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formnext magazine

Growth is the right thing to do in this market now.

[Daan A. Kersten, Additive Industries]

EDITORIAL

For members of the human race on Earth, time is a constant we can neither stop nor turn back. On occasion, arriving too late at a train station, an airport, or an important meeting gives us a rather harsh reminder of that fact. Time is, after all, like many other things: You only realize how important it is when you don't have enough. This is why economists view time not as a physical dimension, but as an object of value.

Indeed, humans seem to be the only living creatures on the planet that put themselves under pressure to meet certain appointments – and then complain about the resulting stress. Most animals take a more relaxed approach to the notion of time. Perhaps the best example is a type of giant sponge found in Antarctica, whose lifespan has earned it a reputation as the oldest animal on Earth. Scientists recorded measurements of the creature for 10 years, only to determine that it had barely grown at all. This led them to conclude that attaining its two-meter diameter must have taken the sponge around 10,000 years – meaning it was alive when humans were still hunting woolly mammoths.

One of the things we witness at formnext is that our industrialized world has much different standards when it comes to time. Every year, start-ups and more established firms develop new additive technologies and cutting-edge production techniques with breathtaking speed and bring them to Frankfurt for all to see. The industry's dynamic nature more or less forces these companies to achieve their next breakthrough … or risk seeing their particular success story come to an end. Facing this kind of pressure, who can afford to be an Antarctic sponge?

Certainly not Concept Laser or Desktop Metal, two companies featured in this issue that have come to terms with these demands and realized that growth is of the utmost importance. Or, to stick with the biology metaphor: Survival in our industry is not guaranteed to the fittest. You have to be the fastest, as well!

I hope you enjoy this edition of our magazine and take inspiration from the many exciting articles, use cases, and developments it contains.

Sincerely,
Sascha F. Wenzler
Vice President formnext

Cover: Philipp Manger

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FORMNEXT NEWS

FORMNEXT IS ALSO BECOMING INCREASINGLY IMPORTANT AS BUSINESS PLATFORM

Additive manufacturing is becoming more and more popular in industry. This has also been demonstrated at formnext 2017. Applications are increasing rapidly, the number of users is growing as well as the number of industrial areas in which additive manufacturing is used. For example, the plastic 3D printer used to manufacture production aids is almost as natural in some advanced companies as the 2D laser printer in the office.

The growth in the breadth and in the multiplicity of the applications results in the fact that the industry no longer perceives additive manufacturing alone as a future technology but looks increasingly at worthwhile applications and business cases. So it's more and more about the concrete business. »The AM industry and formnext as their leading trade fair have grown up,« explains Sascha F. Wenzler, Vice President for formnext at event organizer Mesago Messe Frankfurt GmbH.

20 SYSTEMS SOLD ON THE FIRST DAY

The great economic importance of formnext 2017 for the entire industry was also shown by numerous exhibitors, such as SLM Solutions. At formnext 2017, the Lübeck-based company not only presented the new SLM 800 with significantly increased installation space (850x500x280 mm), but also announced the sale of 20 of these systems on the first day of the exhibition.

»Numerous discussions and business deals directly at the trade fair show the high economic significance of formnext for us«, was the conclusion of Uwe Bögershausen, CEO of SLM Solutions. »We are very satisfied with the expert discussions with representatives from numerous industrial sectors such as the energy sector, the aerospace industry, the automotive and medical technology industries.«

XJET ALREADY ACHIEVED GOALS ON THE SECOND DAY OF THE EXHIBITION

Formnext was also a worthwhile business platform for young companies. The Australian company Spee3D had also sold its exhibited machine on the first day of the exhibition. Dror Danai, Chief Business Officer XJet, also showed great satisfaction. »We had already achieved our goals on the second day of the exhibition. We have come a great deal closer to our vision of changing the AM market for metal and ceramics.«

Rainer Grünauer, Head of Sales AM, TRUMPF Werkzeugmaschinen GmbH & Co. KG, gave the reason for the outstanding business deals at formnext 2017: »At formnext we meet all the customers we want to meet. Formnext brings together everyone who thinks about additive manufacturing and it's getting more and more.«

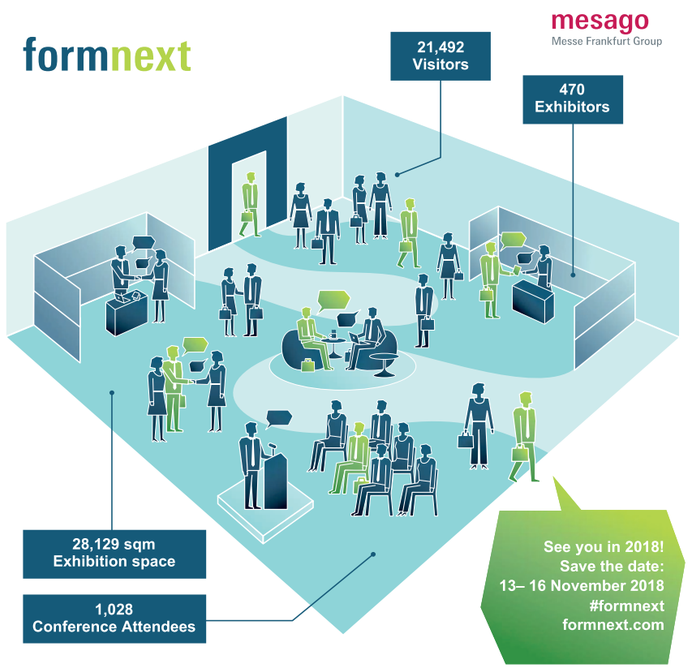
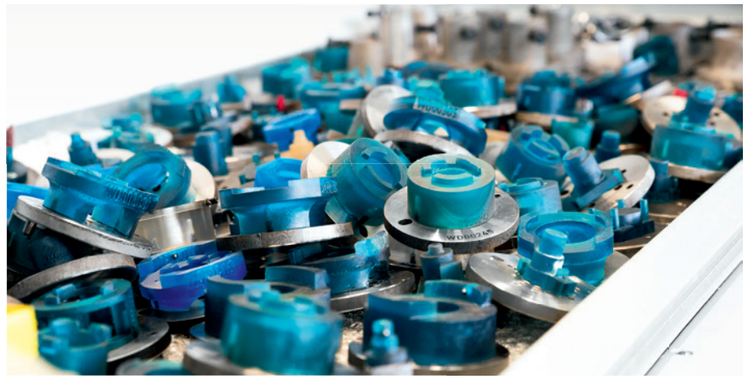


