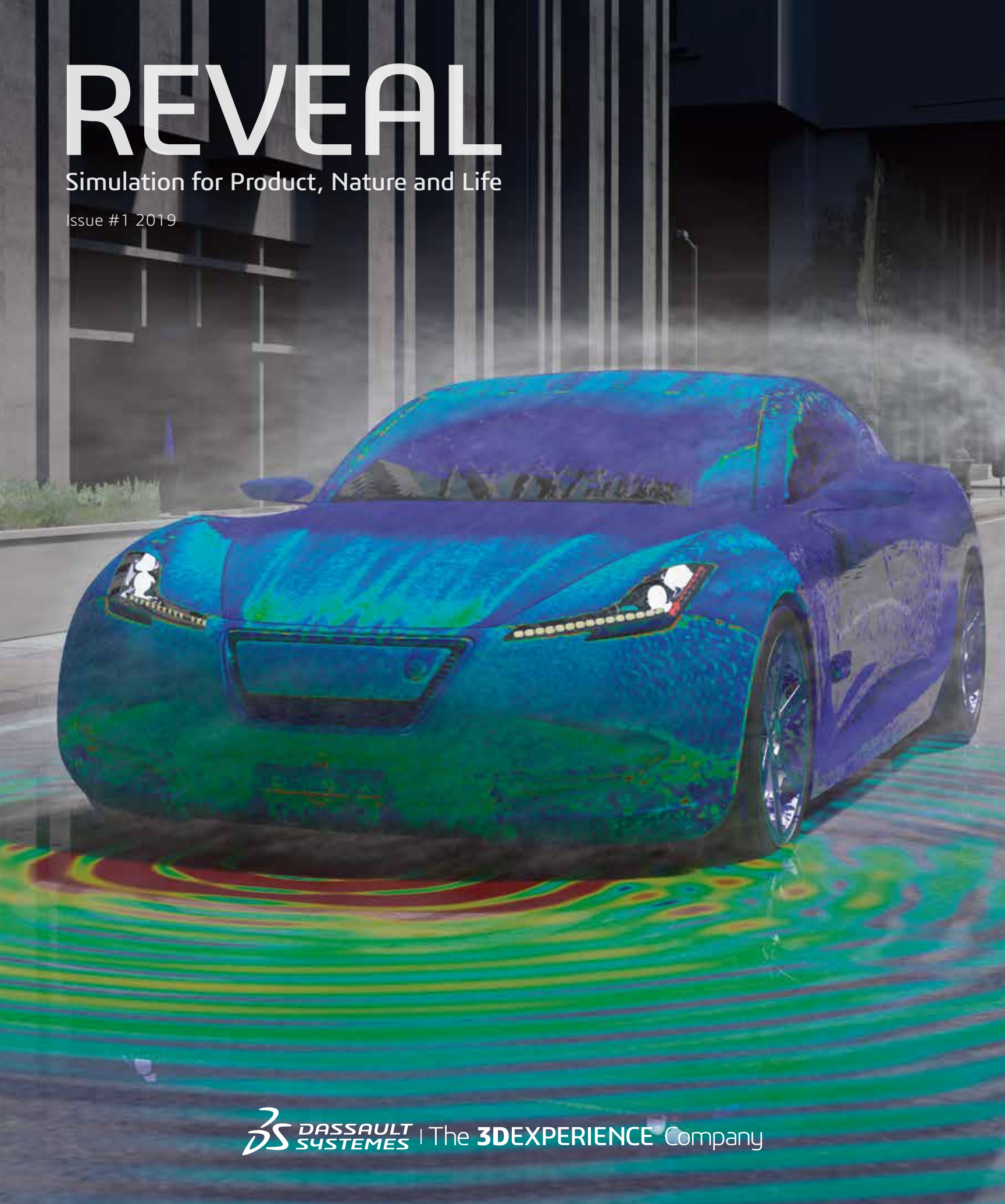

REVEAL

Simulation for Product, Nature and Life

Issue #1 2019

DASSAULT SYSTEMES | The 3DEXPERIENCE® Company

In this **Issue**

REVEAL

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PHOTO BY TODD SABELLI

REVEALING A MORE SUSTAINABLE WORLD

As more and more people wake up to the real need for sustainable solutions in our world today, we at SIMULIA find ourselves looking at how simulation and design can impact humankind's footprint on the planet. What if you could design out waste and pollution, or create robust parts with less material? This is what we call the handprint. With the **3D**EXPERIENCE® platform, we deliver solutions that drive transformative, generative engineering that is accurate, reliable and accessible. Now, as we look toward the future, we are assessing how those solutions can be leveraged to Reveal the World We Live in and to make that world a better place.

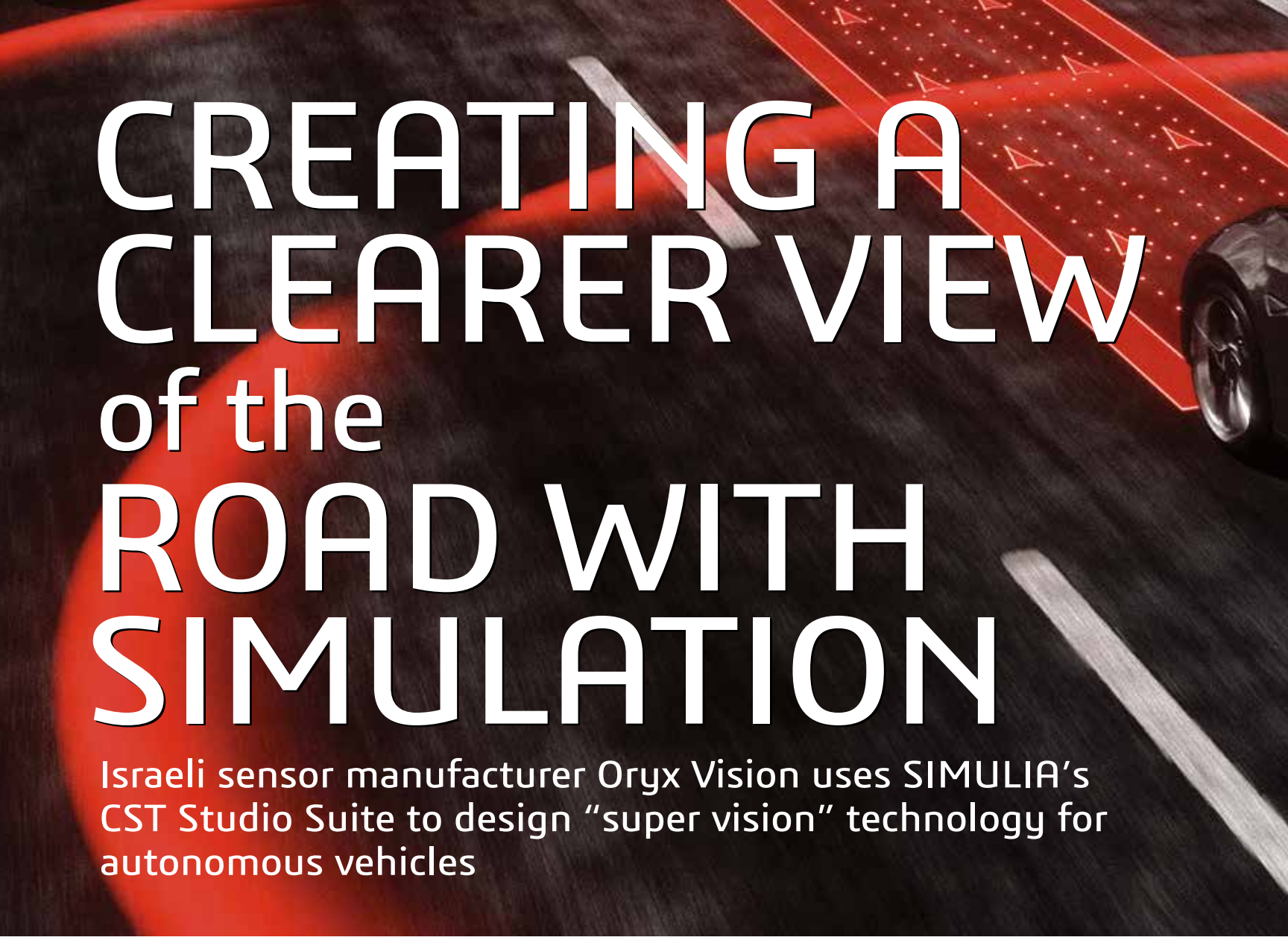
New regulations are taking effect across the planet to promote sustainable living; for example, the Worldwide Harmonized Light Vehicles Test Procedure (WLTP), which you will read about in this issue (pg. 14), is changing the way we measure automobile emissions and holding manufacturers to a higher standard for fuel efficiency. Designers, engineers and manufacturers in all industries are thinking creatively in order to design products that are better for both consumers and the planet they inhabit.

Simulation is a key player in sustainable innovation, and thus we are seeking a broader reach that expands beyond our user community to address the many developments in simulation today. Will there be a connection between transportation and sustainable power in the cities of tomorrow? Is it possible to harness the energy of the ocean without disrupting its ecosystem? Is there a way to reinvent packaging with the environment as our top priority?

As part of our evolution, we want this magazine to become a more social and interactive experience. Our community is a critical part of who we are as a company, so we want to welcome you as participants in our future, not just observers. In this issue we are trying out some new things that we think you will enjoy. We are sharing novel science innovation, academic inspiration and simulation stories with a global impact.

We deeply value our reader's and your opinions and insights. Our community is a bright and creative one, and we invite you to build and grow along with us as we move toward the sustainable future. Please let us know what you think of the changes we are making—what works for you, what doesn't work, and what else we can do to improve our publication. Our world is evolving, hopefully for the better, as we, the planet's inhabitants, work together toward a more sustainable way of living. We hope that our magazine reflects that viewpoint as we aim to inspire and share stories, interviews and news with our readers about the world we all live in.

SUBHAM SETT
VP of Marketing and Strategic Initiatives, SIMULIA



CREATING A CLEARER VIEW of the ROAD WITH SIMULATION

Israeli sensor manufacturer Oryx Vision uses SIMULIA's CST Studio Suite to design "super vision" technology for autonomous vehicles

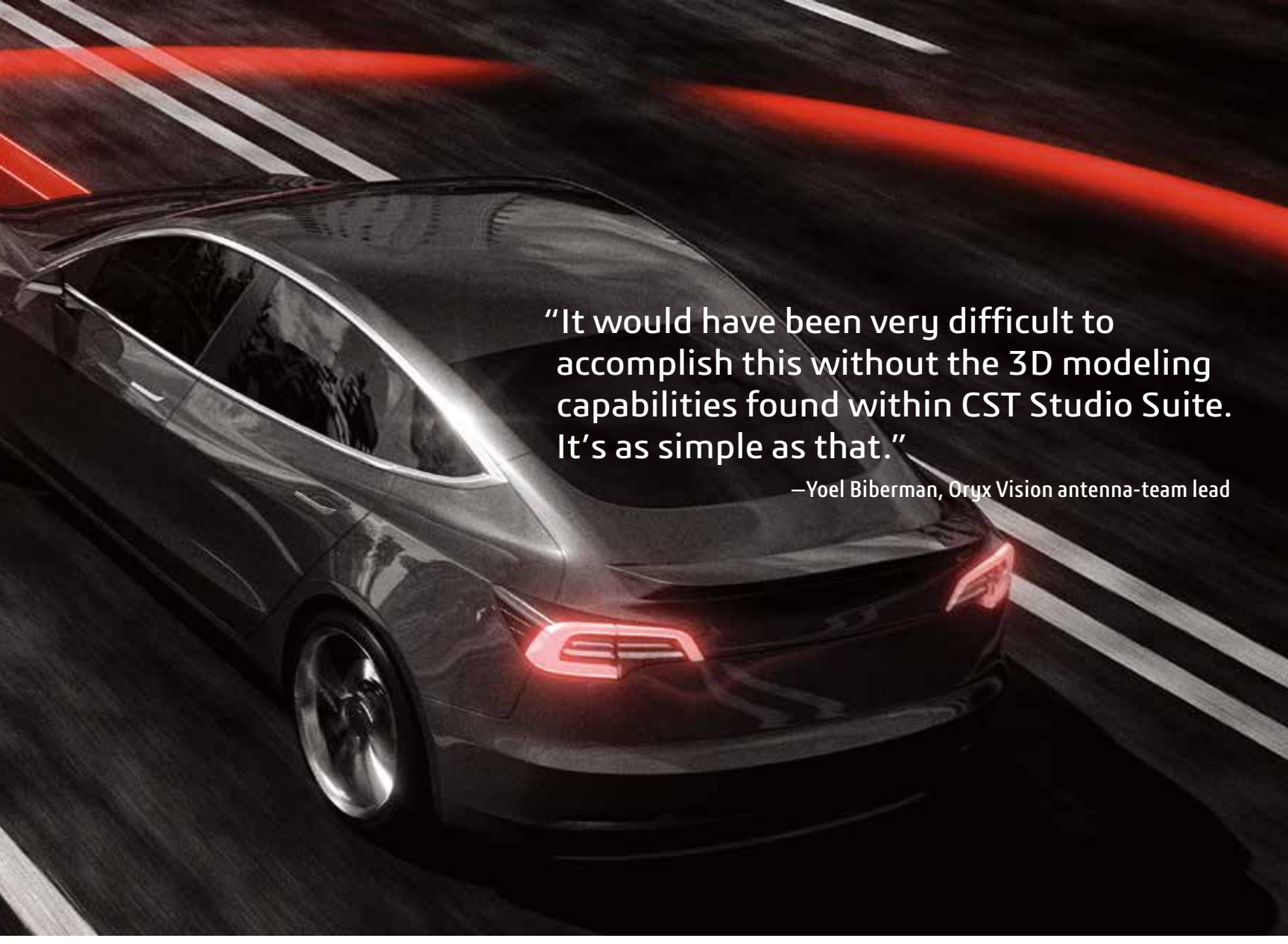
Autonomous vehicles are all the rage these days. From the promise of app-controlled driverless taxis to relaxing in the back seat while your robo-chauffeur drives you to work each day, taking human drivers out of the loop promises to make personal transportation both more convenient and safer. People can only look in one direction at a time, but potential hazards can appear from anywhere. Driving could be made significantly safer, if only your car could watch every angle for you.

