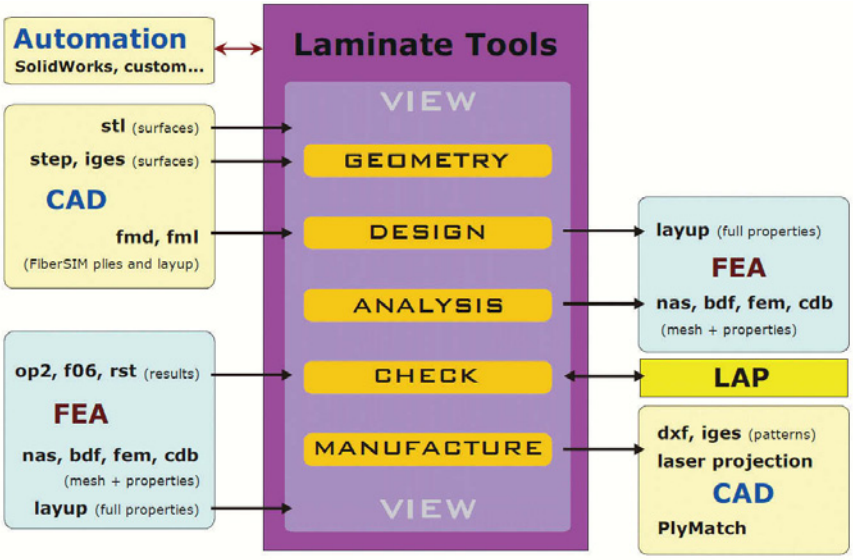
"The material and manufacturing costs of composites are high compared to 'traditional materials,'" explains Markku Palantera, general manager at Componeering. "Therefore, the superior performance of the end product must be achieved by careful design, which eventually involves software."

Defining Your Role

Componeering, which markets ESAComp, is one of a number of companies focused on composites-specific software. How these firms can help you depends partly on your specific project, partly on your existing CAD and CAE software, and partly just on your preferred approach to working with these materials.

Not surprisingly, opinions run strong and deep in this corner of the design world. Dr. John Klintworth, Simulayt's founder and managing director, points out the major source for differences in perspective is whether you operate in a CAD environment or an analysis environment.

"Any conventional [finite element analysis, or FEA] package cannot do design and manufacture, and cannot even create a decent composites model," he continues. "What you



This typical Anaglyph Laminate Tools composite analysis flow chart shows how Laminate Tools interacts with other engineering software applications. *Image courtesy of Anaglyph.*

need is a dedicated tool in the design or analysis environment that can model the composites structure."

Dr. Olivier Guillermin, VISTAGY director of product and market strategy, echoes these thoughts, saying that while both sides may need to simulate draping of a composite, the intent is different.

"Design works with a very detailed, complete, producible design, while analysis works with a simplified model made for analyzing such behavior as delamination, buckling and noise or vibration," he says.

Whichever your angle, your part should also be evaluated for producibility—meaning you may want to tap the power of micromechanical analysis found in such packages as Alpha STAR Corp.'s GENOA, ESI Group's SYSPLY, e-Xstream's DIGIMAT, Firehole Composites' Helius:CompositePro or LUSAS Plus Composite.

Identifying the complexity of your application will also help guide you to an appropriate choice. (See "Composites Analysis: Making New Choices," *DE* March 2009, for detailed software feature checklists.)

Composites Symposium at NAFEMS World Congress

A great time and place to hear the latest on composites design, analysis and manufacturing is at this month's NAFEMS World Congress 2011, to be held in Boston, May 23-26. Two sessions will focus on varied aspects of this field and give you a chance to talk shop with consultants from Firehole Composites, SAMTECH and e-Xstream Engineering. Learn more at NAFEMS.org/congress.

Digging into Details

No two packages offer the same features, so here we highlight 10 possibilities to give you a sense of the breadth in today's tools. For more options grouped by general product function, see "A Spectrum of Composite Software for Design, Analysis, Manufacture and Optimization," page 24.

e-Xstream Engineering's material modeling platform, DIGIMAT, increases the predictivity and accuracy of a user's current design and analysis tools for reinforced plastics and a range of composite materials. DIGIMAT's coupling of the material description with commercial CAE codes (e.g. nonlinear FEA solvers, injection molding software, etc.) allows precise modeling of the composite structure's behavior, accounting for fiber orientation and determining its effects at the micro-structure level.

When dealing with molded parts made with reinforced plastics, Keith Parmentier, business development manager at e-Xstream Engineering, notes, "Designers need to be able to make accurate predictions and optimal choices regarding issues such as product performance, weight reduction, material costs, etc., in order to select the right mold designs and materials. DIGIMAT can, for example, indicate the need to modify a mold design to optimize the dispersion or orientation of the reinforcing fibers, resulting in higher final product performances."

Continued on page 25

A Spectrum of Composite Software for Design, Analysis, Manufacture and Optimization

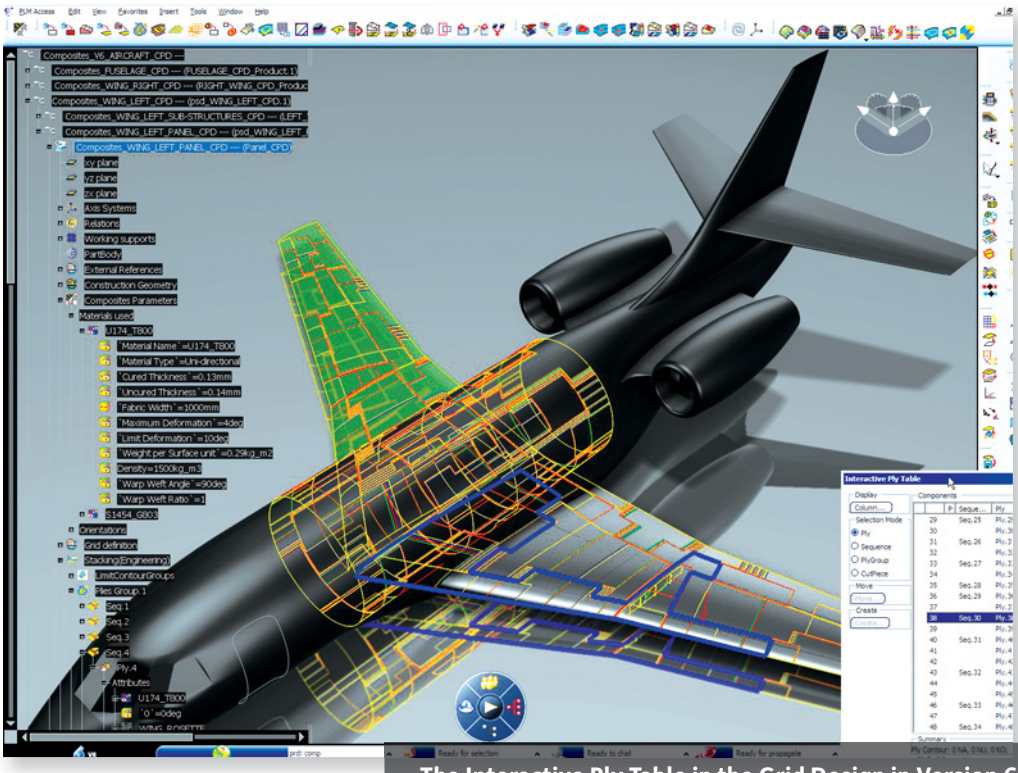
Following is a sampling of composite software packages, categorized from modeling the simplest structures to performing general and complex FE analyses. Crossover among categories also exists.

- **Laminate analysis packages:** Based on Classical Laminate Theory, these tools allow you to define a flat laminate material made of an arbitrary stack of lamina, and calculate stresses and material failure at a given point under a given load.
- **Substructure analysis:** This type of software calculates stresses and material failures in simple composite structures such as tubes, beams and other straightforward configurations.
- **Micromechanical structure analysis:** This process creates detailed micromechanical models of a composites structure to calculate elastic and failure properties, particularly progressive failure. These tools are often linked to, or integrated within, non-linear FEA solvers to predict failure.
- **FEA:** Most FEA packages allow users to define laminated composite materials on shell elements. More advanced packages support laminated solid and beam elements. A few even support ply-level modeling, where you can define the orientation of the material at each element.
- **FEA optimization software:** This software works in conjunction with FEA tools and ties into the manufacturing process by modifying the composites layup on elements, using an optimization strategy to achieve the required structural response.
- **FEA-based Integrated Design/Analysis/Manufacture:** In an FEA environment, users can define a high-fidelity composites model by simulating the manufacturing process of each ply, building up the stack model.
- **CAD-based Integrated Design/Analysis/Manufacture:** In a familiar CAD environment, these tools let users define plies using boundary curves on an underlying surface (rather than specifying shell FEs).

Category of Composites-Handling Software	Company (Product)
Laminate analysis	Anaglyph (Laminate Analysis Program LAP), Componeering (ESAComp, ComPoLyX), Lindell (The Laminator)
Substructure analysis	Anaglyph (Component Design Analysis CoDA), Componeering (ESAComp)
Micromechanical structure analysis	e-Xstream Engineering (DIGIMAT), Firehole Composites (Helius:MCT, Prospector:Composites and Helius:CompositePro), Alpha STAR Corporation (ASC) (GENOA), Componeering (ESAComp)
Finite Element Analysis (FEA)	ADINA, Altair (HyperWorks), ANSYS, Autodesk (Algor), COMSOL, Cranes Software (NISA), LUSAS (LUSAS Plus Composite), MSC. Software, NEi Nastran, SAMTECH, Siemens PLM Software (NX), SIMULIA (Abaqus/CAE), Strand7, Vanderplaats R&D (GENESIS)
FEA optimization	Collier Group (Hypersizer), ESI Group (SYSPLY), e-Xstream Engineering (DIGIMAT), Vanderplaats R&D (GENESIS), Componeering (ESAComp)
FEA-based Integrated Design/Analysis/Manufacture	MSC.Software (Patran Laminate Modeler), Simulayt Composites Modeler for Abaqus/CAE (SIMULIA), Simulayt Composites Modeler for Femap (Siemens PLM Software), VISTAGY with ANSYS, Anaglyph (Laminate Tools for Nastran and ANSYS)
CAD-based Integrated Design/Analysis/Manufacture	Dassault Systèmes (CATIA V5/V6 Composites Design) (with Partner Products: ESI Group — PAM-RTM for CATIA V5, Simulayt — Advanced Fiber Modeler for CATIA V5/V6, Composites Link for CATIA V5/V6), VISTAGY (FiberSIM for NX, ANSYS, Pro/ENGINEER and CATIA V4/V5), Simulayt (Composites Modeler for SolidWorks), Anaglyph (Laminate Tools for SolidWorks)

Continued from page 23

VISTAGY's FiberSIM software suite bridges the design-manufacturing gap by incorporating non-geometric data that CAD systems do not. It can work with ply-based, zone-based or structure-based designs, and has versions targeted to NX, ANSYS, Pro/ENGINEER (now Creo Elements/Pro) and CATIA. Recently, VISTAGY and ANSYS announced an integrated version of FiberSIM 2010 with ANSYS 13.0 Composite PrepPost software to help close the loop between composites design and analysis. The integrated, bi-directional solution (an add-in for both packages) will help designers and stress analysts efficiently exchange data, eliminating the disconnect between part certification and manufacturing—a huge issue, especially for aeronautic applications.