Illustration: Mesago

formnext 2017: all figures at a glance.

INDUSTRY NEWS



CHEAPER JIGS FOR MOTORCYCLE GEARS

Using 3D-printed jigs in its production environment has enabled Austria's Pankl Racing systems (a subsidiary of KTM Industries) to achieve savings of around €150,000.

At its new €36 million facility in Kapfenberg, the company has also increased its capacity to produce entire gear assemblies for a well-known motorcycle manufacturer. In doing so, it had to create more than a dozen different transmission models, each of which included around 10 gears.

The actual gear wheels required now undergo several processing phases during production (which involves automated lathing, stress-relief annealing, and other techniques). In each phase, specific jigs are needed that used to be made out of metal. To reduce its lead time by several weeks, Pankl has begun relying on 3D-printed variants.

These jigs were created using three Form2 stereolithographic printers from Formlabs, which reports that it was then possible to incorporate the printed units directly into Pankl's production line. In addition to its new jigs, Pankl is producing prototypes and gripping attachments for robotic arms on its 3D printers.

Instead of taking several weeks, Pankl's 3D-printed jigs were ready to use in just 5 to 10 hours. The company has managed to achieve significant cost reductions, as well: While a machined jig used to cost around €40-50 (and more complex parts up to €300), Pankl says that a printed variant runs between just €8.50 and €25. Based on the more than 1,000 jigs Pankl needs over the course of an entire production run, 3D printing is thus saving the company more than €150,000 in manufacturing costs.

YOUR 3D-PRINTED NAME ON THE BLINKERS

Mini, a subsidiary of BMW, is banking on personalization in its new line of cars. The British manufacturer plans to offer customers the option to apply their own designs to add-on components such as turn-signal inserts, decorative interior lining, and LED door projectors. These parts will be 3D-printed and delivered in the space of just a few weeks.

In realizing this new »Mini Yours Customised« project, the BMW group entered into strategic partnerships with Carbon, EOS, and Hewlett-Packard. Mini itself states that one of the aspects it focused on was »delivering a high quality of plastic«.

These upgrades can be selected, designed, and ordered through Mini's online shop. In addition to providing their own lettering, interested customers can choose from a variety of colors, patterns, and surface textures. Mini also points out that these parts can be replaced as often as drivers want – when it comes time to sell a vehicle, for example. According to the company, these options will be made available in the course of 2018.

Photos: Formlabs / Pankl (on top), Mini (below)

INDUSTRY NEWS

TURNING ALGAE INTO 3D-PRINTABLE BIOPLASTIC

Dutch designers Eric Klarenbeek and Maartje Dros have developed a bioplastic they hope will eventually replace conventional synthetic materials.

The new substance is based on algae, which the duo dries and transforms into printable material. Klarenbeek and Dros claim that their innovation can conceivably be used for anything currently made of petroleum-based plastic, from plates and shampoo bottles to garbage containers.

This 3D-printable algae is the result of a three-year research effort that involved a number of universities and labs. It also included the establishment of an algae production facility at the LUMA Foundation in Arles, France.

For Klarenbeek and Dros, manufacturing bioplastics goes hand-in-hand with the concept of decentralized production. »We want to change the system in a way that enables people to grow their own materials locally and use them to print the things they need,« Klarenbeek explains. In around 10 years, the designers hope to have witnessed the emergence of a local network of 3D bioplastic printers they call the 3D Bakery. »3D printing is going to be a new, decentralized craft economy,« Klarenbeek reveals.

Klarenbeek and Dros have already examined several biomaterials with an eye toward 3D printing, including mushrooms, potato starch, and bean shells. Six years ago, for example, they used a mushroom to print a chair. The pair more recently showed off products made of their new algae material as part of the Change the System exhibition at the Museum Boijmans Van Beuningen in Rotterdam, the Netherlands.

»WE'RE TALKING ABOUT NANOMETERS«

XJet's Carmel 1400 was one of the exhibition's key innovations at formnext 2017. The Israeli company had already displayed its precursor version last year. The first machine to be shipped is now in use at Oerlikon AM in Magdeburg, Germany. XJet consciously decided to make Germany the location of the first machine, viewing the Central European market as key.

Chief Branding Officer Dror Danai took great pleasure in reporting the exact resolution of the Carmel 1400: »We're no longer talking about microns here, we're talking about nanometers.« The precision of the XJet development reaches 10 nanometers with silver and 100 nanometers with ceramics. According to Dror, the industry norm had been around 10 microns, so 100 to 1,000 times greater.

To reach this new level of precision, XJet has devised a very sophisticated process in which the finest droplets of a dispersion are used to »print«. The Carmel applies 220 million droplets per second. The water from the dispersion evaporates in a split second on the 200-300°C building board. The remaining nanoparticles stick, forming a green body that then needs to be sintered. XJet promises not only high precision but also an extraordinary component density of 99.91%.

