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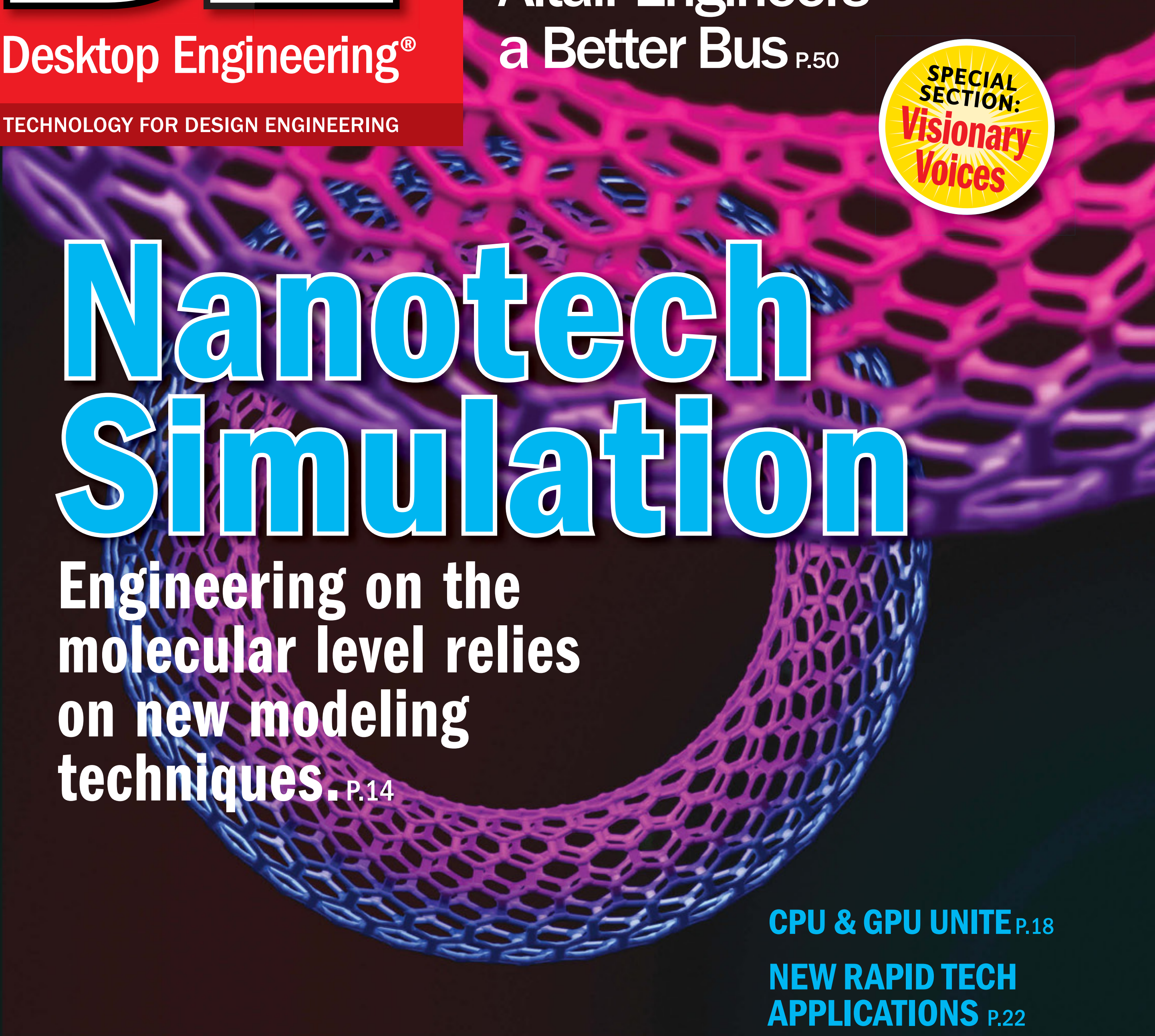

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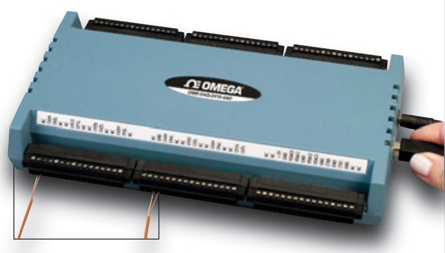

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Degrees of Freedom

by Jamie J. Gooch

Engineering on the Edge

Right now, in public and private labs across the globe, technologies are being developed that will drastically change the way you design, simulate, prototype and test products for the better. I'm not talking about the next version release of your favorite engineering software or a bump in processor speed. I'm talking about Bronze Age to Iron Age changes, steam power to internal combustion engine changes, vacuum tube to semiconductor changes. I'm talking about technologies that will change the world.

I know, you've heard all of this before. You've been waiting for your personal robot since (or even before) you first heard "Danger, Will Robinson" on *Lost in Space* or watched Rosey taking care of the Jetsons. But this time it's different.

The Merging of Emerging Tech

Different how? Different because the sci-fi dreams of the past lacked any substantial technological shoulders to stand on. Now a platform of advanced materials, blazingly fast computational power, nanoelectromechanical systems, and highly efficient power sources is emerging. This confluence of breakthrough technologies will make many of the products we use everyday better and previously impossible or overly expensive ideas a reality.

Design engineers are on the forefront of turning new technologies into useful products.

When breakthroughs in nanotechnology (which you can read more about on page 14) are combined with new computing, sensor and battery technologies, the possibilities are mind-blowing. Add biotechnology to the mix, and it's hard to comprehend what tomorrow's products will look like.

That's where you come in. Imagine materials so thin, strong and lightweight that a space elevator is possible, small and flexible sensors that could be used to create artificial skin, or 1-atom-thick transistors used to create tiny computer processors? Researchers can already build crystalline materials from nanoparticles and DNA, which could lead to building any structure on demand.

Find a Need, Fill a Need

Necessity has always been the mother of invention, and there are certainly global needs that these new technologies are being used to address.

Lightweight materials and advanced simulation software are improving the efficiency of our use of natural resources by reducing the weight (and therefore the energy consumption) of aircraft and vehicles without reducing their safety. Nanotech is bringing new and improved alternative energy options into the mainstream by improving the efficiency of solar cells, fuel cells and superconductive materials. Advances in sensors, computing and materials are expanding the role of robots outside of factories and into battlefields, disaster areas and soon our homes. The convergence of biology, electronic and mechanical technologies are creating new medical devices that can help the deaf hear and the paralyzed walk again.

While some of these technologies are still far into the future, many are set to emerge from the lab or are already being commercialized. As they are, design engineers like you are on the forefront of turning these new materials and technologies into useful products. That's why *DE* has launched *Engineering on the Edge*, a new website dedicated to informing you about breakthrough technologies and the impact they could have on design engineering.

A Focus on the Future

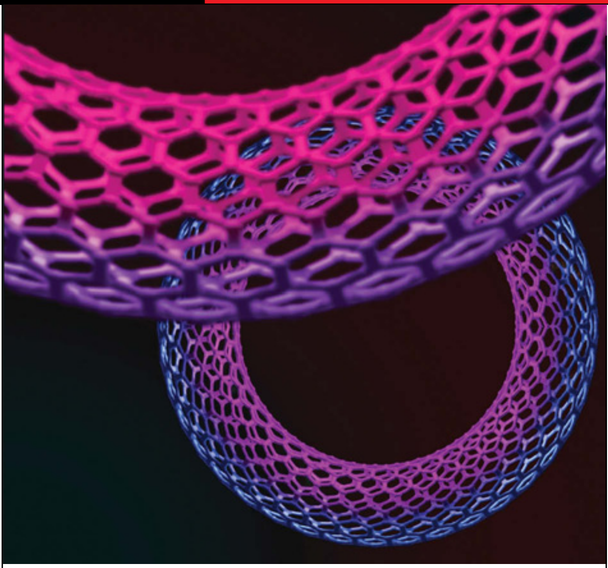
At EngineeringontheEdge.com, you can learn about graphene, programmable magnets, robot substitutes, quantum dots and the other "Innovations That Could Change The Way You Manufacture," according to the Society of Manufacturing Engineers (SME). We've already covered hybrid supertankers, in-orbit satellite recycling, biomimicry, electric car networks for energy recycling, brain-machine interfaces, rescue robots, salt-based computer storage and more.

The mission of *Engineering on the Edge* is to prepare design engineers for what's next by reporting on the cutting-edge research, products and theories that are set to change the way you work. We aim to bridge the information gap between the lab and the shop floor via written posts, photo galleries and videos.

You can check out a small portion of the site's articles on page 12 of this issue. But we hope you'll visit the site to get the latest news on the future of engineering technology. We'd love to hear your take on advanced technologies, which ones you are already using and which ones you think will never make it out of the lab. The site allows you to comment on every article. Let us know what you think at EngineeringontheEdge.com. DE

Jamie J. Gooch *is the managing editor of* DE. *Send comments about this subject to de-editors@deskeng.com.*

DE December 2011 VOLUME 17/ISSUE 4



COVER STORY

Simulating Nanotech

ON THE COVER: Carbon nanotubes can be coaxed into different shapes to perform various functions. *Image courtesy of iStock Photo.*

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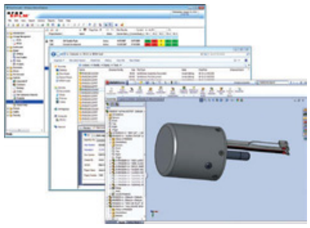

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A LEVEL 5 COMMUNICATIONS PUBLICATION
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***Desktop Engineering*® magazine**
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603-563-1631 • Fax 603-563-8192
E-mail: DE-Editors@deskeng.com
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***Desktop Engineering*®** (ISSN 1085-0422) is published monthly by Level 5 Communications, Inc., 1283D Main Street, P.O. Box 1039, Dublin, NH 03444, 603-563-1631. Periodicals postage paid at Dublin, NH, and at additional mailing offices. Desktop Engineering® is distributed free to qualified U.S. subscribers.

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

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by Kenneth Wong

Bentley Gives its i-models the iPad Treatment, Acquires Pointools

The iPad, one of the enduring legacies of the late Steve Jobs, is about to become much more prevalent in the greasy fieldwork of plant managers, wastewater facility supervisors, roadway designers and structural engineers.

Infrastructure software giant Bentley's iWare module family now includes three apps for iPod, iPhone and iPad users:

- i-model optimizer for iPad (to convert DGN, Revit, DWG, DXF, Rhino and 3DS files into an i-model optimized for the iPad);
- ProjectWide i-model packager (to group i-models optimized for iPad together with other documents into a single package); and
- structural synchronizer view for iPad, iPhone and iPod Touch (to view and explore your 3D structural models created with Structural Synchronizer V8i).

At press time, the first two are in beta; the last one is still in development. The collection of apps makes i-model, Bentley's preferred lightweight format for visualizing integrated infrastructure projects, easily accessible for markup, annotation and data exchange for field crews equipped with Apple devices.

In addition, Bentley also offers Bentley Navigator and Bentley ProjectWise Explorer, both available for the iPad. Working in conjunction, the two apps let users perform walkthroughs inside 3D infrastructure models, inspect predesignated points of interest, view attached documents (PDFs, spreadsheets, and so on), and add notes and highlights.

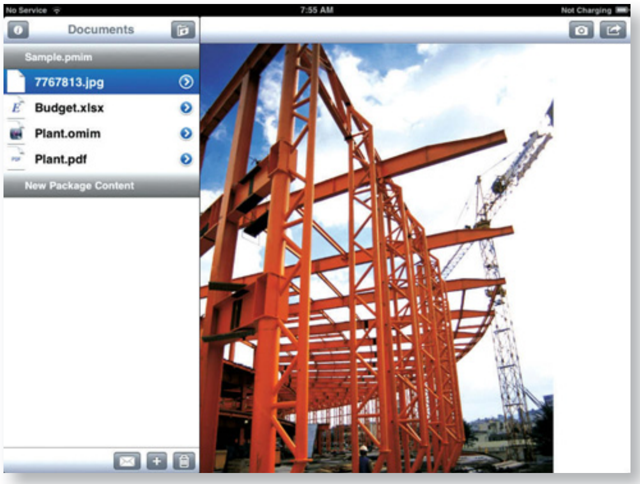
With the latest partnership with Adobe and Bluebeam Software, Bentley plans to add more security, read/right controls, and digital rights management tools to 3D PDF documents associated with i-models.

Bentley's new partnership with Microsoft, announced in November at the company's Be Inspired 2011 conference, is expected to let Bentley ProjectWise and AssetWise users use Windows Azure-powered transmittal services.

"Most of our users have invested significant resources on manual processes or enterprise systems to handle the crucial task (of transmittal)," said Bhupinder Singh, senior vice president of Bentley Software. "Unfortunately, most generic approaches aren't well suited for this infrastructure project need."

The long-awaited function can now be performed right inside Bentley's ProjectWide collaboration and AssetWise management environments, according to the announcement. The collection of services will enable "AECO (architecture, engineering, construction and operation) organizations to accurately and securely package, and deliver, receive and track transmittals through a dashboard portal," the company revealed.

In a recent shopping spree, Bentley acquired Pointools, which specializes in streaming large point cloud datasets. (Think of it as using Google Maps' on-demand map streaming approach for point cloud databases.) As Bentley's Singh puts it, "A unique new ProjectWide capability will stream on-demand to Bentley applications only the subset of point cloud data being viewed or queried. This function is what has been needed to allow point clouds to fulfill their potential as an intrinsic, fundamental data type in information modeling workflows."



Bentley Navigator for the iPad will let you connect to ProjectWise database and documents from an iPad.

Because of point cloud database size in infrastructure projects, mobile devices with limited storage and memory are not always suitable for interacting with the data set. With on-demand streaming, Bentley is poised to overcome the hurdle to deliver point cloud data to mobile platforms. This will allow a plant worker to, for example, conduct a walkthrough of a site captured in point cloud and CAD data using his mobile device as a virtual window—even though the actual site may be thousands of miles away. Similarly, he may also turn on the mobile device's location sensors at a project site, then overlay an i-model of a section of the design to the as-build conditions in a mobile app to identify discrepancies between the two.

With mobile apps and lightweight clients providing visualization and editing functions, Bentley envisions ProjectWise and AssetWise to become information hubs where collaborators' actions get synchronized.

"Everything is connected wirelessly. Ultimately, the opportunity is for us to build a semantic city, where everything talks to each other," said Greg Bentley, CEO of Bentley. "Thank goodness we don't have to invent [the device needed]. We just need to apply it." DE

NVIDIA Introduces **Tesla-powered Maximus Workstations**

When you think of a high-performance computing (HPC) system, you might envision a series of rack-mounted servers housed in a climate-controlled room. It's the parallel-processing Goliath that the entire company relies on for heavy-duty simulation jobs, like finite element analysis (FEA) and computational fluid dynamics (CFD). Now, NVIDIA is introducing what amounts to a mini-HPC system inside a workstation—Goliath's enviable strength in David's nimble form.

Packed into a standard workstation, NVIDIA's Maximus technology is expected to let you work in a CAD modeling program, render photorealistic product shots, and run simulation jobs—all at the same time. Usually, a workstation is powered by a multi-core CPU and a processional graphics processor (like NVIDIA's Quadro GPU). In a Maximus machine, however, you get the combined horsepower of a CPU, a Quadro GPU and a Tesla GPU.

With the ability to dynamically balance computation workload, Maximus workstations are designed to determine and distribute processing jobs to the appropriate processors—for example, delegating interactive CAD modeling to the CPU, graphics rendering to a Quadro GPU, and fluid dynamics jobs to a Tesla GPU—with little or no intervention from the user.

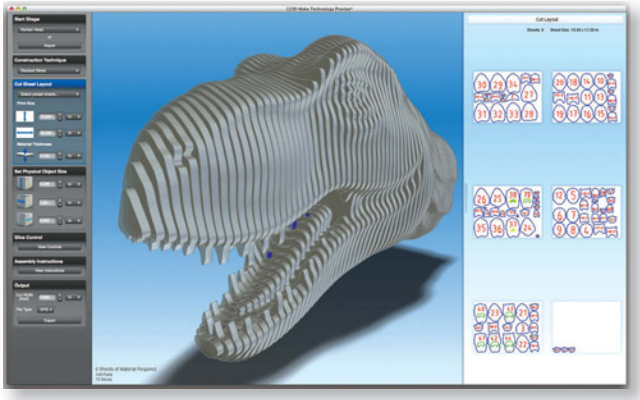
According to NVIDIA, its hardware partners are on board to begin delivering Maximus workstations equipped with NVIDIA Tesla C2075 GPUs. The earliest units are expected to come from Dell, HP, Lenovo and Fujitsu. Prices for Maximus workstations are estimated to begin around $8,000 to $10,000.

NVIDIA explains that the Tesla GPU used with Maximus technology is the same ones used for clusters, but its architect has been slightly modified to fit into a traditional workstation. To enable easy load balancing, NVIDIA will allow Quadro and Tesla GPUs to run on a unified driver.

In many engineering firms, the HPC system is a monster with a long tail. Because it's a shared resource used by a pool of engineers and designers, many submitted jobs tend to sit in the system's queue for a while before they get their turns. The wait, which puts critical design decisions on hold, has become an inevitable part of simulation-driven projects. NVIDIA anticipates that many of these users will look to Maximus workstations' local HPC-processing power as a way to bring relief to their simulation bottlenecks. DE

Editor's Note: To listen to an audio clip of Kenneth Wong's interview with David Watters, NVIDIA's senior marketing director for manufacturing and design segments, visit deskeng.com/virtual_desktop/?p=4604.

Autodesk's New 123D Apps: **Make and Catch**



Autodesk's latest 123D app, dubbed 123D Make, lets you turn 3D models into a series of 2D cutouts. When assembled, the stack of cutouts provides volume and mass corresponding to the model. Currently, it's available only for Mac OS users.

In November, Autodesk bolstered its consumer-friendly product line 123D with two new additions: Autodesk 123D Catch, a free application to transform digital photos from standard point-and-shoot cameras into editable 3D models; and Autodesk 123D Make, a model-making application (currently only available for Mac OS X) for creating 3D physical prototypes.

123D Catch is the public beta of what used to be Project Photofly, previewed on Autodesk Labs more than a year ago. It allows users to upload a series of digital photos of the same subject taken from slightly different angles, then extract a 3D point-cloud and mesh model of the subject. The most intense computing operations take place on a remote server.

Though it targets consumers, the method exemplified by 123D Catch will also be appealing to professional designers and commercial manufacturers, as it allows them to capture the approximate shape of an existing product to explore possible improvement to its aesthetics, function and durability.

123D Make mimics the 3D printing and laser-cutting process, whereby users can turn a 3D model into a series of 2D cutouts that represent the desired volume and mass. When assembled, the resulting flat patterns will give users a 3D physical object corresponding to their ideas. The cut pieces are numbered to make assembly sequencing easy.

Though Autodesk caters primarily to professionals, the latest push for 123D products, along with its investment in a fledgling Consumer Division (responsible for such products as Autodesk Sketchbook Mobile), suggests the company is looking at new opportunities beyond the professional customer pool. DE

by Kenneth Wong

Siemens PLM Software Releases Solid Edge Design1

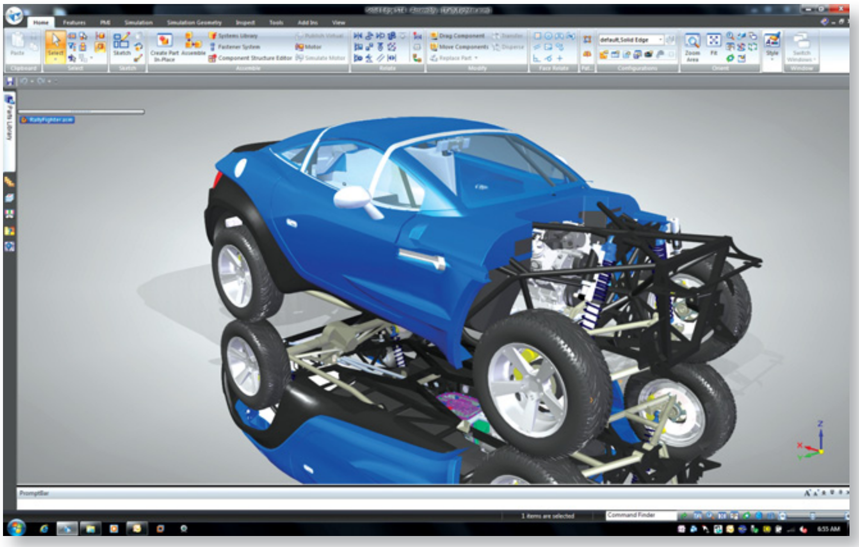
An unorthodox automotive manufacturer and a new CAD software distribution model are about to come together for a trial offer.