The Interactive Ply Table in the Grid Design in Version 6 of CATIA Composites from Dassault Systèmes. ***Image courtesy of Dassault Systèmes.***

Componeering has improved ESAComp from its European Space Agency origins. It includes a material database, options for performing material trade-off studies, and laminate analysis and lay-up design tools. In comparison to a generalized FE program, it offers capabilities for a quick, initial structural analysis, as well as a more advanced analysis that accounts for statistical variations in material properties, layer angles and loads. ESAComp helps users find the most suitable structural concept (such as solid laminate, sandwich or stiffened panel) and includes tools for specialized applications such as pressure vessels.

Another well-known company in the composites design world is **Firehole Composites**, offering four packages including Helius:CompositePro (originally developed by Peak Composites).

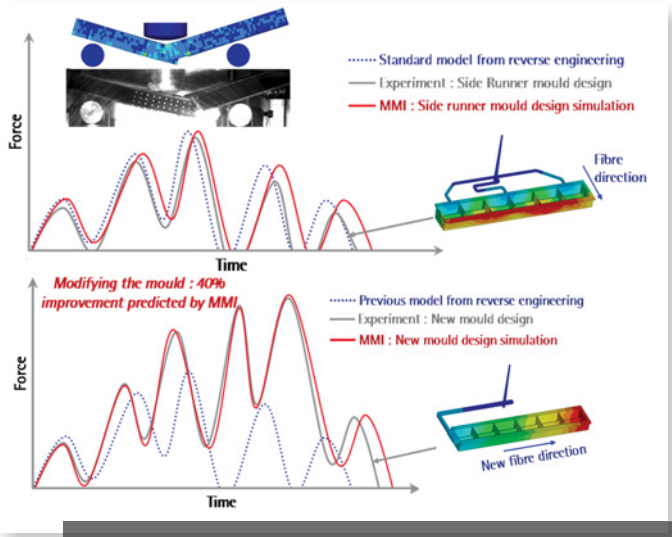
"Prospector:Composites and Helius:CompositePro are really front-end tools designed to quickly and easily help engineers of any level of expertise in the early stages of composite design and analysis," explains Angie Shrader, the company's engineering manager. "Helius:MCT and Helius:Fatigue provide enhanced composite capability to FEA."

She adds the latter have been particularly designed for both accuracy and practicality, combining a multi-scale failure analysis approach with computational methods targeted to composites.

Once you have a design, how can you make it better? The Hypersizer family of products from **Collier Research** tackles the job of optimizing the fine details of fabricating composite parts—identifying, for example, which plys should span the length of a part, which could be cut to save weight, and just how to shape the resulting boundaries. As company president Craig Collier explains, the three primary products in this family—Hypersizer Material Manager, Basic and Pro—show you the most efficient and manufacturable ap-

Carbon Fiber Manufacturing Plant to Supply BMW

It all starts with the fibers, and we can't seem to get enough. BMW is building a facility in Moses Lake, WA, which may soon become the world's largest such plant. BMW and SGL Group, a carbon manufacturing company, are creating this source to supply BMW's Megacity high-tech electric car, planned for launch before 2015. See goo.gl/YlXum for more information.



This illustrates the macroscopic response dependency on the process parameters using DIGIMAT to LS-DYNA. MMI denotes the DIGIMAT to Moldflow and LS-DYNA solution process. *Image courtesy of e-Xstream Engineering.*

proach to a design. This helps determine the complete specification, including just how to interleave the plys—a level of detail that saves time, assures repeatability and assists manufacturers' compliance with test regulations.

Dassault Systèmes' CATIA Composites Workbench, with various releases, continues to be a widespread tool in many composites design applications, so it's no surprise that multiple paths exist to its use. Rani Richardson, CATIA Composites product specialist, observes that collaboration among designers, analysts and manufacturers is critical, particularly because an analyst is making updates while the designer is still working on the part, for example.

"All of those models have to be in sync, and not all the tools are made to do that—and none to the capacity of CATIA Composites," she says, noting that because SIMULIA is a Dassault Systèmes product, it is therefore well integrated with the company's brands. "We also use Simulayt's Composite Link to talk to ANSYS, Patran/Nastran and Abaqus/CAE—in some cases, in a bidirectional loop."

This coupling helps provide a seamless, integrated approach for analysis, and includes the manufacturing processes as well, Richardson says.

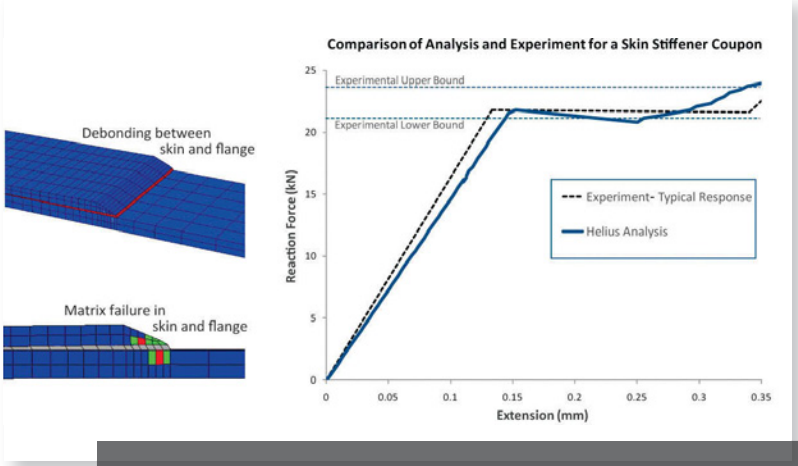
NEi Software's NEi Nastran has years of development behind it for handling many aspects of defining fiber orientation directly. It also brings in advanced ply-based model building as needed through Simulayt's Composites Modeler for Femap and Composites Modeler for SolidWorks. One of the company's users, consultant Joseph Kummer of ALLRed & Associates, says that NEi has done an excellent job including composite materials in its simulations, not only with improved models but with a better user interface, too.

"Now I don't have to spend as much time setting up a problem," he says. "They've made it easier to set up assemblies where there are contacts with some parts glued and others pressing up, and the newer models give me high confidence consistent with validations."

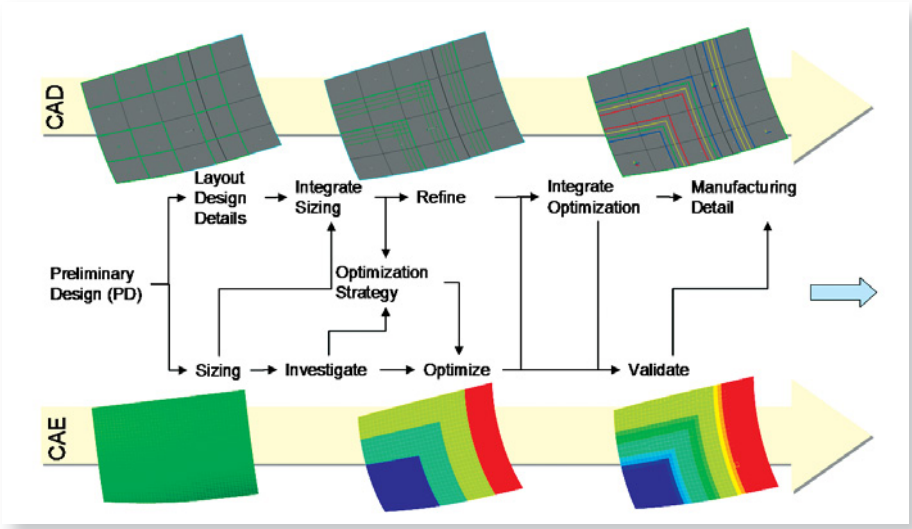
Anaglyph is the developer of several relevant packages, including the extensive Laminate Tools. This stand-alone application is comprised of six modules: View, Geometry, Design, Analysis, Check and Manufacture. It provides an integrated solution dealing with all aspects of the process: from geometry import through design (draping simulation) and analysis of properties specific to composites, to producing the export plybook with flat patterns of the plies to be manufactured. All partners involved in this process can exchange data.

In addition, as a pre- and post-processor, Laminate Tools interfaces with standard CAD and FEA applications to produce composite-specific results. It also offers an embedded interface with Solidworks, Nastran and ANSYS, as well as with Anaglyph's hand layup ply-placement software, PlyMatch.

STRAND7 is a general-purpose FEA package with an optional laminated com-



Debonding and matrix failure in a laminated composite, as analyzed with Firehole Composites software. Red in the upper image shows failure of cohesive elements, using the new cohesive functionality in Helius:MCT v4.0, indicating debonding between skin and flange. In the lower image, green indicates matrix failure and red indicates fiber failure. The plot shows correlation with physical testing. *Image courtesy of Firehole Composites.*



Seamless workflows between VISTAGY's FiberSIM software and MSC.Software's SimXpert move a design from preliminary sizing to final part validation. The parallel process helps designers and analysts optimize the part based on weight, performance, design specifications, and manufacturing costs. ***Image courtesy of VISTAGY.***

posite module tightly integrated with the rest of the system. Users can easily combine traditional plate/shell composite elements with 1D prismatic beam elements, as well as 3D brick elements. The company notes that its price/performance ratio in the FEA software arena is particularly appealing for small organizations because it supports the full spectrum of design concept evaluation, detailed analysis and the production of layup schedules.

Simulayt's solutions for the composites field have been in continuous development for 20 years. As the developer of Layup Technology, which incorporates advanced fiber simulation and ply modeling capabilities, the company is positioned to offer software tools running in both CAD and CAE systems. The products are deeply embedded in CATIA V5, Abaqus/CAE, SolidWorks and Femap, and allow users to define plys on individual finite elements, reflecting the actual manufacturing process.

As an example of its power, you could define a part with 200 plies, then with the push of a button automatically generate 2,000 laminate properties—a task impossible to do by hand.

Multi-layered Challenges

A metal is a metal, but composites are a whole 'nother ballgame. As Firehole Composites' Shrader puts it, "The biggest software challenge in working with composites is simultaneously capturing all of the physics involved, while also maintaining reasonable computational time and resources."

You definitely need specialized tools to achieve this balance. The good news is, as users realize there's a good return on investment in specifying these materials, the software developers are right there, expanding their support. DE

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
- **ADINA R&D:** Adina.com
- **Alpha STAR:** ASCgenoa.com
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For more information on this topic, visit deskeng.com.

Monitoring Radiation in Japan

Engineers give data to the people.

BY MARK BOYD

Following the devastating earthquake in Japan this year and its dangerous impact on nuclear power plants in Fukushima, a network of engineers has banded together to create wireless radiation sensors for the Japanese community. But limitations to radiation sensor technology and stockpiling of key components in other nations threatens to stall opportunities to help. Spanish wireless sensor manufacturer, Libelium, is working on a low-cost solution.

On March 11 this year, an earthquake decimated areas of northern Japan. This, and subsequent aftershocks, caused disturbances at nuclear power plants in the Japanese city of Fukushima, requiring the evacuation of more than 150,000 residents living within a 20-mile radius of the nuclear power sites. Thousands more — including a large organic farming community — still live in relative proximity to the nuclear sites.

For many living in surrounding areas, a key concern now is to monitor radiation levels to ensure ongoing safety. Radiation risk is measured by a number of parameters and can be quite complex, but in general data is usually recorded in terms of microsieverts per hour (µSv/H), which reflects the level of radiation in the atmosphere and how much energy a human body absorbs from it. Background radiation levels generally fall around the 0.03 µSv/H range, with any readings above 0.081 µSv/H representing an above average result. Fukushima was registering as high as 80 µSv/H in the days immediately following the disaster, with levels at the start of April of around 10 µSv/H.