SEEING THE LIGHT

Enter Oryx Vision. The brainchild of company founders Rani Wellingstein and David Ben-Bassat, the Israel-based sensor manufacturer is raising the bar on self-driving vehicles by greatly increasing all that they can see. If the car can see it, chances are better it can avoid it. The company's mission is not only to improve vehicle vision, but to replace existing bulky and expensive sensors with a sleek, lightweight and mass-producible chip.

Oryx Vision antenna-team lead Yoel Biberman says it's no easy task, but high-performance electromagnetics (EM) simulation software has made his team's work more manageable. "The CST Studio Suite from Dassault Systèmes has a powerful but friendly user interface," he explains. "Whether I need to perform frequency-domain verification of an antennae structure, share data with one of the mechanical engineers, or do any sort of complex simulation or design optimization, CST is the right tool for the job."

Biberman and his team members use SOLIDWORKS® for their CAD modeling needs. They are impressed with the two-way flexibility between it and the CST Studio Suite, which is integrated with the full range of design engineering tools on the **3D**EXPERIENCE platform. This enables the analysis of thermal, mechanical and other multiphysics challenges that can arise as a design evolves.



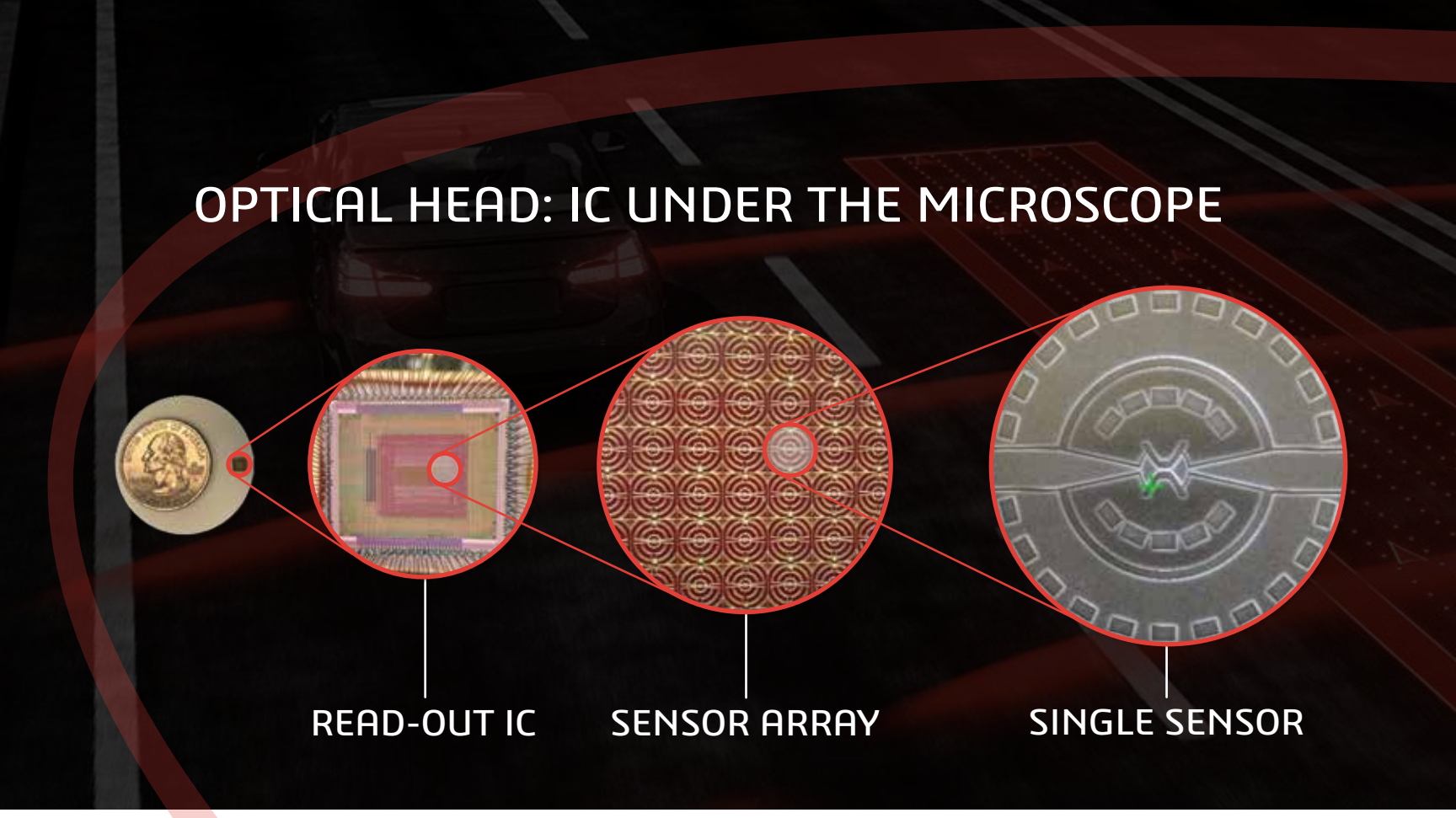
BUILDING BETTER VISION

But is this technology even necessary? Well-known companies such as Tesla and Google have logged millions of miles with their autonomous vehicles, and accidents have been few and far between, with these and other companies learning valuable lessons along the way. Do we really need a better set of eyes for our self-driving cars?

Ben-Bassat, who aside from his role as the co-owner of Oryx Vision is also the vice-president of research and development (and Biberman's boss), says we absolutely do. Where most automakers rely on a combination of cameras, radar, LiDAR (light detection and ranging), and sensor technology to visualize a car's surroundings, his company has created a revolutionary super-LiDAR that relies on silicon-based microscopic antennae to detect light waves. "Our coherent, frequency-modulated LiDAR achieves a signal-to-noise ratio one million times better than current competing technologies, and can be produced in volume at a fraction the cost," he says.

Other technologies may have the lead in market share so far, Biberman acknowledges. One CEO of a notable automaker suggests that an array of cameras together with a 70-gigahertz radar is all a car needs. Another proposes filling the car with sensors and connecting it to a cloud-based computer system—while the sensors provide a view of the immediate surroundings, the real-time cloud connectivity means the car can better avoid traffic jams and adverse road conditions.

"The advantage of LiDAR is its high resolution," Biberman says. "It works within a very short wavelength, which gives it the ability, for example, to identify a road marking or an obstacle at a fairly long distance—say 100 meters or so. But the disadvantage is the energy equation: LiDAR is not terribly efficient. Also, the photoelectric effect makes it non-coherent, meaning it can see objects but only statically—there's no Doppler effect, so traditional LiDAR can't tell whether something is coming towards you or moving away. What we've done is combine the high resolution of LiDAR with the high efficiency and coherency of radar, giving us a best-of-both-worlds advantage."



RAISING UP THE ANTENNAE

Though effective, the high efficiency of Oryx Vision's was challenging to achieve. The engineering team started by designing a virtual antenna in CST. After manufacturing, they measured the antennae using AFM (atomic force microscope) and imported the acquired 3D data into CST using SOLIDWORKS. Their goal was to verify and quantify the effects of the individual layers covering each dipole antennae, while also determining their geometry.

"This approach allowed us to conduct various experiments on the physical dimensions of each dipole, to determine and then verify the optimal ratio of each within the array," says Biberman. "It would have been very difficult to accomplish this without the 3D modeling capabilities found within CST Studio Suite. It's as simple as that."

With the correct physical configuration was confirmed, Oryx Vision applied semiconductor manufacturing techniques to build a microscopic array containing tens of thousands of individual antennae. The team placed their solid-state depth-sensing sensor system inside an "optical antenna chamber," giving them an opportunity to measure its various functions. The results were as predicted by the CST Studio Suite.

Because of their efforts, the "world's first coherent frequency-modulated flash automotive LiDAR" now provides previously unachievable depth-sensing capabilities. It is not "blinded" by bright sunlight (or even other LiDARs) as some systems are. It can be produced in large quantities at a significantly lower price point, but offers a longer operating range, greater precision, and a "richer" view of its environment.

NEXT STEPS

"I've worked at several other electronics companies and each of them used CST Studio Suite," says Biberman. "I can't imagine anyone trying to design antennae such as the one we have built without such an advanced simulation tool, especially considering the constraints we are under. There are literally thousands of miniature antennae on a chip just millimeters in size. It has no moving parts, and it works exceedingly well. It's quite simply a game changer."

Ben-David and Wellingstein agree. Having secured $50M in funding recently to pursue their groundbreaking technology further, Oryx Vision co-founder Wellingstein was quoted in a recent article as saying, "Oryx is building the first solution that will meet all the key requirements of automotive LiDARs—high performance, car durability and low price—without a trade-off. We are delighted to receive a vote of confidence in our vision from such sophisticated investors, and to have the resources to bring this technology to market quickly and at the highest quality."

For More Information
www.oryxvision.com

RESPONSIBLE PACKAGING: WHEN EVERY GRAM COUNTS

Amcor Rigid Plastics uses Abaqus FEA to reduce waste, design better products

It's something that many of us take for granted: you twist the lid off a plastic bottle, consume the iced tea or soft drink within, and never give a second thought to the container except when you drop it in the recycling bin. If the bottle is poorly designed, you might complain about its flimsiness, and how it collapses if squeezed too hard, but as long as the thing doesn't spill all over your lap, who cares?

Hansong Huang does. As the director of advanced engineering at Amcor Rigid Plastics, he and his colleagues spend their days designing plastic containers that are both lightweight and strong, yet meet the additional customer requirements of being aesthetically pleasing and cost-effective to manufacture.

It's not an easy job. With concerns on the rise globally over sustainability and the environment, never mind the need to meet the demands of an increasingly competitive marketplace, Huang faces tremendous pressure to design robust packaging that uses less raw material, and does so in as short a time at the lowest cost possible.

Without Abaqus Unified Finite Element Analysis (FEA) software from SIMULIA, the Dassault Systèmes brand for realistic simulation, meeting those goals would be extremely difficult, if not downright impossible. "We pride ourselves on having some of the highest performance, quality, and speed to market in the industry," he says. "Starting with the product's design all the way through to end of its lifecycle, Abaqus helps us achieve that."

ART AND SCIENCE AT AMCOR

Amcor Limited boasts more than 35,000 employees and 200 manufacturing sites worldwide. The 150-year old company designs and manufactures a wide variety of responsible packaging for the food and beverage industry, healthcare, home, personal products and more. The cup of coffee you drank this morning may very well have come from an Amcor container, as did the yogurt you had for lunch, the TV dinner you will eat tonight, and the blood pressure medication you'll take before bedtime. Amcor is everywhere.

The Amcor Rigid Plastics division is responsible for many of those containers. Headquartered in Ann Arbor, Michigan, its 65 plants and 6600 employees service everyone from Pepsi Cola and Coca Cola to Kraft Foods, Jim Beam to Bausch and Lomb, producing more than 20 billion containers, preforms, and closures annually.

To design these products as quickly and effectively as possible, Huang and the other members of the research and development department in nearby Manchester R&D center use advanced digital engineering techniques that include Abaqus, CATIA and other software tools from Dassault Systèmes. This allows them to move from concept to production within just a few months.

This creasing simulation illustrates how Abaqus makes it easy to test multiple design iterations without the need for expensive prototypes and tooling.

LESS IS MORE

Consider this: shaving off a gram or even a half gram of material from each of the billions of containers that Amcor and its customers produce annually adds up to big savings all around. Because less PET (polyethylene terephthalate) and other thermoplastics are needed, consumption of the fossil fuels used to make them is reduced. This also means less energy used while processing the raw materials, less energy needed to manufacture the finished products, and less burden on recycling and disposal.