Siemens PLM Software is launching a new edition of Solid Edge, created exclusively for members of Local Motors. The trimmed-down version of Solid Edge, dubbed Design1, is available for a subscription fee of $19.95 per month in a node-locked configuration (to be installed on a single machine) to those who are involved in Local Motors projects.

In its November announcement, Siemens PLM Software explained, “Local Motors and Siemens PLM Software are making available, for a limited time, a downloadable trial of Solid Edge Design1. The trial is being made available now through the end of the year to select Local Motors community members. The entire global community will then be able to purchase Design1 subscriptions starting Jan. 1, 2012. ”

The two companies are also delivering a free 3D viewer for the Local Motors community, which will let members exchange and view project files in Siemens PLM Software’s lightweight JT format. Files supported by Design1 include Parasolid, STEP, IGES, SolidWoks, Inventor and Pro/ENGINEER. (But don’t expect to be able to pass files between commercial versions of Solid Edge and Design1. You’ll run up against licensing restrictions, according to Siemens PLM Software officials.)

Local Motors is pioneering a concept called open-source automotive design. Members of the Local Motors community submit car design ideas, or help refine others’ design—a process dubbed “co-creation” by the company. The most popular design, usually decided by votes, will be built into a functional, one-of-a-kind vehicle at one of Local Motors’ micro-factories.



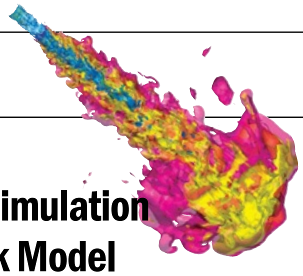
Siemens PLM Software launches a new edition of Solid Edge, dubbed Design1. The software is available only to members of Local Motors involved in automotive projects. Shown here is the Rally Fighter designed in Solid Edge in one of the projects.

Unlike a mass-produced car, you may choose to custom-design nearly every aspect of your car, from its skin to its shape. The process is also appealing to the tinkerer-inventor types, who take pride in personal creations. You may also sell your creation through Local Motors’ site—perhaps to those who are enamored with your design, but have neither the time nor the inclination to sweat through the manufacturing process.

Think this is all too experimental? The Defense Advanced Research Projects Agency (DARPA) doesn’t seem to think so. DARPA has used Local Motors to host a design challenge to solicit ideas for an Experimental Crowd-Derived Combat-Support Vehicle. The winning entry, 22 Flypmode, came from Victor Garcia, a professional designer and an Art Center College of Design graduate.

Siemens PLM Software continues to sell Solid Edge and its other CAD and product lifecycle management (PLM) software titles through authorized resellers. However, with its investment in the infrastructure required for subscription licensing, the company may be testing the waters to determine the subscription model’s viability. **DE**

Kenneth Wong *is* DE’s *senior editor. He writes about technology, its innovative use, and its implications. Read more of his articles on* 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.*



Robot Rovers Poised for Battle

Soldiers take the battlefield carrying as much as 70 lbs. of gear on their backs, and have to lug it across all sorts of terrain. Waltham, MA-based robotics company Boston Dynamics has come up with a possible solution to lighten the load.

The Legged Squad Support System was financed by the Defense Advanced Research Projects Agency and the U.S. Marine Corps. Its animal-like movements are the result of innovative hydraulics and terrain sensors. The company expects to field test a completed version in 2012.

In addition to galloping like a horse and carrying up to 400 lbs. of gear, the robot can hold enough fuel for missions covering 20 miles and lasting 24 hours.

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NSF Tackles Man-Machine Interface

The exacting man-machine interface of Steve Austin in the old "Six Million Dollar Man" TV series may still be the stuff of science fiction, but researchers working with a grant from the National Science Foundation (NSF) hope to bring us closer to seamless interactions between humans and machines.

The NSF Office of Emerging Frontiers Research and Innovation announced 14 grants totaling $28 million for 2011. Six of them are part of the Mind, Machines, and Motor Control project, which will focus on how the brain senses the physical world, how it processes this information, and how that brain activity can be used to control machines such as prosthetics, rehabilitative equipment, or robots.

A second set of grants will fund the Engineering New Technologies Based on Multicellular and Inter-Kingdom Signaling (MIKS) project. Research teams will investigate the chemical and mechanical signals that allow living organisms to engage with, and respond to, their environment at the cellular level.

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Birth of a Simulation Benchmark Model

A team of mechanical engineers at Sandia National Laboratory was recently given 60 million processor hours this year on Oak Ridge Leadership Computing Facility's Jaguar supercomputer to conduct high-fidelity simulations of combustion in advanced engines. The models they create are validated against benchmark experiments to simulate turbulent combustion at different scales. Once validated, the models can be used by design engineers.

The Jaguar supercomputer is a Cray XT5. It has a peak speed of 2.33 petaflops. That's more than 2,000 trillion calculations per second. Multiply that by the 60 million processor hours Sandia was given to simulate combustion, and it equals quite a bit of confidence in the team's benchmarks.

MORE ➔ http://www.engineeringontheedge.com/?p=183

787 Dreamliner by the Numbers

Boeing has delivered the first 787 Dreamliner to Japan's All Nippon Airways Co. (ANA). The new plane is quite a feat of engineering. Here it is by the numbers:

- 50% of the 787 is comprised of composites, including the fuselage and wing.
- 1,500 aluminum sheets and 40,000 to 50,000 fasteners were eliminated thanks to the one-piece fuselage.
- 10,000 holes were drilled into the fuselage during assembly, which sounds like a lot until you compare it to the 1 million holes drilled in the 747.
- 60 miles of copper wire was eliminated on the 787.
- 800,000 hours of computing design time was spent on Cray supercomputers while working on the 787.
- 545,000 lbs. is the maximum takeoff weight for the 787-9.

MORE ➔ engineeringontheedge.com/?p=88

Beyond Silicon: the Nano Computer

Silicon just not fast enough for you? Not to worry, researchers are working on new ways to process those zeroes and ones.

The University of California, Riverside has received a $1.85 million grant to develop a new way of computing. The money was awarded to UC-Riverside under the nationwide "Nanoelectronics for 2020 and Beyond" competition sponsored by the National Science Foundation and the Nanoelectronics Research Initiative.

It is based on two breakthroughs in nanoelectronics: The concept of spin-based computing using a magnetologic gate and the demonstration of tunneling spin injection and spin transport in graphene in 2010.

Learn more about nanotechnologies in this month's cover story, which begins on page 14.

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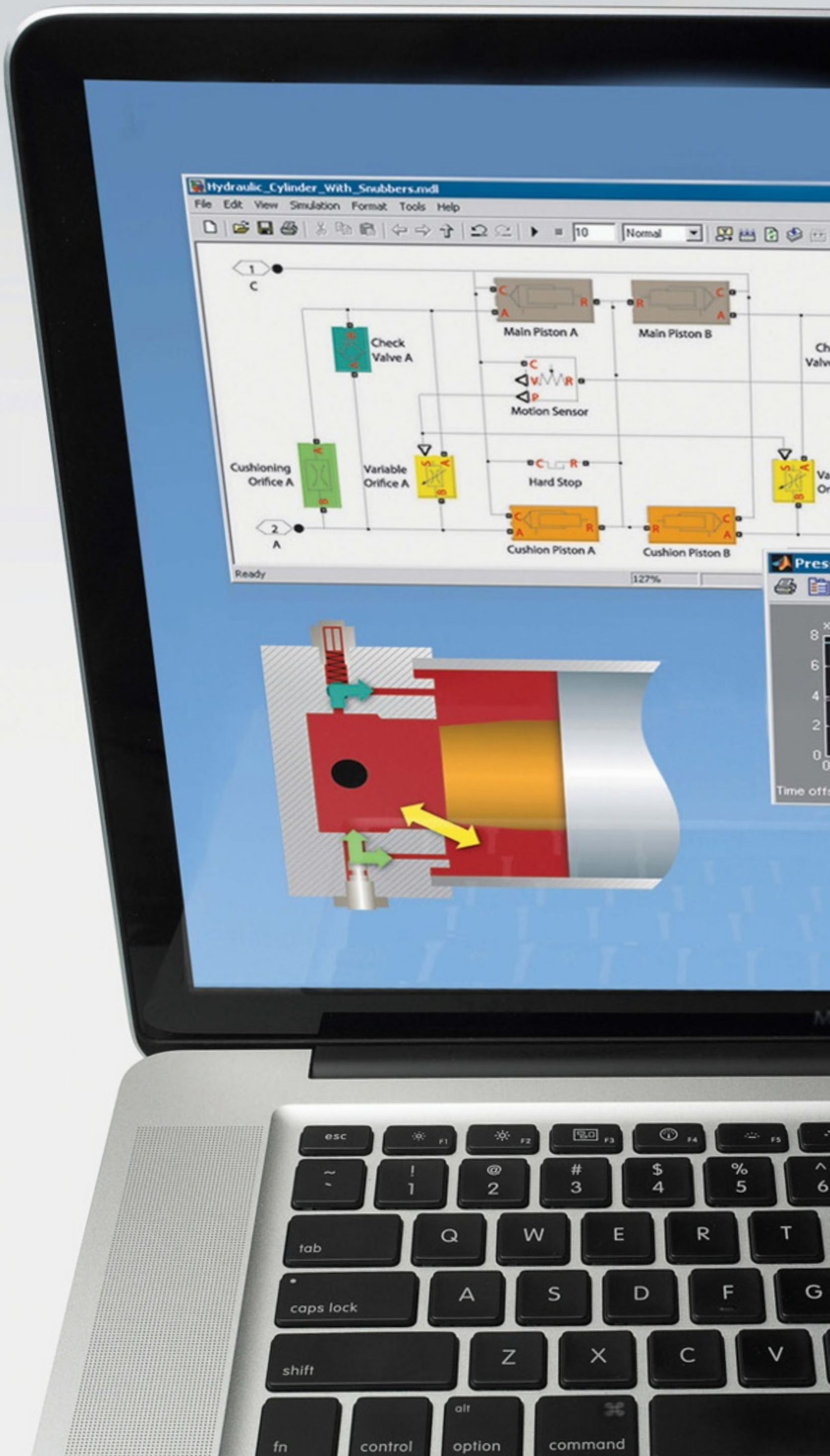

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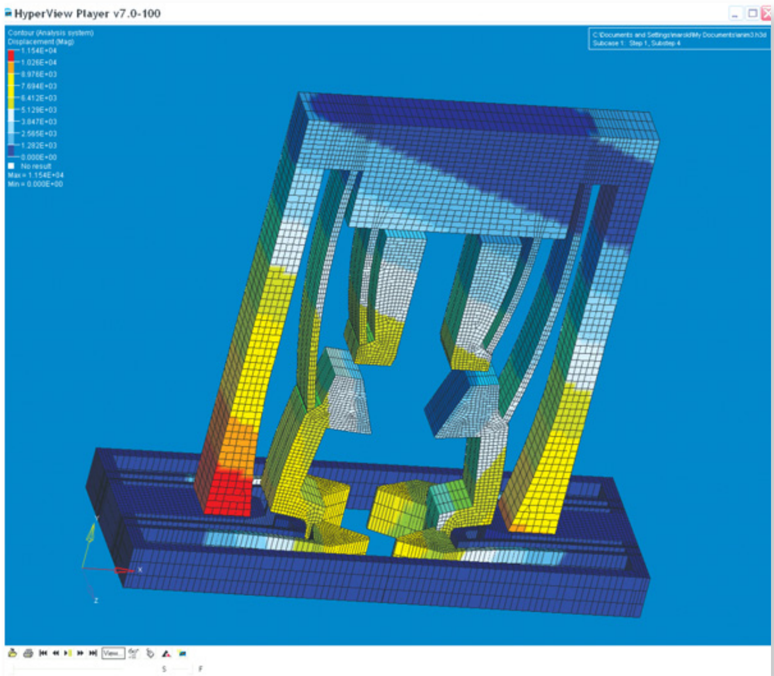
Twinkies, Tennis Rackets and Nanotechnology

In a world where materials and structures are built molecule by molecule, computer simulation is critical.

BY PAMELA J. WATERMAN

Getting a handle on nanotechnology is tricky, to say the least—both literally and figuratively. On a factor-of-10 scale, nanoparticles such as a DNA strand are about 10,000 times smaller than a red blood cell and 100,000 times smaller than a human hair. Or, as clarified so eloquently by Dr. Andrew Maynard in his Twinkie Guide to Nanotechnology video, comparing a DNA molecule to a Twinkie snack cake would give you roughly the same perspective as viewing a Twinkie sitting on Earth's moon.

Though science and industry have worked with nano-sized particles for several centuries (think colloidal gold giving color to stained glass windows in French cathedrals), this field of study couldn't really take off until the advent of scanning electron microscopes. But "seeing" nanoparticles is one thing—manipulating them, understanding them and using them in new ways is another. As with so many other fields of science and engineering, predicting material behavior with computer simulations can be not only insightful, but an absolute necessity. *DE* looks at the basics of nanotechnology, why it's increasingly important, and some current work done with nanotech simulations.



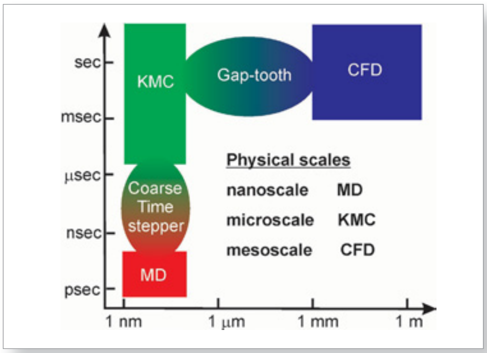
Meshed model of nanoscale microconductor ready for finite element analysis, created with Altair HyperMesh software; FEA results presented in Altair HyperView. ***Image courtesy Altair Engineering and Zyvex Instruments.***

A Nanotech Primer

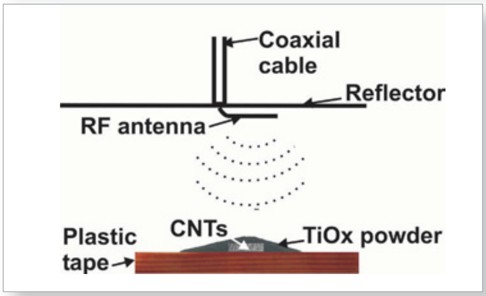
Nanotechnology, or nanotech, or the-science-of-the-extremely-tiny, involves the study of materials and physical interactions of particle sizes ranging from 1 nm to 100 nm. From a practical point of view, nanotech is the combination of chemistry and mechanical engineering that can manipulate and control materials and interactions at the level of atoms and molecules.

A very readable overview of this subject is presented by the Project on Emerging Nanotechnologies (PEN), a program established in 2005 as a partnership between the Woodrow Wilson International Center for Scholars and the Pew Charitable Trusts, of which Dr. Maynard was chief science adviser. He now leads the University of Michigan Risk Science Center. PEN collaborates with researchers, government, industry, non-governmental organizations, policymakers and others to look at all aspects of nanotechnology long-term, identify gaps in knowledge and regulatory processes, and develop strategies for closing them.

Why is this important? Nanoparticles, already in use in more than 1,300 consumer products, hold tremendous promise for improved processes and products that may involve close, everyday encounters. Their very small size may allow them to get into places that larger particles can't go. This could be good for, say, creating medicine that travels deeply into a brain tumor, but could be bad if they pose inhalation or



Performing simulations with nanomaterials requires accounting for their behavior across different scales. CFD Research Corporation has developed a Multi-Scale Computational Environment that integrates tools for molecular dynamics (MD), Kinetic Monte Carlo (KMC) analysis and Computational Fluid Dynamics (CFD), including proprietary "bridging" software.



Schematic of direct growth of CNTs on plastic tape via selective heating. RF power is predominantly absorbed inside TiOx powder. Hydrocarbon gas is heated while diffusing between loosely packed TiOx particles and decomposes on the tape surface patterned by catalytic nanoparticles. The resulting carbon atoms assemble vertically oriented CNTs via endothermic catalytic reactions. After the CNT growth, the TiOx powder is washed off. *Images courtesy CFD Research Corp.*

environmental risks. Science and industry need to "get it right" to make sure producing and using these materials is beneficial, not problematic—and much work is already under way.

Why Nanotechnology

At the nanoscale, researchers can directly control material properties, making them lighter, harder, more rugged or improved in seemingly uncountable other ways. Just making things on a nanoscale may cause a chemical to change color or start conducting electricity. Nanoscale particles (which come in dozens of shapes) tend to be more chemically reactive than the same materials at the bulk scale, because they generally have more surface area and a greater portion of their atoms in close proximity to their surface. Even within a single chemical compound, researchers have seen nanoparticles shaped as rings, tubes, hexagons, brushes, ovals, helices and ribbons. Each of these has the potential for different applications, because shape determines behavior.

Sample nanoparticle and nanofiber applications already in use include clear zinc-oxide sunscreen, anti-microbial socks, water- and stain-resistant trousers, nano-structured organic light-emitting-diode displays, plastic containers that extend the lifetime of food, lighter/stronger tennis rackets and carbon-fiber conductive gloves for operating touchscreens in cold weather. By 2014, the global worth of nanotech products is projected to be $2.25 trillion.

Research is well under way applying nanotechnology to targeted drugs for treating cancers, Parkinson's disease and cardiovascular disease, showing promise for success without side effects. Carbon nanotubes are so strong that scientists are working with them to create T-shirt-weight bulletproof vests. Nano-oxide particles have been tested for in situ oil-spill remediation projects. Solar panels built from nanotech devices may be far more efficient and lighter than current versions, and fiber-optic bundles seem to transmit with lower losses when nanometer-slots are built into fiber cores.

Simulation Programs

Simulating the behavior of nanoparticles (creating them, moving them, influencing them) or of nanomaterials (fluids, composites, etc.) is a challenge for traditional finite element analysis (FEA) and computational fluid dynamics (CFD) software. How do they flow, connect, absorb gases, respond to temperature, and conduct electricity? Do these parameters change for every different nanoshape? In many cases, the laws of quantum physics take over from Newtonian physics, so defining even basic material properties becomes a challenge—and solver math may have to change.

Barry Zorman, a Phoenix-based consultant who has worked in nanosimulation, notes, "From a mechanical design point of view, it is still very challenging for computer simulations to include nanoscale or molecular scale detail, along with the much larger structural features that also determine a real complex material's mechanical properties."

Because of the potential benefits and fundamental fascination of nantotechnology, dozens of organizations have addressed these issues, and many offer simulation assistance. nanoHUB.org, for example, is a group that encompasses opportunities within the nano community to share, publish, teach, research, collaborate and learn across the spectrum of technologies. Its website states, "We believe that modeling and simulation is, in general, underutilized in both research and teaching." To improve that situation, the site provides more than 160 online simulation tools that run

Resources in the Nanotechnology World

- Nanotech Associations/Directories/Initiatives/Test Facilities
- LGC Standards: LGCstandards.com
- NanoBusiness Alliance: NanoBusiness.org
- NanoMaterials Innovation Center: NanoMIC.org
- Nanotech Now: Nanotech-Now.com
- NanoVIP: NanoVIP.com
- National Nanomanufacturing Network: interNano.org
- National Nanotechnology Initiative: Nano.gov
- Society for the Study of Nanoscience and Emerging Technologies: theSnet.net
- UnderstandingNano.com: UnderstandingNano.com

LinkedIn Groups

- Carbon Nanotube Society
- Graphene Society
- Micro/Nano Technologies and Global Research and Consulting Network
- Nano Materials
- Nano Technology
- Nanochemistry and Nanoengineering
- Nanotechnology Zone

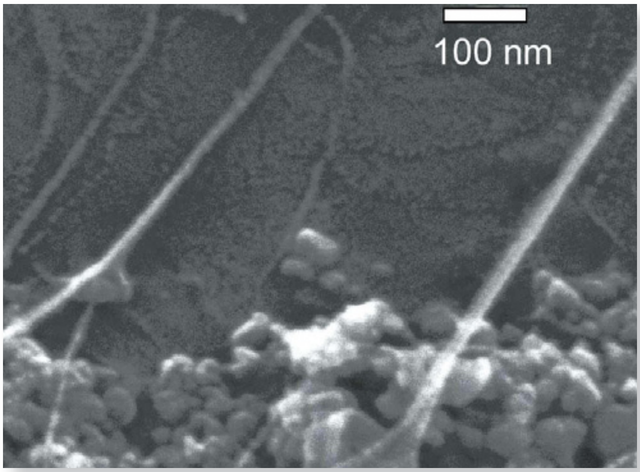
Market/Product Reports

InnoResearch.net: "Production and Applications of Carbon Nanotubes, Carbon Nanofibers, Fullerenes, Graphene and Nanodiamonds: A Global Technology Survey and Market Analysis," Innovative Research and Products Inc., Report Code: ET-113, February 2011. An exhaustive look at the field of nanocarbon materials, including profiles of more than 180 companies manufacturing nanocarbon materials and companies that manufacture products using these materials.