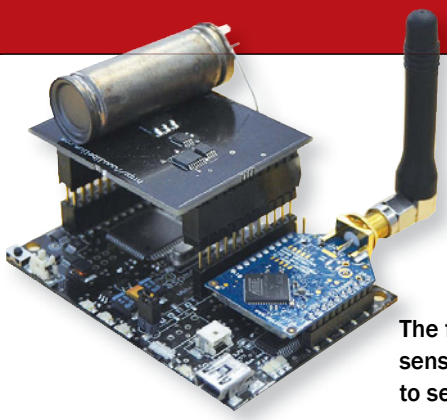
For local citizens, the lack of available, trustworthy information on current radiation levels has been a cause of anxiety and fear. According to the Bulletin of Atomic Scientists, TEPCO — the corporation that manages the Fukushima power plants — has been accused of falsifying data in the past, and in this recent disaster has been reprimanded more than once for inadequate data collection processes.

Even if official data was more reliable, there are more needs for radiation monitoring than current infrastructure can provide. For local residents, it is a matter of being able to measure their household risk, while for farmers in the area it is necessary to monitor their crops, and for community groups to be able to scan radiation levels of donated food before distributing to those in need. A group of local engineers in Tokyo has been training local citizens and community leaders to interpret radiation readings, and online data platforms like pachube (pachube.com) have set up maps and feeds so that anyone with radiation measuring devices can share real-time data online.

Some of the radiation sensor engineering team members look over their handiwork.

Engineers Respond

As a result of the need for more local radiation monitoring, Spanish wireless sensor manufacturer, Libelium, has initiated an international project with the support of the professional engineering community. Engineers and enthusiasts have been keen to offer their expertise and time to develop radiation sensors that can be used by affected populations to monitor risks and manage evacuation strategies. Libelium has harnessed this goodwill and developed a prototype radiation sensor that can be deployed quickly, providing local communities with the technology necessary to assess their risks and manage any potential harms.



The finished radiation sensor prototype ready to send to Japan.

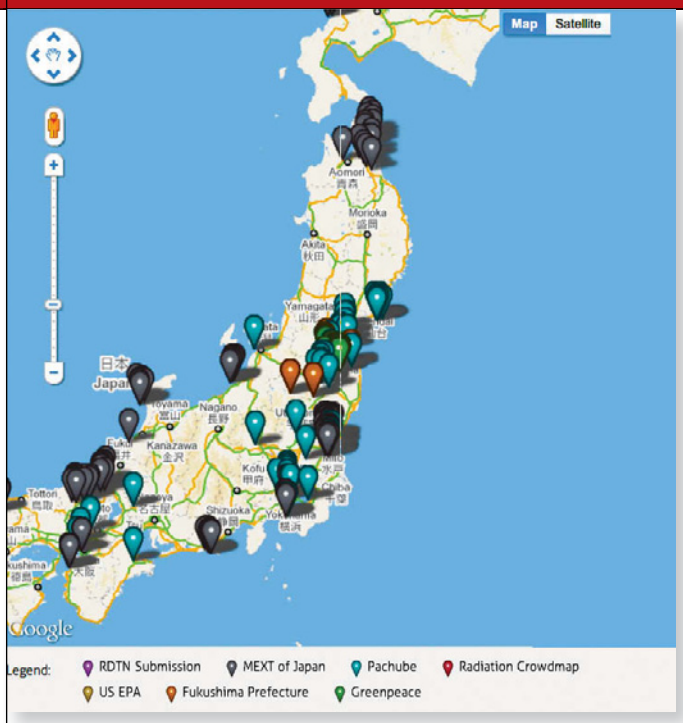
"At the moment, everyone is needing to trust a few powerful sources for information on radiation levels. This project gives power back to local people. It tells them what is happening in their garden, their house, their supermarket. It won't be a highly sensitive reading, but even something that shows whether radiation levels are low, medium or high will be of value," explains Libelium's Chief Technology Officer, David Gascón.

Using Industry Leadership

To date, Libelium has concentrated on a range of sensor boards for industries including agriculture, viticulture, logistics, health and manufacturing. While this has included, for example, a gases sensor board, measuring radiation had not been part of their vision for commercial products. "We hadn't considered Geiger counter sensors in the past, as we never had in mind to integrate this type of sensor before because of the high entry costs into this market," says Gascón.

Libelium's wireless sensor boards include Waspmote boards for corporate, security and government use, and Arduino boards for home enthusiasts. Both types of boards are designed to collect and transmit data wirelessly using Zigbee, Bluetooth, and GPRS protocols, or can use a range of radio frequencies to transmit information. This allows the sensor boards to be used in high-risk areas without threatening human lives. Sensor boards can be deployed across dangerous zones and transmit data without the need for anyone to enter the area.

The practical use of wireless sensors to monitor physical environments has been restricted by the energy needs required to maintain a constant vigilance of an area. Libelium's sensor boards include a battery supply and programmable interface that allow the boards to be used in the field without constant recharging. Consumption levels range from 9mA when constantly switched on, to as low as 0.7µA when in hibernation mode. In order to limit power needs, the sensor boards are able to remain dormant for



Radiation readings are mapped and shared on sites such as RDTN.org.

much of the time, waking up only to take readings and send data before returning to a sleep state.

Open Hardware Solution

Libelium's industry strengths — both the power of Waspmote to relay sensor data without the need for manual data collection, and the longevity of their boards' power supplies — motivated the company to devote resources to developing a prototype radiation sensor board for use in affected Japanese areas.

"This is not going to be a commercial product. At Libelium, we're not interested in making money from this initiative. Of course, we don't want to lose money either, but we are pricing the sensors as low as possible in order to encourage participation and to make them available to the communities and households that need them," says Gascón.

For the open hardware prototype, Libelium's team used Arduino boards, as they are a cheap sensor board that people can use in a home environment. "They are around 22 euros each (US $32), can be connected via USB, and will allow households to measure their immediate physical area," Gascón explains. While Libelium is providing the prototypes to Japanese engineers, if they prove useful, they wanted to make sure that meeting further demand was not prohibitive.

Limitations of Technology

Many of the available radiation sensors had been rapidly bought up across the globe in the immediate days after the disaster. US-based manufacturers including Centronic and Gammastart have diverted their telephone systems to voicemail due to the overwhelming demand on their products. Some second-hand suppliers, such as Ustream and Reuseum, allocated a handful of available supplies to Japanese engineers. Gascón explains the delays to the project commencement: "The first thing we had to do was get the Geiger tubes, which was difficult as many manufacturers had sold out. They were being bought up by people who didn't even know how to use them."

In addition, most available radiation sensors are analog devices. Among engineering teams that have been able to access sensor supplies, methods had to be developed to use the technology wirelessly. Analog sensors are often connected to a speaker to allow a "chirp" whenever a reading above a given µSv level is measured. One adaptation was to solder the GND and peizo element of the speaker to an Arduino board and have the board listen to the chirps at intervals of 20 milliseconds to collect useable data. A simple software code was written to count the number of chirps in a 10-second period, multiplied by six to get the counts per minute, and divided by the conversion factor (cpm/360) to get a µSv/H reading.

Engineering Solutions

After accessing the Geiger tubes necessary to take sensor readings, building the prototype on a readily available Arduino sensor board and making the electronic designs freely available, Libelium is now ready to share its prototype in Japan.

Hackerspace Tokyo — like other similar groups around the world — is an open community space that brings together technology enthusiasts to work on projects that benefit local citizens. Libelium is hoping that at Hackerspace Tokyo, a collaborative effort between radiation scientists and engineers will be able to calibrate the prototype model and assist with its deployment across local communities.

Despite barriers to supply and technology, this project has shown that teams of engineers can help respond to the needs of communities in danger around the globe. As the radiation sensor board technology gets posted on Libelium's website (libelium.com) and in online forums, it is hoped that engineers living or working with communities near other nuclear power sites can build and adapt the model to ensure that in the future, there is a more prepared network of early responders able to monitor risk and contribute to preventing local threats. DE

Mark Boyd *is a freelance writer specializing in wireless sensor technologies and their impacts on citizen rights. A selection of his other writings is available at mgboyd.com. Contact him via de-editors@deskeng.com.*

INFO ➜ **Libelium:** libelium.com

➜ **Hackerspace Tokyo:** tokyohackerspace.org/

➜ **Pachube:** pachube.com

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

Supercomputing on the Desktop

New computer hardware technology can change the way we do our jobs.

BY PETER VARHOL

Only a decade or so ago, if engineers were lucky enough to have a supercomputer at their disposal, it was in a remote facility, either within our company or leased from a larger facility. They had a computing budget that decreased every time they sent a job off to that unseen computer.

Today, the power of that same supercomputer from 10 years ago is right underneath the desk. If you are using one of the newer Intel-based engineering workstations, you have as many as two processors and 12 processor cores available for your computational work. You also have the fastest memory and processor busses ever, and often solid-state storage for quick access.

While our needs for computational performance have gotten more demanding, engineering workstations have more than kept pace, enabling engineers to run increasingly sophisticated design, analysis, and simulation applications locally, under the direct control of an individual professional. This new capability is the result of advances in processing power, memory, graphics, and data throughput. The addition of multiple cores and hyperthreading to processors has enabled workstations to do more computational work in the same amount of time.

The fact is that today's workstations are designed much like supercomputers were in the past, with multiple processing pathways, and fast memory and processor buses. They are capable of running parallelized applications such as fluid dynamics and simulations as fast as supercomputers of a generation or so ago.

A big advantage of new workstations is the ability to virtualize operating systems and applications, enabling engineers to run multiple independent computing jobs using resources not being fully utilized by the host operating system. Engineers can create entirely self-contained virtual machines for true parallel work. Further, 64-bit processing and address spaces allow for larger and more complex applications, and large amounts of data, similar to supercomputers of the recent past.

Using Your Workstation Like a Supercomputer

Thanks to increasingly fast data interconnects such as Fibre Channel and 10 gigabit Ethernet, systems using the same hardware architecture can be linked together to form a true supercomputer, much like the system on the Top 500 Supercomputer list (top500.org). There will always be things that large compute clusters can do much faster than individual workstations, but the workstation today can set up larger computations, and do some preliminary analyses before you get to the more powerful cluster or supercomputer.

On the surface, using this supercomputer on your desktop is the same as using older workstations. However, the added sophistication of multiple processors and processor cores, hyperthreaded processors, and up to 192GB of main memory means that how you structure your work is likely to change.

The multiple processors and cores mean that you can use applications that can utilize multiple cores at one time through parallel execution. An alternative is to assign processors and cores, along with significant memory resources, to one or more virtual machines, and run independent analyses and simulations fast while you're doing design work on the host operating system.

Other capabilities of the processor and chip set improve performance. For example, Intel VT-d support for direct access to graphics, network, and other PCI devices supports high levels of I/O. This improves graphics performance, networking, and applications that read and write large amounts of data.

Another example is Intel QuickPath technology. With Intel QuickPath, each processor core features an integrated memory controller and high-speed interconnect, linking processors and other components to deliver performance features. These include dynamically scalable interconnect bandwidth that provide faster access when applications need it, outstanding memory performance and flexibility to support leading memory technologies, and tightly integrated interconnect reliability, availability, and serviceability with design-scalable configurations.

Take advantage of the supercomputer your desk. Use applications in parallel, and don't worry about running out of memory. Run your most demanding design and rendering, analysis, or simulation applications on your desktop first. At the very least, this will help you fine-tune your work before sending it off to the cluster in the data center. But you may be surprised. You may be able to do all of your work with the supercomputer on your desktop. DE

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

Fast & Flexible Control

RapidPro by dSPACE allows automotive designers, in particular, to do their work more efficiently.