Amcor understands all this. Since 2006, the company's lightweighting initiatives have reduced its PET resin consumption by more than 100,000,000 pounds annually. Over the past decade, this has helped to bring down the weight of typical hot-fill beverage bottles by 35-50%. The company has also recently pledged to develop all of its packaging recyclable or reusable by 2025 and use significantly more recycled materials. "Our products protect food, baby formula, juices, etc. that consume resources and energy to produce," says Huang. "By engineering high quality containers that reduce spillage and waste, we probably contribute more to sustainability than many realize."

SETTING A HIGH BAR

Prior to investing in advanced design and simulation software from Dassault Systèmes, Amcor's design process was similar to most in the industry. Engineers would develop a few designs for customer approval, prototype molds were then manufactured, prototype containers blown and tested in the lab. One or two designs would then go into pilot production and be tested in customers' filling lines and supply chains. All those costs and time added up quickly. Engineers had to be conservative, and were reluctant to push the lightweighting envelope. Simulation with Abaqus changed all that.

Today, Amcor designers can quickly and easily generate as many virtual design iterations as they like and validate performance before any metal is cut. Using Abaqus throughout the process, each one can be verified for structural integrity, with potential failure points identified and real-world usage evaluated. With confidence in the virtual process, in-house rapid molding and pilot production becomes more for customer trials than for design iteration.

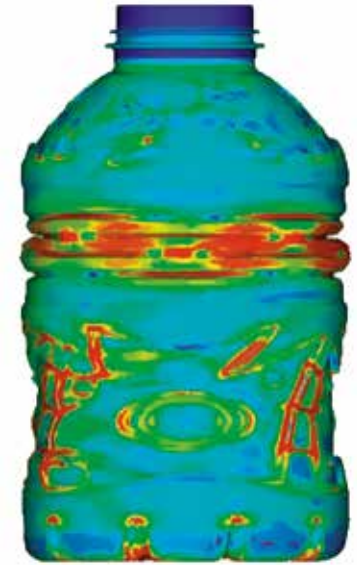
"Our engineering simulation capability is one of the things that make Amcor unique in the industry," says Huang. "We're able to produce some of the lightest containers because we leverage the best engineering tools to accurately forecast potential problems early and optimize our products. Our speed and responsiveness to customer needs sets us apart from our competition."

POWERING THROUGH

Pick up a bottle of Vitaminwater or other leading sports drink and flip it over; see the flower-like pattern on the base? That's called a PowerStrap, and it's Amcor's patented design. It makes the bottle stronger but uses less plastic than competing or legacy designs. So does the ribbed area two-thirds of the way up, and the reinforced section at the top. All of these enhancements were delivered through simulation and finite-element analysis using Abaqus.

There's much more to the lightweighting story than taking material away. Because sports and energy drinks, bottled tea, and flavored water have lower pH levels than their carbonated counterparts, they are more prone to contamination and must be "hot filled" to kill microorganisms. As liquid cools from about 85°C fill temperature, the vacuum generated could collapse the bottle. Instead of increasing weight, Amcor now engineers containers to be flexible in certain areas, such as in the base or ribs, to offset that vacuum while still maintaining overall rigidity.

"Development of a thin-wall structure that is both flexible and strong is difficult enough on its own, but when you add in the need for continuous weight reduction, it becomes a highly technical exercise of optimization," notes Huang. "For instance, we realized a 30% weight savings for a hot-fill sports drink container after more than 60 iterations. We could not have done that without simulation."



Using Abaqus FEA from Dassault Systèmes SIMULIA, designers are able accurately simulate real-world product loading under a variety of conditions.

This Abaqus simulation clearly illustrates side panel displacement when a rigid plastic bottle is subjected to pressure.

REDUCING TIME AND COST FOR COMMERCIAL SUCCESS

The ability to simulate product designs is good for business as well. Engineers regularly use animation and plots to show customers virtual bottles, and help them understand the complexity behind their design and manufacturing. Says Huang, "Having a visual illustration makes it easier to convince customers that removing that last gram of material they want could actually be a bad idea."

Once the ideal design for a given set of requirements is determined, Abaqus makes it easy to share the design with the customer and ask for approval while still in the concept stage, long before prototyping. The outcome is less risk downstream, greater customer involvement and more confidence up front.

Since the concerns over investment in prototype tooling and testing are vastly reduced with Abaqus, Amcor engineers are now free to brainstorm new ideas and prove them out. Achieving an optimal design is no longer a luxury, but rather necessary and increasingly expected. Industrial designers and engineers can afford to iterate designs daily for the lightest possible bid with confidence. And, for example, if something does go wrong—such as a container bulging out when dropped—simulation can provide a solution in just a couple of weeks to get a project back on track.

Abaqus has also helped make the Amcor R&D team more effective. Having well-documented performance reports generated in Abaqus means never needing to start a project from scratch. Each new product design leverages what worked before.

PUSHING THE LIMITS AND DRIVING INNOVATION

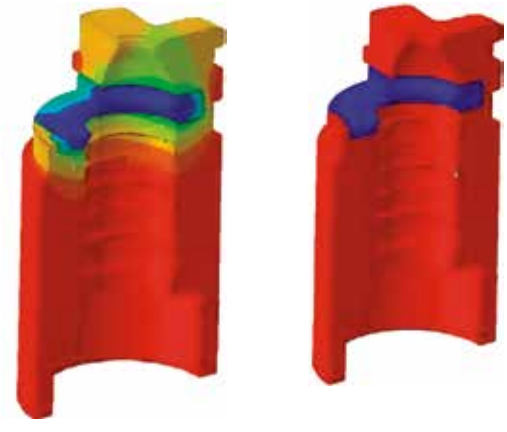
With two young children of his own, Huang is understandably concerned about preserving the environment for future generations. That's one of the reasons he'll continue to push for lighter, stronger products that use less material. In the case of the PowerStrap base design concept driving 20-30% weight saving across hot-fill products, the development leaned heavily on a concept-to-product simulation process using Abaqus as well as SIMULIA's Isight optimization software for virtual DOE. Says Huang, "Simulation was a critical component in this development from literally paper sketches to millions of bottles. As a result, we were able to bring the concept to market in less than three years, compared with typical six to eight years previously. Our new concepts are maturing even faster."

Recyclability and reusability are front-and-center in Amcor's R&D strategy. "In exploring new polymer materials made from renewable sources, their properties are plugged into simulation to predict performance and cost position in a realistic context," says Huang. "As one of many examples, in overcoming the environmental cracking of re-usable carbonized containers, simulation was leveraged to reduce the stress level and increase the reuse cycle."

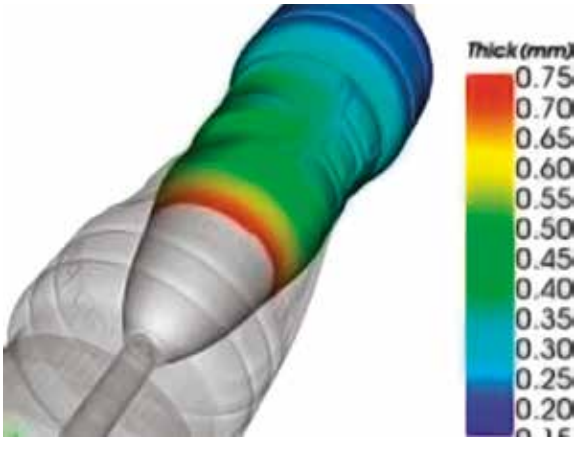
"Obviously, we would need a great deal of support from society to meet our pledge," he says. "As we launch products with our goal of 100% recyclable and reusable in mind, there remain plenty of challenges to be tackled with our customers and suppliers in the areas of longevity and reusability. Simulation is a valuable tool for this."

In the meantime, Huang will continue to strive for the perfect container. "We're sometimes fighting for fractions of a gram nowadays," he says. "That said, we're very proud of the amount of plastic we've removed from the environment. It's one of the biggest contributions to responsible packaging we've made over the years. Our goal is to realize an end-to-end virtual product design, development and manufacturing process to bring the highest value to our customers. Abaqus will continue to be a key part of future success stories."

For More Information
www.amcor.com

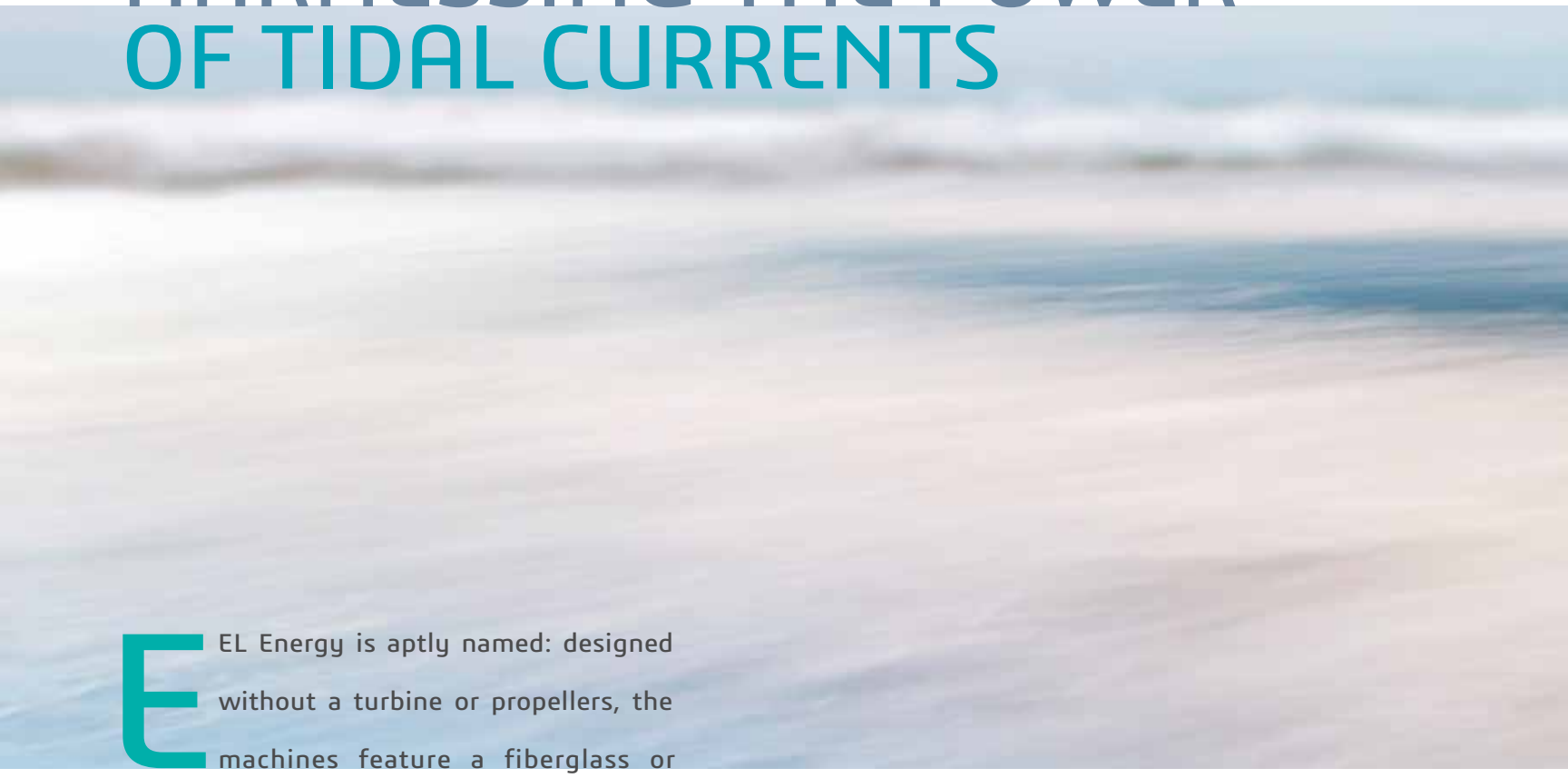


Abaqus can also be used to simulate the manufacturing process. Here, the effects of inadequate mold insulation are easily visualized—on the left is a tool with no insulation, while the right shows one that's been fully insulated.



Ever wondered what the inside of a blow mold or injection mold look like during filling? With Abaqus, you can visualize exactly what's going on.

HARNESSING THE POWER OF TIDAL CURRENTS



EEL Energy is aptly named: designed without a turbine or propellers, the machines feature a fiberglass or polymer membrane that, like an eel, undulate under the water with the tidal current.

Several models are under development in different shapes or adapted to a specific aquatic environment. In the marine version, the power generators are located on the membrane. The river version has a mast that triggers a generator outside the water. Compared with other sources of renewable energy such as wind and solar power, this solution offers greater predictability. EEL Energy is developing and testing its river prototypes in the reservoirs of the Ifremer oceanographic research institute, and its tidal prototypes off the coast of Brest in northwestern France, with the support of Dassault Systèmes. Digital simulation is used to avoid errors, reduce testing costs and optimize design. The membrane is submerged virtually to measure performance, practicality and profitability before it is physically produced. Thousands of variations of virtual prototypes can be tested on a computer in the time it would take to build just one physical prototype.