NanoTechProject.org/iphone: iNano, the new iPhone application from the Project on Emerging Nanotechnologies. It lists everyday nano-items in the Nanotechnology Consumer Products Inventory.

Nanotech-related Conferences

- NanoTechinformatics.org: Nanoinformatics 2011, Dec. 7-9, 2011, Arlington, VA
- NanosConference.com: 12th Annual Nanocomposites and Nanotubes Conference, March 6-7, 2012, Brussels, Belgium



A typical scanning electron transmission microscope image of deposited CNTs on the overall intact kapton tape. Some bubbling on the surface of the tape was detected, indicating that the surface temperature was near the melting point of kapton. *Image courtesy CFD Research Corp.*

like applets. They include a nano Materials Simulation Toolkit, the MIT Atomic Scale Modeling Toolkit, and a Carbon Nanotube MEMS Relay Simulator.

Nanotechnology research centers are located at government research laboratories and major universities worldwide. In the United States, the former includes five Nanoscale Science Research Centers founded by the U.S. Department of Energy (such as the Center for Functional Nanomaterials at Brookhaven National Lab). The latter includes university members of the National Science Foundation (NSF)-founded National Nanotechnology Infrastructure Network.

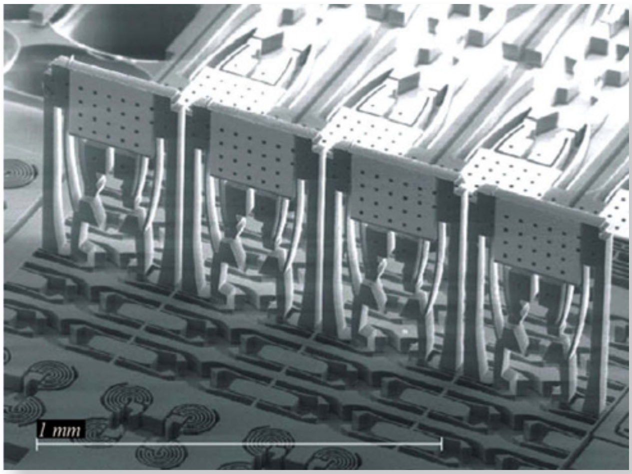
Several other academic centers (with some areas of specialization) include:

- University of Wisconsin-Madison Center for Nano Technology (nanobiology, nanolithography);
- University of Massachusetts-Amherst Center for Hierarchical Manufacturing (university-to-industry transfers; roll-to-roll printed electronics processing);
- Virginia Polytechnic Institute and State University (a member of the NSF-funded Center for the Environmental Implications of Nanotechnology [CEINT] at Duke University); and
- University of Akron Goodyear Polymer Center (adhesives; nanofiber wound-healing bandages; ceramic nanofiber filtration).

Simulation Options

Many groups address the multi-scale challenges of nanosimulation mentioned by Zorman; details of one such methodology and its proponents are at Quasicontinuum (qcmethod.org).

However, the commercial world has also been busy in this



SEM image of nanoscale micromachined connectors assembled vertically into micromachined silicon sockets, with close-up view. Zyvex Corporation used Altair HyperMesh to develop FEA models and Altair HyperView for results visualization. ***Images courtesy Altair Engineering and Zyvex Instruments.***

field for years, though possibly under the general radar. CFD Research Corp., or CFDRC, provides advanced simulation software and consulting services for the analysis, design and optimization of nanomaterial fabrication processes. Customers may seek the company's help, for example, in determining the best initial conditions for growing carbon nanotubes on a substrate.

"The problem with (manufacturing) nanomaterials is that their outstanding features are formed at nanoscales, and you have to account for all these different scales during the growth," notes CFDRC Principal Scientist Alex Vasenkov. To manage this issue, the company has developed a multi-scale computational environment integrating standard CFD tools with Kinetic Monte Carlo (KMC) and Molecular Dynamics (MD) software.

The key to this successful approach is CFDRC's creation of two bridging modules, or "gap tools," that transfer the results between each pair of analysis tools. Analyses for materials beyond carbon (such as metal alloys and ceramics) are in the works. It's a complicated process. Trust me—you'll want to talk to these people.

COMSOL Multiphysics simulation software has also been a key tool for numerous users working in nanotechnology applications, as seen by the titles of papers presented in recent years at the COMSOL annual conference. Study topics have included biomedical applications of micro- and nano-electromechanics, multiphysics simulation of cancer therapy using carbon nanotubes (CNTs) and near-IR irradiation, the behavior of ionic currents through an electrolyte-filled CNT, and microfluidic/heat transfer/chemical behaviors in nano-photonic devices.

Altair's HyperWorks family of CAE software plays a big role in product development at customer Zyvex Instruments, a division of DCG Systems. The company creates devices that physically grip and manipulate parts during micro-electro-mechanical systems (MEMS) assembly, which in turn can help with nanotech fabrication. Zyvex mechanical engineer Aaron Geisberger says he has found HyperWorks' open architecture useful in his workflow, because he can customize HyperMesh templates for non-experts to help with intensive meshing tasks. Post-processor HyperView has also let his group visualize the finest details of FEA results.

Speaking of fine details, QuantumWise, a Danish company with U.S. representation, offers atomic-scale simulation software targeted to electrical properties. The company notes that many application areas in nanotechnology are related to effects occurring at junctions, interfaces and surfaces, and that it is critical to accurately model such phenomena from quantum theory. Its Atomistix ToolKit (ATK), in use since 2006, handles complex nanostructures—combining molecules with periodic systems and macroscopic elements. The software has been applied to work with such materials and devices as graphene, nanotubes, nanowires and single-electron transistors.

Always Room for Improvement

A parting perspective on computer simulation in nanotechnology comes from Stan Prybyla, a Ph.D. in physical chemistry and president of Breakthrough Technology Development. His consulting firm specializes in using statistical design of experiments (DOE) to help businesses zero in on the best manufacturing parameters for producing nano-composite materials.

"There's a wealth of opportunity for discovery and utilization in nanotech product development," observes Prybyla. "Development of modeling techniques beyond the empirical techniques will help us get to the next stage of development of these materials." **DE**

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INFO ➜ Altair Engineering: Altair.com

➜ **Breakthrough Technology Development:** Breakthrough-Technology.com

➜ **CFD Research Corp.:** CFDRC.com

➜ **COMSOL:** COMSOL.com

➜ **Quantum Wise:** QuantumWise.com

➜ **The Twinkie Guide to Nanotechnology:** NanotechProject.org/news/archive/the_twinkie_guide_to_nanotechnology

➜ **Zyvex Instruments:** Zyvex.com

➜ **NanoSafe Inc.:** NanoSafeInc.com

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GPU vs. CPU: You May Not Have to Choose

The engineering design and analysis world is slowly becoming big enough for both industry-standard CPUs and parallel processing GPUs.

BY PETER VARHOL

As GPUs with multiple processing cores increasingly find their way into standalone workstations, engineers are looking for ways to take advantage of the computational power provided by these special-purpose processors. Today, few people doubt the value of GPU computing, especially for computationally intensive uses such as engineering analysis and simulation.

But GPU computing presents a difficult dilemma for engineers, hardware vendors and engineering software providers alike. The problem is that most code, whether commercial or in-house, has been written to industry-standard CPUs. If you own the code, you have to determine whether it's worth the time and effort to convert to a GPU architecture. While a lot of in-house analysis code should, in theory, be portable, it can be a very large undertaking—requiring specialized skills and months of effort—for a return that may not be worth the cost.

A commercial analysis and simulation software vendor has to determine whether the potential revenue from a GPU implementation justifies the effort to create a new version of a product. Several companies, including ANSYS, have already made that leap, but it's a tougher decision for some of the smaller vendors.

Hardware vendors have to look at GPU architectures and decide whether to offer them in system configurations. While such systems are becoming more popular, it results in a more complex integration effort for the system vendors, making such systems more expensive to design and manufacture.

The situation gets still more complex. There are two primary GPU architectures, one from NVIDIA and one from Advanced Micro Devices (AMD). An individual engineering group with its own code can make a decision on which architecture to use, and port its code accordingly. But commercial vendors are almost obligated to choose one or the other, because they usually don't have the engineering or financial resources to do both.

Today, NVIDIA has a clear lead over AMD, thanks to a concerted effort to build and promote GPU computational architectures, but it's still early in the game. Some engineering software vendors have made the decision to port software to both platforms.

"We support both the NVIDIA and AMD platforms," confirms Acceleware Ltd. Chief Technlogy Officer Ryan Schneider.

But few others can afford to make that call, so you may be limited in your choice of engineering applications if you want GPU performance—and even more limited in your GPU selection.

What About Performance?

From a performance standpoint, the GPU is a clear winner for many engineering applications, especially those that involve floating point applications. Depending on the GPU, the type of computation being performed and specific code details, computations can run as much as 10 times faster on the GPU than a corresponding CPU. Of course, those results are on benchmarks, and real-life application performance gains tend to be lower. But there is usually enough of a performance advantage for engineers to look carefully at the GPU hardware and software.

Industry-standard CPUs haven't ceded a major role in engineering application performance, despite an architecture geared more toward general-purpose computing. But CPU leader Intel hasn't given up on GPU computing, despite the failure to release a GPU multicore processor, code-named Larrabee, two years ago. The company is likely to build on the Larrabee technology, preferring to incorporate its GPU features into its popular CPU architecture.

Still, Intel doesn't see a role for GPU-only processors, at least for high-performance parallel computing: "We're satisfied with our Xeon performance and tools for engineering applications," says James Reinders, director of marketing and business for the Intel Software Development Products group.

Smart phones such as the Motorola Droid Bionic use the tiny but powerful Tegra 2 chip for general phone operations and graphical display.

Despite its computational performance advantage, you're not going to see a mainstream GPU-only machine anytime soon. While Linux is likely to be ported to one or both GPU architectures as soon as the languages and development tools mature, it is highly unlikely that the GPU will support mainstream applications on its own operating system, for example.

So, the likely configuration for the foreseeable future is a system with a Windows operating system running on one or more CPUs, combined with either an expansion card or a chassis with multiple GPU processors and up to 10,000 cores. These systems will support engineering software that displays on the CPU and renders on a graphics chip, but does computations on a GPU card or array.

Best of Both Worlds?

NVIDIA just might have an answer to the dilemma of when to use CPUs and GPUs. In conjunction with OEM hardware partners such as Dell, HP, Lenovo and Fujitsu, NVIDIA has recently announced a class of workstations, code-named Maximus. Maximus is powered by a CPU, a Quadro GPU and a Tesla GPU. These systems will use the CPU to run the operating system, the Quadro GPU to handle graphics processing, and the Tesla for parallel GPU computations. According to Jeff Brown, general manager of the Professional Solutions Group at the company, NVIDIA refers to the vision as "unifying graphics and parallel computing."

Traditionally, simulation and analysis jobs requiring parallel computing are outsourced to server clusters—a workflow that hampers productivity among engineers, designers and digital content creators. With a Maximus-class workstation, an engineer may do CAD work, render graphics, and run simulation—all at the same time—without seeing a slowdown in system performance on his or her workstation.

The Maximus platform looks a lot like what Intel is doing with some of its hardware and software partners, in promoting virtual machine computing using its VT-d direct I/O technology. But there are important differences. Intel and its partners are focusing on lower to mid-range cluster computing, utilizing unused memory and processor cores. It's a smart strategy, but it doesn't make complex computations complete more quickly. That's where GPUs can fill the gap.

NVIDIA promises dynamic resource allocation with its systems. In other words, the engineer doesn't need to know which part of his or her job is best suited for the CPU, Quadro GPU or Tesla GPU. Maximus-certified machines will have the ability to balance load among its CPU, Quadro GPU and Tesla GPU on its own.

The Bottom Line

While there are a lot of question marks surrounding GPU computing today, it's clear that it is fast becoming a significant force in engineering work. Engineers seeking a higher level of performance on individual workstations can adopt GPU computing via a plug-in card. Dedicated multi-processor and multi-core GPU systems are also available, with an industry-standard CPU running the operating system and many applications.

But software remains the key ingredient, and good engineering applications will continue to be slow in coming. Until GPU computing becomes ubiquitous, engineers may have to search for the right application mix. The alternative

Mobility and Mixed Processor Architectures

Most of us don't give a lot of thought to the processors in our smartphones or other handheld devices. Most are ARM processor designs, which offer good performance with low power consumption. However, phone interfaces and applications are becoming increasingly graphical, and are starting to necessitate performance well beyond what is available in a mainstream ARM processor. High-performance portable devices are needed by engineers as extensions of their workstations—and even their clusters—as their work continues to become more mobile.

Sumit Gupta, director of the Tesla GPU Computing Business Unit at NVIDIA, notes that some design engineers are already working in this manner.

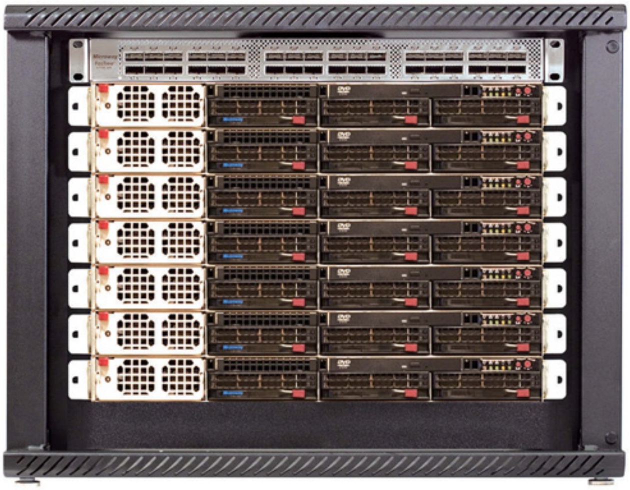
"I have a relative who's an architect, and he uses his iPad to change designs right up until the time he arrives in the client's office," Gupta says.

It's clearly within the reach of design engineers to work using portable and handheld devices. For example, NVIDIA offers a system-on-a-chip configuration that includes both an ARM CPU and a Quadro GPU, specifically for smartphones, tablets and other handheld devices. This chip, the Tegra 2, consists of a Dual-core ARM Cortex-A9 CPU, coupled with an ultra-low power NVIDIA GeForce GPU. This chip is intended to power smartphones that are just as much computer as phone.

The Tegra 2 provides a strong combination of phone performance, including web browsing and app execution, as well as graphics display for the UI, graphical applications and video streaming. It is possible to get PC-like response from video or from detailed graphics, albeit on a much smaller display.

Today, Tegra 2-based phones are available from the likes of Motorola Mobility, Samsung and LG. Phone design is often a careful balance between performance and power consumption, but performance is climbing fast. The Tegra 2 provides a platform that looks like a phone, but performs more like a computer.

You may not be using your smartphone as a design tool today, but the day where it will seem indispensable isn't that far away. Whether you modify design components, run analyses using different parameters on your cluster or in the cloud, or use it as a demonstration platform, your smartphone is fast becoming a way to connect more closely with your designs.



The Microway BioStack combines Intel Xeon CPUs and Tesla Fermi GPUs totaling 84 CPU Cores and 6272 GPU cores.

is to pass on building a GPU computing environment, and stay with slower, but more universal CPUs.

As software catches up, more engineers are likely to adopt GPU solutions for computational purposes, while keeping CPUs to run the operating system and general business applications. DE

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

INFO ➜ **Acceleware Ltd.:** Acceleware.com

➜ **Advanced Micro Devices:** AMD.com

➜ **ANSYS:** ANSYS.com

➜ **ARM:** ARM.com

➜ **Dell:** Dell.com

➜ **Fujitsu:** US.Fujitsu.com

➜ **HP:** HP.com

➜ **Intel:** Intel.com

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➜ **L G:** LG.com

➜ **Linux:** Linux.com

➜ **Motorola Mobility:** Motorola.com

➜ **NVIDIA:** NVIDIA.com

➜ **Samsung:** Samsung.com

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Quick, Custom and Really Unusual Parts

Rapid technology is now appearing everywhere.

BY PAMELA J. WATERMAN

Applications of rapid prototyping and manufacturing, regardless of the technology used, have spread well beyond the industrial, aerospace and medical arenas of the past decade. *DE* takes a look at some far-reaching, innovative uses that might surprise and inspire you.

Magic Flutes, Magic Photos

Amit Zoran, a student at the Massachusetts Institute of Technology, used an Objet Connex 500 3D additive manufacturing (AM) system to print a flute. Yes, a concert flute, with full mechanical keywork—created in just four parts, then assembled with the addition of metal springs. Zoran, working at the MIT Media Lab, took advantage of the Objet system's ability to jet or "print" with more than one plastic-like material on the fly: a rigid material for the flute's body, a black rubbery material for the pads and a soft, clear material for the mouthpiece. Run-time was about 15 hours. (Check out the video at YouTube.com/watch?v=zwHgszH0aqI.)

While this is a rendition of the Kor Ecologic two-seater Urbee car, the first operating model has recently been built. Stratasys Fortus AM machines produced all the body panels. *Image courtesy Stratasys and Kor Ecologic.*

A team from Made in Space modified and tested a 3D Systems BfB 3000 3D printer for a total of more than two hours during two zero-gravity sub-orbital test flights. The members printed various test parts from polylactic acid, and are studying them to better understand how additive manufacturing can work in space. *Image courtesy 3D Systems and Made in Space.*

Built to make the point that this process can create an instrument that is both ergonomically and acoustically comparable to a standard metal-based flute, the design could use some "fine-tuning." However, it sounds amazingly good, and demonstrates the possibilities of fabricating intricate, non-techy products in short timeframes, using classic or entirely new designs.

Looking for a different way to reach out and touch someone? Digital Forming is a UK-based company (and a sister company to Within Technologies), developing a service for businesses that brings together online design and various AM services. What's unique about its technology—soon to be accessible on UCODO.com (User Co-Designed Objects)—is how the interface readily engages non-CAD users in "shape changing" a product's image file to customize its 3D design. One video shows this being done on a lemon-squeezer: YouTube.com/watch?v=RxH_7r4_bnc&NR=1.

"We wanted to make it quite intuitive," says Lisa Harouni, Digital Forming's CEO. "The interesting thing is that it's a collaborative design platform. Its tools can be used not just by brands to engage customers in the next level of customization, but also by engineers and product designers. You want to allow that team to co-concept products—for example, to

A digital color photo has been converted (with proprietary software) into a thin, EOS-laser-sintered plastic bas-relief comprised of varying thicknesses. When the card is held up to the light, the thicknesses transmit light of varying amounts, giving the appearance of a black-and-white photo. *Images courtesy Digital Forming.*

have the input of a management team that doesn't know how to design or of a user/test group." The aim, eventually, is to enable local AM manufacturing. Current efforts use EOS laser-sintering systems.

One fun test project at Digital Forming is a new take on greeting cards. Proprietary image-processing software converts each shade of a digital-camera photo into a different physical thickness. An EOS laser-sintering system uses this information to build an all-white plastic bas-relief "card." When viewed against a light source, the card displays the full shading of a black-and-white image.