BY BARBARA G. GOODE

Targeting common tasks such as transmission controller development, powertrain electrification, and fuel consumption optimization, Paderborn, Germany-based dSPACE GmbH recently introduced standard configurations of RapidPro, its modular signal conditioning and power stage hardware for rapid control prototyping (RCP). RCP enables quick testing and iteration of control strategies in real-time on a computer, with the input/output devices being planned for the design. dSPACE's new entry represents the latest step in the evolution of a product that aims to enable "control engineering in a convenient way," according to Holger Ross, dSPACE's product engineer, Rapid Prototyping Systems.

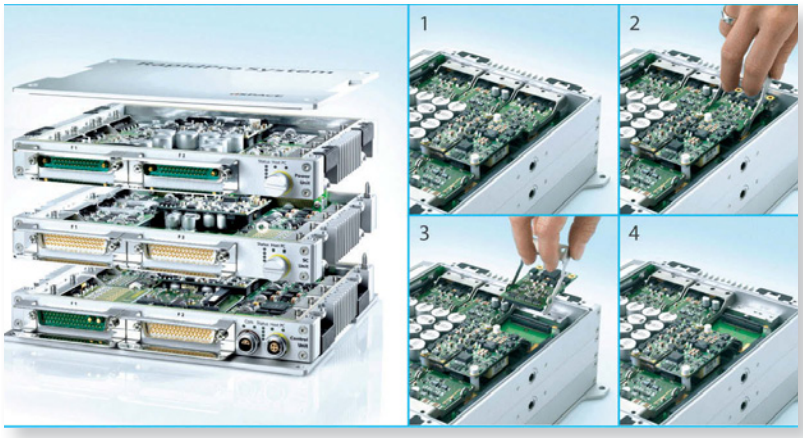


FIGURE 1. Sensors and actuators are adapted for rapid control prototyping with the help of the RapidPro Signal Conditioning Unit and the RapidPro Power Unit. The MicroAutoBox unit is at upper left.

As a pioneer in RCP, dSPACE originally created RapidPro to not only combine the advantages of flexibility, which is traditionally hard-won through custom design, and off-the-shelf availability, which typically means limited flexibility, but to deliver these advantages in a compact format. The space consideration is critical for some applications, including automotive.

"There is only very limited space available under the car seat or in the trunk," says Ross, explaining that "highly scalable housing" is one feature distinguishing RapidPro. The modular concept means that all components can be reused, reconfigured (either via hardware or software), or extended if requirements of a project change. The components can also be used in later projects.

Hardware flexibility via its modular I/O is the reason Mark Wilcutts of Tula Technology chose RapidPro for his company's automotive powertrain RCP work. Tula, based in Santa Clara, CA, is working to apply digital signal processing to overcome a longstanding problem: Making sure drivers have maximum power and torque during the occasional times when they need it—without compromising on efficiency during the majority of the time, when they don't. "Basically," says Wilcutts, RapidPro "has enabled full-authority powertrain control development at our company."

Flexibility is also the reason that ArvinMeritor (Troy, MI), provider of drivetrain mobility and braking solutions for truck, trailer, and specialty vehicle original equipment manufacturers (OEMs), chose RapidPro for development of advanced chassis and driveline systems on development vehicles. Although the company uses multiple rapid prototyping systems, RapidPro allowed the team the flexibility to configure the hardware, specifically the sensor and actuator characterization, to meet the requirements of a specific application. As Jon Honig, engineering manager for controls, software and mechatronics in ArvinMeritor's Advanced Engineering & Electronics unit, explains, "RapidPro was selected to implement fuel injector drivers to help reduce system response time." Honig says that using RapidPro allowed his team to focus its efforts on system and controls development.

Automotive and Beyond

While the majority of dSPACE's customer base is in the automotive industry, RapidPro has broad application in other areas such as aerospace and industrial settings. All these applications can involve a wide variety of sensors and actuators—especially during the rapid prototyping phase—and

each one may require its own signal conditioning and power stage circuits.

Connecting the sensors and actuators to the prototyping system can be an expensive, time-consuming design and implementation task. But with RapidPro, there is no need to do soldering, signal adaptation or circuit design, says Ross (see Figure 1). Efficient RCP is a matter of choosing the appropriate module and hooking up the sensors. RapidPro takes care of configuring the signal conditioning and power stage hardware, as well.

Units and Modules

"The broad range of sensor and actuator interfaces demands a high level of flexibility during signal adaptation," says Ross. dSPACE addresses this need through a range of specialty signal conditioning and power stage modules that can be adapted in terms of interface.

dSPACE's approach to RCP allows users to design embedded software in the MATLAB/Simulink (MathWorks) environment, and then execute that in high-performance, real-time hardware. In addition, RapidPro works as an extension to other prototyping hardware, so it requires either MicroAutoBox or one of dSPACE's other units.

The software that comes with RapidPro, dSPACE's ConfigurationDesk, enables control over certain signal conditioning and power stage characteristics. It also allows monitoring of the power stage states to highlight any malfunctioning.

The RapidPro hardware consists of three unit types and 19 interchangeable modules (see Figure 2). The units are aluminum boxes with slots for modules. They are designed so that you can use the units separately—or connect several of them to build a stack for use as one physical unit.

An integrated unit connection bus (UCB) allows you to connect several RapidPro SC or power units directly to the control unit without external wiring. The fanless architecture was designed for maximum acceptable power dissipation to even hold power stage modules with output currents up to 60A. Shock and vibration resistance, along with temperature and voltage ranges, make RapidPro suitable for not only laboratory/test bench use but also in-situ use. The three unit types include:

- signal conditioning (SC) unit, which provides slots to install SC modules;
- power unit, with slots for power stage modules; and
- control unit, a box equipped with a microcontroller module (Freescale MPC565) and slots for SC and communication modules.

For its 19 modules, dSPACE uses a naming convention that identifies the modules' main features. The initial letters indicate module category (for instance, SC for signal conditioning and PS for power stage). Following that is the input/output specification (AI for analog input, DI for digital input, etc.), followed by number of channels and then variant identification. For instance, the SC-DO 8/1 is a digital output signal conditioning module providing eight decoupled open drain outputs, while SC-DO 8/2 is also a digital output signal conditioning module, but with eight galvanically isolated push-pull outputs able to operate in a variety of output modes.

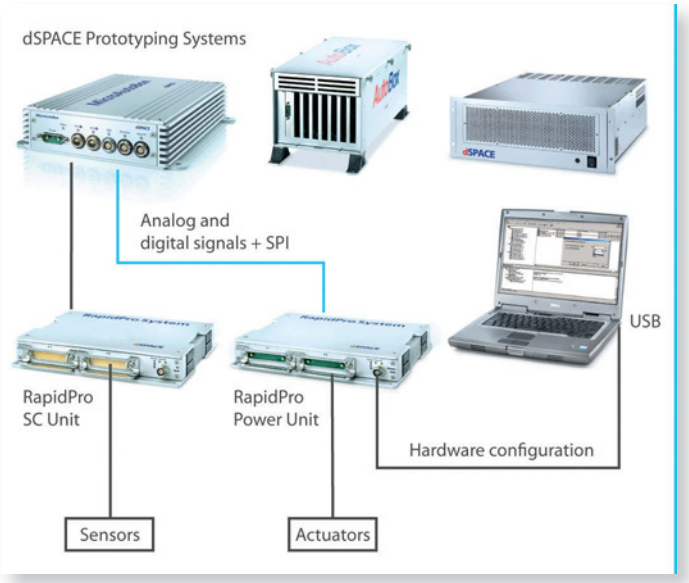


FIGURE 2. The RapidPro hardware consists of three unit types and 19 interchangeable modules that easily snap into place. The flexibility enabled by this design is a key advantage customers cite for choosing RapidPro.For more information on this topic, visit deskeng.com.

In addition to multi-purpose module functionalities such as analog and digital I/O and sensor supply, dSPACE's array of modules includes application-specific offerings. Modules specific to engine management, for instance, capture the camshaft and crankshaft position, connect lambda probes and knock sensors, and generate injection and ignition pulses. Half- and full-bridge modules able to deliver peak currents up to 60A address applications in electrical drives and valves, while another module allows for the universal control of brushless electric motors. Each module has its own operating specs, which are outlined in dSPACE's RapidPro System Installation and Configuration Reference.

According to Ross, elements such as filters, voltage dividers, and pull-up/down resistors can be inserted on the modules wherever required, and the ConfigrationDesk software allows users to control settings such as the voltage ranges, signal inversion, and special behavior modes. "Module-specific diagnostic and error messages are output,

and the pinout list is generated as an aid for configuring the cable harness," Ross notes.

Tackling Complexity

RapidPro competes with products from National Instruments (for instance, LabVIEW paired with a reconfigurable I/O product such as CompactRIO), The ETAS Group, Opal RT and PrecisionMBA. Although NI lists its pricing information online, dSPACE is more circumspect, with no pricing published; dSPACE hopes that interested engineers will call the company for pricing. However, word on the street is that a RapidPro system for a six-cylinder combustion engine costs about $14,000, and a configuration for electric motor control runs around $7,000. Add to that the cost of the core RCP system (such as MicroAutoBox).

"For simpler engines, cheaper solutions exist," says Wilcutts. "Also, at automotive OEMs, there will be development ECUs available for which a bypass-only solution—say, using a MicroAutoBox—may be all that is needed."

But Wilcutts says he would recommend RapidPro for working with "control systems for advanced engines with many controllable features, or for controlling multiple engines with differing I/O sets."

Honig advises that, because RapidPro can be tailored for each application, similar to a hardware-in-the-loop (HIL) system, engineers thinking about this type of solution "spend sufficient time early in development to specify and configure the hardware properly."

FIGURE 3. RapidPro can be tailored for specific applications. Engineers working with it should spend time to configure the hardware properly.

One example of RapidPro's ability to "pre-process" sensor data and generate complex control signals comes from the field of engine control. Here, motor angle must be calculated with the help of output from crankshaft and camshaft sensors. Highly precise, rapid pulses are generated from this data to control the ignition and injection systems. This means that rapid pulse sequences must be processed at high engine speeds, and also that complex calculations must be made for angle interpolation and for the generation of multiple pulses. The calculations necessary for this would cause such a load on the main RCP system that the valuable processing power for the actual controller model would be lost. To address this, RapidPro offers a field-programmable gate array (FPGA)-based unit with an additional I/O controller, which offers special signal preprocessing to relieve the strain on the RCP system's main processor. DE

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INFO ➜ **ArvinMeritor:** ArvinMeritor.com
➜ **dSPACE International:** dSPACEinc.com
➜ **The MathWorks:** MathWorks.com
➜ **Tula Technology:** Tula-Tech.com

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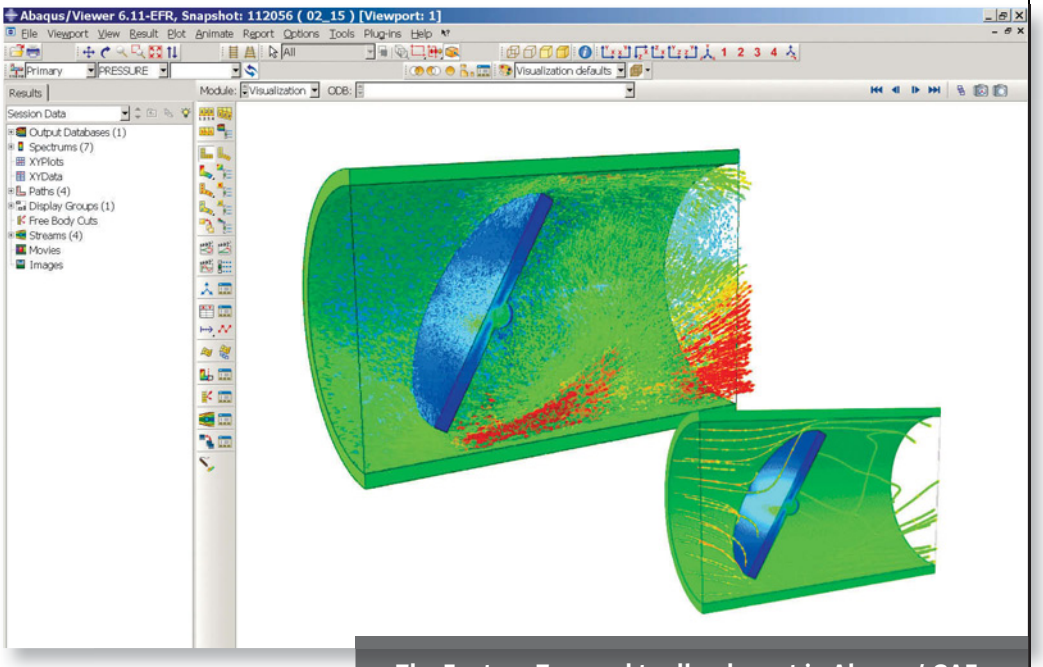
Multiphysics Simulation for All

SIMULIA wants to make multiphysics easier to implement, via its new version of Abaqus.