Founded in Israel in 2016, the company continues to grow. There are currently 85 employees, and this number is increasing by one a week on average.

Photos: Atelier LUMA / Antoine Raab (on top), Mesago / Thomas Klerx (below)

AM ON THE RISE IN MANY AREAS OF INDUSTRY

Additive manufacturing will permeate the production chain on an even deeper level in virtually every industry in the years ahead. In its latest forecast, the American market research firm Gartner takes a closer look at aerospace, medicine, and consumer products and predicts that 3D printing will continue to advance at a rapid pace. Gartner believes this will be evident in other areas of industry, as well.

In the aerospace sector, its market researchers expect that 75% of all the civilian and military aircraft that take to the skies in the next three years will contain 3D-printed components. Boeing, for example, began employing AM methods 20 years ago and now uses the technology at 20 locations in four countries. According to Gartner, more than 50,000 3D-printed parts are currently supporting both civilian and military flights. It also reports that GE Aviation has used AM to increase the output of its turbines by 10% while reducing consumption by 20%.

Meanwhile, Gartner sees additive technologies gaining further ground in hospitals and laboratories. In addition to estimating that around 3% of all major hospitals and research institutes now have their own 3D printers, the firm expects this technology to play an ever-greater role in training and simulations. Here, Gartner projects that 25% of all surgeons will prepare for operations using 3D-printed models by 2021.

INDUSTRY NEWS

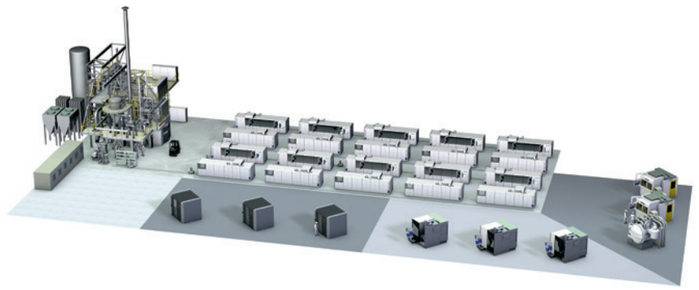
TURNKEY AM FACTORIES

Additive Industries and the SMS group have entered into a cooperation that aims to develop and jointly sell AM factories on an industrial scale. Their production concept will include powder production, 3D printing, and the further steps necessary in delivering finished components.

»The entire process will be designed to maximize productivity and finally make additive manufacturing competitive in series production,« states Guido Kleinschmidt, who belongs to the SMS group's management board. In this endeavor, the Düsseldorf-based group plans to leverage its experience in designing vacuum melting systems and engineering related processes.

The starting point of the whole procedure is powder production, where pure argon is used to atomize liquid metal in an oxygen-free environment. For the SMS group, the new, industrial-size pilot unit at its facilities in Mönchengladbach, Germany, represents an important milestone. A MetalFAB1 machine is to be installed right next to this unit in order to facilitate fully integrated powder processing.

Additive Industries' MetalFAB1 will also handle the additive manufacturing at the turnkey factories the two partners are planning, which will make it possible to apply stress-relief heat treatment and automate component storage. After that, mechanical processing, quality assurance, and other steps are also scheduled for implementation.



The AM factories will be designed to maximize productivity and finally make additive manufacturing competitive in series production.

Photo: SMS Group

FORMNEXT 2017: TOP STATEMENTS FROM SOCIAL MEDIA

Elementum 3D @Elementum3D · 21. nov
Formnext was a great success. The »Startup Challenge« award presentation was a hit and our first booth generated over 100 contacts!

Alexander Daniels Global @Alexanderdanielsglobal · 16. nov
This is awesome! There are so many incredible exhibitions on the different stands.

XJet @XJet_3d · 17. nov
What a fantastic @formnext_expo show! Thank you to everyone who has supported us.

Farsoon Technologies @FarsoonAmericas · 17. nov
@formnext_expo was a blast, great seeing all the #3dprinting innovations for the future and meeting with amazing people. Until next year!

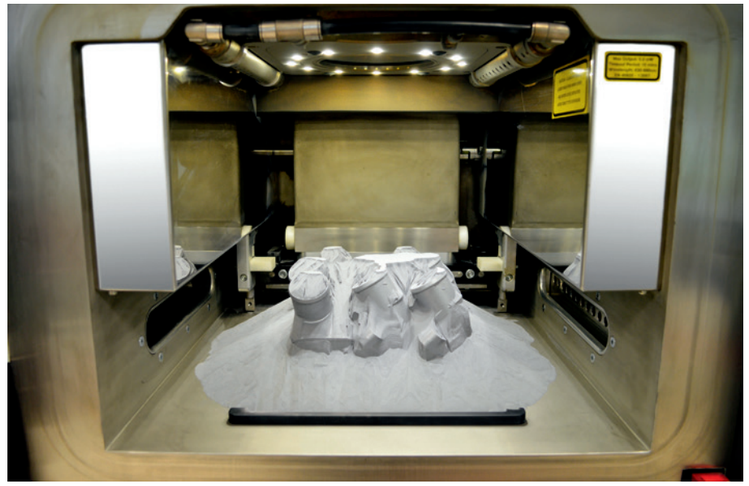
@BigRep · 23. nov
Formnext was bigger this year than last, and with the main focus on the big players on moving the industry from prototyping to manufacture it was far more interesting. A clear vision shined through to integrate 3D printing into long-term design and manufacturing processes, for both advanced polymers and metal technologies.

Rachel Park @RPES12 · 15. nov
#formnext never disappoints! #3DPrinting Information overload today. Lots of it exciting, some of it par for the course some trouble brewing.