A customer of Mcor Technology—developers of the office-friendly layered-paper printer—has taken 3D imagery in a very different direction. Innermost Secrets in Cardiff, Wales, a private specialist in women's health, regularly provides pregnancy ultrasound scans and was seeking a new way to capture full 3D data. Dr. Bryan Beattie, the practice director, commissioned a software development project to turn the non-proprietary files from the ultrasound scanner into commercial 3D files, which could then be output to various types of 3D cutting and printing equipment.

Artwork done by university student Jacqueline Huang under the direction of Professor Jason Pilarski at the Art Center College of Design, using a Roland MDX desktop milling system. The hexagonal pattern was milled from urethane plastic, and the rounded shapes are from high-density urethane foam. *Image courtesy Roland.*

"We were looking for a cost effective, eco-friendly method of producing a 3D print of our baby scans," explains Beattie. "The Mcor Matrix 3D printer provided us with the perfect solution. It provides value for the money, and its eco-friendly credentials are very important to our customers." When built from bonded sheets of white paper, the 3D images have the look of carved cameos.

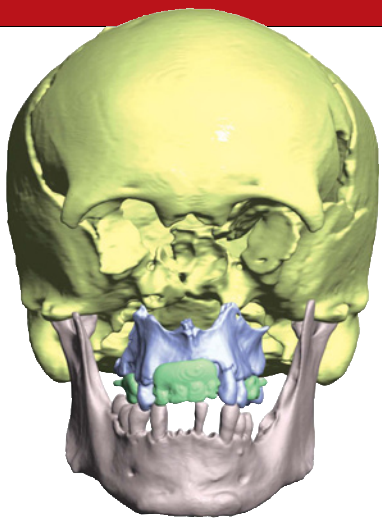
Imagery and Abstractions

Technology from Z Corp. was a crucial link in the process of identifying the remains of a WWI soldier found years ago at a construction site near Avion, France. Andrew Nelson, a key researcher on the project and associate dean of research for social science at the University of Western Ontario, explained that although there were several large skull fragments, for this case, DNA testing was not a viable option.

CT scans provided enough data to create a physical model using a Z Corp. 3D printer. The research team then worked with artist Christian Corbet to construct a rudimentary face over the model. By superimposing photos of the model onto photos of potential matches and assessing the agreement, they found their man: Private Thomas Lawless, born in Dublin in 1889 and killed in action as a member of the 49th Battalion, Canadian Expeditionary Force. Nelson observes, "This may result in a new protocol for identification of the missing."

From the specific to the abstract, pushing the limits of physical art is on the agenda for Jason Pilarski's students at the Art Center College of Design in Pasadena, CA. Art Center graduates include designers for several automobile manufacturers, as well as film and broadcast professionals, graphic designers, product design specialists and artists.

One of the college's major student resources is its 3D Lab, founded by Pilarski 10 years ago, which includes additive and subtractive processing equipment. In the latter group are two Roland MDX desktop milling systems.



A Z Corp. 3D-printed skull model played a role in assisting with the identification of the skeletal remains of a WWI soldier. CT scans of the few fragments provided the data for constructing the ZCorp. model. *Image courtesy Z Corp.*

"We needed a prototyping machine that the students could operate themselves," says Pilarski. "Being able to create their designs in 3D is a tremendous teaching tool."

Pilarski estimates that between his classes and those taught by other instructors, students use the Roland systems to create more than 200 different projects each year. Materials used include tiles, foams, plastics and RenShape modeling boards; sample projects include interlocking repeated parts (think Escher prints) and bas-relief/full 3D art.

Although crafting small AM parts with fine detail is a critical achievement, thinking big is also an admirable goal—leading to new, mind-bending applications. Picture a freeform sculpture standing 10 ft. tall, or even a building "grown" on-site simply from sand and a binder.

Enrico Dini, founder and chairman of Pisa, Italy-based Dinitech, has combined inspiration by architect Antoni Gaudi with experience in civil engineering to devise a large-scale AM construction method. Termed D_Shape, the CAD-driven process solidifies ordinary sand with an inorganic binding "ink;" the results are structures unlimited by standard constraints of geometry and material.

The D_Shape system is assembled as a rigging over the build site. Two hoses provide the build materials. No water is needed, and because the components mix outside the nozzles, the machine does not clog. Also, because no limestone is heated in the process, no carbon dioxide (as with cement formation) is created. D_Shape equipment can print layers of 5 to 10mm at 25 dpi, with final parts as large as 6x6x1m.

Dini has already built the model for a freeform gazebo sculpture designed by Andrea Morgante of Shiro Studio, London. The full-size form will be installed as public art in the center of a Pisa roundabout. For marketing efforts outside Italy, Monolite UK is the first licensee.

Can life-size sandcastles be next?

Really Outside the Box

Did you catch the September unveiling of the über-efficient Urbee (urban-electric) car at TEDxWinnepeg? This sleek, two-person prototype from Canadian company Kor Ecologic is the embodiment of a team that sees "the way things should be" for vehicle design and production (See "3D Printing Accelerates Cars into the Future," *DE* March 2011).

Kor Ecologic's vision for this project includes using materials available as close as possible to where the car is built, and building the car in small quantities. Applying digital manufacturing for the body with fused deposition modeling (FDM) equipment from Stratasys met and surpassed both goals—the parts were created as one-offs with no waste and no tooling required.

A Stratasys Dimension 3D printer was used for some small concept models. All the full-size body panels were built on Fortus production machines (mainly the large 900mc versions, because of the build envelope of 36x24x36 in.). Extra impressive, according to Kor, is the fact that the same computer files that made the scale model were used to make full-size body panels, ensuring that all would fit properly.

Because designers and consumers alike often make comparisons between additive manufacturing systems and Star Trek replicators, it's exciting that some AM systems have already operated under deep-space conditions—at least for a few minutes at a time. Made in Space, a start-up company based at NASA Ames Research Center in California, won a spot in the NASA Flight Opportunity Program to operate a modified 3D Systems BfB3000 3D printer on aircraft that undergo zero-gravity conditions. Team members from Made in Space have taken the equipment on multiple flights for more than two hours of zero-gravity manufacturing time, printing research-oriented polylactic acid (PLA) parts. These test parts are core samples or columns that, when studied under microscopes in the lab, yield information about layer bonding and resolution. **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 → **3D Systems:** 3Dsystems.com

→ **D_Shape:** D-Shape.com

→ **EOS:** EOS.info

→ **Innermost Secrets:** InnermostSecrets.com

→ **Kor Ecologic:** Urbee.net

→ **Made in Space:** MadeInSpace.us

→ **Mcor Technologies:** McorTechnologies.com

→ **Objet Geometries:** Objet.com

→ **Roland DGA:** RolandDGA.com

→ **Stratasys:** Stratasys.com

→ **Within Technologies:** WithinLab.com

→ **ZCorp:** ZCorp.com

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From "What If" to "What Else" – Iterative Design Simulation is Possible Today on a Workstation

Why are we settling for just one design in a single step when so much more is possible?

BY PETER VARHOL

Technology, hardware and software have made tremendous advancements in the last 5 years, but we still continue to work as we have. It's time to break the mold and see what might happen if we elect to really exploit all the technologies we have available.

Some leading finite element analysis/computer-aided engineering independent software vendors (ISVs) profess that dual processor workstations are now very capable of quickly and efficiently processing models that scale up to 5M degrees of freedom (DOF) and in some cases can range to as large as 10M DOF. But workstation use remains dominated as a CAD-only platform.

Today, a workstation with two Intel® Xeon® processors processors and 12 computation cores is very capable of concurrently performing CAD and simulation tasks. Yet we find the adoption of simulation-based design solutions from companies like Autodesk, ANSYS, Altair, MSC and SolidWorks to be meager.

Dual processor workstations can help to increase the overall throughput of simulation results and increase the value of your ISV investment.

Dual socket workstations are playing an ever increasing role in helping engineers and analysts to address fundamental engineering questions such as "what is the best design," "how safe is it," or "how much confidence do I have in my answer." Dual socket workstations based on Intel® Xeon® processors are helping engineers explore more "what if" ideas. But more is possible.

What If
The process of exploring a single design idea in a given time step.

What Else
The process of exploring multiple design parameters in a given time step.

History Does Not Repeat Itself

In the early '80s, organizations explored the opportunity to combine CAD and CAE on a single UNIX workstation. Almost all the experiments failed. They found it was too difficult to concurrently allocate resources to process CAD and CAE. Today, Intel is making this possible with an interesting technology known as Intel® Virtualization Technology for Directed I/O (Intel® VTd for short).

This technology makes it possible to concurrently share resources between interactive CAD design and hardcore engineering simulations. Intel® VTd creates hard partitions between computational resources that both operate at near native performance. The result of using Intel® Xeon® based workstations with Intel® VTd is users have a very capable CAD workstation and a more than proficient CAE/FEA server, at the cost of a single workstation.

Expanding "What If" To "What Else"

While a dual-processor workstation may help an engineer explore "what if" faster, it may not be capable of exploring an iterative array of parameters that is part of a design of experiment (DoE) workflow. Imagine being able to explore "what else" in the same time step as "what if." Rather than reviewing one variable (e.g. material, diameters, thickness, frequency, operating temperature, etc.) engineers could review a combination design parameters and alternate designs. Now designing an optimal product in less time becomes more realistic.

Accessing Resources for "What Else"

Many engineering organizations from small and medium businesses and even large enterprise organizations have the need to either access or augment their HPC resources. One way to do this is to consider migrating to dual processor workstations and forming them into a "micro cloud," which is also known as a carpet cluster. In this form, users can explore "what else" and use Intel® VTd on their workstations to separate interactive CAD and FEA/CAE simulation jobs. In this same arrangement, organizations can use the partitioned workstations as an HPC device capable of running applications like HyperWorks, Autodesk Simulation, MSC Nastran, Abaqus and almost any FEA applications. The notion of DoE is now available to almost any company that wants to leverage its advantages.

Conclusions

- Push the edges of technology and make it work harder for you.
- Experiment with DoE workflows.
- Look at Project Dakota from Sandia Labs and how they use DoE workflows to accelerate their investigations. DE

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

DE Desktop Engineering®

Visionary Voices

A take on the future of engineering from the people bringing it to you.

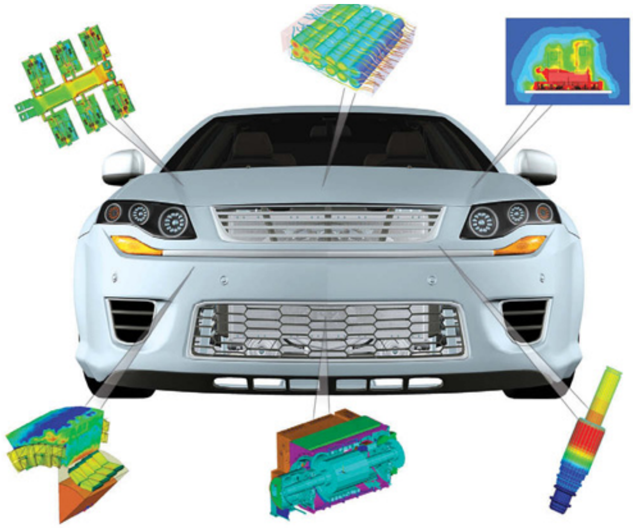
As the computer scientist Alan Kay famously said: "The best way to predict the future is to invent it." And so he did. He is called one of the fathers of object-oriented programming, the modern graphical user interface and is credited with conceiving the concept (in 1968, no less) that led to notebook and tablet computers. That type of vision is what drives the future of engineering technology.

It's tough to predict the future, especially the future of technology. But, leaders prepare for what's next while everyone else scrambles to understand what just happened. One of *DE*'s goals is to keep you up to date, as evidenced by the future-focused articles in this issue and the launch of our EngineeringOnTheEdge.com site.

The commentaries on the following pages come from *DE*'s advertisers. They were invited to share their visions of the future. Some explain what new technologies and processes they think design engineers will need to know in short order, while others focus on their companies' inventions and why they feel those products are the future of engineering. They're one more way to stay in front of the leaps and bounds of new technologies, directly from the people who are bringing you those tools.

A Cultural Change

BY THIERRY MARCHAL



In response to well-known pressures, today's global automotive industry faces an incredible challenge: designing a new hybrid electric vehicle/electric vehicle (HEV/EV) powertrain in just a decade. In comparison, inventing and fine-tuning the internal combustion engine took more than a century. So leading car manufacturers, which cannot afford to miss out on this opportunity, are creating a cultural change. They are moving from a test-centric culture to a computational analysis-centric one, paving the way to a new world where safe, robust, sustainable innovations will be the norm. Other industries will have no choice but to follow.

At ANSYS, we have noted that engineering simulation is being adopted more and more across all industries as a strategic tool for innovation, cost reduction, and even addressing important environmental challenges. An increasing number of companies leverage advanced simulation involving multiphysics to gain a realistic and reliable product-behavior prediction. We see two major trends emerging: one related to advanced technologies and the future of simulation (robust design optimization), and the other, perhaps more pragmatic but definitely more business oriented, related to optimization of the product development process to amplify engineering.

Major Trends

Robust design optimization is quite straightforward, and it is the next standard for simulation. Companies want to make their products or processes insensitive to any variation of parameters, whether it is material properties, dimensions, operating conditions or the environment in which the product operates (including unintended end-customer usage). A product is robust if it delivers expected optimized performances in any circumstance throughout its lifecycle. Engineers can deliver robust design by digitally optimizing the solution, taking into account any possible probabilistic or accidental variation. There is no effective way to ensure product insensitivity using a traditional product design approach.

Even with large-scale deployment of simulation, some companies are coming up short in engineering resources; others feel that their current resources could be used more efficiently to involve simulation more systematically, more pervasively, without massive additional investment in human resources. The trend, therefore, is to optimize the product development process itself, to use simulation results and investments in a smarter way so that more can be done with less. This is a management issue. It calls for sharing and customizing best practices from best-in-class companies. The outcome is that companies can amplify the value of its existing engineering workforce.

Synergies in these two areas lead to a third important trend: systems engineering leading to a smart product system. This involves going beyond localized design and simulating the system as a whole. Early in the development cycle, ANSYS software can help cross-functional engineering organizations predict system-level performance. R&D teams then work on improving individual components and subsystems as well as their interactions with one another. The entire product system can be continuously and rapidly fine-tuned in a virtual environment until it is ready for physical assembly and testing. The end result is an accelerated development process and increased confidence in ultimate performance when products are launched.

Anticipating Evolving Users Needs

ANSYS has made a commitment to engage with both industrial and research worlds for facilitating and accelerating this cultural change, beginning with the launch of release 14.0. Our software includes seamless integration of multiphysics in a single environment. It offers product development protagonists—designers, analysts or even executives—reliable and smooth interaction. And we have developed innovative licensing strategies for cost-effective massive adoption of parametric studies. These are the cornerstones of tomorrow's engineering framework. Simulation has an amazing future: it will be everywhere. Within 10 years, engineering simulation will no longer be a step in the product design process, it will become the process itself. DE

Thierry Marchal *is Industry Marketing Director for ANSYS.*

The Evolution of Additive Manufacturing

BY SCOTT CRUMP

Additive manufacturing (AM) is instrumental in bringing products to life. Its role now spans concept development to manufacturing. While many of today's conversations turn to the amazing ability to manufacture end-use items with little more than CAD data, I believe there is still much more we can do to assist design engineers in creating great products.

We see three distinct areas, each with distinct needs. Desktop 3D printers will be office peripherals that deliver professional-grade parts. 3D production systems will be a centralized solution for the more demanding applications. They are also the bridge between 3D printers and on-demand manufacturing systems.

Through user interaction and our RedEye On Demand production services, we've learned that an all-in-one system isn't the best option. Systems are multi-purpose, but the engineer in me knows that the demands are too diverse to tackle in one system. A system for all applications overcomplicates the design, and this breaches our prime tenet for desktop systems.

In the near term, you will have professional-grade desktop 3D printers for less than $10,000. But as we have witnessed, low price alone doesn't mean much. To be your go-to device, this CAD peripheral has to work transparently. You won't accept anything other than perfect, high-quality prints every time. You want a push-button device that spits out parts without any effort. And you demand a whisper-quiet machine without nasty emissions.

To do all that, the next-generation 3D printer will have few user options and small capacity. They will also be designed for one or two materials.

When you need more—more materials, bigger working envelopes and total control over speed and quality—you will turn to your company's shared 3D production systems. We recently rolled out the Fortus 250mc for those very reasons. Our Dimension customers wanted a low price-point system that allows them to dictate exactly how a part is built.

Expect more application-specific materials, such as ABS-ESD7, which dissipates electrostatic charge in this medical inhaler.

Like 3D production machines for manufacturing, these systems will get faster and the material selection will get bigger. The engineer's 3D production systems and those for manufacturing will have a lot in common. Advances in one will find their way to the other. Yet, they will become increasingly distinct.

The recently launched Fortus 250mc offers the total process control of a 3D production system at an entry-level price.

A new class of 3D production systems will emerge. These machines will be industrial grade. Our direction is to make them with the traits of a CNC workhorse. They will be even more dependable, predictable and rugged. Part-to-part and machine-to-machine repeatability won't be a concern. And to keep pace with demand, these systems will have higher throughput and extended duty cycles with fast, automated post-processing.

The challenge for design engineers will be keeping pace with all the advances; knowing what is possible with each platform. You will use a combination of 3D printers and shared 3D production systems. And when capacity peaks or alternative materials are needed, you will turn to outsourced services.

Another challenge is preparing for the future of manufacturing. Design engineers will be vital to AM's success as a production method. Design innovation will be critical. Merely replicating today's designs with AM marginalizes the technology. So, you must learn how to leverage AM, how to design around limitations and understand when direct digital manufacturing makes sense.

You will need to break free of established design standards. I know that habits are hard to break, but trust me, adopting new practices will be well worth it. You will be free to innovate your designs in extraordinary ways. DE

Scott Crump *is CEO, President and Chairman of the Board at Stratasys.*

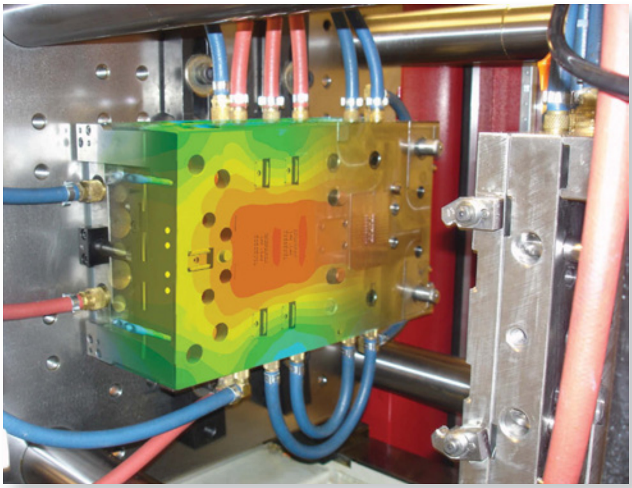
The Next Leap: Process Chain Integrated Simulation

BY CHRISTOF HEISSER

Simulation has established itself as an invaluable tool for design engineers in developing new parts and deciding what materials to use in metalcasting or plastic injection molding manufacturing processes. In the past, such simulation tools were used by analysis groups. The operators of such tools were specialists who would "setup and run" simulations. Today, however, design engineers need to be able to provide answers to questions regarding all areas of the manufacturing process, requiring communication between all members of the production team. Pure design simulation tools, however, do not cover the simulation of the manufacturing process.

MAGMASOFT® Casting Process Simulation was introduced 23 years ago as a simulation tool primarily to be used by process engineers in metalcasting operations to move the trial-and-error process of finding optimum process parameter combinations from the manufacturing floor into the computer. Designers and analysts in the automotive industry were the first ones who recognized the benefits of using such process chain integrated simulation tools, either by themselves or in collaboration with in-house manufacturing engineers and with their suppliers. Using such simulation software, suppliers and designers can work together from the beginning of the development of a new part to design parts that are optimized for performance, castability and costs. Process simulation becomes, thereby, an invaluable communication tool between designers and production engineers in an environment of ever shorter product development processes. Indeed, many OEMs, both within and outside of the automotive world, now require their casting suppliers to use MAGMASOFT® and refuse to procure parts from foundries not utilizing this technology.