BY VINCE ADAMS

SIMULIA, the Dassault Systèmes brand for simulation based out of Providence, RI, wants to democratize multiphysics, or MP. This is an exciting direction from the makers of Abaqus, considered by many to be the high-end of high-end finite element analysis (FEA) products.

Eric Weybrant, SIMULIA's product manager for analysis products, says the company's vision is to make simulation an integral business practice for product development organizations. This means fewer assumptions with more realistic analyses. Accessible MP is the key to making this happen. Abaqus, with its standard (implicit) and explicit solvers, has always had components of MP—and with Abaqus 6.10, released last summer, and 6.11 scheduled to be released this month, the developer says the end goal is in sight.



The Feature Tree and toolbar layout in Abaqus/ CAE adapts automatically to the multiphysics domain active in a current session.

MP 101

Over the past decade, the definition of MP simulation has evolved to encompass the incorporation of two or more traditionally isolated analytical domains into a solution that reflects the combined results of each. These analytical domains might include stress/deformation, thermal, computational fluid dynamics (CFD), electromagnetics (EM), acoustics and—in the eyes of some—multi-body dynamics (MBD).

SIMULIA expands this definition to include simulation across greatly different scales, such as molecular and macros sizes.

Fluid-structure interaction (FSI), or the coupling of fluid flow fields with deformable or moving solids with bi-directional feedback, was the breakthrough that brought the term multiphysics into the common product development engineer's world.

MP requires that the inputs and outputs of the various

domains be coupled. This is handled in a few different ways. When physical responses are one-directional—such as negligible deformation of a stiff solid in a flow stream—direct sequential, often manual, coupling of the results is sufficient. The pressure field from a CFD solve is applied to the solid structure, and stress is computed.

FSI, as implemented in Abaqus 6.10, provides a simultaneous solution of multiple domains, where the results of many staggered solutions are used to obtain bi-directional equilibrium. Thus, the true or natural response of the system to the various physics applied can be determined.

Finally, MP models can be coupled within a single mesh or across distinct domains. Coupled thermal flow with thermal stress effects on a solid mesh represents one application of a single mesh solution.

Multi-domain models are the most difficult computationally, but are also the most versatile. These are typically discontinuous at the domain boundaries—and constantly changing, requiring sophisticated management of the interactions. However, each mesh can be optimized for that particular domain (CFD vs. stress, for example), for more efficient solutions.

Coupled Euler-Lagrangian Model

Abaqus 6.10 supports multi-domain models using a coupled Euler-Lagrangian (CEL) method. This is an important concept in FSI, but requires some explanation for non-CFD specialists.

At the risk of over-simplifying, an Eulerian model is common in CFD, where the field variable changes within a fixed mesh. A Lagrangian model is characterized by a deformable mesh. The boundaries change as the solution progresses. This is typical of structural FEA problems.

Efficient modeling of FSI with deformable bodies requires the best of both worlds. CEL provides for the creation of an Eulerian fluid mesh within a Lagrangian solid body. Abaqus couples these models by enforcing the boundary of the fluid domain to map to and stay "attached" to the deforming solid mesh. The computation of sloshing in a deformable tank is made possible by this technique.

Abaqus/CFD for HPC

The CFD capabilities in Abaqus/CFD, new in Abaqus 6.10, were written from scratch by SIMULIA with high performance computing (HPC) in mind. While more difficult than incorporating an existing CFD solver, ground-up development provides potential for leveraging massively parallel solving technology that might not have been anticipated 10 years ago. Large problems are common in the MP world, and model sizes will continue to grow.

Abaqus/CFD analysis of transient thermal analysis of an engine exhaust system.

In addition to the CEL algorithm, Abaqus/CFD has also integrated smoothed-particle hydrodynamics (SPH), which uses mathematically generated points within a fixed mesh to represent the movement of the fluid. This technology is well suited to complex flow boundary problems, and expands the size of the problem set that can be addressed in Abaqus multiphysics.

Abaqus/CFD currently only solves incompressible flow problems, but does incorporate transient and turbulent conditions. This is sufficient for many common FSI or MP problems.

Abaqus/CAE pre- and post-processing for CFD was released simultaneously, with all the visualization capabilities experienced CFD users have come to expect. This includes multiple section views, and streamlined calculation.

MP in Abaqus 6.10

SIMULIA has grown its MP capabilities by working closely with customers and responding to their needs, Weybrant says. With the incorporation of CFD in Version 6.10, and EM in Version 6.11, Abaqus will have all the building blocks to tackle commonly understood MP challenges, he adds.

In a SIMULIA press release, Dr. Fred Yang, technical leader of bearing analysis from Federal-Mogul Powertrain Sealing and Bearings Group USA, says his company is pleased that Abaqus provides the CFD capabilities for FSI, which enables his team "to perform accurate fluid and solid co-simulations.

"The new solution certainly gives us significant enhancements to explore multiphysics interaction in our designs, and optimize our products to reduce engine power loss and lower overall material costs," he adds.

While FSI and HPC are native to the product, an important focus of the development team is to identify existing problems of commercial and social importance, such as hybrid electric vehicle (HEV) design, and expand the MP capabilities available to these challenges. Vertical, industry-specific products are planned to address these growing needs. This will require expanding the boundaries of the simulation workspace.

One example of expanded boundaries is the ability to integrate Dymola models, from the CATIA division of parent corporation Dassault Systèmes, into 3D MP problems. Dymola is a 1D system-modeling tool that can capture logic statements, external energy flows and control al-

gorithms.

SIMULIA is working on the infrastructure to ensure support for real-world MP problems—even considering MP possibilities that aren't yet commercially available. Understanding that the right technology might come from other research organizations, SIMULIA has provided a unified framework for all MP tools with a network of more than 100 partners offering complementary technology.

MP for Product Development

MP coupling can be intimidating for design engineers who are primarily trained to model stress/deformation problems. SIMULIA is working to build this additional functionality into the current workflows with which a structural engineer would be comfortable.

To start with, Abaqus/CAE, the pre- and post-processing environment popular among Abaqus users, is the chosen platform for MP modeling. Users create a separate "model" in the feature tree for each domain. All common modeling tasks, such as meshing, selection and manipulation, are consistent by definition. Domain-specific needs, such as boundary condition and material definition, are incorporated using familiar forms and formats so that a structural user can focus on the engineering application—and not have to learn a new workflow.

Once the models of each physical domain are complete, Abaqus/CAE allows for co-execution of the system. This initiates the MP solution. A separate solver job is created for each model, but the coupling is done automatically.

In fact, SIMULIA has built most of the coupling into the background, thus eliminating repetitive definitions or redundant tasks. Abaqus 6.10 has also implemented "High Level Application Parameters" that set solver defaults to the most commonly used and effective values behind the scenes, based on user research, to make it easier for engineers to explore new or infrequent modeling combinations.

Once complete, the results of each job can be viewed independently in Abaqus/CAE or overlaid upon each other for a complete snapshot of the system response.

"Using FEA provides us with a more sophisticated method to understand and predict realistic behavior of complex geological environments," Phil McCurdy, principal geomechanics engineer for Senergy, said in a SIMULA press release. "We selected Abaqus due to its industry-proven track record and well documented use cases. Its open architecture also gives us the potential to link reservoir geomechanics models and flow models for more precise co-simulation and multiphysics solutions."

All Dassault Systèmes brands are starting to integrate MP with user-level appropriate products, including expert- and designer-focused products. The impact of this can already be seen in the latest releases of the integrated simulation tools in SolidWorks and Catia.

Weybrant is quick to point out that this is not a simplification of MP technology, but a repackaging to make advanced technologies more accessible: "Multiphysics must be accessible if it is going to be integrated into the engineering of real-world products." 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 ➜ **Dassault Systèmes:** 3ds.com

➜ **Federal-Mogul Powertrain Sealing and Bearings Group USA:** Federalmogul.com

➜ **Senergy:** Senergy.BASF.com

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

The 3DBOXX 8550 XTREME is KING OF THE HILL

This dual-CPU system is the fastest (and the most expensive) we've tested.

BY DAVID COHN

In the January issue, we reviewed a powerful workstation from Austin-based BOXX Technologies. At that time, the 3DBOXX 4860 Extreme, equipped with a single over-clocked six-core Intel i7 CPU, outperformed every system we had tested to date.

Not willing to rest on its laurels, however, BOXX sent us another system: its 3DBOXX 8550 XTREME, equipped with a pair of over-clocked Intel Xeon W5680 six-core CPUs. To say that this system outperformed the company's previous system would be a serious understatement. The 3DBOXX 8550 XTREME blew the doors off.

If you missed that earlier review, BOXX Technologies has been building high-performance systems since 1996, but targets most of its workstations toward digital content creation and visual effects. However, its workstations have also found homes among higher-end CAD and engineering users, and its systems are certified by numerous ISVs, including Autodesk and SolidWorks.

The 3DBOXX 8550 XTREME workstation from BOXX Technologies houses a pair of over-clocked Intel Xeon six-core CPUs. It is the fastest system we've tested to date.

Cramped Interior

Once we opened the 3DBOXX 8550 XTREME, we immediately noted lots more differences between this and the previous 3DBOXX workstation. Where the earlier system had a roomy interior, the 8550 XTREME was extremely cramped. A cage with four cooling fans for the liquid cooling system filled the lower front quarter of the case, with the large, 1,500-watt Silverstone Strider ST1500 power supply filling the remaining bottom portion of the chassis.

The 3DBOXX 8550 XTREME is built around a Classified Super Record 2 (SR-2) motherboard manufactured by EVGA and based on the Intel 5520 and ICH10R chipset, as well as the NVIDIA NF200 chipset. This enables the system to provide more PCIe lanes, and results in a system capable of supporting up to seven single-slot graphics cards or four dual slot GPUs. The motherboard also provides a dozen 240-pin DIMM sockets, arranged around the pair of CPUs as two banks of six sockets each. The board supports up to 48GB of memory and has six SATA II connectors.

Unfortunately, the high-performance technology extended (HPTX) motherboard, which measures 15x13.6 in., extends beneath both the power supply and cooling system. As a result, both the CPUs and memory sockets are concealed beneath the power supply and cooling fans.