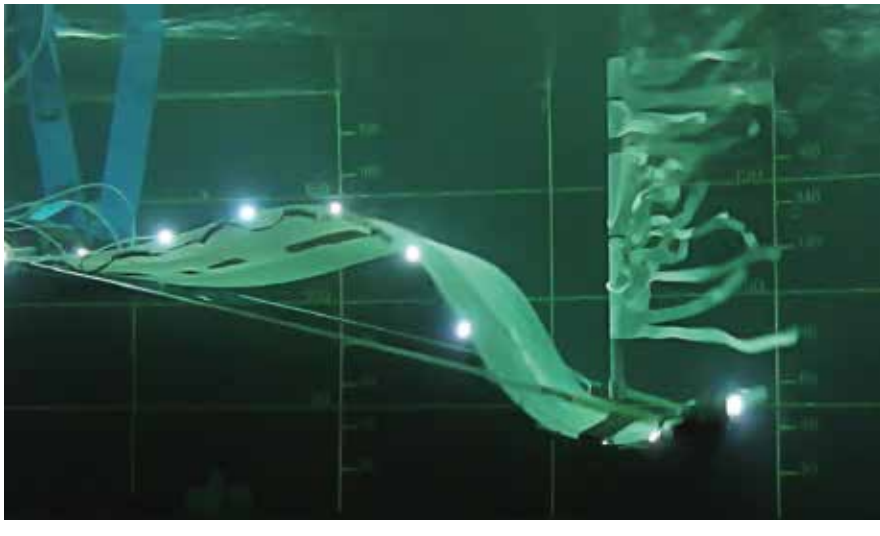
RESPECTING THE ECOSYSTEM

Different models of membranes are available, ranging in size from 0.8 m for test prototypes to 1.6 m and 2.6 m for small 2-3 kW retail models, and up to 5 m for a 30 kW version developed and tested in late 2018. A 10 m, 100 kW model is being developed for 2020, and after that, possibly a 16 m, 500 kW machine. Admittedly, this is far below the power output of traditional energy generation methods, but the membrane is not meant to compete with tidal turbines, which need stronger and faster currents to operate. However, the solution is perfectly suited to places with weaker currents. Another advantage of EEL Energy's models is that they respect ecosystems. As they are underwater, there is no visual pollution. Also, tidal turbines take up a lot of space, like a dam, and have the same drawbacks. The membrane, in contrast, does not interfere with the movement of

"Tidal currents have been studied for centuries. We know when and how much clean energy we can produce, and the energy is predictable. That's not the case with solar power at night or when it's cloudy, or with wind power when it's nice out and there's no wind!"

—Franck Sylvain, CEO of EEL Energy

underwater life. "During one of our ocean trials, a dolphin came to play with the membrane," Franck Sylvain says. "The system is very gentle and not aggressive." To promote new forms of renewable energy, the production of which is by nature irregular and unpredictable, we need to have better control over its distribution. Stationary batteries can play a key role in stabilizing grid generation and energy distribution. Storing and releasing power as needed, these batteries balance out peaks in supply and demand.



For More Information
https://3dexperiencelab.3ds.com/en/projects/city/eel-energy

UPCOMING EVENTS

Dassault Systèmes hosts major events around the world to connect our wide community of users. We are excited to bring together our design, modeling and simulation communities for the Modeling and Simulation Conference in Novi, MI beginning September 18. This conference will drive engineering discovery and design decisions in an integrated modeling and simulation environment. Co-located is the launch of our **3D**EXPERIENCE® Simulation on Wheels tour, 'Reveal the World'. SIMULIA will take a mobile playground of interactive experiences on the road, showcasing the power of simulation throughout the Mid-West this Fall.

SEPT. 18–19

3DEXPERIENCE MODELING AND SIMULATION CONFERENCE
Novi, Michigan

SEPT. 18–20

Reveal the World Tour
Detroit

SEPT. 23–27

Reveal the World Tour
Indianapolis

OCT. 22

3DEXPERIENCE MODELING AND SIMULATION CONFERENCE

OCT. 23

SIMULIA China User Meeting

OCT. 28–NOV. 1

Reveal the World Tour
Chicago

NOV. 19–21

3DEXPERIENCE CONFERENCE
DESIGN, MODELING & SIMULATION
at the Darmstadtium in Darmstadt, Germany

SEPT. 30–OCT. 4

Reveal the World Tour
Columbus

OCT. 7–11

Reveal the World Tour
Cleveland

OCT. 14–15

SCIENCE IN THE AGE OF EXPERIENCE 2019

OCT. 14–18

Reveal the World Tour
Detroit

OCT. 21–25

Reveal the World Tour
Cincinnati

OCT. 29

SIMULIA Japan User Meeting

OCT. 30–31

SIMULIA EuroNorth Regional User Meeting

NOV. 4–8

Reveal the World Tour
Minneapolis

NOV. 11–15

Reveal the World Tour
Milwaukee

NOV. 18–22

Reveal the World Tour
Detroit

DIGITAL CERTIFICATION: DISRUPTIVE INNOVATION FOR AN EVER-CHANGING REGULATORY ENVIRONMENT

DAVID HOLMAN,
Vice President R&D,
SIMULIA Brand Leader
Photo by Steve Morse

Let's face it. Launching a new product into any market is a challenging task. Not only is the industry trying to win over consumers with superior experiences, exceptional products and fewer recalls, they must also have the regulatory seal of approval to release the product into the market. Whether it's an existing product with new features or configurations or an entirely new model, in order to be available to the consumer, it must comply with standards and certifications. These standards are the rule of law, regulated at global or regional levels—while enforced locally. As policymakers around the world strive to find the appropriate balance, is there a way for product manufacturers to still bring disruptive innovation to the market while complying with environmental, safety and societal requirements at a global scale?

Let's explore this further in the context of automotive manufacturers. This past decade has been frustrating for them. As OEMs have drastically expanded their model and trim offerings to satisfy every customers' desire, stricter global regulatory and certification requirements have been implemented to protect both consumers and the environment. Due to this, the automotive industry has been forced to find innovative ways to please customers, regulators and investors simultaneously.

REGULATIONS AND CERTIFICATIONS: PAVING THE WAY FOR REAL CHANGE

From the US Environmental Protection Agency (EPA) to the United Nations Economic Commission for Europe (UNECE), there is a global commitment to improving vehicle fuel economy, while reducing pollutants and CO_2 emissions, with the goal of a healthier planet. In particular, European regulators have built a comprehensive action plan to protect our Earth. They know that change is necessary…and possible. Partnering with automotive OEMs, the UNECE developed the Worldwide Harmonized Light Vehicle Test Procedure (WLTP) as a new, robust testing process for certification as a replacement for the New European Driving Cycle (NEDC). WLTP compliance is now required for every new car sold in Europe

How is this different from what has been done in the past? With WLTP, emissions certification and fuel consumption prediction tests were designed to more accurately reflect real-world conditions and expected performance. These tests better evaluate how we drive in realistic wind scenarios, at different speeds, in varied temperatures and even accounting for the fact that we often brake more frequently than we probably should. For the first time, the impact of options such as fancy spoilers and beautiful sunroofs are evaluated, and their impact measured and accounted for in the certification. These aesthetically pleasing options can have an enormous negative impact on fuel consumption and an electric vehicle's expected range. However, as these new WLTP regulations have been established and enforced, conventional testing has proven to be ineffective, expensive and limited in its abilities. Some OEMs have been forced to reduce options on new vehicles and leave parking lots full of uncertified, rusting vehicles due to the overwhelming expense and time needed to test and certify every configuration.

SIMULATION-DRIVEN DESIGN AND CERTIFICATION

Leading vehicle manufacturers are becoming more nimble and efficient in addressing the new regulatory requirements. These OEMs no longer certify just before public launch, but rather address regulations early in the product development process. They include simulation and optimization at each and every stage while engineering their cars and trucks. By planning and designing for certification, manufacturers are meeting requirements at the same time that they are addressing other multi-faceted considerations such as aerodynamic performance, engine temperatures and even passenger comfort. Optimization of each vehicle configuration is addressed and resolved digitally—long before a physical model is ever built. These OEMs know that the final vehicle manufactured is digitally certified and ready to sell.

GLOBAL COMMITMENT

While WLTP is a European program, there are similar efforts underway globally. The EPA has stringent certification and compliance requirements for onroad vehicles and engines covering light-duty (passenger cars and trucks) and heavy-duty (commercial trucks and buses) vehicles. Digital certification, using simulation solutions, has been part of the product development process used by OEM programs for many years to meet escalating EPA regulations.

Change is happening. Not tomorrow, but today. We are witnessing it. This impacts ourselves and our children, our climate and our planet. Greener cars and trucks are already gracing our highways, and our cities are seeing lower exhaust particulates pumped into the air we breathe.

Simulation-based validation, verification and compliance are being implemented in other industries as well, from aerospace to electronic and medical devices. These efforts are not only crucial for faster time-to-market, but critical to the consumers' safety and sustainability of our planet.

For More Information

https://www.3ds.com/products-services/simulia/trends/wltp

"Because of the significantly increased burden of certification, many manufacturers were unable to meet the requirements by the September 1st deadline for their entire vehicle fleet. Manufacturers responded to these challenges in different ways depending on how behind they were in their certification. Some disabled custom vehicle configurators, only offering standard options for sale, thereby reducing the number of vehicle variants needed to certify. Others reduced their product offerings, not offering some options that hadn't been certified, while some vehicle OEMs had to resort to parking thousands of already manufactured vehicles in storage, because they simply could not offer them for sale by law without having passed certification."

—Rick Shock, SIMULIA T&M Experience Management, Technical Sales Director

REVEAL THE WORLD TOUR

Enjoy VR experiences, short lectures, hands-on workshops and simulation competitions at our **3D**EXPERIENCE® Simulation on Wheels tour, traveling the Midwest this fall. Those who attend will be able to engage with the power of simulation firsthand through a virtual replication of the real world, the "**3D**EXPERIENCE twin". Attendees will also have time to engage in enriching conversations with other users and SIMULIA's technical team.

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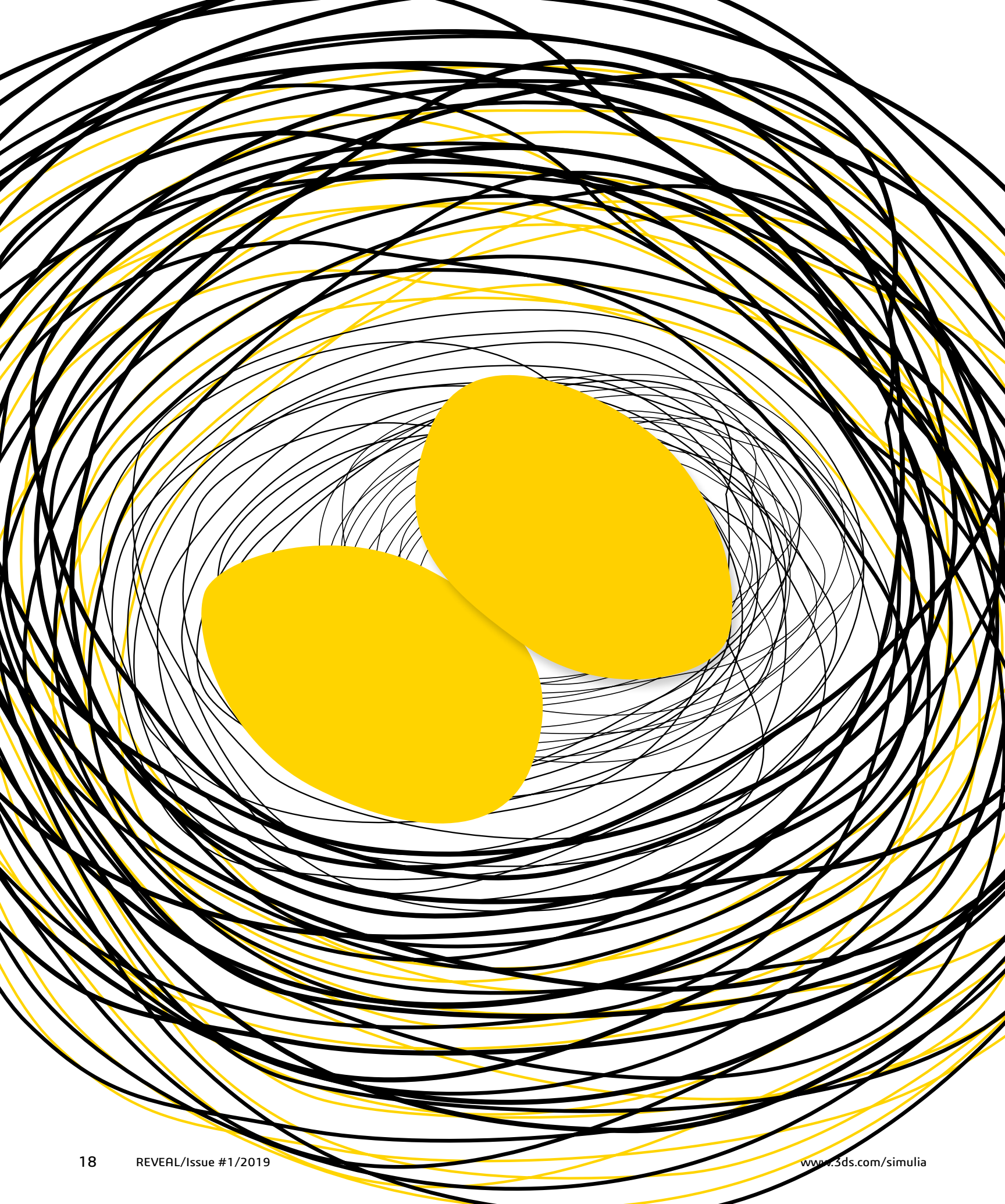