While mold flow simulation has been established as a product design tool in the plastics industry, process simulation has not been adopted by manufacturing and design engineers. The main reason is that the simulation tools that were originally intended to be used only in the design process lacked the ability to consider the complexity of the entire injection molding process. SIGMASOFT® was introduced by SIGMA® to provide the first true process simulation software for polymer injection processes. It even simulates the elastomer injection process, i.e. for LSRs, a material category not covered by traditional design simulation tools. This process chain integrated simulation makes simulation accessible to everyone, not only

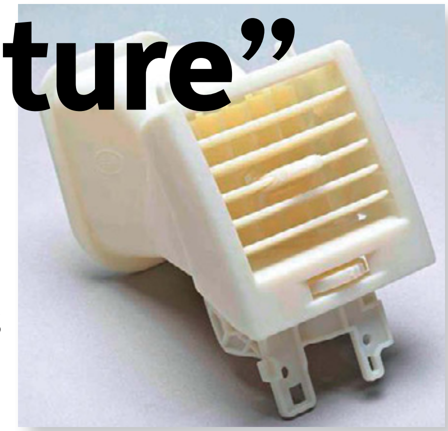


"meshing specialists." SIGMASOFT® has been lauded as "The Next Generation of Polymer Simulation" by our customers because of its unique combination of ease-of-use and its capability to consider all details of the entire mold and molding process. This opens the utilization of this technology to designers with product responsibilities and production engineers, as no finite element meshing experience is required to use it. Based on the success and vast experience of its parent company MAGMA®, SIGMA® is determined to provide comprehensive, accurate yet easy-to-use software.

One challenge of process simulation is that there are so many material, process and design variables to consider. Manufacturing processes are, therefore, inherently complex, which has resulted in the use of the phrase, "process window." How many simulations do I need to run to cover the entire "window"? Historically, however, the time needed for each simulation had required engineers to limit the number of simulations run. Fortunately, computers now provide calculation times that were only dreamt of 10 years ago. Simulations that took three days to run are now finished in less than 20 seconds. By using multi-core or even cluster technology, process simulation tools like MAGMASOFT® and SIGMASOFT® can perform DOEs quickly and open the opportunity to use automatic optimization technology to find the best material, design, and process parameter configuration to establish robust metalcasting and injection molding processes. DE

Christof Heisser *is President of MAGMA Foundry Technologies, Inc. and SIGMA Plastic Services, Inc.*

"Back to the Future" for Prototypes



How expectations for your prototype part has changed and will change in the future.

BY BRUCE BRADSHAW

Forget about going to 1955 in a DeLorean, even 10 years ago the needs and requirements of your prototype parts where relatively simple: a part that required some post processing to get it to function and resemble your final part. Your expectations of the material used in the prototype where not that stringent either. You just wanted a plastic part to review your design. What's more, you probably got your prototype from the local service bureau and never envisioned you'd have prototyping technology that was cost effective enough to bring in house.

Today, most organizations either have one or two prototyping technologies under their roofs, or are at least looking seriously at bringing a 3D printer in to take more control of the design process. The desktop 3D printers of today deliver far superior quality than what you got 10 years ago when you outsourced, and the higher-end 3D printers allow you to get a host of material properties that resemble elastic rubber like polypropylene and high-temperature materials for "under the hood" applications.

Printing Two Materials at Once

Cutting-edge technology like Objet's Connex 3D printers enbale simultaneous printing of two base materials allowing users to get as many as 14 different mechanical properties in the same part. Jetting of two materials also solves an issue that has plagued materials in other technologies. Prior to the Connex, you had to choose between using a high-temp resistant material that was often brittle vs. a tough material that did not have a good heat deflection measurement. By combining two materials into a single part you effectively can get the best of both worlds—a part that has a high-heat deflection (up to 95C after post curing) along with a part that proves as tough as an ABS molded part.

All of this cool stuff sounds great, but what will your requirements be 10 years from now? We are already seeing requirements in the medical field that some might consider space age—like jetting of human tissue or producing a titanium part from a 3D printer that can be used directly for a knee replacement. In the commercial world, personalized "on-demand" products for industries like shoes and other sporting goods is a very real requirement. 3D printers may help companies meet their customer requirements if the speed and material properties are advanced enough.

More Performance Gains to Come

What's reassuring for 3D printer manufacturers and the users of 3D printers are the advancements made in print head technology. 3D printers leverage the print heads developed for the 2D printer world for wide-format printers, and we already see huge leaps in performance happening to print heads that could easily be adopted for 3D printers. Performance gains of 20 times for print speeds are not unreasonable, and other variables like dot size can be regulated to help meet tomorrow's requirements for sporting goods, shoes, medical and industrial applications that will become the demands of tomorrow.

The entry-level or hobbyist market is also heating up rapidly. The up-and-coming technologies seen at Maker Faires and other venues will also impact the future, but the question that will dictate the adoption rate for consumers will come from the material costs. Sure, this technology is cheap and you can assemble the printer in your garage—but is it more than a toy for the hobbyist? Only time will tell. What is a more likely scenario is we will see 3D printers popping up at office stores, allowing you to create 3D designs and hand them the file to print the idea that might make you millions.

Marty and Dr. Brown from 1985 would be amazed at what you can do today, but I am confident they would be absolutely blown away but what the future holds. A 3D printer that allows them to print their time machine in a day, with the flux capacitor already in place? OK, maybe that's a little far fetched, but you get the point. 3D printers of tomorrow will produce things we can't even imagine, but as we've seen so often, nothing is certain and there are multiple courses with endless limitations. DE

Bruce Bradshaw *is Objet's Director of Marketing.*

BOXX Builds Productivity

BY SHOAIB MOHAMMAD

There is an ancient Chinese proverb: "May you live in interesting times," which is also considered by many to be a curse. In the crowded field of professional workstations, there have been many interesting changes over the past decade; large powerhouse companies like Sun, SGI, and even IBM, have exited (or been driven out), mainly because the Microsoft Windows-Intel model has flourished. However, the substantially smaller, yet well respected BOXX Technologies continues to thrive.

So what makes BOXX so special?

From its inception more than a decade ago, BOXX chose to be in the business of productivity, i.e., electing to conduct our own research, and focusing on the specific needs and requirements of customers. Our approach is the antithesis of the cookie cutter PC makers, who promote their "one size fits all" approach, usually at the expense of the customer's productivity. They fail to understand professional creative applications and the specific configurations needed to optimize those workflows.

As a result, misnomers abound—most notably, a belief that the majority of engineering software applications are multi-threaded, therefore requiring Intel Xeon processor technology and NVIDIA Quadro graphics cards. This is simply not the case. In fact, the current lower cost Intel Core i7 processors outperform (in most instances), workstation class Intel Xeon products for single-threaded engineering applications. Similarly, the lower cost, consumer-focused NVIDIA GeForce GPU outperforms workstation-class Quadro products for these same apps. BOXX produces the world's fastest Intel Xeon-based workstations featuring NIVIDIA Quadro graphics cards, but we only recommend those systems for the right application and workflow—not simply to sell you our most expensive product. As for cloud computing, BOXX does not subscribe to the herd mentality either. Cloud computing may be great for the masses, but is not ideally suited to professionals, specifically lead designers forced to wait long hours uploading or downloading large datasets via the Internet.

Focus on Productivity

Since BOXX is in the business of productivity, we design and build our 3DBOXX workstations and dedicated rendering systems (including chassis) at our production facility in Austin, TX. And because BOXX is a smaller company, we have the advantage of being agile, enabling us to rapidly adopt these leading technologies in response to customer needs. BOXX labs consistently strives to develop optimal configurations in order to help improve our customers' overall productivity— even if that means pushing the envelope with processes like overclocking, liquid cooling, putting four GPUs in a desktop workstation chassis, using Intel Smart Response Technology (which provides faster caching of data), and 2133 MHz DDR3 memory for maximum overall performance. To top it all off, BOXX products are backed by full, three-year warranty.

The Professional's Choice

Another key reason why BOXX is the professional's choice is that we are a solution provider. Our expert sales consultants, engineers, and legendary technical support not only know everything about our Autodesk and SolidWorks-certified hardware; they also have intimate knowledge of these professional software applications and optimal workflows. If you have ever experienced the frustration inherent in conversing with the tech support of our competitors, you know that they are sorely lacking in this regard.

Those who argue that BOXX customers pay a premium for our solutions also believe that the only way to succeed in the hardware business is by shipping US manufacturing, support, (and even most engineering jobs) halfway around the world. In both instances, they obviously miss the point. Sure, most customers want lower cost products. However, they do not want them at the expense of their own productivity. BOXX is occasionally referred to as "The Apple of the PC Industry" for good reason, as we have carved out a niche as workflow experts, designers and producers of the world's fastest workstations and innovative rendering products. Although we take tremendous pride in record-setting performance and rave reviews from industry publications and independent testing, our greatest satisfaction comes from the daily accolades we receive from customers who have never experienced a level of performance like this before. We hear time and again how BOXX solutions have profoundly impacted their businesses, saving them countless hours while increasing their profits.

Review a sample list of a few of our thousands of incredibly satisfied customers, their glowing recommendations, and customer stories at www.boxxtech.com/customers **DE**

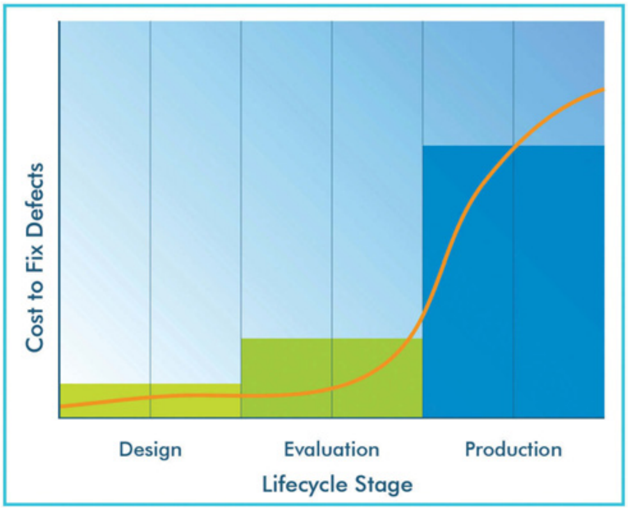
Shoaib Mohammad *is Vice President of Marketing and Business Development at BOXX Technologies.*

Managing Quality Through the Product Lifecycle

BY BRIAN SHEPHERD

Assuring product quality, reliability, and safety is an integral part of product development. Yet many manufacturers perform quality checks too late in their process to be effective. A clearly defined method to track a product's quality against its requirements throughout the development cycle can help manufacturers avoid shipping faulty or unsafe products as well as budget-busting expenses such as scrap, rework, postponed product launches, or, worse, mid-project cancellations. Quality Lifecycle Management (QLM), an emerging enterprise-wide solution, provides manufacturers a formalized system to manage product quality, reliability, and risk from the onset of product development throughout each successive stage of a product's lifecycle. But just what does QLM entail?

QLM is a cross-functional solution that integrates quality and reliability analyses, risk planning, field use data, and even customer complaint tracking/resolution into every facet of product development from concept to management. It makes product quality data readily accessible to all stakeholders, whether their job is planning, design, testing, manufacture, service, or oversight. QLM helps manufacturers align functional needs from every potential source with requirements by systematically tracking a product's characteristics at every lifecycle stage. It ensures that a product's characteristics match its requirements and arms manufacturers with the data needed to address quality issues proactively before failures manifest themselves.



A Unified Platform

A successful QLM solution seamlessly integrates analysis methodologies to enable cross-functional quality activities, enterprise-level accessibility in support of personnel collaboration, and structured workflow tools to implement closed-loop quality processes. To accomplish all this, QLM unifies within a single database platform several methodologies commonly used to fulfill quality, reliability, and safety-related analyses throughout the product development lifecycle. Among these are predictive analysis to calculate the probable failure rates of components and systems; fault-tree analyses to quantify system risk and reliability; failure mode and effects analysis; failure reporting, analysis, and corrective action; nonconformance handling; and customer feedback tracking and reporting.

In practice, what this means is that QLM organizes a workflow in which everyone is in the know. Design engineers know the precise criteria defining the parts they select in support of functional requirements. Test engineers know exactly what characteristics to examine and what their minimum performance specs need to be. Manufacturing knows what attributes require intense control during production to achieve product safety and performance benchmarks, while service technicians know where to focus during routine maintenance or repairs. Planning knows what's right and wrong with the current iteration of a product. Management knows that its visibility into product performance at every lifecycle stage is complete.

Collaboration and Correlation

Collaborative methodologies are a key attribute of QLM. They make certain that quality information garnered in one lifecycle stage is communicated in a timely and accurate manner to the relevant processes in all other lifecycle stages. For example, one of the central functions of QLM is to investigate any correlation between field failures and manufacturing, component, or design defects. QLM maintains a closed loop system that relays quality issues experienced during service and use back to quality planning, design, testing, and manufacture. This enables manufacturers not only to record, disseminate, and react to lessons learned—but to retrieve and apply those lessons in next-generation products.

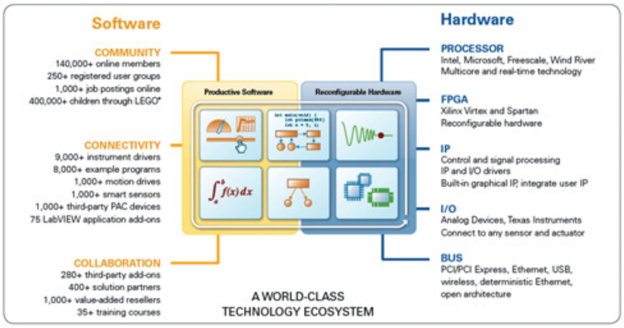
Too often, manufacturers short-shift product quality checks for reasons ranging from time to market to coping with globally disbursed workforces and supplier networks. Too often, the result is disastrous. QLM enables manufacturers to leverage quality control as an everyday component of their product development process. DE

Brian Shepherd *is Executive Vice President, Product Development, PTC.*

Graphical System Design Accelerates Development

BY NORMA DORST

Graphical system design is a platform-based approach to accelerate the development of any system that needs measurement and control. With it, you shorten the development process by using your knowledge of the platform to map any application requirement through a consistent API to deploy to the specific hardware target you need. This flexible, integrated software and hardware platform speeds the development of test, control, monitoring, embedded and measurement systems. It helps you more easily integrate changing technology and requirements over time while providing better productivity, higher performance, and lower costs than point solutions.



Graphical system design using the NI platform is supported by a growing ecosystem of IP, technology, and applications.

Key Elements to a Flexible System Platform

Any system that needs measurement and control can be broken down into key elements: measurement and control I/O, mathematical models and analysis, user or operator interfaces, processing, communications, and other technologies. To design and implement these systems, you need ways to describe system functionality in software: models of computation, representations of system timing, etc. You can combine these elements with the physical hardware platforms to make the functional system.

NI LabVIEW system design software integrates system elements in a way that abstracts complexity to help you focus on meeting your application challenges rather than on system integration. It offers the ability to visualize multiple ways to program system functionality, using the best model of computation for the behavior that you need. With LabVIEW, you also gain access to thousands of built-in and community-developed libraries that integrate mathematical models, I/O hardware, and any other components you need to build a system.

Abstracting Complexity

LabVIEW abstracts the complexity of commercial technologies like FPGAs. An intuitive loop and icons replace thousands of lines of equivalent VHDL code. Without this approach, you have to learn technology-specific development tools or interface with specialists. By leveraging commercial technology more easily with graphical system design, you gain the performance and cost benefits of those technologies faster.

Integrating Diverse Requirements

Graphical system design also helps you meet diverse requirements faster than traditional methods. To visualize system functionality, different system components may need different methods, or models of computation, to best describe them. LabVIEW incorporates multiple models of computation to describe various components of your system in the way that best fits your need.

Finally, LabVIEW VIs compile through the desktop, real-time, FPGA, and DSP compile tools to multiple hardware targets. The targets share common architecture elements that make it easier to scale from high-performance and high-power requirements to lower cost, smaller footprint systems.

Architectures Optimized for Graphical System Design

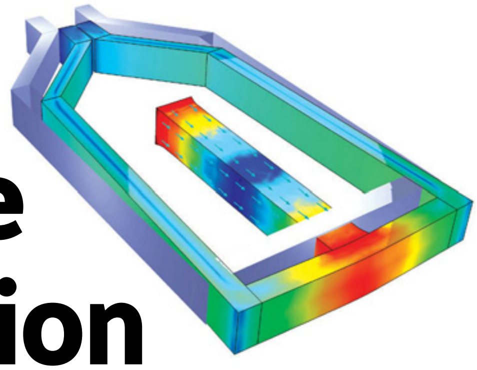
Graphical system design includes both software and hardware as part of a design and implementation platform. Often in the implementation phase of prototypes or end systems, IP from design tools needs translation, slowing down development. Graphical system design helps you overcome challenges by integrating software with off-the-shelf hardware. This approach takes a comprehensive view of the system for the ultimate purpose.

Platform Ecosystem Drives Innovation

When using graphical system design, you can leverage the work of other engineers in the platform ecosystem by accessing thousands of software and hardware components to efficiently solve your application. You gain a flexible platform that abstracts complexity and tightly integrates software and hardware to shorten the most time-consuming portions of the design process. With LabVIEW, reconfigurable hardware, and an ecosystem of IP, you can leverage thousands of person-years of work to help you innovate and invent—fast. DE

Norma Dorst *is Corporate Marketing Manager, National Instruments.*

Multiphysics: Simulation for the Future of Innovation



The image above, created using COMSOL Multiphysics, shows a simulation of a piezoelectric microgripper. Made up of a stacked piezoactuator, simultaneous contraction in the transversal direction and elongation in the longitudinal direction closes this microgripper. Shown is the von Mises stresses and deformation.

BY DAVID KAN

Every engineer dreams of inventing—of creating something genuinely new to improve the lives of others. The creative process is so fundamental to engineering that it defines careers, companies, and industries. So for the desktop engineer, living in the era of innovation—a time when creativity through technology is on everyone's mind—is truly a privilege.

Bringing Ideas to Life

As the developers of multiphysics simulation software, we have had the opportunity to see tens of thousands of high-tech organizations come up with radically new products and processes. New battery technology has been designed for greener cars and trains. Arc welding methods have been optimized by multiphysics simulations combining electromagnetic forces, fluid flow, and heat transfer. Scientists have been able to simulate cloaking devices to make objects invisible for the eye and radar. The list goes on and on. The common denominator for all these remarkable inventions is the ingenuity of the inventors themselves and their skillful use of simulation software.

One key to our customers' success is the ability to include all relevant physical effects into their simulations. That is to say the simulation is able to "capture the concept." We designed COMSOL Multiphysics from the ground up with exactly this in mind, providing multiphysics simulation capabilities even in our most basic products. The integrity of our core technology is so solid that adapting the software to entirely new application areas is as simple as writing it down. This makes the simulation process highly productive. It frees the user to model just about any physical system, opening the doors to fresh ideas from creative minds.

The Next Step for Multiphysics Simulation

The current focus of our development of COMSOL is expanding multiphysics applications. This means we will continue to include capabilities that will reach out to new communities of engineers. From one angle, we're adding new products to our LiveLink suite that will make it easy for design engineers using popular CAD software to incorporate multiphysics with just a few clicks. From another angle, we're adding fundamentally new capabilities that overcome previously insurmountable barriers.

A great example of this is the Particle Tracing Module. This new tool extends the functionality of the modeling environment for computing the trajectory of particles in a fluid or electromagnetic field, including particle-field interaction. The absence of particle-field interaction, in particular, prevented some engineers from incorporating multiphysics into their work. But now these engineers are free to use particle tracing for both traditional CFD and electromagnetics analysis, and for more novel combinations with any other physics simulation.

Other examples of expanding multiphysics applications can be found in most industries. One fascinating case comes from the mobile device market. Small speakers are critical for the performance of smart phones, hearing aids, and earpieces. On that scale, even thermal effects impact performance and sound quality. Now, manufacturers of these small acoustic devices can perform thermoacoustic simulations with an off-the-shelf software package for the first time. The ability to combine such simulations with electrical circuits and structural vibrations brings a new simulation solution to this fiercely competitive industry where a hi-fi sound feature would be a crucial differentiator.