Our evaluation unit came equipped with 24GB of memory, installed as a dozen 2GB DDR3-1333MHz ECC memory modules, thus filling all 12 sockets. A BOXX representative told us that customers who want to add memory themselves can do so by loosening two screws and removing the power supply, although they can also simply send the system back to BOXX and let tech support do the work.

Happily, the hard drive connectors remained totally accessible, so we could have easily installed additional storage. Like the 3DBOXX 4860, the hard drive cage is actually the metal back plane behind the motherboard. Removing the side panel on the left side of the system reveals this space. There, we found a single 300GB Western Digital 10,000rpm SATA drive. The cage actually provides mounting locations for up to 12 drives, which attach easily using four Phillips head screws.

Several additional sets of data and power cables were al-

ready in place to support more hard drives, and BOXX included lots of additional cables and hardware should customers want to install even more. BOXX offers hard drives of up to 600GB capacity, as well as redundant array of independent disks (RAID) and solid-state drives. As we noted in January, however, while this is a novel spot to mount the drives, they're likely to get just a fraction of the air flowing through the case.

Twelve Over-Clocked Cores

Our 3DBOXX 8550 XTREME came with a pair of 3.33GHz Intel Xeon processors, each providing six CPU cores. BOXX then ups the ante by over-clocking the CPUs to 4.2GHz. Given that the processors also support hyper-threading, we had the equivalent of 24 CPU cores.

Since receiving our evaluation unit, BOXX has raised the bar yet again: The latest 8550 XTREME systems, which remain priced the same as the one we received, now come with the Intel Xeon W5690 CPU, which BOXX tweaks just a bit further to 4.3GHz.

Our evaluation unit also came with the same NVIDIA Quadro 5000 graphics board we found in the previous BOXX system as well as the Dell T5500 that we recently reviewed (*DE* March 2011). The Quadro 5000 is built on NVIDIA's latest Fermi architecture, with 352 CUDA cores and 2.5GB of GDDR5 video memory. That graphics board was installed in one of the PCIe x16 slots.

The motherboard provides a total of seven PCIe slots, but no legacy PCI slots. Four of those slots are x16, while the

Design Engineering Workstations Compared

		BOXX 3DBOXX 8550XTREME workstation (two 3.33GHz Intel Xeon X5680 six-core CPUs over-clocked to 4.2GHz, NVIDIA Quadro 5000, 24GB RAM)		**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)	
Price as tested		$11,396		$9,240		$6,545		$6,325		$1,224		$2,089	
Date tested		3/20/11		1/14/11		12/13/10		11/14/10		9/15/10		8/7/10	
Operating System		Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7 64-bit	Windows XP	Windows 7	Windows XP	Windows 7
SPECviewperf	higher												
3dsmax-04		**95.97**	95.44[1]	76.05	78.72	88.15	87.07	n/a	90.25	66.73	64.98	60.87	**60.65**
catia-02		120.44	**121.1**[1]	98.48	100.25	75.35	84.85	n/a	115.36	68.28	**63.79**	68.13	66.87
ensight-03		**132.41**	130.13[1]	118.29	121.70	62.22	58.33	n/a	120.41	45.79	**43.40**	53.85	53.06
maya-02		**529.89**	476.95[1]	490.95	435.44	174.45	218.33	n/a	458.21	185.81	**157.57**	238.59	208.40
proe-04		113.84	113.24	92.19	90.61	83.16	77.29	n/a	**114.34**	64.08	**59.17**	68.03	65.74
SW-01		221.31	214.06	180.49	169.75	174.74	157.70	n/a	**233.03**	97.07	**89.67**	138.22	137.48
tcvis-01		**98.58**	94.17	93.99	90.34	40.16	37.36	n/a	95.26	23.66	**23.00**	35.60	34.81
ugnx-01		**89.32**	86.90	89.31	87.95	37.46	35.49	n/a	88.75	23.15	**16.93**	30.91	31.23
SPECapc SolidWorks	lower												
Score	seconds	106.56[1]	n/a	146.86	n/a	**106.51**[1]	n/a	n/a	n/a	**153.29**	n/a	148.72	n/a
Graphics	seconds	35.33[1]	n/a	58.42	n/a	**32.17**[1]	n/a	n/a	n/a	**58.71**	n/a	56.83	n/a
CPU	seconds	**25.99**[1]	n/a	32.27	n/a	26.87[1]	n/a	n/a	31.63	**33.67**	n/a	32.81	n/a
I/O	seconds	**46.51**[1]	n/a	60.76	n/a	47.99[1]	n/a	n/a	54.68	**65.44**	n/a	63.10	n/a
SPECapc SolidWorks	higher												
Score	ratio	**8.23**[1]	n/a	5.32	n/a	8.04[1]	n/a	n/a	n/a	**5.21**	n/a	5.27	n/a
Graphics	ratio	**6.08**[1]	n/a	**3.23**	n/a	6.07[1]	n/a	n/a	n/a	3.25	n/a	**3.23**	n/a
CPU	ratio	**12.61**[1]	n/a	10.00	n/a	12.01[1]	n/a	n/a	10.20	**9.58**	n/a	9.83	n/a
I/O	ratio	**6.81**[1]	n/a	5.21	n/a	6.60[1]	n/a	n/a	5.79	**4.84**	n/a	5.02	n/a
Autodesk Render Test	lower												
Time	seconds	34.0[1]	**19.0**[1]	42.0[1]	28.0[1]	53.5[1]	46.3[1]	n/a	39.6[1]	**222.3**[1]	203.0[1]	137.4[1]	135.2[1]

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

The power supply and fans for the liquid cooling system block access to the CPU and memory sockets. But there's plenty of expansion, thanks to seven PCIe slots.

ones between them are x8. This enables the motherboard to support up to four boards the thickness of the Quadro 5000.

BOXX offers other graphics accelerators from both ATI and NVIDIA, ranging from the Quadro 600 and Fire Pro V4800, to the ultra-high-end Fire Pro V9800 and Quadro 6000.

Fastest Performance Ever

Because the 3DBOXX 8550 XTREME was similar to the Dell T5500 (the significant differences being the CPU over-clocking and amount of memory), we were curious to see how the performance would stack up. The extra CPU speed proved to be the deciding factor. On the SPECviewperf test, which focuses solely on graphics performance, the 3DBOXX 8550 XTREME outperformed every other system on all but two of the datasets.

This time around, BOXX provided a dual-boot system, so we could perform our tests under both Windows 7 Ultimate 64-bit and Windows XP 64-bit. This enabled us to run the full SolidWorks benchmark, which is more of a real-world test and additionally breaks out graphics, CPU and I/O performance separately from the overall scores. Once again, the 3DBOXX 8550 XTREME beat every system we've tested to date.

When we turned our attention to our own AutoCAD rendering test, which clearly shows the advantages of hyper-threading, the 3DBOXX 8550 XTREME absolutely astonished us, completing the rendering in *just 19 seconds*. Less than a year ago, most systems took two minutes or more to complete this test.

Of course, if you're going to over-clock a CPU, you'd better provide lots of cooling. The liquid cooling system has four dedicated fans. There's also a separate fan on the front panel, one in the NVIDIA graphics board, one in the power supply and one on the motherboard itself. We definitely knew when this system was running—but the fan noise was not overly intrusive and would likely fade into the background in a busy office.

BOXX rounded out the system with a Logitech K120 104-key keyboard and a Logitech LX3 optical mouse. In addition to Windows 7, SUSE and Red Hat Linux are also available. BOXX Technologies backs the system with a three-year warranty, and phone and email tech support are available Monday through Friday from 7 a.m. to 6 p.m. CST.

Needless to say, this much power comes with a hefty price tag. The 3DBOXX 8550 XTREME carries a base cost of $8,317, which gets you two CPUs, 6GB of RAM, an NVIDIA Quadro 600 graphics board and a 160GB 7,200rpm SATA hard drive, plus the optical drive, OS, keyboard and mouse. Adding the extra memory (+$999), high-end Quadro 5000 graphics board (+$1,816), and 300GB hard drive (+$264) increased the total price to $11,396, making the 3DBOXX 8550 XTREME not only the fastest system we've ever tested, but also the most expensive. That price will surely place this system beyond the reach of many, but for those who need the absolute fastest performance available, coupled with support for up to four dual-slot GPUs, the 3DBOXX 8550 XTREME is now the one to beat. DE

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INFO → BOXX Technologies, Inc.: BOXXtech.com

BOXX 3DBOXX 8550 XTREME

- **Price:** $11,396 as tested ($8,317 base price)

System Requirements

- **Size:** 7x19.5x17.5 in. (WxDxH, w/handle) tower
- **Weight:** 32 lbs.
- **CPU:** two Intel Xeon W5680 (six-core) 3.33GHz (over-clocked to 4.2GHz)
- **Memory:** 24GB DDR3 ECC at 1333MHz (up to 48GB supported)
- **Graphics:** NVIDIA Quadro 5000
- **Hard Disk:** Western Digital 300GB SATA 10,000rpm drive
- **Optical:** Pioneer 24X DVD+/-RW Dual-Layer
- **Audio:** onboard integrated high-definition audio (microphone and headphone on front panel; microphone, line-in, front, center/subwoofer, side and rear speakers on rear panel)
- **Network:** integrated 10/100/1000 LAN with two RJ45 sockets

SPOTLIGHT

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

Are We Outsourcing our Creativity?

As emerging economies move up the product development food chain, they are competing with the West in increasingly creative ways.

BY MARK CLARKSON

We've come to accept that mechanical, low-skilled work goes wherever the moment's low-cost opportunities are found. But the notion that we could outsource the grunt work and keep the creative work at home now seems a little … naïve. If you outsource the manufacture of your laptop computers to an overseas firm, it would be foolish to presume that firm isn't learning a lot about making laptops, and getting a few ideas about how they might improve upon it, too.

"Smart people and governments realize they need to move up on the product development food chain if they're going to be playing in this game in five or 10 years," says Joel Delman, creative director of Product Development Technologies' California office.

That means getting away from 50-cent-an-hour assembly work, and getting into the more creative, front-end work. And many emerging economies are investing heavily in just that. Way back in 2005, *Businessweek* reported that China was graduating some 10,000 industrial designers a year, and growing.

According to Chen Dongliang, director of the Beijing Industrial Design Center, there are about 250,000 people working for design firms in Beijing alone.

"Beijing is also expanding technology service and high-end manufacturing industries," he says. "Both of them can help boost the industrial design sector."

That's a lot of new designers.

Free Engineering

"We not only do engineering," says Delman. "We also help clients do the front-end research: what they should be engineering at the end of the day, and how to make it not only aesthetically compelling, but functionally and ergonomically suited to its markets."

In the last two years, he says, his firm has seen a "threatening" increase in the overseas offerings at the front end of the process.

"Our Asian vendors, who used to focus primarily on tooling, manufacturing and assembly, are starting to offer very inexpensive engineering services with the purchase of tools," Delman explains. "They say, 'You buy the tools from us and we'll also engineer the parts for you for free.' The cost might be amortized into the cost of the tooling itself but, for all practical purposes, it becomes free."

These services can include anything up to and including taking your rough design all the way through to final manufacture, he says. "The skill sets these vendors are bringing to the table is quite high," he adds, "provided the product isn't too complex or specialized. Particularly with electronics, it's becoming more common to outsource these kinds of services — which cross the line between technical and creative — to China, to India and, these days, even to Vietnam."

That's My Idea!

