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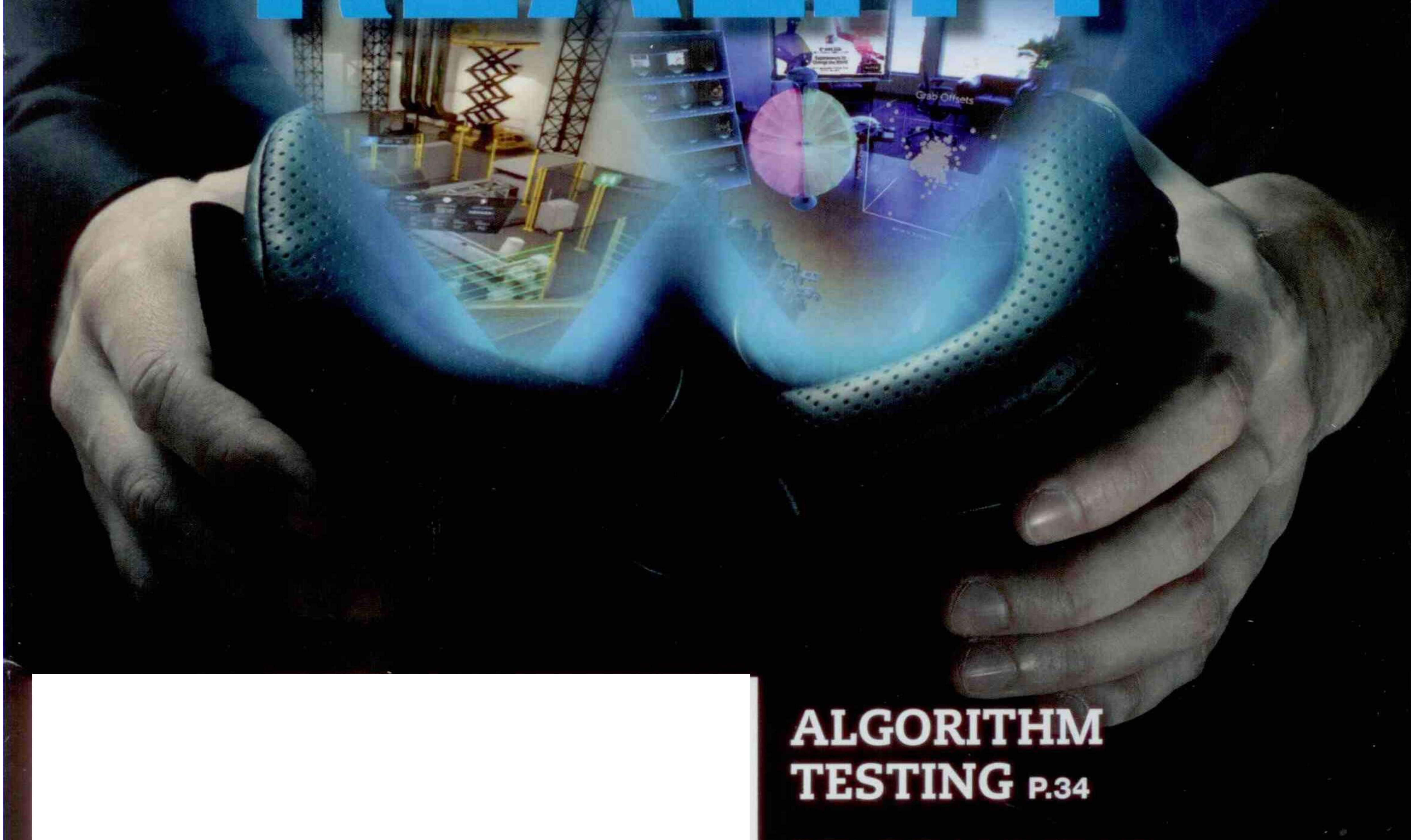

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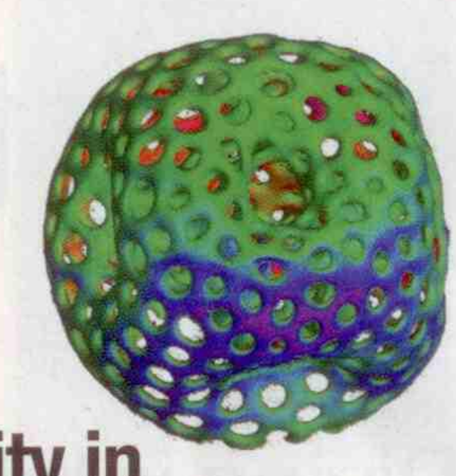

Reverse Engineering: Reducing Production Costs

The production of functioning prototypes, that at the same time have to achieve the demands of a sports car, requires precision and durability.