DesignBox3D @DesignBox3D · 16. nov
What a great week to be in Frankfurt at #formnext2017 – we love it!! #3DPrinting at its best.

3DPrint @ 3DPrint_com · 17. nov
#formnext 2017: is a wrap! Brilliant, busy week of #3Dprinting in Frankfurt.

INDUSTRY NEWS



SPARE PARTS GO DIGITAL

Five percent of spare parts could currently be stored in digital warehouses. This would make parts more quickly and easily available, while creating considerable cost savings. A two-year project led by VTT Technical Research Centre of Finland and Aalto University, investigated how businesses can gain a competitive advantage from digital spare parts. »3D printing technology has reached the stage where high-quality manufacturing is possible,« says Sini Metsä-Kortelainen, VTT's project manager.

Big production plants maintain large spare-part warehouses, where a vast number of parts wait for long periods before being used. The research project found that digital spare parts are particularly appropriate in the case of extremely old or rarely needed parts, the warehousing or availability of which would not be viable.

Manufacturers are already using 3D printing in product development and, to an increasing extent, in the production of spare parts. However, most spare parts are designed for manufacture by traditional methods. The challenge lies in identifying 3D-printable parts from spare part libraries and arranging the data in such a manner that all other manufacturing information is available in addition to 3D models.

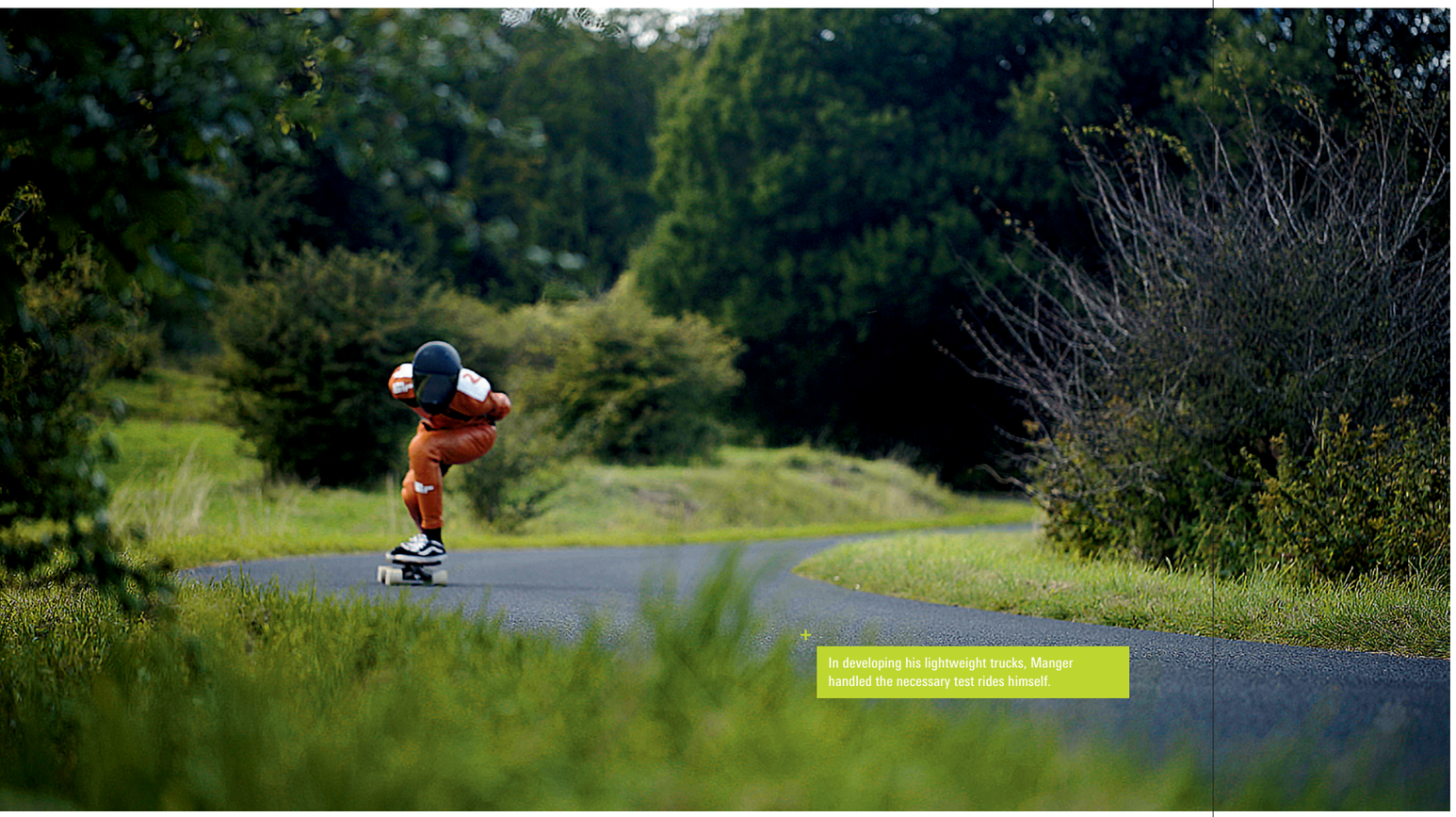
Already some month ago Mercedes-Benz Trucks announced to 3D print metal spare parts for older Mercedes-Benz model series. The first 3D metal part produced was a thermostat cover. According to Mercedes-Benz this replacement part is only ordered in small numbers, and is used in older truck and Unimog models whose production ceased around 15 years ago.