User Developed Applications

Going forward, we are expecting a tremendous increase in the number of application-specific simulation solutions. The best part is that these applications will be developed by the users themselves, who, after all, have the ultimate application expertise. We believe it's time for a simulation software package that is built to adapt to the varied needs of the user to bring bold product ideas to life. DE

David Kan, *is Vice President of Sales—Southwest USA, for COMSOL, Inc.*

Engineering The Future

BY JOE CURLEY

Innovation remains one of the primary drivers of job creation and economic stability. Innovation is rewarded. Perhaps the best example is Apple's ascent from near collapse to being one of the most respected companies for creativity and innovation. But innovation is not for the timid. It needs to be fed and cultivated. It needs to embrace change.

Testing one idea at a time as Thomas Edison did when he first created the light bulb is no longer plausible in the today's competitive markets, and even more certainly won't be in the future. Design of experiment (DoE) workflows offer organizations the opportunity to consider more design factors and potentially develop an optimal product in the same time it took to create an adequate product design. However, this time the product will be less expensive to manufacturer, use a third of the material, and deliver the experience it was intended to.

Experiment, Predict, Calculate

Looking forward, I see a dramatic expansion in ideas like the DAKOTA project (design analysis kit for tera-scale architectures) at Sandia Labs. In fact, I expect software technologies like DAKOTA or other DoE workflows to morph into an intelligent design agent that will help engineers quickly and efficiently interrogate model parameters and ideas. Imagine the impact this might have on your organization and how it could be used to reduce design costs by accelerating the design process, lower the need for expensive engineering of physical prototypes and associated design changes, or simplify product material requirements. I suspect that when you look at the cost to support the development of DoE workflows and compare it to the opportunity cost, you may quickly realize that not investing in these iterative design workflows or associated technologies may be more expensive.

One thing is certain: The need for engineering compute capacity will not diminish anytime soon. In fact, it will explode exponentially. Intel expects to be one of the center pieces in this explosion. What this means is that workstations, where your innovative ideas first take their shape, will be more powerful and more capable of doing even larger, more complex modeling locally at your desktop. Your opportunity to explore "what if" on an Intel® Xeon® processor-based workstation will be nearly interactive, and I do not expect systems like these to be relegated to the cloud.

DAKOTA will place unbelievable demands on high-performance computing (HPC) solutions. I expect intelligent design agents that spawn from today's DoE workflows will reach beyond tera-scale computing, and at Intel we are working at ways to meet those needs. It is not just about the CPU, the number of cores or the frequency, it is about the entire infrastructure and how data is plumbed around the system. It is about system balance, providing solutions that do not starve or drown parts of a computing architecture. Yes, there will be more cores and solutions with many cores, and yes, there will be new ways to plumb data that include larger caches, new memory topologies, integrated i/o controllers and much more. High-density drives (HDDs) will be supplanted by solid-state drives (SSDs) and the performance per watt ratio will hit an all-time high, providing for denser processing centers capable of delivering exascale class computing. However, more cores and higher speed infrastructure only represent part of the issue. These exascale computing solutions require programming tools that afford users and independent software vendors (ISVs) access to massively parallel computing solutions that scale from multi- to many-core architectures and allow forward scaling strategies in performance that provide users and ISVs an opportunity to quickly take advantage of new architectures as they are made available.

By 2018, I expect to provide 125 times the performance of today's processors. To make this increase possible, engineers at Intel will push Moore's Law as far as it can go. One approach to exascale-capable processor design is to stack chips and transistors on top of each other so that processors will be built more like cubes rather traditional flat chips. For example, our recently announced Intel® Tri Gate Technology represents our first foray into 3D transistors, and it is just the beginning. The reason for 3D cube-shaped chip architecture is to facilitate faster data transfer in and out of the processor cores.

Join on us on the ride, embrace change, and accelerate your innovation cycle.

If you are not currently using DoE workflows, you may want to investigate them. They offer you an opportunity to explore more what ifs in less time. If you are using DoE technologies, I'm sure you will appreciate how they will change in the years to come and help you optimize your product development cycle. We will have the compute power to meet your needs. **DE**

Joe Curley *is Director Technical Computing marketing, Intel Corp.*

Emerging Technologies in Multi-Domain SWM

BY LUKA ONESTI & DR. WILLIAM T. BERSING

A paradigm shift is under way in managing simulation workflow and business processes. The advent of multi-domain simulation systems to include advanced enterprise or global solutions has enabled the CAD/CAE industry to manage more activities. Design engineers are adopting emerging industry standards allowing middle managers to change design parameters quickly based on both customers' demands and their own creative ability. Traditional desktop applications are leveraging the power of enterprise global solutions in boundless datacenters. New simulation workflow management (SWM) technologies will make complex design simulation tasks available to a wider global community.

Traditionally, simulations require heavy data transfers and computational resources. Emerging technologies challenge leaders with large global simulation workflows in multi-domain environments. Over the next few years, these challenges will be met through increased bandwidth, global datacenter capabilities, and new business technologies. ESTECO, for example, has extensive experience with aligning simulation and optimization technologies together with standard industry accepted norms and notations to meet these challenges. ESTECO is currently beta testing a ground-breaking multi-domain SWM solution built to implement innovative customized tools for the CAD/CAE industry.

Considering this technological breakthrough, CAD/CAE specialists can develop and store simulation workflow processes while middle and upper management control and test new concepts and ideas from any computer, laptop, or mobile device. Decision makers can explore design alternatives with their customers and maintain a history of their proprietary SWM concepts. Leading new strategies should be flexible and communicate something tangible in-order for everyone to have a shared vision and energy. **DE**

Luka Onesti *is the Chief Technology Officer of ESTECO Srl.* **Dr. William T. Bersing**, *DM, PE is the President of the Institute for Program Solutions, PC.*

Knovel Accelerates Speed to Solution for Engineers

BY SASHA GURKE

Industry leading companies worldwide, including 74 of the Fortune 500, rely on Knovel as a source of trusted technical references. Engineers use Knovel to support design decisions, save time, avoid mistakes and expand their knowledge.

We continually add new content and features to increase the speed by which engineers can find answers to their technical questions. Engineers have an insatiable need for data that often exists in a variety of sources that isn't convenient to access. Our customers increasingly need to locate reliable data for very detailed requirements that are otherwise time consuming to find.

In response, we have revamped our Data Search functionality to facilitate queries. Additionally, we will also exclusively publish new databases to supplement the technical information in our existing subject areas. The data will include interactive tables, graphs and calculations compiled from authoritative, publicly available and unpublished sources. In Q4 2011, we'll roll out a Magnesium Alloy Database to extend our coverage of the properties of lightweight, high-strength alloys, and an Optical and Filter Glass Database that will include properties of commercial optical and filter glasses from 16 commercial manufacturers around the world.

In 2012, we'll offer must-have equations for day-to-day use in several engineering disciplines. They will be in MathML format that can be exported for calculation in software applications, and each equation will have standard metadata for easy keyword search. The equations will be validated by experts and have worked-out calculation examples and links to the sources.

With the new databases and the equation libraries, we further our goal of providing answers and data that engineers can easily incorporate into their workflows. **DE**

Sasha Gurke *is Senior Vice President and Co-Founder, Knovel.*

Know More. Search Less.

Build Your Own Analysis Software

These tips can help you pull together an improved simulation process.

BY PAMELA J. WATERMAN

Have your design simulations hit a non-converging wall? Does your lineup of post-processing tasks make morning traffic look light? Your engineering skills may be as sharp as ever, but your software may need retooling to handle today's complex problems.

See whether you recognize these symptoms: The basic analysis tools that came with your CAD system can't help you with a specialized analysis. Your meshing tool is causing element failures. Your simulated results don't match lab or field-test results. And the last person in your department who understood the in-house solver code just retired.

It's time to reconfigure your simulation workflow—and the best solution may just involve building it yourself.

Mesh, Solve, Visualize, Repeat

Whether for finite element analysis (FEA), computational fluid dynamics (CFD) or multiphysics, the workflow of model-mesh-solve-understand-remodel remains the norm. You may use an all-in-one package or separate pre- and post-processors and one or two classic solvers. How can you recognize it's time for change, and what tools will improve the process?

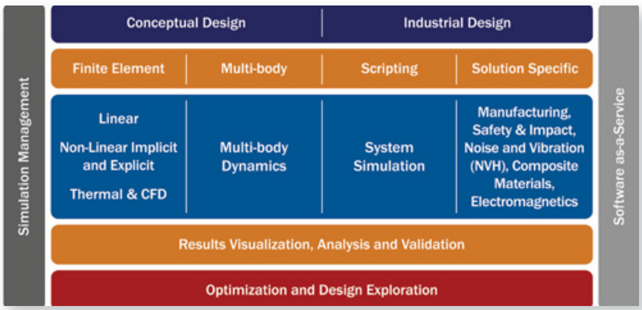
Jeff Brennan, chief marketing officer for Altair (known for its HyperWorks analysis products), identifies a simulation maturity model many engineers now face, starting with interfacing perhaps to a customer's CAE tool, adding non-linear analysis, writing scripts for process automation and lastly, defining a business model for scaling software across an enterprise. All these factors influence moving from today's solution to tomorrow's.

Solvers, the Analysis Workhorses

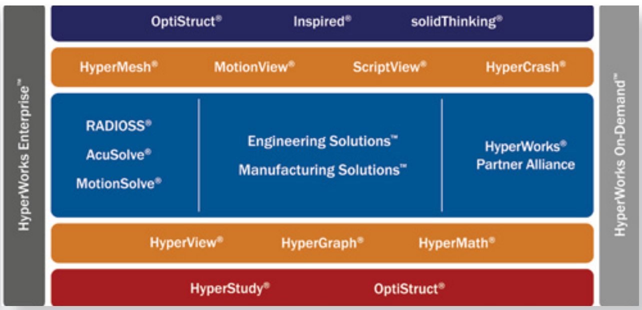
For small and medium businesses, an integrated package such as NEi Fusion from NEi Software may offer just the right combination. For example, SolidWorks' 3D solid-modeling tools "fused" with NEi Nastran solvers for accurate solutions at an affordable price. The company offers a natural growth path: As projects increase in complexity, users can move to NEi Nastran within the Femap pre-processing environment (via Siemens PLM Software) and still find the tools to be familiar.

Expanding beyond CAD, designers are exploring tools that support more sophisticated analyses. As Vipul Kinariwala, Cranes Software NISA product manager, says, "People are finding that the basic analysis packages that came with their CAD systems are not sufficient—that the tools available from a single vendor are very good for doing basic things, but not for specific, more advanced tasks."

Kinariwala also points out, "Where (designers) were making simple shortcuts before, they now want to account for realistic simulation; they need to have more powerful hardware and



A breakout of the many paths possible for taking a full finite element analysis project from design through optimization. Users may choose an all-in-one software package, separate packages designed for interoperability or a combination of in-house and commercial solutions.



The range of software analysis products from Altair Engineering addresses every stage in the linear/non-linear structural-analysis process. CFD capabilities are also included with the recent addition of AcuSolve. *Images courtesy of Altair Engineering.*

more powerful software, which are niche or single-application-oriented packages."

One way to achieve this power is with add-on modules. For example, users can buy Cranes Software's NISA 17.1 basic FEA package, then add just the Heat or Rotor modules as needed. The company is also considering short-term leasing.

Even more issues are driving users of high-end, internally developed codes to a commercial package. In-house software is not cheap to write and maintain; the experts involved may all be retiring; and the solver itself may lack the required power. Dale Berry, SIMULIA director of technical marketing, expands upon this scenario: "Maybe the legacy software is linear only, using methods based on '90s technology. But today's customers are running more complicated and much larger problems—for example, a 50-million-DOF powertrain problem on a 128-node cluster.

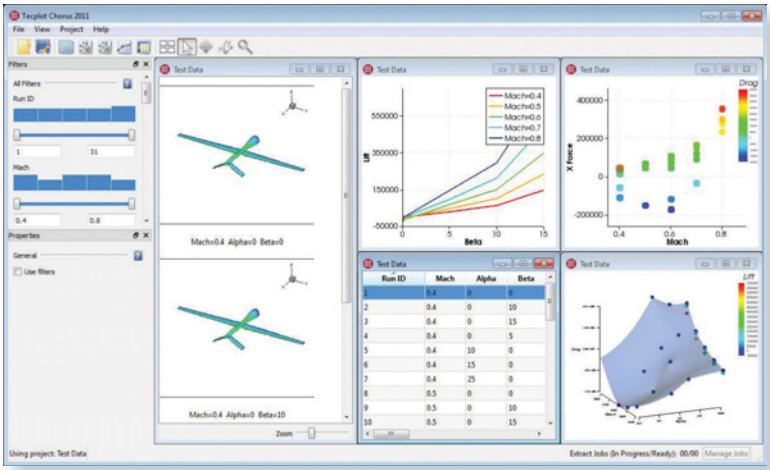
"You need a commercial tool to tackle those kinds of problems."

Berry knows that many customers may need to define a unique material behavior or do exactly the same analysis sequence over and over again. SIMULIA's software allows user-created subroutines that add such functions beyond the Abaqus Unified FEA product suite, its multiphysics capabilities and add-on tools. Abaqus also helps users extend analysis capabilities through linking commercial products together via a host of strategic partners.

COMSOL, with its COMSOL Multiphysics family, offers a wide range of functions internally. Still, the company extensively supports users who want to combine its products with other packages—offering no fewer than six different approaches. If you ask Bjorn Sjodin, COMSOL vice president of product management, he'll give you a great run-down of each. Here are three to start:

1. Use COMSOL's LiveLink products for major CAD products to work simultaneously with CAD within the COMSOL environment.
2. Employ COMSOL's LiveLink for MathWorks MATLAB to link vast amounts of legacy code with COMSOL and other simulation software from inside the MATLAB environment.
3. Build an expert-driven user interface that others can easily implement using the new Physics Interface Builder (currently in beta testing).

Altair's suite of HyperWorks products covers the gamut of modeling (HyperMesh), analysis (RADIOSS and AcuSolve), visualization (HyperView), and optimization (OptiStruct), to mention a few. Altair's Brennan says that the topic of interoperability with external packages is "something our company has lived and breathed for 20 years." Its strength is in handling the



Tecplot's new Chorus simulation analytics tool works with CFD results to help users identify trends and anomalies across tens of thousands of runs. Chorus, which includes Tecplot's 360 software, sits downstream of the post-processor and lets users run a wide range of analytics, from tracking a custom-defined value or function to extracting a convergence history. *Image courtesy of Tecplot.*

gory details in creating vertical solutions, helping users build their own process from conceptual design through manufacturing simulation. In fact, the task the company spends the most on is interface design to dozens of CAD and CAE systems.

According to Barry Christenson, ANSYS director of product marketing, the need to interface with other physics, incorporate the properties of a proprietary material or add an industry-specific function are all reasons that users may "build their own" system. "But," he says, "as commercial simulation suppliers, if we're doing our jobs right, we should be eliminating the need for people to have to bring together general-purpose kinds of software tools. In terms of general-purpose flow, with more integrated solutions, the need for massive customization should be reduced."

In the meantime, ANSYS input file-formats are open, so users can write out input files fairly easily in a third-party tool to run through ANSYS solvers. ANSYS also offers scripting options through its Workbench product, as well as more direct solution extensions with its 80-plus partner companies.

Long-time classic Siemens PLM Software's CAE offerings include NX CAE and NX Nastran. Ravi Shankar, Siemens NX CAE marketing manager, says NX Nastran can be a complementary solver—particularly for specialized post solutions such as durability evaluation.

"NX Nastran output formats are well known standards," he says. "NX Nastran can also be easily customized with the direct matrix abstraction program (DMAP) software language capability." He offers coupling hydroelastic and structural-dynamic solutions as examples.

Meshing and Visualization Tools

One vendor calls meshing "a critical pain point;" another terms post-processing "a necessary evil." If done poorly, these tasks at best create a bottleneck—and at worst, produce meaningless answers. A clearly recurring thread in vendor discussions is that, to help more users quickly produce useful results, especially on short-term projects, performing both of these stages well is crucial.

Pre-processing software guides users to setting up an accurate and effective mesh. Such tools must be highly interoperable with multiple CAD packages, while also being solver neutral. Examples include Siemens' Femap, MSC Software's Patran, ETA's PreSys, CEI's EnSight and Pointwise's Gridgen/Pointwise. The first three packages address a wide range of structural analysis tasks; the last two are focused almost exclusively on CFD applications.

Al Robertson, Siemens Femap marketing manager, sees the need for more accurate meshing to represent real-world structures.

"We've seen where, for the simpler analyses, users continue to use their original FE capability—often with SolidWorks Simulation or Autodesk Simulation—but when they need to perform dynamics or something more advanced, they use solver-neutral Femap with NX Nastran," Robertson says. Femap also offers extensive post-processing and visualization functions, has an application program interface (API) to help with third-party integration, and writes files directly to ANSYS and LS-Dyna.

Six years ago, Pointwise decided to completely overhaul its Gridgen meshing package to give it a modern interface and more functions, naming the expanded package simply Pointwise. This pre-processor attracts users with a range of needs, such as large and/or more accurate grids, more control instead of automated generation, and easy integration to more than one solver. Rick Matus, Pointwise vice president of sales and marketing, says the software's interoperability is a strong point, with output to more than 40 CFD packages.

Looking to the other side of a CFD solver, Steve Legensky, general manager and founder of Intelligent Light, sees a place for both bundled post-processors and for his advanced Fieldview 13 product. "The packaged version is OK for people not on mission-critical jobs," he observes. "Other users view fluid flow as the heart of a problem."

Fieldview is targeted to those special, vertical workflows such as when designing turbomachinery, where you absolutely need to accurately account for unsteady flow. A customizable graphical user interface (GUI) simplifies solver integration, and the company's tech model is well suited to cloud computing to handle huge amounts of data.

Tecplot 360, a numerical simulation and CFD visualization package, has been that company's flagship product since 1988. Tecplot President Mike Peery talks about the importance of post-processing software that can handle extremely large projects, such as aircraft wing design, where analysts easily generate 5,000 to 15,000 CFD runs.

Tecplot Chorus, the company's newest product, includes 360—but also manages all the details, allowing engineers to identify trends in physics across thousands of runs. Peery notes that this function differs from optimization because it does far more than identify extrema.

Done with care, users shouldn't be afraid to try one from Column A, one from Column B and so on, to improve the analysis process all the way through optimization. It's time for change. As SIMILIA's Berry quips, "If I'm using five-year-old methods, and my competitors are using today's methods, I'm stuck." **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 → **ANSYS:** ANSYS.com

→ **Altair Engineering:** Altair.com

→ **Autodesk:** Autodesk.com

→ **CEI:** EnSight.com

→ **COMSOL:** COMSOL.com

→ **Cranes Software:** NISAsoftware.com

→ **ETA:** ETA.com

→ **Intelligent Light:** iLight.com

→ **MathWorks:** MathWorks.com

→ **MSC Software:** MSCsoftware.com

→ **NEi Software:** NEiSoftware.com

→ **Pointwise:** Pointwise.com

→ **Siemens PLM Software:** Siemens.com/plm

→ **SIMULIA:** SIMULIA.com

→ **SolidWorks:** SolidWorks.com

→ **Tecplot:** Tecplot.com

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

Great Expectations

The Bunkspeed Pro Suite 2012 includes the capabilities of Bunkspeed Shot (rendering) and Move (animation), as well as distributed rendering, displacement maps and actual lights.

BY MARK CLARKSON

I reviewed Bunkspeed Shot back in January (deskeng.com/articles/aaazmj.htm). Opening Bunkspeed Pro 2012 for the first time, I found everything to be very familiar, except … there were no resources on my hard drive. Rather, everything is on the web—"in the cloud," at least, at first. Once you create a Bunkspeed account, you can access an ever-growing collection of materials, environments, background plates and models (although, at the moment, there's only the one model). Once you apply a material, for example, it's downloaded automatically to your hard drive, where it's immediately available at any time.

With the exception of a handful of primitives (boxes, cubes, walls, etc.), you can't model in Bunkspeed; all your models must come from a program such as SolidWorks, SketchUp, etc. I imported models in a variety of formats (OBJ, SKP, DAE, SLDPRT), and had good luck with the process.

Once in, models and their sub-parts can be scaled and repositioned.

Now with Animation

Bunkspeed has now, inevitably, added animation to its toolkit, with both Bunkspeed Move and Bunkspeed Pro Suite.