From the very beginning, a project for the first Polish supercar, Arrinera Hussarya, has been arousing strong emotions and hopes that the Polish automotive industry will come back to its past glory. The production of functioning prototypes, that at the same time have to achieve the demands of a sports car, requires precision and durability.

Unlike most contemporary Polish automotive projects, Arrinera Hussarya is built from the ground up. All parts of the car body, engine and interior, despite the fact that they often use proven technologies, are redesigned to not only meet all the requirements but to also represent the aesthetics worthy of a supercar.

Reverse Engineering Reduces Production Costs

Redesigning a supercar is not only a very time-consuming, but also an extremely costly process. The Arrinera engineers searched for ways to accelerate the development and reduce the costs. They finally decided to use reverse engineering, which is the process of reconstructing the technical documentation of an existing element in order to re-design it.

By using a professional SMARTTECH 3D scanner, the engineers working on the supercar gained the ability to quickly obtain comprehensive information about the geometry of the car parts. An excellent example of the capabilities of the 3D scanning technology is the process of designing and manufacturing the clutch housing.

It is no secret that a sports clutch is subjected to completely different pressures than a normal clutch working in a standard car. An 810 Nm torque requires the use of not only a reliable but also lightweight clutch design. The 3D scanner made it possible to obtain the technical documentation of a housing already present on the market and redesign it in CAD software to install the mounts fitted to the vehicle's structure.

Green Light is the Future

A 3D scanner, MICRON3D green, with a 10-megapixel detector was used for accurate measurement. The technology, based on the green LED light, allows the measurements to achieve 30% better results than when using 3D scanners with white light, according to the company. With a field of view of 800x600mm, the 3D scanner obtains a point cloud representing the scanned shape with 0.084 mm accuracy.

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Ensuring Part Quality in Industrial Metal Additive Manufacturing

Sintavia uses Concept Laser's meltpool-monitoring system to demonstrate value of in-situ monitoring of metal AM builds.

Now that metal additive manufacturing (AM) is creating fully functional industrial parts, many OEMs are taking a closer look at how the technology might support their individual production goals. Interest has also been piqued by the commitment to AM of some very major players.

"I think the news about the GE Leap engine fuel nozzle really resonated throughout industry," says Doug Hedges, president and COO of Sintavia LLC, a metal AM service provider for aerospace, defense and other industries. "That got everyone's attention and certainly increased the pace of inquiries for us." The nozzle, produced internally at GE, was the first 3D-printed part certified by the U.S. Federal Aviation Administration (FAA) to fly inside a commercial jet engine.

Brian Neff, Sintavia CEO, had already founded Sintavia (a combination of "sintering" and "aviation") in Davie, FL in 2012, the year before the GE milestone announcement. Informed by his and Hedges mutual aerospace backgrounds, they'd had an eye on AM for quite some time.

"Additive manufacturing is a very challenging field," says Hedges. "We felt we needed to enter it in the early stages—rather than wait until the industry was more mature—in order to refine our skills." Their AM resources now include five machines from three of the leading metal manufacturers as well as an electron beam melting (EBM) system—and they are finalizing plans for a new facility, over five times the size of the current 10,000-sq.-ft. building, to open in mid-2018.

Metal AM for Aerospace

While metal AM is at the center of Sintavia's offerings, their core competencies also include full material characterization (including ISO 17025 accredited powder analysis and mechanical testing laboratories), as well as finishing processes such as Heat Treatment, HIPing (Hot Isostatic Pressing), and CNC machining—plus CT scanning to inspect the integrity of the final product. "AM gets much of the attention, but post-processing and analysis are pivotal to delivering critical parts," says Hedges. "Our customers are looking for a facility that can control the entire AM-build process."

After five-plus years in operation, Sintavia's client roster is currently about 75%-80% aerospace (including all of the top-20 OEMs) plus oil & natural gas, automotive and turbomachinery for power generation. Clients are interested in AM research and development (R&D) as well as production of finished parts.