LEARNING FROM AVIAN NESTS

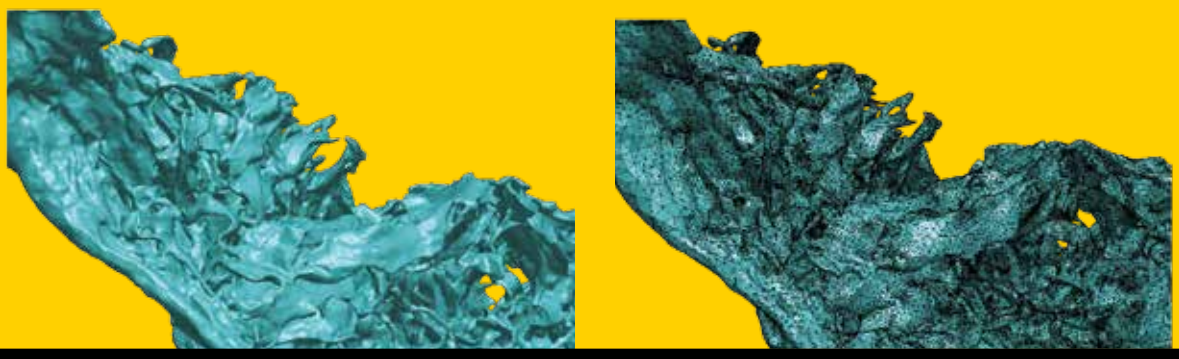
Synopsys Simpleware Used to Gain Insights into Biomechanical Design

Bird nest construction offers valuable design insights, with similarities to Additive Manufacturing in terms of control over structural features and layering of materials. Edible-nest swiftlets create nests from their own threaded saliva, allowing them to closely follow design principles at a high resolution. The work described below looked at how material properties in nests integrate with structural designs, using numerical models processed in Synopsys Simpleware™ software from µCT data and Finite Element (FE) simulation of stress distributions in SIMULIA Abaqus. Results demonstrated remarkable consistency between macro and micro-scale structural patterns in nests, suggesting that a response to applied loads relies on an overdesign strategy to avoid fracture of important regions used to store swiftlet eggs.

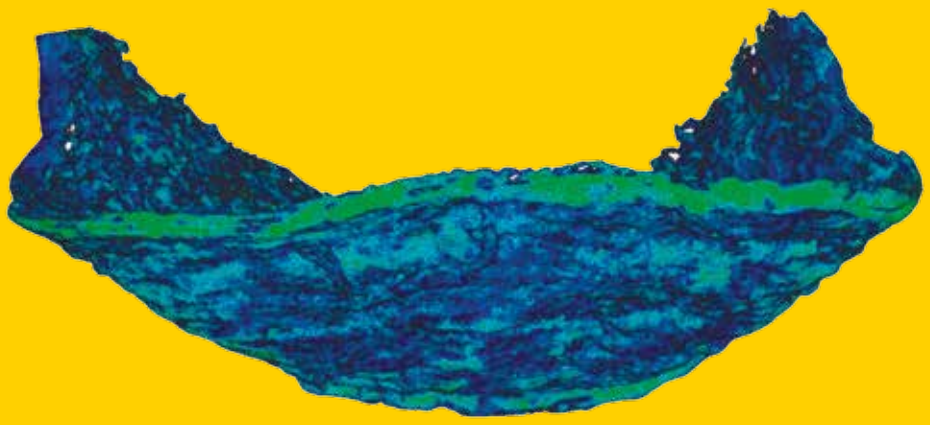
HIGHLIGHTS

- Robust models in Simpleware software enable detailed capture of nest microstructure from µCT
- FE meshes from Simpleware software offer excellent quality for realistic simulation
- Simulation results in Abaqus provide insights into biomechanics and design strategies
- Generating Models in Simpleware Software

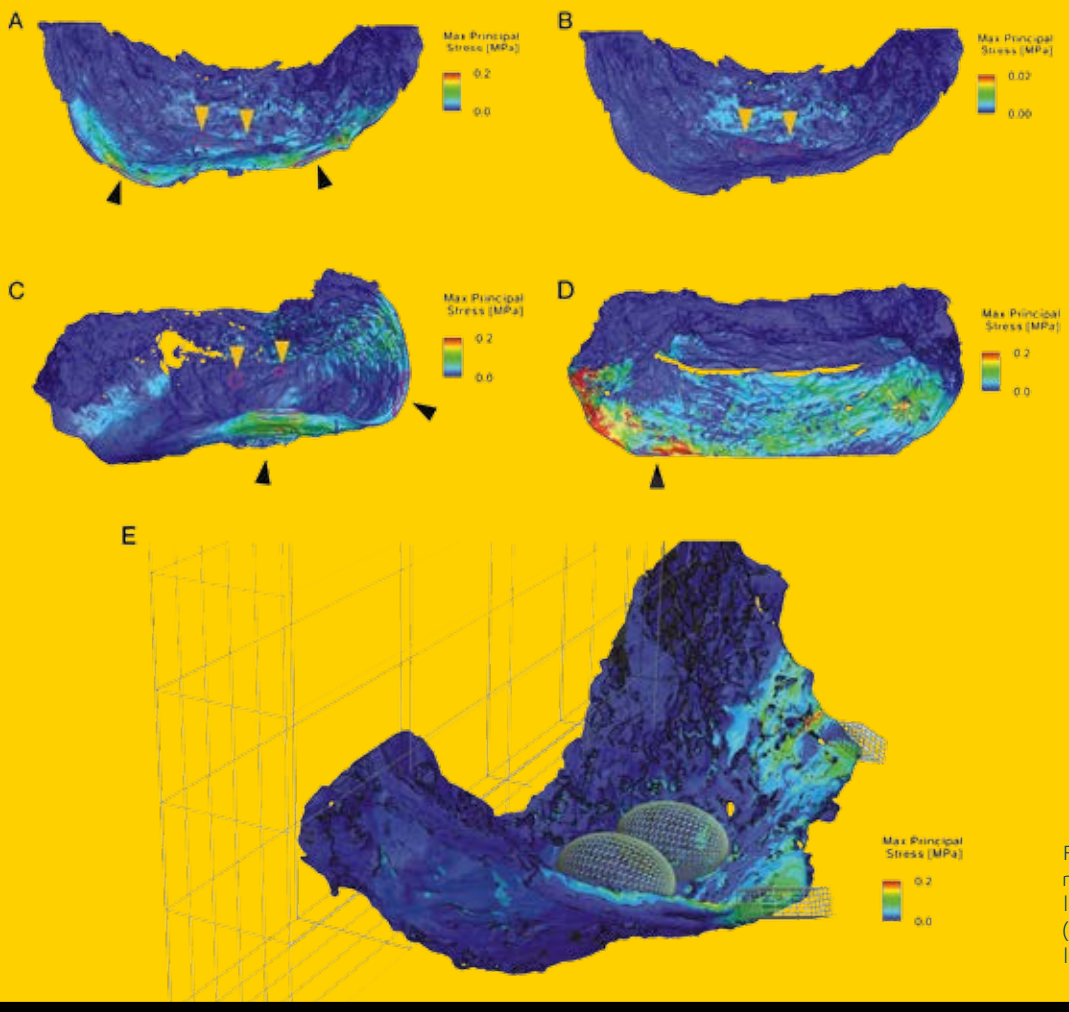
To carry out the work, five swiftlet nests were obtained from a commercial farm and scanned using a SkyScan 1176 high-resolution uCT (SkyScan, Aartselaar, Belgium) machine. The µCT data was imported into Simpleware ScanIP to visualize and segment regions of interest. The image data was resampled for efficiency, with regions of interest segmented from the background data. Artifacts and noise from µCT data were corrected—thresholding segmented the nest, excluding background noise. The flood-fill tool was used to remove non-connected mask artifacts, and a recursive Gaussian filter applied to reduce image noise and detail level. Closed pores with less than 125 voxels were selected and added to the mask to reduce computational time and increase the quality of the generated elements.



Simpleware software segmentation and FE mesh of birds nest showing level of detail



High-resolution FE mesh of the nest from the 3D model using mechanical measurements, with color scale showing different material densities



FE simulation results showing maximum principal stress at each linear static loading scenario (A,C,E), as well as worst case loading scenarios (A-D)

Morphometric parameters of the whole nest were calculated using Simpleware ScanIP measurement and statistics tools, including: mass density, the volume of the nest, nest surface area, and pore analysis. Measurements were taken of a segmented mask for the nest and a separate mask for the closed pores. A slice-by-slice script was written for slicing the masks in yz, xz and xy coordinate planes. The data of the pore and nest masks were analyzed in every slice, and a multi-label mask generated of the closed pores. This mask was created to interactively visualize and analyze the pore mask containing several regions, for example scattered pores in between the saliva strands. The pore multi-label mask was obtained by labelling disconnected regions within the pore mask, assigning each region a separate color.

EXPORTING FE MODELS FOR SIMULATION

High-quality FE meshes showing microstructure features were generated in Simpleware software for simulation of different loading scenarios. The FE Free meshing algorithm was used to ensure high geometric accuracy of the highly detailed nest microstructure, with a true representation of porosity in the structure. The meshes were smoothed and exported as all-tetrahedral FE models containing approximately 5 million elements with a mean edge length aspect ratio of 4-5 and a mean in-out aspect ratio of 0.8-1.

Contact entities and node sets were defined in the software before exporting a mesh in a dedicated Abaqus solver, with the node sets selectable in the solver for applying boundary conditions and loads. Material properties for strains and stresses were obtained using in-situ uniaxial tensile testing through scanning electron microscopy.

SIMULATING STRESS AND STRAIN

In Abaqus (6.14), the FE meshes were modeled using the material properties from the tensile test data. Input data was set up following the nominal stress-strain curve, as well as a linear elastic model to account for small deformations. The material was assumed to be isotropic at the fiber level, where structural anisotropy is arising due to the geometric arrangement of the fibers as captured from the µCT scans. Simulations assumed a worst-case scenario with two birds and two eggs applying body forces (gravity), with additional testing being performed with just the eggs to compare results.

Loading areas predefined in ScanIP contained a certain number of nodes, including two defined areas on the rim where the force of a bird is applied and two areas where the force of an egg is applied to the center of the nest. For each FE model of the nest, the node sets in the geometrical locations where the nest is in contact with the wall, were constrained as fully pinned (zero displacements in all directions), when calculating stress and strain distributions. FE simulation results showed maximum principal stress at the end of each linear static loading scenario. The central 'egg-region' experiences lower values of stress, allowing for protection of the anchoring region.

CONCLUSIONS

The edible nests created from saliva show a remarkable similarity in macroscopic (weight, shape) and microscopic (pore area and distribution) properties, suggesting that nests are constructed by the species using specific design principles. The studied nests also indicate that they were constructed with the goal of supporting two birds and two eggs. Management of peak stresses ensures an optimized structure that successfully bears stress levels without fracturing the nest when carrying eggs and birds.

Taken further, the study shows how a single material, distributed properly across a specific structure, can create a sustainable and resilient structure. These design principles from animal-made structures provides insight into how complex structures can be built using only local or self-produced materials, sharing commonalities with Additive Manufacturing techniques.

For More Information

www.synopsys.com/simpleware.html

ACADEMIC PERSPECTIVES ON SUSTAINABILITY

Researchers, professors, students and others working in academia are at the forefront of shaping the future of our world and in many cases, they are using simulation, design and engineering to do so. In this section of *REVEAL* Magazine, we hear directly from academics about their perspective on important trends and topics and learn about some of the work they are doing to create the future. This edition of *REVEAL* focuses on sustainability and we ask academics to tell us about how sustainability plays a role in the work that they do across various industries including additive manufacturing, life sciences, transportation and mobility, and renewable energy.

SIRIVATCH SHIMPALEE, PHD
Research Professor,
Chemical Engineering Department,
University of South Carolina

How has the simulation of fluid mechanics advanced your research in the area of renewable energy including fuel cells, energy storage, high temperature thermal system, and bioenergy?