Bunkspeed uses simple, key-framed animation. Shut the door, set a key frame, move forward on the timeline, rotate the door open and set another key frame. Play the animation to see the door smoothly opening. The program will also automatically generate both turntable and sun study animations for you.

If you want to take it a step further, you can animate individual parts—and even materials. By grouping your parts hierarchically, you can achieve some articulation. But there are no complex linkages, relationships or kinematics. In other words: You can open and close a door pretty easily, but I wouldn't want to set up a rotary engine.

Materials Library

You'll want to apply new materials to your imported parts before rendering them. Bunkspeed's online library includes a good starting assortment of materials. These fall into one of several types, such as metal, plastic, glass, emissive, etc. You can tweak their settings, to an extent, and assign maps to control their color, bump, transparency and specularity. But the actual controls and maps available vary from type to type: You can make transparent plastic, for example, but not transparent metal.

Bunkspeed Pro supports displacement mapping, which distorts geometry based on a bitmap image. To create a 3D brick wall without having to model all those bricks, just import a grayscale height map and apply it to your flat wall. (While you're at it, you'll probably want to bring in a matching map for the bricks' color.)

Bunkspeed Pro lets you save different configurations of a model—a computer mouse that comes in four different color schemes, for example.

Controls are few and straightforward, and the tooltips are actually helpful. Still, some things baffle me. I made a plastic part and set its transparency color to bright yellow. Viola! It was transparent yellow. But exactly how transparent was it? There are no settings for opacity, although you can specify the index of refraction. It appears to be a function of the brightness of the transparent and diffuse colors, but I never figured it out.

To assign a material, you drag-and-drop from the Materials pane onto your part. I occasionally had a surprising amount of trouble with this. Bunkspeed would not let me drop a material onto a part. Instead, it insisted that I drop it somewhere more-or-less near the part—in the empty air 6 in. to the right, for example.

Environments and Lighting

Bunkspeed's primary lighting method is still high dynamic range (HDR) environments; the program uses the light from a photograph to light the scene. Drag in a desert sunset and the light is warm, the shadows are long, and cacti are reflected in your chrome.

You can also tweak the environment, rotate it and make it visible or invisible in the final render. Because the environment won't always render at sufficient resolution for final output, you can drop in high-resolution photographic back plates to provide a more suitable background.

If you prefer, you can create a sun-based sky environment. Set the longitude and latitude, day of the year and time of day, and Bunkspeed replicates the sun's position, hue and brightness. You can adjust the sun's intensity and apparent size, add some haze, and fine-tune the color of the light.

With Pro, you can now add actual point, spot and distant lights as well.

Rendering

Bunkspeed's rendering is fast, but not amazingly fast. That is, until you introduce a compute unified device architecture (CUDA)-enabled video card. The program can leverage the power of your GPU cores as well as your CPU cores, pushing your render performance up by a factor of five to 20—depending on how many GPU cores you have, and how many CPU cores you started with. With several hundred CPUs online, its performance is a wonder to behold, producing surprisingly good renders of complex scenes in just a few seconds.

The program starts rendering your model the moment you add it to your scene. You can set it to raster, ray tracing or a blend of the two. Ray tracing looks way better, but can slow things down if you're moving things around a lot on the screen, especially if you're running on a machine without a CUDA-enabled video card.

The longer you let your scene sit, the better it looks—Bunkspeed's renderer continues to refine it, forever. There are no quality settings in the traditional sense; instead, you give the program a set time limit, or set the number of passes (Bunkspeed calls them "frames") to be rendered. Or, just let it run until you're happy with the results.

You can perform basic post-processing: changing the camera's white balance, adding vignettes, crushing blacks and burning highlights, and adjusting the saturation. You can simulate depth of field—but not, as far as I can discover, motion blur.

You can save snapshots of the on-screen render, or render out higher-resolution stills and animations, either within the application or in the background. Strangely, some rendering options—such as separate render passes for diffusion, reflection, etc.—are only available with the background renderer.

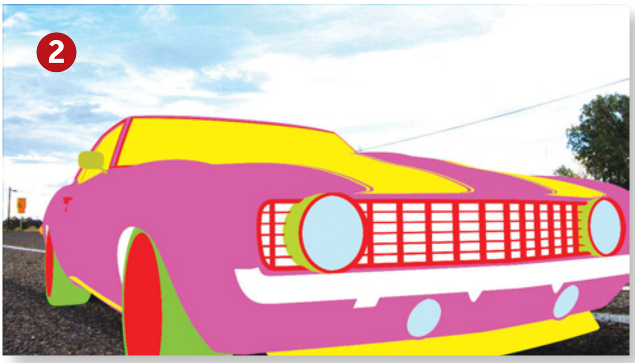
The Pro Suite includes a couple of utilities of special interest to those with extra computer power available, either on another desktop or at a different time of day. You can queue your renders jobs up and run them in the background, or start them at the end of the day and let them churn overnight. The Boost utility allows you to offload rendering chores onto other, Boost-equipped machines on your network.

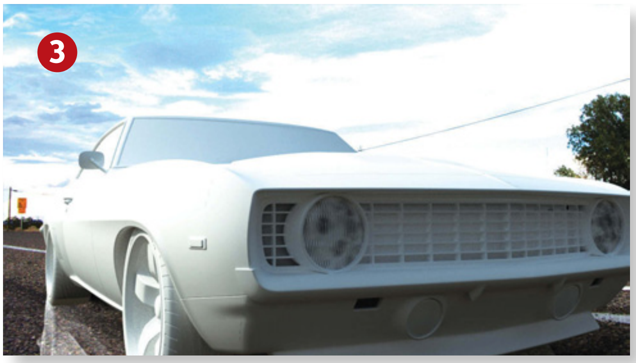
A Little Rough

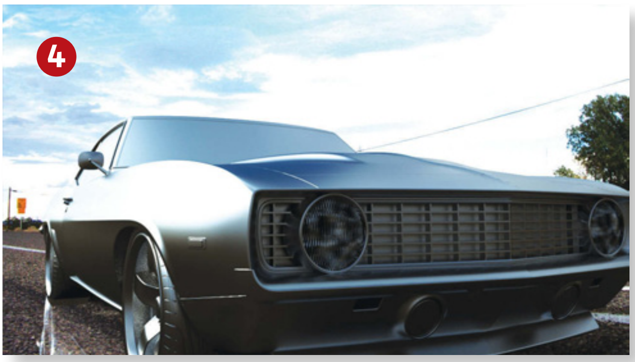
Pro Suite 2012 seems a little rough around the edges. The queue is awkward, and doesn't allow for reordering the jobs. There's no

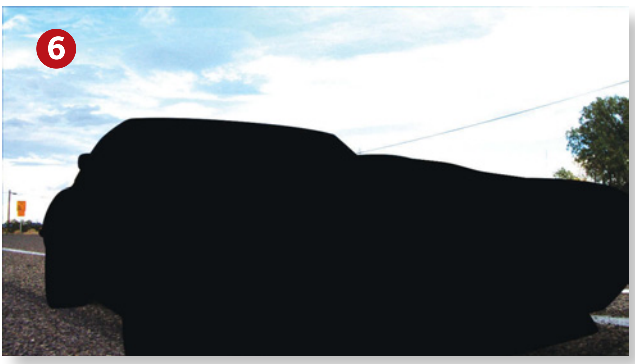
Image sequence of separate render passes:

1: Final Image
2: Clown pass (Each material shown in a different color.)
3: Global illumination
4: Gloss
5: Ground shadow
6: Incandescence
7: Specular









documentation at the moment, and the UI has some quirky issues—such as not remembering settings and window placement.

And speaking of the UI … yes, white on black looks sexy, and a black interface minimizes distraction from your work. But, and I think I speak for many aging engineers when I say this, white on black is no fun to look at for any extended period of time. Scrolling through the parts list, looking at translucent gray parts over white text on a black background, is an exercise in eyestrain. At least throw in an option to change the color of the UI.

These things have easy fixes, but Bunkspeed faces potentially bigger problems. For example:

- It would be nice to have multiple panels or viewports. I'd like to be able to, say, drag-and-drop a material from the Material pane onto a part in the Model pane. Can't do it. Only one pane is active at a time.
- You can have multiple cameras, and you can switch any camera quickly to top, front or side views, but you can only ever have one viewport at a time.
- You can't hide certain objects from the camera, or selectively turn their shadows off.
- You can't dig deep into the textures.

Bunkspeed is caught between a rock and a hard place here. The company is focused on simplicity, but, as the product becomes more comprehensive (and expensive), these arguably missing features become harder to defend. On the other hand, as Bunkspeed adds features and capabilities, it runs the risk of becoming exactly the kind of "big" application it doesn't want to be.

Final Thoughts

Do you need the Pro Suite? If you do a lot of rendering and have additional machines on your network, the combination of Queue and Boost is certainly appealing. But even with real lights and displacement maps, I'm not sure I can justify the rather steep price of $3,495 (more than twice the price of Move and Shot, combined). For that money, you can step into a full-featured modeling and animation program like Maya.

Bunkspeed's primary appeal, though, is precisely that it isn't an application like Maya. It's quick to learn, easy to use and renders like greased lightning. **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 → Bunkspeed: Bunkspeed.com

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Coming Soon
to a Highway Near You

Experimentation in SolidWorks Flow Simulation leads to new possibilities in aerodynamic truck design.

BY KENNETH WONG

Based on Bob Sliwa's idea, Jeremy Singley turned the SuperTruck into a digital model in SolidWorks.

Underneath its fiberglass and metallic skin, the SuperTruck, as it's been proudly dubbed by its co-creators Bob Sliwa (AirFlow Truck Co.) and Jeremy Singley (Jeremy Singley Industrial Design), is still a class 8 tractor trailer rig. But it looks more like a bullet train, poised to shoot down the highway at unprecedented speed.

Sliwa and Singley hope that, unencumbered by a typical truck's square front, the SuperTruck's elegant nose will slice through the air more efficiently, promising to burn 25% less fuel than a standard rig. The aerodynamically improved vehicle "could potentially save the trucking industry over 7.5 billion gallons of fuel and 21 million tons of toxic exhaust emissions annually," according to its makers.

Meeting of the Minds

When Sliwa was a child, he satisfied his mechanical curiosity by taking apart his toys to study their inner workings. Later, as a teenager and auto mechanic, he discovered the thrill of drag racing. Eventually, his passion shifted to trucking and truck design.

Using lessons from his racing days, Sliwa wanted to "substantially lower the cost-per-mile operating cost for fleet operators and owners of rigs," as he put it. Through experimentation and real-world freight runs, he felt he could push a truck's fuel efficiency to 10 miles per gallon. But to prototype, test and verify his ideas digitally, Sliwa turned to Singley, an industrial designer and a SolidWorks user.

"Sliwa's ultimate aim is to produce a kit so truckers can do what he's doing: rip off the body of their truck, then replace it with a more aerodynamic body," Singley explains. Sliwa hired Singley to help design the kit—not the entire vehicle, but the portion that will attach to the front of the truck. The working relationship was reinforced by Singley and Sliwa's shared tendencies to tinker with vehicles.

"My wife and I, we built our first car from junkers," Singley admits.

Singley encountered CAD for the first time in a design communication course at the Vermont Technical College, under the tutelage of a former Black & Decker home appliance designer.

"In my [furniture] shop, I used to just grab a piece of wood and start working," he recalls, noting that with CAD, he can do the same—all while breathing in less sawdust. "I just like the way parametric CAD systems work."

Though he was trained on Autodesk Inventor in school, Singley eventually switched to SolidWorks after graduation.

Skinning a Truck

Sliwa's original idea for SuperTruck is to produce a kit that truckers can use to make their vehicles more aerodynamic. What usually hampers a truck's efficiency, as it turns out, is the classic shape of its head. Comprised of blocky geometry and flat surfaces, it pushes against the wind to create more resistance than necessary. With Sliwa's kit, truckers would be able to replace the original truck's front portion with a smoother nose.

One of the major hurdles, Singley reveals, was the shape of the SuperTruck's hood, constructed with spline curves. "To loft a surface from a square to a parabola, especially with a square that's perpendicular to the parabola—that's something parametric software hates to do," he says. "You have to trick the software into doing it for you. I did it in sections, connecting up the pieces with boundary surfaces with curvature control."

SolidWorks comes with advanced surfacing tools, but, like most parametric mechanical CAD programs, it may not offer the ease and freedom found in non-uniform rational basis spline (NURBS) surfacing programs, such as Rhino.

"I would very much look forward to such capabilities [freeform surfacing], and I think SolidWorks may be overlooking the fact that 21st-century engineering will find uses for morphable surfaces in fluid dynamics, optics, acoustics, medical devices and a slew of other fields," says Singley. "At the very least, it's handy when engineers and designers need to refit enclosures as internal parts are revised. I designed a health product recently, where I was able to quickly adjust a curvaceous enclosure to fit by tweaking the surface with SolidWorks' freeform feature. That's a handy feature for minor adjustments like that, but it's pretty clunky otherwise. Softer splines would be nice, too. That's really my only criticism. Even with that limitation, I feel SolidWorks is the best software for the price."

Next up: The Alpha Concept Vehicle

Sliwa relied on his experience and intuition to dictate the specs for the digital model of the SuperTruck, which Singley translated into a SolidWorks CAD model. Because the SuperTruck kit was designed to fit onto a conventional truck's frame, the kit's parameters had to conform to truck manufacturers' specifications.

"There was a limit to what we could do. We can't change where the windshield is, where the driver sits, and where the tires are," Singley points out.

Once the digital SuperTruck model reached the prototype stage, Singley grew more ambitious and decided to design the ultimate truck of the future, dubbed the 2015 Alpha Concept Vehicle. He started the project by asking, "If we were able to build a new truck, using new tooling, from the ground up, how far could we go with aerodynamic streamlining?"

Singley asked SolidWorks whether the company would be willing to sponsor the project by offering a courtesy seat of Cosmos FlowWorks. (After SolidWorks' acquisition of CosmosWorks, SolidWorks rebranded FlowWorks as SolidWorks Flow Simulation.) The company agreed to his proposal and gave Singley the opportunity to look at the truck's aerodynamics.

When Singley ran airflow analysis on the SuperTruck design to see what improvements could be made, he was in for a surprise.

"Bob's got the knack," says Singly. It turned out only slight tweaks were needed to optimize the SuperTruck kit's shapes. With a similar method, he was also able to identify the best possible shapes for his subsequent project, the Alpha Concept Vehicle.

The sponsorship from SolidWorks included not only a seat of the software, but also a training class. Singley drove to SolidWorks' Concord, MA, headquarters, and spent two days learning the computational fluid dynamics (CFD) program.

"It was a breeze," he says. "It was so intuitive … It was just very easy to pick up. There are certainly some principles involved in aerodynamics, but you can get those off the web anyway. What it really comes down to is just trying stuff."

Though digital experimentation, Singley discovered that "sometimes, adding something to the hood can have effects 20 ft. behind the truck. The analysis software offers so many ways to look at that—surface plots, pressure probes, etc."

Dealing with Vacuums

The biggest drag that hampered a truck's agility, Singley discovered, was the square-shape back end. "There's a huge vacuum back there," he notes, "and the effect stretches many hundreds of feet behind the truck."

Building on tricks he'd learned from Sliwa, Singley figured out that he could reduce turbulence by introducing a more curvaceous boattail and redesigning the skirt, which also provides surface area for sponsorship logos to appear. However, he's still grappling with the air trapped in the underside of the truck. It may be a problem many truck designers are willing to accept as inevitable, but, Singley admits, "Bob and I are both perfectionists, so we keep looking at it and asking, 'Well, what else can we do?'"

In his photo-realistic rendering of the SuperTruck presented to potential sponsors, Singley added the current sponsors' logos on the skirt of the model as decals (2D image projected on 3D surface). If AirFlow Truck receives more sponsors, Singley envisions having trouble fitting more logos onto the skirt.

Earlier this year, a 3D-printed fused deposition model of the Alpha Concept Vehicle made its debut under a glass case at SolidWorks World 2011. Meanwhile, with about 20 corporate sponsors fueling the project, the SuperTruck now moves from digital design to physical prototype. Currently, the kit includes the hood, bumper, skirts and an extensive package of mechanical fuel-saving improvements. If all goes well, the beta version of Sliwa and Singley's SuperTruck will literally hit the road in October. **DE**

Kenneth Wong *is* DE's *senitor editor and writes* DE's *Virtual Desktop blog at deskeng.com/virtual_desktop. You can follow him on Twitter at KennethwongSF, or email him via de-editors@deskeng.com.*

INFO → Airflow Truck: AirflowTruck.com

→ Jeremy Singley Industrial Design: JeremySingley.com

→ DS SolidWorks: SolidWorks.com

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HP recommends Windows® 7.

Don’t Settle for a Good Enough Design

HP Z800 Workstations let engineers deliver the best designs without taking additional time.

BY PETER VARHOL


Screen image courtesy of ANSYS

Many design engineers are quietly frustrated with the work they do. They create good designs, and are rightfully proud of them. Yet they dream of being able to do even better work, with more time or better tools. Too often the pressures of delivering designs to meet schedules or market windows can take the challenge and enjoyment out of doing the best job possible.

With HP Z800 Workstations, they don’t have to settle for time-constrained designs. With dual Intel® Xeon® processors and up to 12 cores, these workstations provide greater performance than a supercomputer of just a few years ago. With up to 192GB of memory, few engineering workloads are too large for a HP Z800 Workstation.

But it’s also more than simply a single-use computer. Using Parallels Workstation Extreme installed on the HP Z800 Workstation, engineers can use their high-performance workstation to play host to several virtual computers with different applications and even operating systems running simultaneously. Within a single HP Z800 Workstation, engineers can allocate the number of Intel Xeon processor cores they need for their interactive work, while reserving the remaining cores and system resources for compute-intensive operations such as finite element analysis (FEA).

Virtualized for Compute-Intensive Jobs

This approach is driven by HP and Parallels’ implementation of Intel’s VT-x2 hardware virtualization technology and working together to apply it to workstations clusters and analysis applications engineers use every day. The Parallels technology opens a new world of virtualization on HP Z Workstations, and provides the software that separates computer resources into independent groups so they can be operated as different virtual machines. Using Parallels Workstation Extreme on a single HP Z Workstation, two or more simultaneous jobs don’t share the same resources, so there is no contention for memory or processing power.

This approach means that design engineers working on a single workstation can literally do two or more things at once. They can work on one part of a design, while the remaining computing resources can be used to run a Monte Carlo simulation or FEA with ANSYS on a separate virtual machine. Without Parallels Workstation Extreme, the engineer would be forced to wait for results of the analysis before they could continue to work on the design.

The true advantage of doing two or more things at once is that engineers are able to test and evaluate more alternatives in a given period of time. Rather than settle for the first design that meets specifications, engineers can use this approach to look for something better. By going through an iterative design process, while getting feedback from simulations run on the virtual machine, engineers can improve a design while not extending the schedule.

Working Together for Even Better Performance

This use of workstation virtualization also provides a new opportunity to link the virtual machines into localized high-performance computing clusters. In an engineering group, it’s possible to take the virtual machines running on HP Z800 Workstations and network them together, producing a computational cluster capable of running analyses and simulations.

The HP Z800 Workstation is an ideal workstation for these kinds of operations, supporting dual Intel Xeon processors and up to 192GB of memory, it has more than sufficient power to handle this task. Portions of both processors and memory can be allocated to the virtual machines, so engineers control what computing resources are directed toward which activities. The HP Z Workstations comes standard with two gigabit Ethernet controllers. This enables engineers to connect to their enterprise network on one controller and to a private network sharing their computer resources with other workstations in a workstation cluster.

With an HP Z800 Workstation with two Intel Xeon Processors and Parallels Extreme Software, engineers can do two things at once. The end result is a better design, while still keeping to the project schedule. You don’t have to settle for good enough. **DE**

For more information on an HP and ANSYS Solutions please go to www.hp.com/go/solver or call 800-888-0261.

Reinventing the Transit Wheel

The Altair BUSolution Project rolls out a hybrid model with 30% better fuel economy.

BY KENNETH WONG

Digital prototyping, a term adopted by design software maker Autodesk as its motto, is also becoming the mantra of leading simulation software developers. It's understandable: The proposition to substitute foam and clay models with digital models favors software makers' bottom line.