Photos: Daimler

BLAZING TRAILS, ONE OLLIE AT A TIME

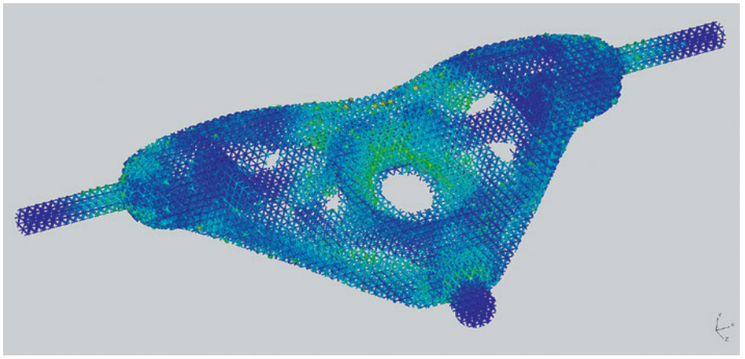
Text: Thomas Masuch · **Photos:** Philipp Manger

In Project T.O.S.T., Philipp Manger is using titanium skateboard trucks as an example of how to achieve extremely lightweight designs. The principle of combining a bionic design with an internal lattice structure should be relatively easy to transfer to other applications.



In developing his lightweight trucks, Manger handled the necessary test rides himself.

Working with as few different software tools as possible was another focus of the project, as Manger was intent on evaluating the lattice structures with a reasonable amount of processing power.



Though he isn't a pro athlete, Philipp Manger probably rides one of the most expensive skateboards in the world. The trucks alone – that is, the parts that connect the wheels to the deck – cost several thousand euros. The fact that they were 3D-printed from titanium hasn't made Manger much faster on the board, but it has given him plenty of additive insights – and a number of contacts in the industry.

»In the beginning, it was just an idea that popped into my head,« the 31-year-old recalls. »It wasn't long before it became the biggest project I'd ever put together, though.« Manger is an avid skater himself, having been an active member of the longboard scene for nearly 10 years. With these boards, it's not about pulling off tricks; it's about speed. It's not uncommon for riders to hurtle down mountains and passes at 90 km/h or more, which puts quite a lot of stress on their boards – especially the trucks.

Attending an Airbus engineer's presentation on additive manufacturing led Manger to take a closer look at the possibilities afforded by metal laser sintering. Ultimately, he came up with the idea to 3D-print his skateboard's most essential components. In doing so, Manger – a design engineer by training – already had 15 years of CAD experience to rely on.

This endeavor eventually evolved into the research project T.O.S.T. (Topology Optimized Skateboard Trucks), in which Manger has cooperated with Fraunhofer IWU (Dresden) as part of his final work on precision mechanics at the University of Applied Sciences Jena. Here, skateboard trucks have served as a basis for pursuing advancements in how additive components are designed and engineered. »I was looking to explore and compare different approaches to optimizing additive manufacturing,« Manger explains. In addition to topology optimization, he began focusing on lattice structures for the interior of components. The trucks he eventually produced featured a »hybrid topology« that combined both methods.

To determine the necessary degree of stability, Manger conducted a number of stress tests. He used a data logger of his own design »

You can apply the concept to any area where you're trying to achieve lightweight constructions by reducing material usage.

Philipp Manger presented his project T.O.S.T. at formnext 2017.

to take measurements during test rides, including on the impact caused by potholes and the forces at play when a rider slides at an angle to slow down. Experimental analyses were also performed at Fraunhofer IWU to measure the rigidity of the trucks typically available in shops.

Since he didn't have direct access to the resources Project T.O.S.T. would require, Manger had to seek out support from partners. This was how he connected with Fraunhofer IWU, Autodesk – which has provided him with two software applications, NetFabb and Fusion 360 – and eventually, Concept Laser. Working with as few different software tools as possible was another focus of the project, as Manger was intent on »evaluating the lattice structures with a reasonable amount of processing power«.

PUSHING THE PARAMETERS TO THE LIMIT

The titanium trucks were 3D-printed by a Concept Laser M2 Cusing machine at Fraunhofer IWU's facilities in Dresden, with each truck requiring around 40 hours of production time. Manger chose a rather expensive alloy (TiAl6V4) for this purpose due to its specific rigidity and resistance to corrosion. Once printed, the trucks were subjected to vacuum heat treatment to minimize tension and increase the ductility of the metal.

During this undertaking, Manger has tried to push the parameters to the limit. The optimized lattices at the core of his trucks now have a diameter of between .2 and .5mm, and most of the outer shell is less than .8mm thick. »That's how you pull off the significant weight reductions that make extremely lightweight designs possible,« Manger happily points out.

While these expensive trucks will likely never make it to series production, the principle of combining a bionic design with an internal lattice structure should be relatively easy to transfer to other applications. »You can apply the concept to any area where you're trying to achieve lightweight constructions by reducing material usage,« Manger explains. Among other accolades, his project's accomplishments garnered a nomination to the final round of the 2017 TCT Awards.

Meanwhile, Manger had more good news to report from formnext 2017: His skateboards were featured at the booths of the four partners involved in his project. Each exhibitor had laid out a fairly significant sum to acquire one of these prized decks from Fraunhofer IWU.

+ FURTHER INFORMATION:
» fon-mag.com

Photo: Thomas Masuch

»WITHOUT SUFFICIENT GROWTH, YOU'LL GET LEFT BEHIND«

Text: Thomas Masuch

According to Frank Herzog, chairman of Concept Laser, GE's recent involvement presents huge opportunities for his company.