To understand heat, mass transport, and other physics such as electrochemical and electrokinetics inside renewable energy and bioenergy devices, the multiphysics simulation of fluid mechanics is necessary for research and development in these areas because those physics cannot be easily obtained by just performing experiments. For example, the water management inside a polymer electrolyte membrane (PEM) fuel cell (FC) is very important for maximizing its performance, since the byproduct of electrochemical reaction is not only electrical power but also water and heat. Condensed water inside a PEMFC can decrease its performance significantly, especially when it is clogged inside very thin (10 to 150 micrometer) porous layer, thus blocking the oxygen flowing to the catalyst surface and reducing oxygen transport to the oxygen reduction reaction (ORR). Computational simulation of this phenomena can definitely help researchers and developers to improve the design of porous materials and optimize operating condition of PEMFCs in order to maximize the ORR. Figure 1 shows an example of a XFlow simulation of water condensation and its evolution in side porous layers [1]. It can be seen that by changing operating conditions, liquid water presented inside this layer will be different. The results from the simulations can help improve the novel porous layer design, by the modification of catalyst and gas diffusion layer structures, and/or the dispersion of a platinum a deleted catalyst. Furthermore, this work should reduce cost and development time for improving PEMFC design. All research projects I have done and been doing will give great impact to several kinds of industry such as electric power, automotive, solar energy, gas, pharmaceutical, and porous-material industries. All of them require the deepest knowledge of transport phenomena to enhance their products and services for a sustainable future.

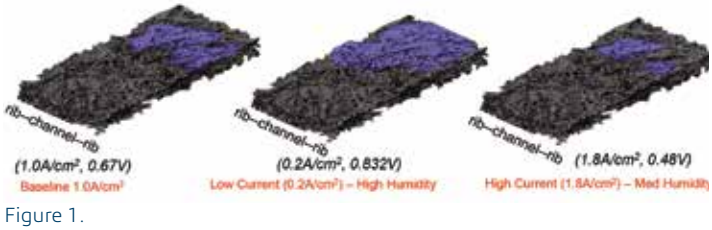


Figure 1.

[1] S. Shimpalee et al., Journal of The Electrochemical Society, 166 (8) F534-F543 (2019)

For More Information
www.che.sc.edu/researchfaculty/shimpalee.htm

LUKA POCIVAVSEK, MD, PHD

Vascular Surgery Fellow at University of Chicago

Medical simulation has a huge impact on the advancement of medical treatments. You co-founded Aruga, a medical device company specializing in vascular implants. However, your approach is different from traditional practices. You created a nature-inspired design of synthetic vascular reconstruction devices and successfully doubled the implant lifetime. Can you talk more about the importance of studying the intersection of nature and simulation, and the ability it gives to visualize the effectiveness of a treatment without resorting to experimental surgeries?

Simulation is critical to integrating novel nature-inspired concepts into medical devices. Our approach capitalizes on the dynamic nature of arterial surfaces and integrates this into a unique vascular graft. These systems quickly become highly complex and involve interaction between a compliant graft, a dynamic pressure field, fluid flow, and surface fouling. To solve such a problem involves capturing correctly the geometrically non-linear elastic deformation of the graft surface, coupling the forces from the fluid to the solid deformation, and correctly modeling the interaction of platelets adhering to and de-adhering from the graft surface. Using Abaqus/Explicit, FSI, and advanced cohesive modeling, this complex simulation can be undertaken. On the basic-science side, it provides us with a tool to test the hypothesis of topography-driven de-adhesion, thus validating the physics behind our approach. On the applied clinical side, having an integrated simulation in place, allows us to do vast parameter sweeps of the different variables in our problem. Medical devices are often designed and tested under ideal conditions. However, these devices, when implanted, exist in a variety of complex loading conditions and under variable levels of fouling. Simulations allow us to test the behavior of our device under the various ranges of conditions may be encountered by the device during its lifetime. For instance, in the case of topographic grafts, the arterial-pulse pressure drives surface actuation. However, normal pulse pressure varies with distance from the heart, the mean arterial pressure, and even heart rate. Integrating these parameters into an experimental pre-implantation study would be nearly impossible. Simulation provides the answer and even allows the personalization of a given device to a particular operation.

L. Pocivavsek, J. Pugar, S. Velankar, E. Tzeng, W. Wagner, and E. Cerda, Geometric Tools for Controlling Soft Surface Adhesion, Nature Physics, 14, 948-953 (2018).

For More Information and to Read the Full Article

https://www.nature.com/articles/s41567-018-0193-x
https://surgery.uchicago.edu

TIMOTHY W. SIMPSON, PHD

Paul Morrow Professor of Engineering Design and Manufacturing at the Pennsylvania State University

As an expert in the field, what do you think additive manufacturing's role can be in creating a more sustainable world? Do you think it will replace other forms of manufacturing completely or simply supplement existing processes?

While the design freedom enabled by additive manufacturing (AM) is exciting, we often forget about the material freedom associated with "printing" parts layer-by-layer. With AM, we only add material where necessary, reducing the scrap and waste associated with many traditional manufacturing processes. In the aerospace industry, this is called the buy-to-fly ratio (amount of material purchased versus material in the part), and AM can help reduce this from upwards of 10:1 to 2:1 or 1.5:1 or better. While we are not at 1:1 yet, we are getting closer as we get better at designing for AM.

By combining AM's design and material freedoms, we can create lightweight structures that maximize material utilization using lattices, topology optimization, biomimicry, and other generative-design tools. Such structures use material more efficiently and require less build time, which saves energy. Improving material utilization may also make a more expensive material viable with AM. Better materials usually last longer, which means components do not need to be thrown away or replaced as frequently, both of which are better for the environment.

AM can also enable "manufacturing on demand:" make only the parts you need, when you need them, where you need them. This means less waste, less inventory, less transportation, etc. provided we can work through the regulatory, legal, and cybersecurity issues that often plague AM.

Finally, just because we can "print" something doesn't mean we should. Traditional processes have their strengths, and AM isn't going to replace traditional manufacturing. In fact, AM often needs other forms of manufacturing to make end-use parts; so, the real question is: how do we combine both to promote global sustainability efforts even more?

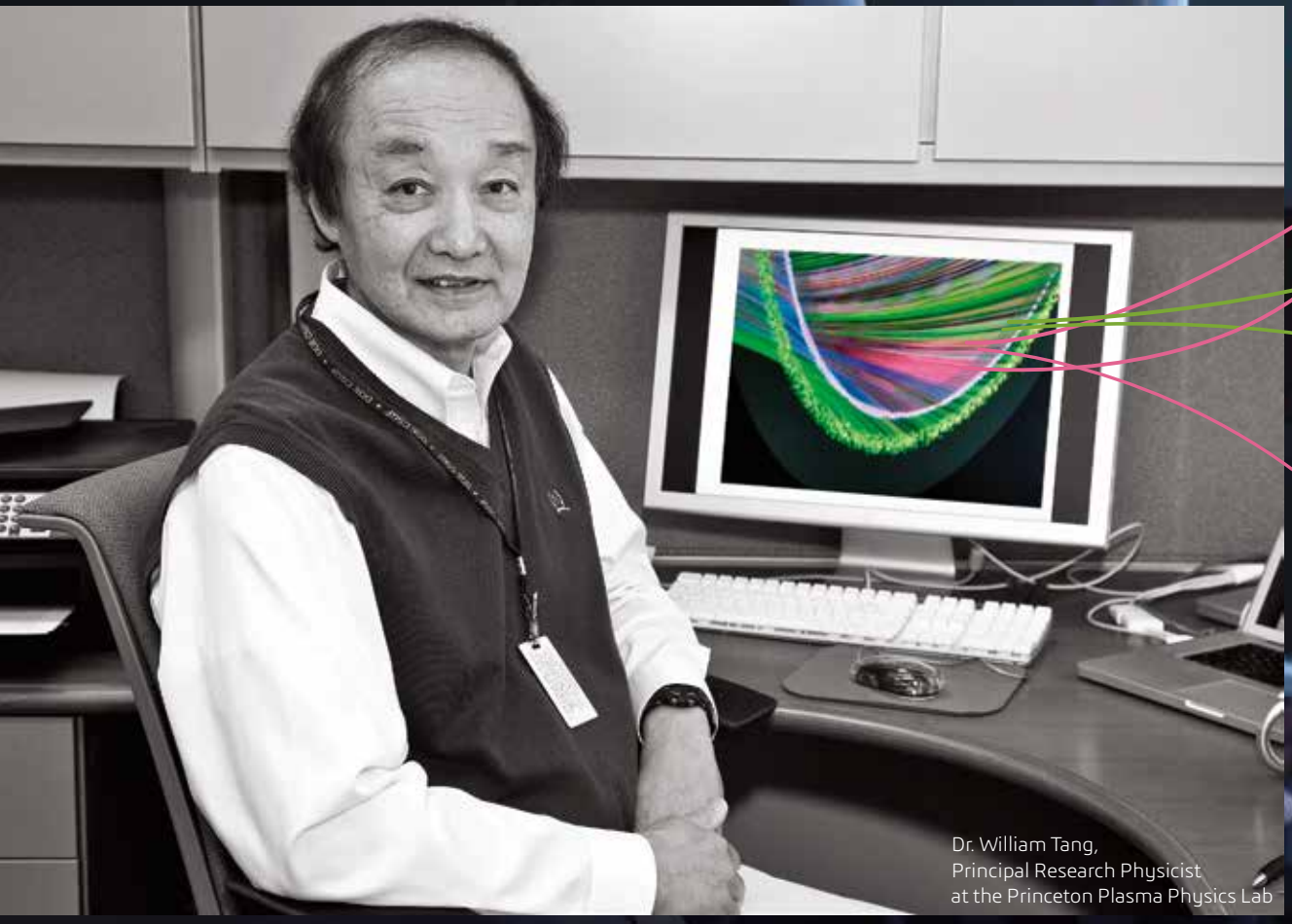
For More Information

http://www.cimp-3d.org

SCIENTISTS TAP AI FOR MAGNETIC CONFINEMENT OF CLEAN FUSION REACTIONS

Argonne National Laboratory's Aurora supercomputer helps spearhead renewable energy research

By Rob Johnson



Dr. William Tang,
Principal Research Physicist
at the Princeton Plasma Physics Lab

Argonne National Laboratory, based in Illinois, is well-known among researchers. Over the years their resident computers have enabled a wide array of complex scientific endeavors. Their current focus involves the development of a new flagship computing system, nicknamed Aurora. Upon its deployment in 2021, the team envisions performance levels approaching a billion-billion calculations per second. Speed of that magnitude will place Aurora among the fastest high-performance computing (HPC) systems in the nation.

Scientists like Dr. William Tang, Principal Research Physicist at the Princeton Plasma Physics Lab, eagerly await their turn on the forthcoming system. He, and a handful of other researchers have early access to Aurora through the Argonne Leadership Computing Facility's Aurora Early Science Program (ESP). In addition to Dr. Tang's work, the ESP will prioritize endeavors in fields like cosmology, cancer research, computational chemistry, aircraft design, and much more.

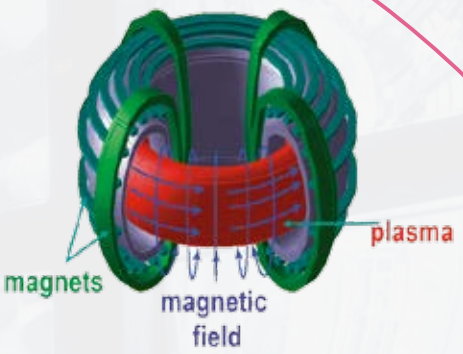
NEW APPROACHES FOR CLEAN ENERGY PRODUCTION

Dr. Tang spearheads research into the ways that artificial intelligence methods, including deep learning, can advance predictive capabilities for fusion-energy research. "Reducing or eliminating carbon emissions is not only urgent; it is critical. The energy of the future must come from clean and safe fusion. We face major challenges in making that transition. However, today, it is an achievable goal thanks to exascale computing, the emergence of AI, and deep learning," said Dr. Tang.

Fusion is the type of power the sun and the stars produce, and it represents an extremely-challenging genie to keep bottled up in a laboratory. Unlike traditional fusion reactors, though, Dr. Tang's proposed design contains less than a minute's worth of fuel at a time. Doing this offers two significant advantages: First the fuel source is the hydrogen isotope deuterium, obtained from seawater and tritium created at the facility. Because the radioactivity generated by this fusion process is quite short-lived, the new reactor design poses no risk of long-term environmental contamination. Second, the reaction chamber only sips fuel in short bursts. Therefore, a catastrophic "meltdown" of the reactor is impossible. It simply shuts down when its mouthful of fuel is consumed.

KEEPING THE GENIE IN THE BOTTLE

The ongoing fusion reaction in our Sun creates extremely high plasma temperatures reaching tens of millions of degrees. Since a fusion reactor on earth must re-create similar conditions, conventional materials can't take the heat, literally.



"We have invested a lot in the effort to deliver clean fusion energy through magnetic-confinement methods," says Tang. "However, there are many barriers to overcome. One major challenge is making quick and accurate predictions regarding so-called 'disruptive events,' which allow hot, thermonuclear plasma to escape quickly. Supervised machine-learning helps us as a predictive guide. If we can predict what we call a 'crash,' we can plan to control it."

Dr. Tang's goal of magnetic confinement addresses the challenges associated with extraordinary reaction temperatures. However, maintaining that reaction for optimal performance requires the aid of optimized neural networks to manipulate the related data sets. The neural nets must learn to decipher all the data representing the three-dimensional reaction space. They must also account for the fourth dimension—time—in the calculations.