It's hard to compete with free, but things may not be as grim as they seem. Even at bargain rates, not everyone is rushing to outsource their creative work. There are good reasons to hesitate; foremost among them is the issue of intellectual property.

"We know the Chinese knock patents off without thinking twice," says Delman. "One of the ways they've gained expertise is by forming partnerships with various American and European companies, taking the knowhow, then saying 'Thank you very much,' and doing it themselves.

"It would be very scary to me to trust a firm in China or India to help me come up with the latest and greatest. Are they going to [generate] great ideas, but then act on those ideas themselves, the minute we walk out the door?"

Cultural Differences, Pros and Cons

And there are more subtle concerns. How well do overseas designers understand the needs of the American consumer? "The Japanese are an incredibly consumer-oriented society," says Delman. "They've got products on their mind all the time. But many people in China and India are quite isolated in understanding what a market like America is looking for."

Isolated or not, different cultures have different tastes, which helps the American designer designing for the American market, says George Brown, CEO and co-founder of the strategic consulting firm Blue Canyon Partners, Evanston, IL. Take cars, for example: Designs vary widely among those found in the U.S., Europe and China.

"Ten years from now, I guarantee there will be a Chinese auto manufacturer producing cars in the U.S, and hiring U.S. design engineers to appeal to the U.S. consumer, who has different tastes—and probably always will have different tastes—than the Italian consumer, the Chinese consumer or the Indian consumer," Brown says. "You see it across the board, in product after product, whether it's cars or entertainment or personal care products."

Moving up the Food Chain

We gain some hidden benefits as emerging economies move up to more sophisticated work. The closer a country gets to the top of the food chain, the less competitive their salaries become. Designers and engineers are well educated and expect to be well paid. The price differential is much smaller than it is in manufacturing. The playing field may not be level, but it's not nearly as tilted.

Furthermore, better paying work leads to more highly paid workers and an emerging middle class. This middle class, in turn, drives an increase in consumer markets within the country; the country becomes increasingly focused on its own needs. That's good news, says Brown.

"Five or 10 years ago, the only employment for an Indian or Chinese design engineer was as an outsourced employee of an American, European or Japanese company. Now, there's an awful lot of design and engineering work that has to be done for Chinese and Indian companies … and soon Indonesia and other developing countries," he says. "These countries are beginning to have a middle class that is expecting a higher level of products."

Where these countries were once a source of low-cost manufacturing, he says, they are now genuinely vibrant markets with companies beginning to compete on the world stage.

"I think these markets are going to grow faster than the outsourcing of labor that doesn't have a local opportunity," says Brown. "We'll eventually recognize that it genuinely is a global market. Not all the consumers are located in the U.S. and Europe, and not all the cheap sources of products in the emerging markets are focused on Europe and North America.

"There will be very good opportunities for the young design engineer in the U.S. or West Europe," he adds, "but they'll be different than 10 years ago, when we were one of the few places where that profession and that expertise really mattered."

Staying Competitive

You should definitely continue to invest in yourself and your own capabilities. "Those who distinguish themselves through creativity and advanced capabilities are going to thrive," says Brown.

Despite the globalization of markets, there are still a lot of opportunities at home.

"We are still the No. 1 manufacturing location on the planet," he says. "The press makes us think we're down to our last three manufacturing jobs, but we still manufacture more here than in China or anywhere else."

And all that manufacturing, Brown says, requires underlying talent in everything from basic research to engineering and design, to the operations associated with everyday factory process control and process operations.

"The U.S. is going to be the biggest market in the world for the next 10 or 20 or 30 years," he concludes. "Being in a position to do a good job for business and consumers in the world's largest market is a key success factor for every firm we work with." DE

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

INFO ➜ **Beijing Industrial Design Center:** BIDCchina.com

➜ **Blue Canyon Partners, Inc.:** BlueCanyonPartners.com

➜ **Product Development Technologies:** PDT.com

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

TriVector Verifies Time Latencies for Ares I Rocket

MathWorks software helps simulate rocket communication system.

The Ares I rocket is central to NASA's Constellation Program missions to the International Space Station, the moon, Mars, and the solar system. There are two stages to Ares I: In the First Stage, a reusable Solid Rocket Booster lifts the Orion crew vehicle toward low-earth orbit during launch before separating from Ares I. In the Upper Stage, a single J-2X engine propels Orion into orbit. Communication between avionics systems on the two stages, Orion, and Ground Systems is critical to the success of each launch.

The TriVector Services Team analyzed the timing of more than a dozen Ares I communications buses. By performing discrete-event simulation of Ares I packet-level communications using MathWorks' Simulink, Stateflow, and SimEvents, engineers assessed network latency and verified requirements for the buses before any hardware or software was developed.

A Timing Challenge

Both of the Ares I elements—the First Stage and the Upper Stage with J-2X Engine—have redundant buses linking flight computers to remote terminals (RTs), which collect avionics sensor data. Top-level requirements from NASA specify that once data is acquired by an RT, the data must be delivered to Orion or Ground Systems within a specified time; lower-level requirements specify the timing for element-to-element data delivery.

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Vero Software Helps Reinvent the Wheel

Lamiflex uses Vero's VISI suite of design and manufacturing tools to put a composite spin on the exercise bike.

BY MARC FREEBREY

The Lamiflex Group, based in Bergamo, Italy, has been an industry leader in the use of composite materials for more than 30 years. It has supported various industries, including aerospace, medical, telecommunications and the sports sector.

The company began in 1976, inventing and developing rapier ribbons made from composite materials for the textile machinery industry. However, constant research and investment has allowed Lamiflex to expand into other market sectors, such as aerospace, where it uses a special "autoclave polymerization of composite materials" process, certified by AgustaWestland. The process allows the company to produce both stiff and flexible lightweight ducts for environmental control systems (ECS) installed in aircraft or high-performance vehicles and machinery used by the military.

Composite materials are, by definition, structures made up of several component materials. These typically include thermoset resins strengthened with carbon, Kevlar or glass fibers, which provide certain characteristics (usually mechanical) and a matrix that holds the fibers in position, protects them and offers other specific characteristics for particular applications. Laminated composite materials can be produced as sheets of continuous strands of fiber, layered so that each fiber lies in a specific direction.

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T-Splines Re-evaluates Surface Modeling for Manufacture

The ability to create large, unified surfaces allows greater freedom in designing complex organic shapes.

BY SCHUYLER GREENAWALT

There's a fundamental problem with non-uniform rational basis spline, or NURBS, according to T-Splines. While NURBS provides the underlying math for nearly all surface modeling for manufacture, the implementation of NURBS in surface modeling software has some inherent limitations. These limitations become especially apparent when creating complex blends among surfaces.

Limitations of NURBS:

1. The workflow itself can sometimes feel like one is stumbling around in the dark. Typically, to create a blend between two surfaces, you first trim those surfaces, and then create guide curves or surfaces to further define the blend. A blend surface is then created, using the existing geometry as input. Only after the designer has gone quite far down the path is the quality and shape of the blend surface apparent. If the resulting surface is not acceptable, the process must be iterated until an acceptable result is obtained. Essentially, the designer is being asked to define the surface blind, which creates a lot of needless work when trying to really refine a surface.
2. For blends to match up nicely at the edges, the surfaces themselves are often dense with isocurves. While the curve used to trim a surface for a blend may itself be quite simple, when that curve is projected onto the surface, the resulting edge is usually "heavy"—meaning it requires many points to be properly defined. The blend surface created with that edge as an input is likewise heavy.

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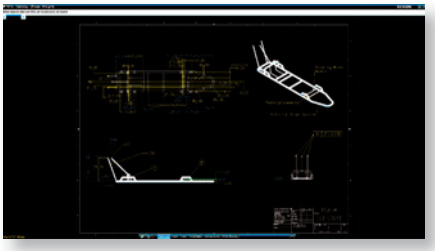
For the complete application stories visit deskeng.com/fastapps

by Anthony J. Lockwood

Editor's Picks

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.



CAD Data Translator Upgraded

Elysium's CADfeature offers enhanced drawing support and new 64-bit capability.

CADfeature enables complete control over your translations so that you can preserve your design intent and control of your intellectual property. It provides control over your process — say, batch remastering, geometry-only conversions, feature suppression, and so forth. And it has a palette of capabilities for healing files.

Healing files? You might ask. Yeah, no system is perfect when it comes to data translation. Dealing with that so that you have a remastered part or assembly from one CAD system for another is the power that CADfeature provides.

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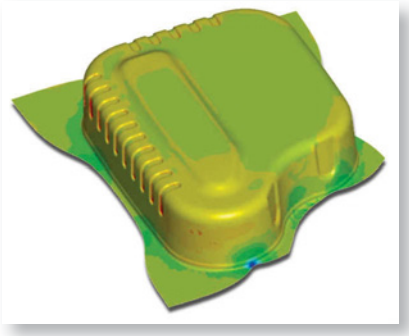

Engineering Technology Associates' DYNAFORM 5.8

Simulation software offers a new, simplified explicit solver for sheet-metal forming.

ETA describes DYNAFORM as a complete die system simulation solution and cites two reasons: One, DYNAFORM has tools that cover the entire die system process — CAD surface and CAE meshing, estimation (i.e., material utilization, piece price, scrap calculation, etc.), die simulation, and die analyses. Two, the software's interface gives you easy-to-use, single location access to all those tools.

In terms of brass tacks, this means that DNYAFORM gives you tools for guided cost estimation, quoting, die face design, and formability analysis. Not done yet. You can virtually move a part from one station to the next through the stamping process inside a plant.

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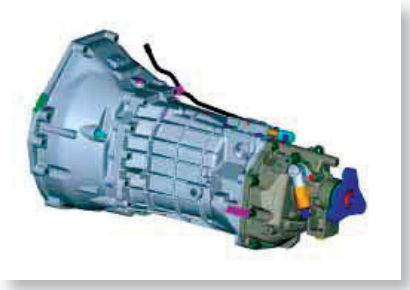

One Tool Simulates Transmissions

MSC.Software unveils Adams Gear Advanced Technology Solution.

MSC.Software recently released the Adams Gear Advanced Technology plug-in for its MD (multidiscipline) Adams mechanical systems analysis software.

Those of you in the loop know that MD (multidiscipline) Adams is widely leveraged because of its ability to integrate mechanical components like hydraulics and control systems into virtual prototypes that you use to make sure that these subsystems work in harmony. The Adams Gear Advanced Technology toolkit sounds loaded with transmission-specific methodologies.

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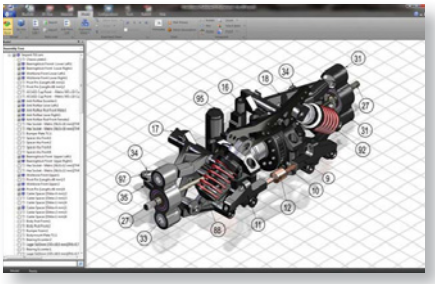

Interactive 3D Document Toolset Upgraded

Linked text boxes, material library, and part import tools highlight QuadriSpace 2011.

QuadriSpace Document3D Suite is for 3D interactive and hard copy document creation. Your 3D documents can have interactive animations of, say, your SolidWorks 3D model. By animated, I mean you can spin it around, assemble/disassemble it, and poke under the model's covers to your heart's content.

And you can publish your interactive 3D documents to a file that you can send to collaborators to play with or you can post it on the web.

This is how illustrating and building manuals or an online parts catalog is supposed to be.