Although Frank Herzog and Concept Laser have been part of the General Electric group since October 2016, this appears to have had no impact at all on his entrepreneurial mindset. In a recent interview with formnext magazine, an enthusiastic Herzog spoke about the evolution of Concept Laser's facilities in Lichtenfels, Germany, and how he leveraged his solid contacts in the region to expand the company throughout an entire industrial park. While he describes himself as still having »the old naivety« it takes to dive into new ideas and projects, the 46-year-old Herzog is also »realistic enough« to see them through in practical ways thanks to his ability to keep his Franconian feet on the ground.

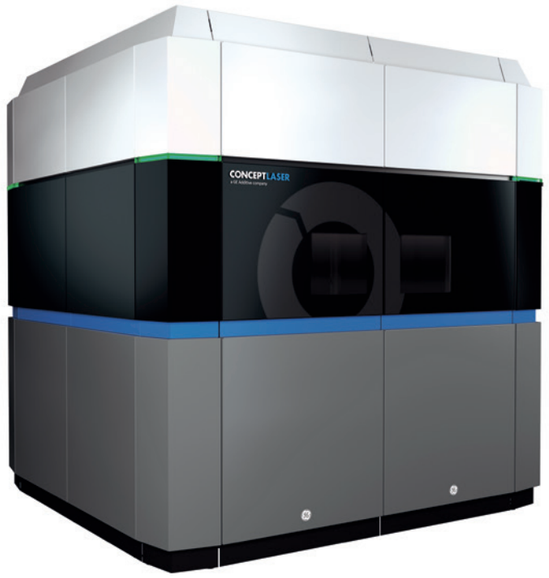
That said, Concept Laser has come a long way since the early days of the company. Its CEO's cheery, light-hearted disposition can distract one from the fact that major changes are under way at its German headquarters in Lichtenfels. In 2017 alone, Concept Laser's workforce grew from 200 to almost 400 employees – a development that proved how prescient it was for the company to invest in founding its own academy in 2007. Herzog, who studied mechanical engineering after training to become an industrial mechanic, could see Concept Laser growing to employ as many as 600 people someday.

PRODUCTIVITY EXPECTED TO KEEP RISING

Unveiled for the first time at formnext 2017, the beta version of the company's Project A.T.L.A.S. (Additive Technology Large Area System) boasts a building envelope of 1.1 x 1.1 x 0.3 meters – a strong sign of the technological boost GE's investment can provide. This is also evident in the machine's portal structure, optimized gas flow, and scanner-laser interface.

Breakthroughs like A.T.L.A.S. are opening up new areas of application in additive manufacturing, where productivity has continued to increase. »Ten years ago, we were doing one cubic centimeter per hour; now it's 40 or 50,« explains Herzog, who sees this as evidence of the vast potential the technology still holds. »There are still a number of tools we can use that will enable us to work much faster in the next three to five years,« he adds.

Photos: Thomas Masuch (left), Concept Laser (right)



Concept Laser's Project A.T.L.A.S. boasts a building envelope of 1.1 x 1.1 x 0.3 meters – a strong sign of the technological boost GE's investment can provide.

TURNING UP THE TEMPO WITH SUPPORT FROM GE

Having founded Concept Laser along with his wife, Kerstin, in 2000, Frank Herzog still holds a 25-percent stake in the company. He says he has no regrets at all about no longer being the only one at the helm; instead, he looks back on GE's 2016 arrival as a step in securing Concept Laser's future. »Before that, we'd been growing at quite a pace – by 100% in some years,« Herzog recalls. »We needed to take a more international approach.« He goes on to describe the resources this required, which ultimately slowed the company down. In a market as dynamic as AM, Herzog considers it very important to keep up with the pack. »In a way, you have no choice but to keep growing,« he admits. »Without sufficient growth, you'll get left behind.«

Thanks to GE and the latest investments in the company, Herzog reports that Concept Laser is back to growing as it once did. Its new, €105 million 3D campus in Lichtenfels is expected to give the company further momentum. Herzog is pleased with how this will benefit his employees, as well, including in the form of intriguing career opportunities within the GE group.

Meanwhile, GE's purchase of €549 million in Concept Laser shares doesn't seem to have changed Frank Herzog much as a person, even if his role is no longer the same. »You have to be prepared to be an important team player within the group,« he points out.

By all indications, Concept Laser is also having a great deal of success in another key area: selling its machines. One of its biggest customers is GE itself, of course, but its products are also very popular with companies outside of the group. »For every machine we deliver to GE, we put another three on the market,« Herzog reveals.

Most recently, Concept Laser had been selling around 160 machines per year. In our interview, Herzog regretted being unable to disclose the figure expected for 2017, citing the culture of communication at a huge public corporation as something he has »had to get used to«.

Ten years ago, we were doing one cubic centimeter per hour; now it's 40 or 50.

AM ARRIVES IN THE AUTOMOTIVE INDUSTRY

As it fine-tunes its approach to additive automotive production at its innovation center in Germany, GKN Additive is hoping to tap into significant economic potential.