Automotive and aerospace manufacturers seem to have found value in this approach. In many operations once accomplished with physical mockups and scale models, top-tier car and plane makers now use a variety of digital replicas (CAD models for design evaluation, mesh models for simulation, polygon models for visualization, and so on). So, why are engineers from simulation software maker Altair Engineering personally getting involved in the construction of a full-scale, 40-ft. model of a transit bus?

THE LCO-140H has a lightweight aluminum construction. Structural support was placed according to analysis results.

The LCO-140H, which stands for "low cost of ownership, first 40-ft. hybrid vehicle," is a life-sized, operational model. It's the centerpiece of Altair's BUSolutions project—and a testament to Altair engineers' belief that theoretical findings should be backed up with real-world tests. The project is hybrid in more than one way. It's a private-public partnership, realized in a physical-digital workflow.

How It Began

In 2004, Altair and Automation Alley, Michigan's largest technology business association, received a $550,000 federal grant to design and build two prototype buses powered by state-of-the-art technologies. The plan is to make the models available for sale to transit authorities across the U.S. when they become a reality.

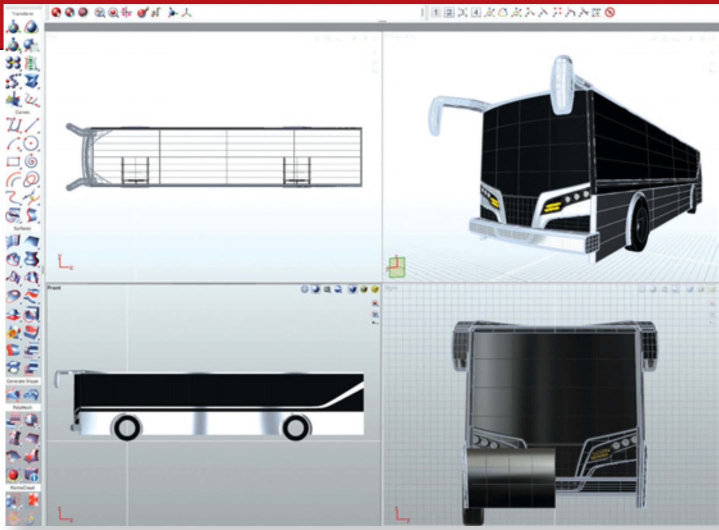
"The program started as an Altair initiative, where we wanted to demonstrate our engineering technologies on a transit bus," recalled Jeff Hopkins, BUSolutions design manager for Altair ProductDesign. "We chose the transit bus because that industry was really not up to par with the standards in the automotive industry. Our objective was to produce a transit bus with a low cost of ownership—plain and simple."

Eventually, BUSolutions received public funding from FTA and the Michigan Economic Development Corporation, and the Detroit Department of Transportation, along with sponsorship and assistance from Suburban Mobility Authority for Regional Transportation (SMART), Parker Hannifin, Meritor (a drivetrain system supplier), PRAN (a control systems provider), and other private entities.

When the first prototype bus was ready for action, Altair drove it to the Proving Ground in Romeo, MI—a 3,880-acre, 100-mile driving ground maintained and operated by Ford for real-world vehicle tests.

According to the U.S. Federal Transit Administration's report titled "Transit Bus Life-Cycle Cost and Year 2007 Emissions Estimation," the cost of a diesel-electric hybrid is $531,605, and its lifecycle cost is $987,176. Altair's model would cost $410,000, with a lifecycle cost of $725,020.

Altair points out, "The LCO-140H Series Hybrid Hydraulic bus more than doubles the fuel economy of today's diesel powered buses and offers transit authorities the opportunity to reduce fleet costs by 20% while dramatically



SOLIDTHINKING was used to quickly evaluate multiple design themes for the transit bus.

lowering emissions. With a purchase price over $100,000 lower and 30% better fuel economy and lower emissions, the lifetime cost to own a LCO-140H Series Hybrid Hydraulic bus is estimated to be 30% less than hybrid electrics."

The Best of Both Worlds

Two notable features of Altair's bus design are the bus' hydraulic hybrid powertrain and its lightweight aluminum structure. The powertrain deployed by Altair's bus is distinctly different from the electric hybrid variety used by some, notes Hopkins. He explains, "For instance, when restoring regenerative energy from the breaking system, about the best you can get from an electric hybrid system is 25% of the energy recovered off the road. With a hydraulic hybrid, you're talking in excess of 70%."

In designing its powertrain, Altair used Parker Hannafin's pure series hydraulic hybrid powertrain. According to Altair, Parker's system is "unique in that the engine is not connected to the rear wheels of the vehicle. This decoupling of the engine from the drive wheels offers several advantages, including: the ability to recover and store as much as 70% of the energy from braking, reduced brake wear, which extends brake life; an engine management system that optimizes the vehicle's engine for reduced fuel consumption; the ability to drive the vehicle with the engine off, significantly reducing carbon emissions in depots and contributing to reduced fuel consumption."

Because of the number of frequent stops along a transit bus' route, the chosen powertrain system is expected to offer significant cumulative benefits over the vehicle's lifetime.

As a cost saving measure, Altair engineers relied primarily on the digital mockup for their experiments, such as different placements of internal components and configurations of length and height of the chassis to make the bus structurally sound.

The bus, according to Hopkins, was designed with a clean sheet approach. "This enabled Altair to do things right from the start," he said. "When you start with an existing design you need to make compromises to make things work. Because Altair had full control from the digital model through the physical build, we were able to do things right the first time."

The initial digital model of the bus was built in SolidWorks, a 3D mechanical design software. Later, it was refined using solidThinking, a conceptual design and styling software from Altair. Tim Smith, director of design engineering, Altair ProductDesign, explains, "From an industrial design standpoint, the ease of use of solidThinking in capturing aesthetic design intent, enabling easy modification, and reuse of existing geometries through the feature ConstructionTree made organization seamless in the design process. This work process allowed multiple design themes to be generated very quickly and allowed quick evaluation within the context of the overall bus structure through the data interoperability between solidThinking and SolidWorks' CAD package."

In designing the bus, Altair's use of digital simulation helped engineers identify potential problems in advance, especially in the diagonal members visible from the front and rear windows of the bus. "The bus wants to grow organically. If you look at our design, you'll see that we've made room for that," said Hopkins. "Typical buses confine the structure to orthogonal members. When Altair's topology software was applied, we let the material grow where it wants to be, and many times that isn't a perpendicular intersection. In this case, the analysis identified a load path through the front and rear windows, and that is where we gave it structure."

Hybrid Transit on Display

In September, Altair's LCO-140H was publicly unveiled at a technology demonstration. (For a report from the event, read "Altair Engineers Think Big to Build a Better Bus" at deskeng.com/articles/aabcag.htm.) The bus was also on display at the American Public Transportation Association Expo (Oct. 2-5, 2011) in New Orleans, Louisiana.

Mike Heskitt, chief operating officer at Altair ProductDesign, said, "BUSolutions demonstrates Altair's expertise and capabilities as a concept-to-release, full vehicle development partner." Going forward, as the bus gets closer to commercialization, Altair will seek to implement additional features, such as a swing-away and folding seat for handicap seating. DE

Kenneth Wong, *is senior editor of* Desktop Engineering *magazine. He can be reached via de-editors@deskeng.com.*

INFO ➜ Altair Engineering: altair.com

➜ **DS SolidWorks:** solidworks.com

➜ **Automation Alley:** automationalley.com

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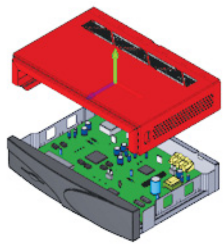
Editor's Picks

by Anthony J. Lockwood

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



Low-Cost Application Creates 3D PDFs

Share3D PDF publishes interactive PDFs from major CAD formats.

QuadriSpace has released a new application for translating your 3D CAD models into interactive 3D PDFs. It seems to do all that I would need to wow clients with a nifty interactive 3D PDF for a $99 introductory price.

Share3D PDF is an entry-level product that gets you into 3D publishing fast. But it's not "entry-level" entry-level. It provides you with the ability to take a 3D DWF, Inventor, Rhino, SketchUp, or SolidWorks file and convert it to a PDF that readers can pan, zoom, and rotate with Adobe Reader 9 or higher. (An optional module is available for PTC Granite .asm and .prt file formats as well as ACIS, IGES, Parasolid, STEP, and VDA.)

MORE ➔ deskeng.com/articles/aabbsm.htm

National Instruments Introduces LabVIEW 2011

25th anniversary version of system design software.

Awhile back I was in Austin, TX, at the National Instruments Graphical Systems Design conference, which is the company's annual user conference and partner exhibition. One of the highlights of the NI event was the introduction of LabVIEW 2011. This happens to be the 25th anniversary version of this system design software and my 16th year writing about it. What can I tell you that you don't know? LabVIEW is everywhere, and it is mission critical wherever it's at work.

LabVIEW 2011 has 13 new features requested by users, a new palette of controls and indicators, and more than 20 new math and signal processing functions.

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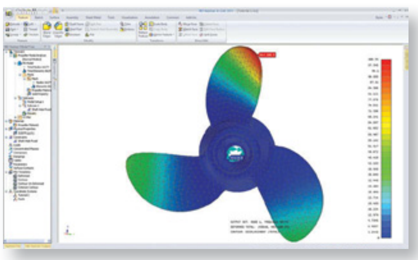

NEi Software Introduces NEi Nastran in-CAD 2011

Finite element analysis solution delivered in a 3D CAD environment.

NEi Nastran in-CAD is a finite element analysis (FEA) application that combines mixed (feature-based and direct-editing) 3D design and drawing, pre-/post-processors, and Nastran solvers in one associative environment. Not only does NEi Nastran in-CAD post-processing create images, graphs, data, and visualizations of your simulation results but, since it also outputs Nastran file formats, its output scales to higher-level analysis if you need it.

The NEi Nastran in-CAD modeler itself is a Windows-based, fully associative modeling engine with what seems like a full palette of tools for model creation and manipulation.

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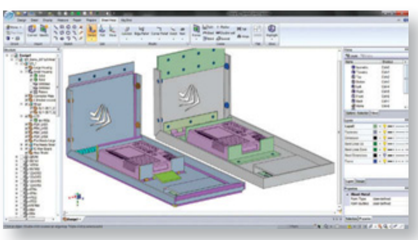


SpaceClaim Announces SpaceClaim Engineer 2011+

Update said to offer advances from concept modeling through manufacturing.

SpaceClaim was one of the first outfits to advance the idea that direct modeling working in parallel with parametric modeling held a key to design and manufacturing process efficiency. Like any insight, SpaceClaim was first met with raspberries. Now everyone talks their talk.

SpaceClaim has just released the 2011+ version of its SpaceClaim Engineer 3D direct modeling system, and it seems to advance its direct modeling vision a bit further. This edition sees improvements and upgrades with the software's concept modeling, design review, and simulation capabilities. It also offers extensive new manufacturing features.

MORE ➔ deskeng.com/articles/aabbzy.htm

1 Eurocom Announces New Mobile Workstation

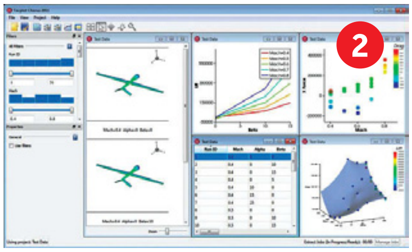
Eurocom Corporation (eurocom.com) is now offering its Neptune mobile workstation, which is designed to support NVIDIA (nvidia.com) 3D Vision with NVIDIA GeForce GTX 580M and 560M GPUs. EUROCOM offers 3D Vision support on the Neptune Mobile Workstation through a built in-emitter, 3D active shutter technology, a 120Hz display and supported NVIDIA graphics cards.

CCE Updates EnSuite Software

CCE (cadcam-e.com) announced an update to its EnSuite software. The new release provides the ability to read and write CATIA V5 R21 and Solid Edge ST4 files without requiring a license of the respective CAD systems. According to the company, EnSuite provides quick access to engineering information residing in CAD data, no matter which CAD system was used to author it.

Digi-Key Launches New ToolsXpress TechZone

Digi-Key (digikey.com) has launched the ToolsXpress TechZone to provide engineers with information on evaluation/development kits and tools for some of the most prominent silicon suppliers in the market, including OEM boards, wireless modules, programmers, emulators, and software.

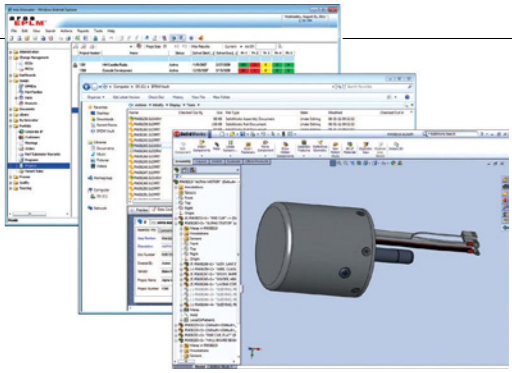


2 Tecplot Inc. Releases Tecplot Chorus

Tecplot Inc. (tecplot.com) has announced the release of Tecplot Chorus, a simulation analytics solution for engineers that integrates metadata analysis, post-processing, and simulation data management in one software tool. Tecplot Chorus helps engineers discover trends and anomalies in computational fluid dynamics (CFD) studies and gain insight into the underlying, fluid-dynamic phenomena that cause these variations.

ViaCAD 2D/3D App Available

Encore Software's (punchcad.com) ViaCAD 2D/3D v8 design product is available in the Apple App Store. The software now includes a new push/pull tool for planar objects and faces of solids. It also allow users to interactively translate, rotate, and scale faces with the gripper, and dynamically create linear and polar arrays of features.



3

Appro Reveals Xtreme-X Supercomputer

Appro's (appro.com) Xtreme-X Supercomputer is based on the upcoming AMD "Interlagos" processor and the Future Intel Xeon processor E5 Family. It will support 2 and 4 socket platforms based on the future Intel Xeon processor E5 Family with design support from Intel's forthcoming 'Many Integrated Core' (MIC) and the new AMD "Interlagos" processor. It will also offer a combination of CPU/GPU configuration options with NVIDIA Tesla computing.

Alcove9 Releases v7 Intranet Search Engine for Engineering

Alcove9 LLC's (alcove9.com) flagship product is a third-generation scalable search technology built on an open source platform that is capable of searching tens of millions of documents, drawings and images belonging to thousands of users, according to the company. The cornerstone of the Suite, the a9 Hub, is based on an open source platform that the company says provides instant access to all data.

Concepts NREC Unveils AEDS 2011

Concepts NREC (conceptsnrec.com) has made more than 250 feature enhancements to its Agile Engineering Design System (AEDS 2011) software, including the new Pushbutton FEA module for finite element analysis. AEDS 2011 integrates the stress preparation code, STRESSPREP, into AxCent and adds an FEA solver.

Omega's AHPF Series

Omega's (omega.com) AHPF series heaters are used to heat low flows of air, gas, water, or aqueous solutions with air/gas flow up to 15 CFM and air/gas out temperature up to 430°C (800°F). This 316 Stainless Steel constructed heater can handle pressures up to 100 PSI and 50 watts per sq. in.

3 Aras Releases EPLM for SolidWorks Enterprise PDM

Aras' (aras-eplm.com) new solution is designed specifically for companies that run SolidWorks. Built on top of SolidWorks Enterprise PDM, the company says Aras EPLM is a scalable and secure business-ready solution for new product development and introduction, complex configuration management, enterprise change management, outsourced manufacturing, quality compliance and more. DE

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Cool Tools

Contex HD Ultra Wide Format Scanner

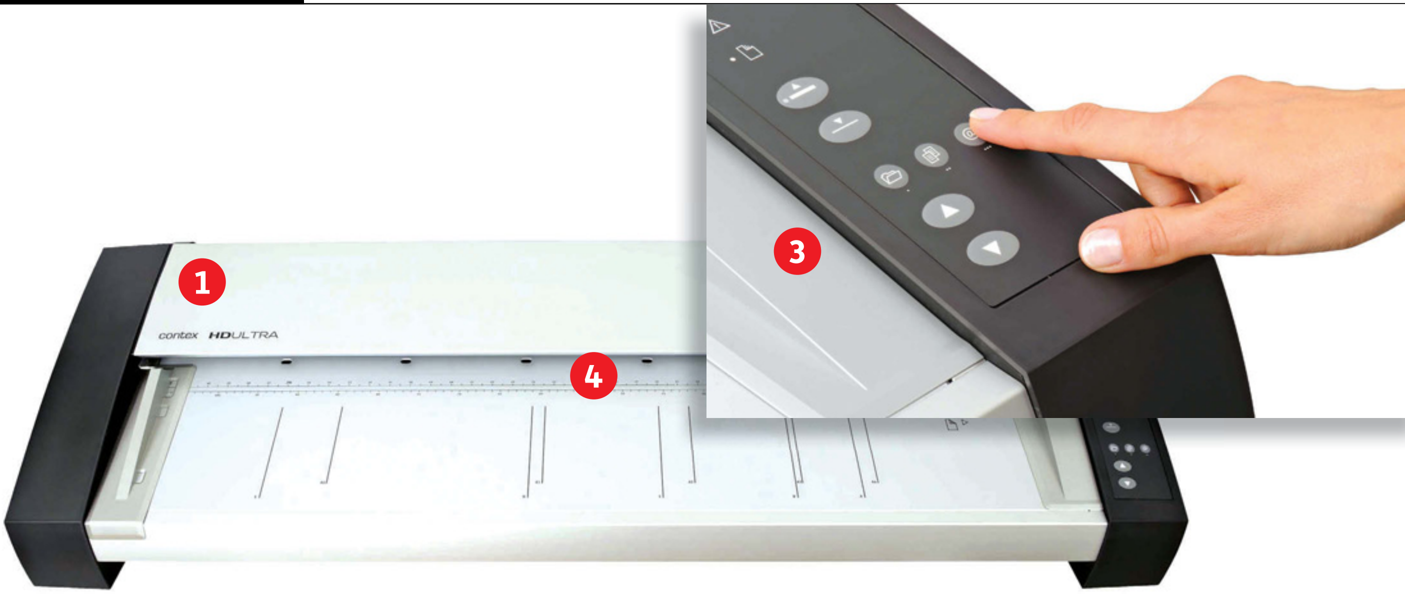

Image Quality

1 The Contex HD Ultra scanner features new precision camera technology, intelligent calibration, and an AccuColor enhancement algorithm, according to the company. The HD Ultra Professional's scanning resolution is 1200x1200 dpi, while the HD Ultra Office features 600 dpi resolutions. The HD Ultra has 48-bit color capture and processing.

Options

2 The Contex HD Ultra line comes in a Professional version for high-volume applications and an Office version for occasional use or walk-up scanning. The HD Ultra will also be available as a multi-function product (MFP), which includes a high stand that allows users to combine the wide format scanner with most large format inkjet and LED printers.

Convenience

3 SnapSize, Contex's optical sensor technology, lets users automatically switch between different-size documents. SnapSize recognizes a standard-size document as it is fed into the scanner, and then optimizes the scanner's setup for that particular document. Another feature, SmartShare, lets users connect to a LAN, so that any computer in the workgroup can access the scanner. The scanner also features FlexFeed with removable, no-rewind paper return guides, right-side loading, funnel-shaped feeding and a new exit tray.

Scan Speeds

4 The Contex HD Ultra Professional delivers up to 6-in. per second scanning speeds and 597 color scans per hour. It is built with Contex's next-generation xDTR2, an extended data transfer rate with Gigabit Ethernet and USB2. The HD Ultra Office features 1-in. scanning per second in color. The scanner is also designed to improve document management, which Contex says allows it to scan twice as many documents per day as its previous scanning solutions.

TECH SPECS

According to the company, the Contex HD Ultra 4250+ and 4290i+ Professional specifications include:

- 1200 dpi optical resolution and 9600 dpi maximum resolution.
- 42-in. maximum scan widths and 44-in. maximum media widths.
- 0.6 in. maximum media thickness.
- Accuracy of 0.1% +/- 1 pixel.
- 48-bit color data capture and 16-bit mono data capture.
- Dimensions of 52.8 x 18.7 x 7.9 in.

For more information, visit contex.com/details

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