EXASCALE LEADS TO INNOVATION

The Aurora system, built by Cray, will feature a future generation of Intel Xeon Scalable processors and Intel Optane DC Persistent Memory, plus future Intel Xᵉ technologies. Says Tang, "These industry-laboratory collaborations are critical for developing a system that will tie together innovative science, new technologies, and AI."

He adds, "The advanced exascale systems of tomorrow will empower us to do amazing things in the coming years. Our work is exciting because we have an opportunity to do something that can benefit the world."

For More Information

www.intel.com/content/www/us/en/high-performance-computing/supercomputing/exascale-computing.html

FROM HYPE TO REALITY—BUILDING THE INFRASTRUCTURE THAT MAKES AUTONOMOUS VEHICLES POSSIBLE

Despite a promising start, many autonomous car projects have run into roadblocks, and the dream of self-driving vehicles as a major part of the transportation mix still seems to be a long way off. Infrastructure has played a big part in this—autonomous vehicles (AV) are still driving on roads designed for humans, limiting their true potential. When autonomous driving goes mainstream, our entire infrastructure will change.

These changes will include smart roads, which will give AVs a more accurate picture of traffic around them, increasing safety while reducing congestion. Advanced 5G communication links between vehicles and surrounding infrastructure will allow AVs to react in real time to other traffic users and then coordinate their driving. Meanwhile a smart charging network would not only prevent AV batteries from ever running out but could potentially be used to help balance the power grid and reduce the carbon emissions of electricity production.

In order for AVs to be successfully integrated into the mainstream of automotive traffic, road infrastructure needs to operate safely and reliably in all weather conditions, with congested roads and all kinds of potential interference sources. Simulation is essential for modeling these challenging real world conditions and driving the design of complex systems associated with this space.

STAYING CONNECTED IN A SEA OF CARS

Communication between road users today is almost non-existent. Taxis, trucks and emergency services have radios that allow two-way voice conversations, but most drivers rely on nothing but lights and hand gestures.

Similarly, most information communicated to drivers comes from road markings and signs. To mimic the reading of this information, current autonomous vehicles are fitted with cameras and image recognition systems that are able to read signs the same way a human would, which can also present a set of challenges when it comes to ensure their proper detection and recognition.

To partly tackle both these challenges, radio frequencies around 5.9 GHz are being set aside for "vehicle-to-vehicle" (V2V) and "vehicle-to-everything" (V2X) networks, with some highways in the EU already equipped with prototype V2X systems. The fifth generation of mobile data standards (5G) are another possibility for V2X communication, giving the advantage of allowing V2X systems to use the same infrastructure as other mobile systems. This will allow vehicles to augment their capabilities compared to relying purely on vision and existing signs.

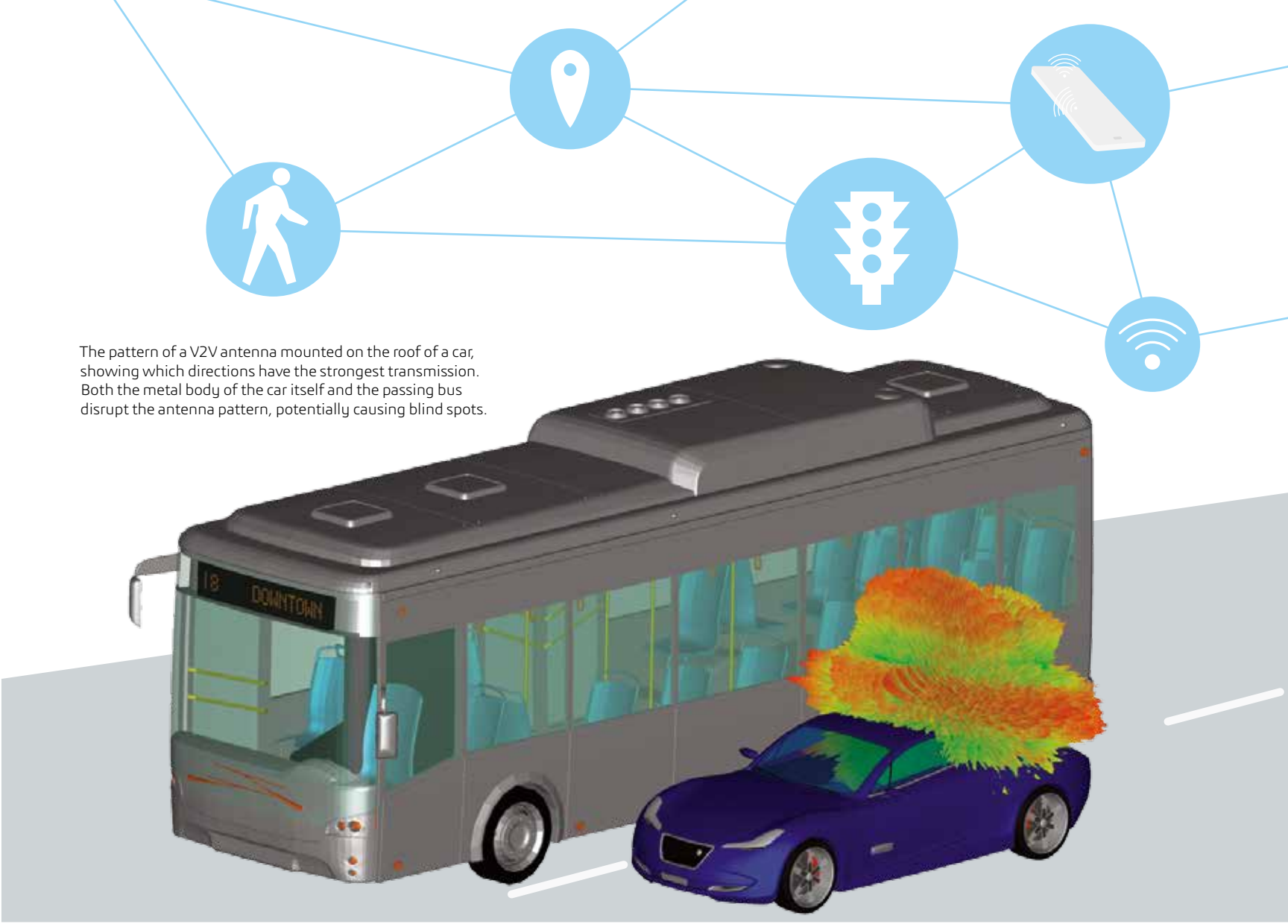
No matter which frequency is used, these systems need to be reliable. Coverage over the entire roadway to eliminate blind spots in the vehicle's antennas is critical considering that there can be hundreds of vehicles on a single stretch of highway. Autonomous vehicles need to communicate with the highway infrastructure even as it drives past a truck that blocks its antennas.

To ensure connectivity, electromagnetic simulation is used to optimize antenna performance in real-world conditions. This can be a computationally challenging simulation. At 5.9 GHz, the free space wavelength is just 5 cm, while a bus or truck can be tens of metres long, meaning that the simulation needs to calculate a very large numerical problem. Powerful solvers, hybrid simulation approaches and cloud based high-performance computing are needed to meet these challenges.

WHAT IS 5G?

Current mobile data networks are approaching their limit. 5G is the term used for the technologies that will allow faster downloads and more devices connected at once.

For more information about how SIMULIA enables 5G design, see **www.3ds.com/products-services/simulia/trends/5g-communication**



The pattern of a V2V antenna mounted on the roof of a car, showing which directions have the strongest transmission. Both the metal body of the car itself and the passing bus disrupt the antenna pattern, potentially causing blind spots.

THE SMART ROAD

From black ice to broken down vehicles, there are numerous hazards that can occur at any time on the road. "Smart road" is the catch-all term for the range of technologies that can be used to monitor road conditions and transmit them to vehicles. For AVs, this informs the car about which route to take, how to drive, and can even help it save fuel by joining a platoon of vehicles coordinated by the smart road. The slipstream of a large truck can reduce the air resistance on the vehicles behind it, but autonomous driving is necessary to get close enough to the lead vehicle safely. Aerodynamic simulation helps calculate the optimal driving pattern to maximize this slipstreaming effect.

One use of smart-road technology already becoming mainstream is the monitoring and controlling of traffic congestion. A combination of different sensors, including cameras on gantries and magnetic sensors buried in the road surface, count the number of vehicles on the road and their flow. Based on this data, temporary speed limits can be imposed and extra lanes can be opened. Delay information can be passed onto mapping and navigation software to suggest alternative routes. AVs will make driving on smart highways more sophisticated, adjusting car behavior in real time to optimize traffic flow at all times.

The sensors will, however, be susceptible to interference from the environment and other sensors and broadcast systems—the more transmitters there are on the road, the more interference potential. Special interference-simulation techniques can quickly highlight potential interference risks and let engineers explore different mitigation techniques. Rain, snow, dust and ice as well as soiling from passing vehicles will also reduce sensor performance. This can be modeled using fluid dynamics to simulate the soiling effect, followed by an electromagnetic simulation.

CLEAN POWER

The majority of AVs currently in development are electric. Today, drivers of electric vehicles charge their cars using cables, but how can AVs charge without the help of humans? One suggestion has been to include robot arms that can plug themselves in, while another is to use wireless charging. Imagine coils buried in the road or parking spots to transmit energy to a receiver coil mounted on the bottom of

DEVELOPING A MORE EFFICIENT CAR

The autonomous vehicle is a complex system with thousands of parts working together. Motor control, battery design, body weight and aerodynamics are just a few factors affecting energy efficiency. To learn how SIMULIA enables full-system analysis and optimization of electric vehicles, see **www.3ds.com/products-services/simulia/trends/electric-vehicles**

the car—the same principles used to charge phones wirelessly but on a much larger scale. Simulation of the coil shielding is a key step in the process to make sure stray power fields do not cause interference on the road, and to ensure the safety of the passengers inside, or pets finding shelter underneath a vehicle when parked.

Wireless charging is especially efficient for buses and delivery vehicles, which stop frequently and park in predictable places. Other vehicles that might benefit from a charging network are autonomous taxis and parcel-dispatch systems. This also promises to help personal car users; instead of needing to find parking at their destination, passengers disembark and let the car drive itself empty to a central parking bay installed with charging coils, and return when summoned.

Most vehicles today spend the vast majority of the day empty and stationary. Car-share programs and autonomous taxis reduce this wasteful parking time, increasing the utility of each AV. But there will always be times—nighttime, midday, weekends—when demand for vehicles is lower. The power grid can already monitor such variations in both demand and supply especially with sources such as wind and solar that are very sensitive to weather conditions.

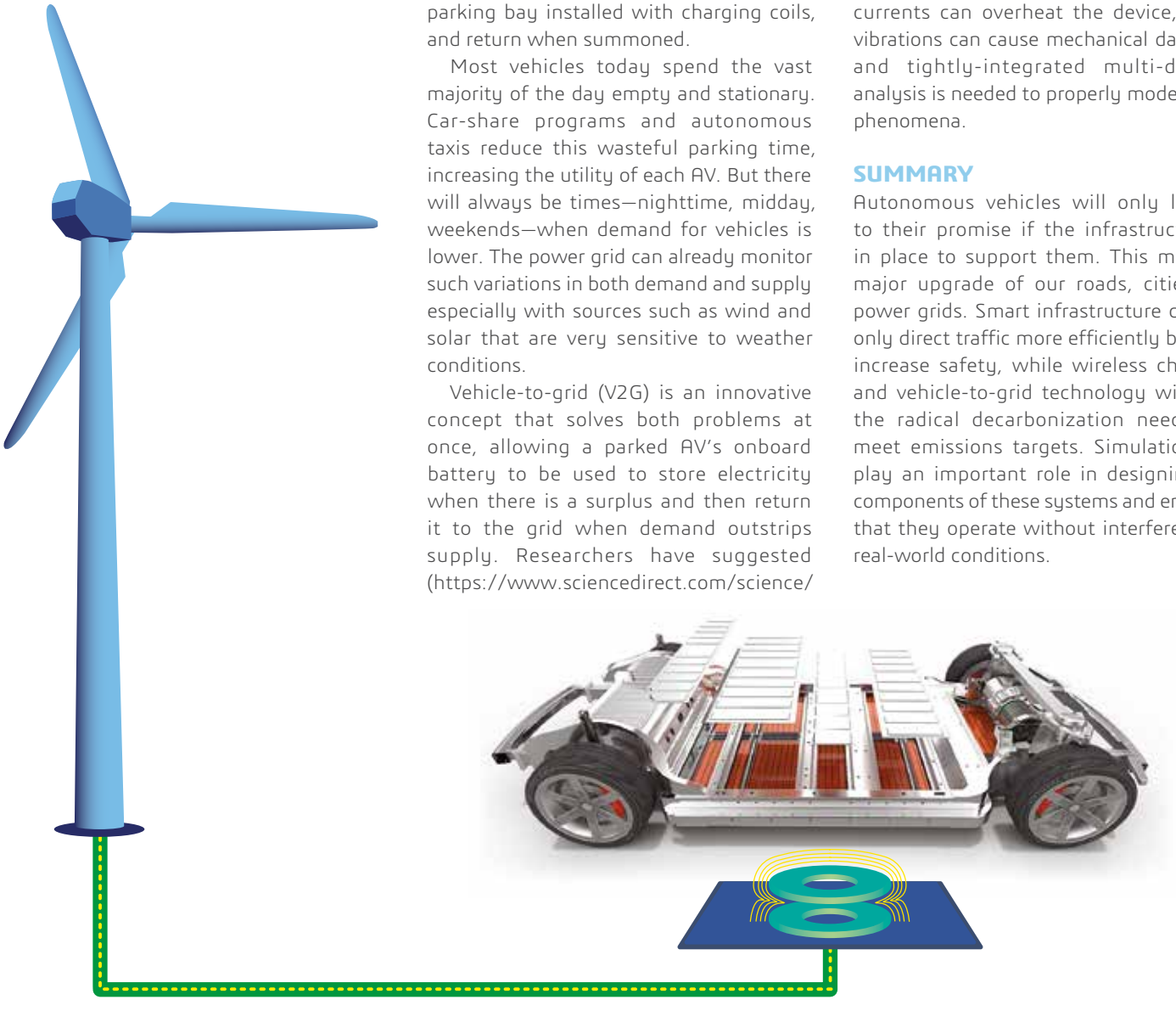
Vehicle-to-grid (V2G) is an innovative concept that solves both problems at once, allowing a parked AV's onboard battery to be used to store electricity when there is a surplus and then return it to the grid when demand outstrips supply. Researchers have suggested (https://www.sciencedirect.com/science/article/pii/S0968090X18309197) that this means an autonomous vehicle fleet is not just a transportation asset but also a power-delivery asset. Adding V2G technology into AVs can significantly increase the profitability and practicality of autonomous taxi technology.