Text: Thomas Masuch

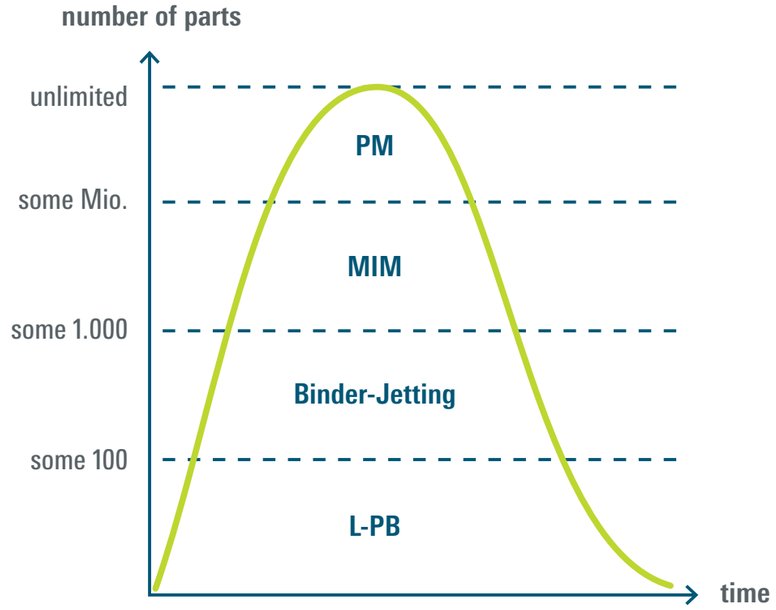
Not far from its glowing-hot sintering furnaces and metal presses rated at hundreds of tons, GKN has established a center for additive manufacturing in Radevormwald (near Cologne). There, a row of well lit, elegantly designed 3D metal-printing machines can be found behind a wall featuring an illuminated green corporate logo. The visual impression alone lets visitors know that this is a place where a new age of production is beginning.

Building up an additive manufacturing area at its German innovation center is a key part of GKN's ambitious plans. »Our goal is to make series production a reality in the automotive industry,« declares Simon Höges, the group's director of advanced AM technology.

GKN uses sintering technology to produce 11 million parts every day, which makes it one of the world's largest automotive and aviation suppliers. To realize its plans for the future, the group will need to take additive manufacturing to an all-new industrial level. Unlike other sectors – aviation, for example, where the advantage of AM mainly lies in weight reduction – the automotive industry focuses primarily on productivity. »We face a completely different kind of cost pressure,« Höges reveals.

At GKN's innovation center in Radevormwald, Germany, additive technologies are used alongside conventional production methods.

Photo: Thomas Masuch (left)



The right production technology is chosen based on the unit quantity required: Here, binder jetting and laser powder board (L-PB) methods make it possible to produce lot sizes under 10,000 units, as well.

Back in 2013, GKN started a business development project in which it wanted to identify and expand on sensible forward-thinking ideas. »Along with e-mobility, additive manufacturing is now one of our core topics,« reports Höges, who earned his doctorate at Fraunhofer ILT (Aachen) and has been responsible for establishing the AM section of GKN's innovation center since 2014. To advance these efforts throughout the group, GKN consolidated all of its AM-related activities under the division GKN Additive. This division now comprises 100 employees and has an external profile equal to that of GKN Aerospace, GKN Driveline, and GKN Powder Metallurgy.

Since powder metallurgy is one of the group's core areas of expertise, GKN is concentrating on metal in additive manufacturing, as well. Being a world-leading producer of such powder offers a number of additional benefits. Using the proven production methods PM (powder metallurgy) and MIM (metal injection molding), GKN typically manufactures quantities that start at around 100,000 units and have no real upper limit. In additive manufacturing, it now wants to start offering lot sizes of less than 10,000. »That's where we've had to turn down a lot of projects that weren't a good fit for our production facilities,« Höges explains. »As we incorporate AM into our operations, we're seeing plenty of demand in this area alone.« He adds that on the whole, AM is enabling GKN to »improve our coverage of entire product life cycles« (see graphic on top).

GKN BECOMES A BETA PROGRAM PARTNER

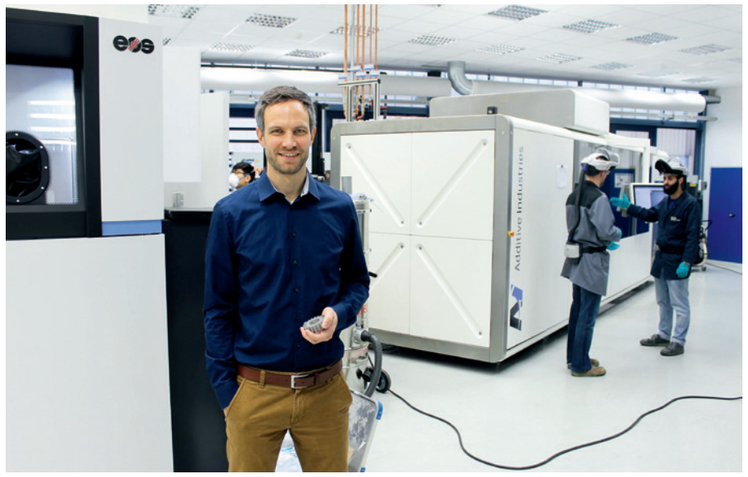
In developing additive series production, one of the obstacles GKN faced involved finding the right machines. »Quite a few systems were designed to produce prototypes, which didn't seem like a match for us,« Höges recalls. GKN was looking for more of a »machine tool«, which it eventually found through Additive Industries. This young Dutch machine manufacturer won Höges over with both its »vision and its mechanical concept for series production«, as he puts it. As a result, GKN was one of the first customers to get involved in the company's beta program as a development partner.

It then took delivery of an Additive Industries MetalFAB1 in Radevormwald in October 2016. At that point, Höges and his »

We face a completely different kind of cost pressure.

Bei über 1000 Grad werden die Grünlinge gesintert. Für deren Herstellung kommt neben dem MIM-Verfahren auch die Binder-Jetting-Technologie in Frage.

development team began working on achieving high (and reproducible) levels of component quality and density. An adjacent lab also examined the microstructures of numerous test series. This resulted in improvements to the MetalFAB1's hardware, which GKN discussed with Additive Industries in their regular monthly meetings. By the time the beta testing phase ended in December 2017, GKN had already produced and shipped multiple components. »It did require a lot of technical expertise in terms of using the machine, though,« Höges concedes. Plans are thus in place to simplify the operation of the MetalFAB1 before it makes its way to its final destination at GKN's production facilities in Bonn in the first half of 2018.