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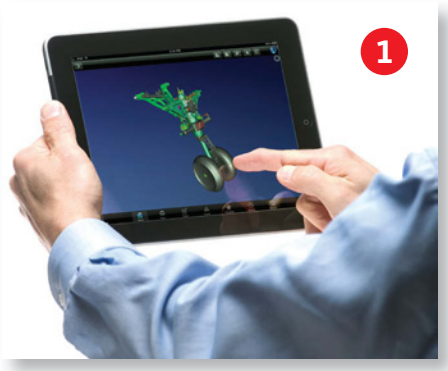
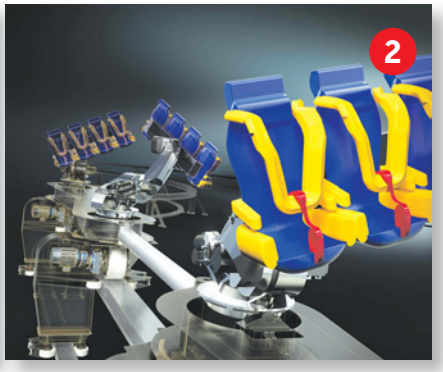
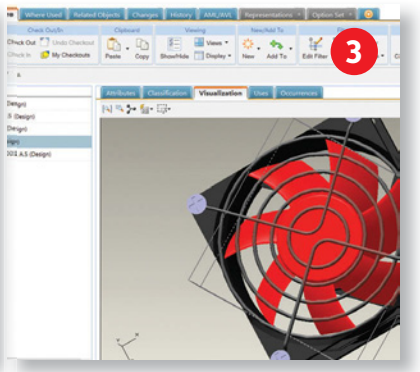






1 Siemens Launches Mobile Teamcenter App

The new Teamcenter Mobility mobile device app enables access — from WiFi- or mobile broadband-available locations — to the information managed by Siemens' Teamcenter software (plm.automation.siemens.com). The app allows companies to interact with product data and workflows. Teamcenter Mobility enables users to search, display and interact with product information, including 3D product models. The initial implementation is being deployed via iPad with additional platform and functionality support to be announced at a later date.

Eurocom Launches Mobile Server

Eurocom Corporation (eurocom.com) has launched the EUROCOM Phantom 4.0. It can support up to two server class processors, 6 memory slots for 48GB of RAM via 8GB sticks, and six storage drives with RAID 0/1/5/10/30. The Phantom 4.0 supports multiple operating systems and virtualization. It starts at $7,999.

3D Mice Can be Used with Any Application

3Dconnexion (3dconnexion.com) has announced 3DxWare 10, a driver platform that it says extends the usage of 3D mice to any application. The 3DxWare 10 interface allows users to assign keyboard strokes and traditional mouse or joystick movements in any combination to the 3D mouse. The choice of application and assignment of the six axes — and up to 31 function keys (depending on the 3D mouse model) — is up to the user.

2 Autodesk Releases 2012 Manufacturing Software

Autodesk, Inc. (autodesk.com) has introduced its new 3D design and engineering software portfolio for manufacturers, including the new Autodesk Product Design Suite. The complete Autodesk digital prototyping software portfolio is intended to help manufacturers design and build better, more sustainable products, reduce development costs and get to market faster. The suite contains Autodesk's design, visualization and simulation software for manufacturers. Three editions are available: Standard, Premium and Ultimate. Product Design Suite Standard includes AutoCAD Mechanical with Inventor Fusion, Autodesk Showcase, Autodesk SketchBook Designer, Autodesk Vault and Autodesk Mudbox software. The Premium suite includes the standard edition tools along with Autodesk Inventor and Autodesk 3ds Max Design software. The Ultimate suite includes the same tools as the Premium edition along with Autodesk Inventor Professional and Autodesk Alias Design software.

Omega Engineering Releases IR-USB

Omega's (omega.com) new IR-USB series of infrared temperature sensors provide a method for most PC-based non-contact temperature monitoring. The unit features an IR sensor/signal conditioner installation with a direct USB connection and free user software that converts a PC into a temperature meter, chart recorder or data logger. Prices start at $175.

Spatial's 3D InterOp Suite Work with IronCAD 2011

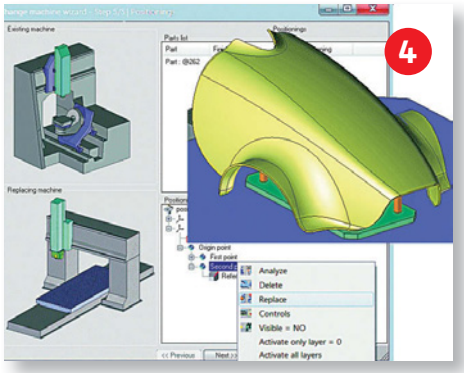
Spatial Corp. (spatial.com) and IronCAD, Inc. (ironcad.com) have announced that Spatial's 3D InterOp Suite provides the native CAD translators for the IronCAD Design Collaboration Suite (DCS) 2011. These native translators are packaged as a Translator Bundle allowing IronCAD users to leverage existing 3D designs regardless of the originating CAD system, according to the companies. The bundle is available for IRONCAD, INOVATE and IronCAD's newest product, IRONCAD DRAFT.

3 PTC Releases Windchill 10.0 PLM Software

PTC (ptc.com) has announced the release of Windchill 10.0, the newest version of its product lifecycle management (PLM) software. With the latest release of Windchill, PTC says it is enabling manufacturers to do more throughout the product lifecycle, know more about product performance and get more value from PLM. New capabilities focus on product analytics and quality management. PTC says Windchill 10.0 allows customers to more effectively define, manage, and validate complete bills of material (BOMs), providing linkages across domain-specific views of product structures throughout the entire lifecycle. Windchill 10.0 also includes a new user experience and updated system administration.

Advanced Design System Platform 2011 Released

Agilent Technologies Inc. (agilent.com) has announced shipment of the latest release of its flagship RF and microwave design and simulation platform, Advanced Design System 2011. ADS 2011 provides engineers with a multi-technology design environment for designing individual RF and microwave integrated circuits with different technologies. It features electromagnetic technologies



for faster, more accurate simulations; a use model that makes electromagnetic simulation easier for engineers; layout improvements for easier physical design; and dozens of improvements designed to enhance the platform's functionality and usability.

4 Missler Software Releases TopSolid' Cam 2011

Missler Software (topsolid.com) is launching the latest version of its Cam software solution, TopSolid'Cam 2011. TopSolid'Cam calculates tool paths for numerically controlled machines including milling machines, lathes and machining centers. It has new functions with a focus on the tool making and the aerospace industries. It includes morphing, machine replacement, Z level helical machining and Z level finishing cycles.

Revware Announces 2011 Product Lineup

Revware Inc. (revware.net) has released information on its 2011 product line-up. Revware, the company behind the MicroScribe, MobiGage and RevWorks software solutions for metrology professionals, is launching an educational campaign to highlight the attributes and applications of its products. The newest addition to the Revware software offerings is MobiGage, a handheld metrology application. It can be installed on an iPad, iPod Touch or iPhone, using wireless network communication to correspond with a MicroScribe digitizer. MobiGage PC is also available.

Flow Science Releases FLOW-3D Cast

A version of FLOW-3D designed specifically for casting process simulation is now available from Flow Science. (flow3d.com) FLOW-3D Cast is the latest computational fluid dynamics (CFD) software to join Flow Science's product family, which includes FLOW-3D/MP, FLOW-3D ThermoSET, and its flagship software, FLOW-3D. FLOW-3D Cast features flow and solidification results; dynamic meshing; material libraries for metals, molds, filters and risers; and postprocessing capabilities.

5 Drive up to 16 Displays from one PC

Matrox (matrox.com) has announced a new software release for the Matrox Extio F2208 dual-monitor and Matrox Extio F2408 quad-monitor KVM extenders. The package enables new multi-display configuration options that include support for two PCIe interface cards, main units and Extio F2408E Expander boxes to drive up to 16 displays — plus keyboard, mouse, audio and up to eight additional USB 2.0 ports — at a distance of up to 1 km from a single PC. DE

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Objet Geometries' Objet24 Personal 3D Printer

High-Resolution Printing

1 The Objet24 Personal 3D Printer is capable of horizontal build layers down to 28-microns, that's 0.0011 in. with accuracies to 0.1 mm, depending on the model being printed.

Material Cartridges

2 Two, fully sealed model material cartridges and two support cartiridges allow printing for up to 36 hours, unattended. It prints with Objet's VeroWhitePlus material, which is opaque and fully cured by UV light when printing is complete. Models can be painted, machined or used as molds.

PolyJet Technology

3 Two jets are used in the Objet24: one for the model and one for support structures. The support structures can be removed using a WaterJet.

Build Tray

4 Resins are jetted onto the 9.45x7.87x5.9-in. build tray in thin layers. Multiple models can be printed simultaneously via Objet Studio software, which can import STL and SLC files.

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SPECS

- *Dimensions: 32.38x24.4x23.22 in.*
- *Weight: 205 lbs.*
- *Tray size: 9.45x7.87x5.9 in.*
- *Net build size: 9.22x7.58x5.85 in.*
- *Build resolution: 600 dpi on X, Y and Z axis.*
- *Material supported: VeroWhitePlus Opaque material in sealed, 2.2-lbs. cartridges*
- *Support Type: FullCure705 Support, which is a non-toxic, gel-like photo-polymer support that can be removed with a WaterJet.*
- *Network: Ethernet TCP/IP 10/100 base T*
- *Input formats: STL and SLC files*
- *Environment: 64°F to 77°F, relative humidity from 30 to 70%*
- *Software: Objet Studio*
- *Compatability: Windows XP and 7*

For more information, visit objet.com.

BEST PERFORMING PROCESSOR FOR DESKTOPS[1]

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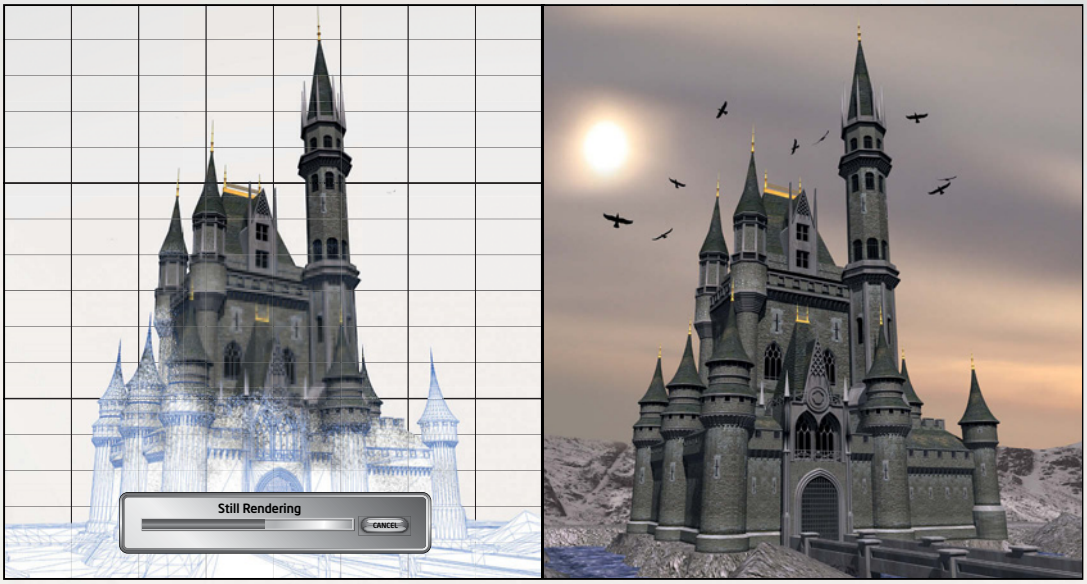

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