Their aerospace customers focus on everything from aircraft to satellites to weapons, according to Hedges. "There's flight hardware that would go on a Boeing 787 and then there's flight hardware that might go on a satellite or an unmanned vehicle," he says. "To qualify parts for flight hardware of any kind is a very intensive thing but for human travel the substantiation is a lot higher. So the better monitoring of manufacturing you have, the better inspection you have, the more assurance you're going to have to say this product is capable of a flight usage."

Many of the same materials used in aerospace are also employed by Sintavia customers from other industries, Hedges points out. "An oil and gas equipment supplier may want us to build a wellhead cap, a sensor or a tool that needs to be extremely corrosion-resistant—so they use the same superalloys, often Inconel 625 or 718, as those in jet engines," he says. "With steam turbines, which are basically just jet engines on the ground, the hardware undergoes much of the same stresses as a jet. So the materials used to additively manufacture all these parts are often remarkably similar."

AM can make such superalloys easier to work with, Hedges notes. "Inconel is notoriously difficult to machine but AM allows you to create complex interior channels directly within a build, cutting down considerably on machining time."

Mastering the Complexity of AM

As their business accelerates, Sintavia's AM expertise continues to deepen, along with an understanding of the complexity of the technology. The "wishbone" roadmap, known in the industry as the Ishikawa diagram of process parameters for AM, continues to guide their inquiries into the many variances that could potentially affect part quality.

"AM has many more input parameters than traditional manufacturing and many of these factors are also more difficult to control," says Sintavia lead engineer Pavlo Earle. Prior to joining the company, he spent eight years at Rolls-Royce specializing in welding, brazing and additive manufacturing. "There are many fundamental similarities between AM and welding," he notes. "There was an intense focus on quality at Rolls-Royce; here at Sintavia we're equally devoted to learning, understanding and controlling every aspect of the pre- and post-process parameters that have an effect on the quality and cost of a product."

There is growing demand for this kind of attention to detail across industries either engaged in, or wanting to become involved with, additive manufacturing, says Hedges. "At this point in time the most pressing needs for additive manufacturing are industry standards that incorporate ASTM, AMS, implementation into the MMPDS, material and process specifications, data collection and access, post-processing, fatigue assessments and standards that include actual CT scanning instead of film.

"We differentiate ourselves by helping customers develop parameters and processes that work towards establishing such industry and company standards."

Monitoring the Meltpool

This philosophy of supporting quality production with intense R&D was behind Sintavia's latest Direct Metal Laser Melting (DMLM) machine acquisition—a Concept Laser M2 cusing system—in the autumn of 2016. German AM provider Concept Laser is known, not only for its equipment, but also for its "QM Meltpool 3D" technology, which won the International Additive Manufacturing Award (IAMA) earlier that same year.

The QM Meltpool 3D system monitors specific process parameters of a LaserCUSING build as it's actually in progress.

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Artec 3D Scanning Helps Create Hybrid Reality at NASA

With the Artec Eva 3D scanner, engineers at NASA's Hybrid Reality Lab are able to scan tools and other assets that are used in space and create 3D printed trackable versions that can be used to enhance training.

NASA is currently on a mission to send humanity deeper into the Solar System than ever before. This includes the completion of programs like the Orion capsule and the Space Launch System. Completing these programs requires the creation of new training and new procedures that astronauts will have to learn.

It is important to find ways to reduce the impact on cost and schedule while still maintaining the efficacy of traditional astronaut training methods, especially when it comes to the exploration of Mars, where missions are expected to last months or years at a time. NASA engineers can take advantage of immersive environment technologies to see how to make the training experience feel as realistic as possible while running various simulations.

In 2015 NASA founded the Hybrid Reality Lab to combine consumer virtual reality technology and tracked 3D objects (locating an object in 3D space using object tracking technology) in order to make realistic visuals and tactile feedback, giving a much stronger and better sense of immersion. The lab uses off the shelf VR headsets, and Unreal Engine 4 (a commercial game engine supporting advanced rendering, physics, and networking capabilities), and NASA-specific content to create training environments.

A major goal is to simulate reduced gravity and the sense of tactile feedback. Right now a sister branch at NASA's Johnson Space Center operates the Active Response Gravity offload system (ARGOS).

"It is essentially a smart tether, which attaches to your back, offloads your body weight and accounts for your momentum in the vertical and horizontal directions to make you feel like you are in Lunar gravity, Martian gravity, microgravity or anywhere in between," says Matthew Noyes, Software Lead at NASA's Hybrid Reality and Advanced Operational Concepts Lab.

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