Existing grid-control scenarios will need to be adapted, smart meters will have to be rolled out, and infrastructure such as cables and transformers will need to be upgraded to get power to where it's needed.

The design of high-voltage power-grid components such as transformers requires electromagnetic, thermal and structural effects to be considered simultaneously. Each domain of physics is tightly linked to the others—for instance, electric currents can overheat the device, while vibrations can cause mechanical damage—and tightly-integrated multi-domain analysis is needed to properly model these phenomena.

SUMMARY

Autonomous vehicles will only live up to their promise if the infrastructure is in place to support them. This means a major upgrade of our roads, cities and power grids. Smart infrastructure can not only direct traffic more efficiently but also increase safety, while wireless charging and vehicle-to-grid technology will help the radical decarbonization needed to meet emissions targets. Simulation will play an important role in designing the components of these systems and ensuring that they operate without interference in real-world conditions.



GLOBAL HYBRID ELECTRIC CHALLENGE

The Global Hybrid Electric Car Challenge is a competition aimed at educating students about renewable energy in transportation. The main purpose is to travel the longest distance in a fixed amount of time and with a fixed amount of fuel and stored electrical energy.

The car is a one-person racing vehicle that runs on battery power in parallel with a petrol engine generator power when being charged. The GHEC organization offers a kit to all teams, composed of all major components (chassis, outer shell, motor, batteries). The engineering challenge is to assemble and integrate these parts to achieve the highest reliability and efficiency. For the Khalifa University team from the United Arab Emirates (UAE), the project offered insight on a discipline of engineering that is not introduced through classroom lectures and theories, a part in which they had to relate the knowledge they had to real car racing issues and tasks.

This was not the first time the co-ed team competed in the challenge. "We have always been the lead in the UAE in such competitions and we've always participated in automotive challenges like this." The last race, held in November 2018, was the third time the KU team has competed in the GHEC race held in UAE. Through the support of the university, the team has been able to give themselves a bigger challenge each year, by innovating more on the basic components and design of the vehicle.

The team had a general understanding of designing and building the vehicle through the components available in the purchased kit including the vehicle chassis, electrical components, plastic shell and even the batteries. However, when they needed to explore weight reduction for the chassis and reducing energy consumption, they knew that a better way of designing and testing was required before building the car. They determined the best way was to design the chassis using CAD software, simulating possible collisions through FEA. This allowed the team to carry out any necessary adjustments to the geometry on the spot whenever needed without having to redo any calculations. The team used Abaqus (student version) to model the integrity and strength of the chassis of the vehicle as they changed the material from carbon steel to aluminum alloy.

"My main motivation to take part of this team is that I wanted to experience being part of a racing team, as well as get hands-on experience with actual electromechanical systems."

—Melad Fahed, a Mechanical Engineer (Master of Science) at Khalifa

At the first stage of the project, the team began with SolidWorks to model and simulate the chassis. Then, as needs arose for more advanced structural simulation, they decided to use Abaqus due to its availability at the campus and its capabilities to run all needed simulations on the chassis, as well as test any modifications made.

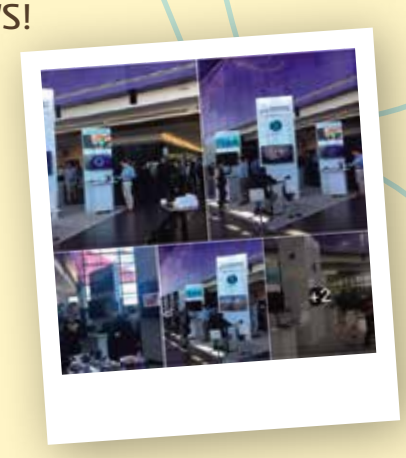
NEXT STEPS

For future challenges, the team plans on taking the development of the car chassis even further by looking at weight reduction and distribution, better car handling and even customizability for wheel setup. They also hope to improve the aerodynamics of the chassis by performing detailed CFD analysis. As the 2019 challenge approaches in November, the KU team hopes not only for a win but for a deeper understanding of hybrid and electric vehicles.

For More Information
http://uae.globalhechallenge.org/pages/About.aspx

Trending

CATCH UP ON THE LATEST SIMULATION NEWS!



There is no end to the fun at NAFEMS this week. Presentations tomorrow by Ross McLendon, Bernd Crouse, Alex Van der Velden, Akshay Narasimhan and Sasi Sithambaram Join us! **#MaterialCharacterization #additivemanufacturing #optimization #simulation #3dexperience #SIMULIA #joinus**

As aerospace and defense becomes an increasingly competitive field, speed in developing products is obviously important, but fast development time means nothing if regulations are not met, and as aircraft become more high-tech, regulations get more strict. Find out the role of **#simulation** in satisfying regulatory requirements. **#SIMULIA #3DEXPERIENCE #fluids #aerospace #airplane**

We are at BMES—Biomedical Equipment Service Company /FDA's Frontiers in Medical Devices conference this week showing our Living Heart and Abaqus technology. Customer presentations tomorrow include the following: Matthieu De Beule of FEops on computational aortic valve implantation; Daniel Cooke of Boston Scientific on modeling of fatigue life of CRM leads; and Sakya Tripathy of Edwards Lifesciences on living heart boundary condition estimation for structural heart models. Please visit **https://lnkd.in/eiAJY_w for the agenda.#livingheart #abaqus #simulation #SIMULIA**

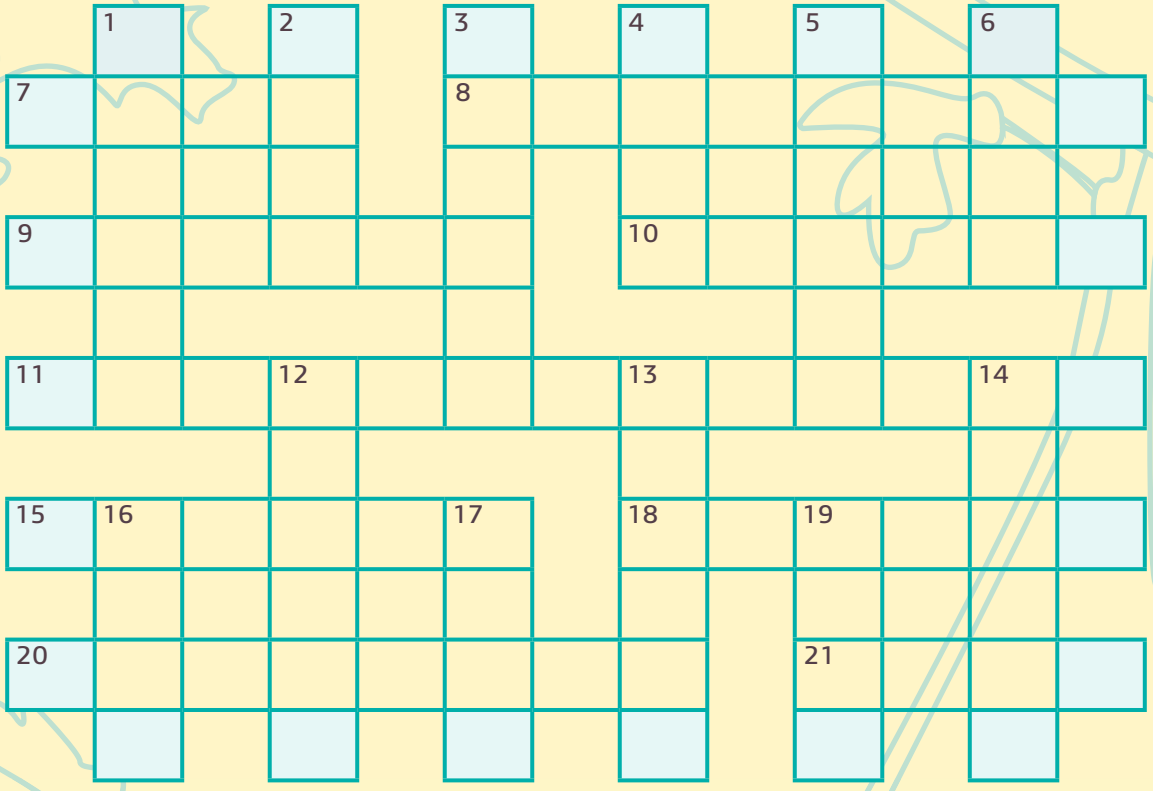
Follow us:

Traffic everywhere is going to get a lot worse especially when you are adding 83 million new humans a year. The world is on track for a gridlock nightmare. How do we address the challenges of ground-level urban transportation? One way is to move into the skies. Urban Air Mobility (UAM), is centered on Environmental Sustainability (electrification, low-noise, recyclable parts, etc.), and the main ambition of **#UAM** is to extend urban transportation from 2D to 3D by means of safe, clean and affordable concepts. **#transportation #traffic #aerospace #sustainable #environment #engineering #simulation #SIMULIA**

The Worldwide Light Vehicle Test Procedure (**#WLTP**) is a new test regime for vehicle emissions that poses several challenges to manufacturers, making it difficult to meet regulatory limits, and also causing significant disruption and delays in the certification process itself. **#SIMULIA** has developed tools and processes to overcome the challenges that the automotive industry is facing under WLTP. Learn more about how SIMULIA is addressing these challenges, and how automotive OEMs can leverage these solutions to ensure their vehicles will meet the requirements under WLTP, on time and without performance compromises. **#automotive#emissions #environment #simulation**

With growing environmental concerns in a competitive market, there is a lot of meticulous thought that goes into bottles we use every day. How does **#Amcor** deal with the tremendous pressure of this industry? With the help of simulation. **#SIMULIA #3DEXPERIENCE #simulation #engineering #environment #WorldEnvironmentDay2019**

Challenge!



The complete grid contains a hidden message, running clockwise around the outside.

ACROSS

7 Clean and tidy (4)

8 Spelled out; like a module of Abaqus (8)

9 Needed to scratch (6)

10 Grab (6)

11 The future of cars (13)

15 Boasts (6)

18 Time when someone must stay inside (6)

20 Tool for precise isotope analysis (8)

21 Prefix meaning "related to Mars" (4)

DOWN

1 Something for hire (6)

2 Carve (4)

3 Seller (6)

4 Legend, or "great" in internet slang (4)

5 Having more space (6)

6 Early computer (4)

12 Finger food (6)

13 Used sustainable transport (6)

14 Someone who watches (6)

16 Missing without permission (4)

17 What 14 down might watch (4)

19 Genuine (4)

VISIT THE SIMULIA BLOG ON OCTOBER 1ST TO CHECK YOUR ANSWERS!
https://blogs.3ds.com/simulia/reveal-magazine-crossword-puzzle-answers

REVEAL THE WORLD TOUR

SIMULIA TAKES MOBILE PLAYGROUND ON THE ROAD

SIMULIA hits the road this fall with our Reveal the World tour to highlight our playground of interactive experiences. The tour starts at the **3DEXPERIENCE** Modeling & Simulation Conference before touring through Detroit and several other cities in the Midwest.

The 10-week tour will visit customer sites, Dassault Systèmes offices and universities. Tour stops include:

- Chicago, IL
- Cincinnati, OH
- Cleveland, OH
- Columbus, OH
- Detroit, MI
- Indianapolis, IN
- Milwaukee, WI
- Minneapolis, MN

WE LOOK FORWARD TO SEEING YOU ON THE TOUR!

#revealtheworld

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