Simon Höges at GKN's innovation center in Radevormwald; pictured on the right is the MetalFAB1 unit GKN was beta-testing until December 2017.

Photos: Thomas Masuch (below), GKN (on top)

»WE'RE BECOMING A MAJOR USER«

Along with the MetalFAB1, GKN has other laser melting machines (including from EOS and Renishaw) at its disposal in Radevormwald. These systems serve as both production units and a benchmark for the MetalFAB1's development. »Our lineup of machines is probably going to keep expanding, especially at our production plant in Bonn,« Höges predicts.

GKN
With around 58,000 employees in 30 countries, GKN is one of the largest suppliers of automotive and aerospace components in the world. The group, which has called Great Britain home since its foundation more than 250 years ago, is also one of the biggest producers of metal powders – much of which it uses in its own production operations. Its divisions (Aerospace, Driveline, Powder Metallurgy, and now Additive) currently generate annual revenues of just under £10 billion, with Driveline contributing the largest share.

With its selective laser melting (SLM) systems, GKN will be looking to offer the lower quantities required in the production chain for small and complex high-end parts. At the same time, the group is also going to be manufacturing larger lot sizes of several thousand units using binder jetting technology. This method is relatively similar to the MIM procedure that has been employed for decades, which means GKN will be able to leverage its wealth of experience in sintering. Since parts produced through binder jetting exhibit a lower relative density than SLM components, Höges sees numerous potential applications in the automotive sector – especially as a complement to MIM and powder metallurgy.

RESEARCH ACHIEVING FURTHER EFFICIENCY GAINS IN PRODUCTION

To ensure GKN's continued success with AM techniques in the future, Höges and his colleagues are exploring a range of other developments. One of their objectives is to keep improving production efficiency, which requires component designs that reduce postprocessing to a minimum and the automatic removal of supporting structures.

The team is also researching other basic materials (such as copper) with an eye toward qualification, along with hybrid construction techniques. Here, additive and powder-metallurgy methods are combined in intelligent ways – by applying axial pressure to powder, for instance – to achieve greater productivity. Tests are currently being conducted on gear wheels, where 3D-printed internal components can lead to significant reductions in noise. For Simon Höges, there are already clear signs that these and other additive advancements will play a significant part in the success of the GKN group going forward. »We're working closely with our customers and partners on these future topics, and their feedback has been really promising,« he says.

FURTHER INFORMATION:

» fon-mag.com
» gkn.com

TALKING ABOUT

»We want to match the traditional technologies«

Desktop Metal was one of the most colorful young businesses to participate at formnext 2017. Equipped with the expertise of numerous MIT professors and €200 million in investments, the budding systems manufacturer, located close to Boston, Massachusetts, had already promised a small revolution in the additive manufacturing of metal parts prior to the exhibition. With the Production System, they aim to be 100 times faster at metal printing than laser-based systems. This led to many interested visitors flocking to their booth. We spoke to Jonah Myerberg, CTO and Co-Founder, about Desktop Metal's strategy for the future.

Photos: Desktop Metal

Text: Thomas Masuch

Jonah Myerberg, CTO and Co-Founder of Desktop Metal

Mr Myerberg, Desktop Metal has promised a lot over the past few months. What's the latest?

MYERBERG We're in beta development at the moment and are working with quite a few »pioneer customers«. Our prototypes are currently located at the factory in Boston and are manufacturing customer applications. With around 100 employees, we are working on designing and finetuning the systems for series production. At present we're also making developments in reliability, holistic automation, and powder recycling.

How will sales be organized?

MYERBERG We're currently developing the sales organization for our Studio System, and we'll then use the structures for the Production System too. We're already taking preorders. In Europe, for example, we are selling through renowned sales partners, such as alphacam, Tri-Tech 3D, and others. To further reinforce our connections with the German automotive industry, we've also opened our European headquarters in Munich. We're planning to ship the series systems from 2019.

Why exactly is the focus on Germany?

MYERBERG At formnext we found that there's enormous potential for our technology and applications in Germany. We made many great contacts in the user industry here. Germany is key for us since it's the most important market for metal injection molding (MIM).

What customers, applications, and volumes benefit from the system?

MYERBERG With the Production System we are mainly targeting the automotive industry. BMW is one of our selected strategic partners and is already using the Studio System with us. The Production System is worth it for volumes of one unit to several hundred thousand units. Conventional metal injection molding requires very high starting investments of over €100,000 and is therefore only worth it with very high volumes. We are filling in a niche and enabling users to find new partners and customers.

Additive metal manufacturing had generally been very costly until now. Therefore it's been important with most of the current applications to create added value.

MYERBERG Added value is the icing on the cake. For us it's mainly about efficient production, though. We want to match the traditional technologies. Added value doesn't always have to come from a component. It's also attainable in production, for instance by economizing on material.

Binder jetting technology has been on the market for many years, already. So far, the technology has not been completely successful, as it sometimes required the use of additional metal or the components are very porous after sintering. What is Desktop Metal doing differently now? What will be the density of the components?

MYERBERG While binder jetting technology has been around for many years, Desktop Metal's Production System is based on a new approach to metal 3D printing – Single Pass Jetting. Created by the inventors of both the binder jetting (Ely Sachs one of our co-founders) and the single pass inkjet (Paul Hoisington, also with Desktop Metal) processes, single pass jetting builds metal parts in minutes instead of hours, making it ideal for the production of complex, high-performance metal parts at high volumes. Since no tooling is needed, it can outperform traditional manufacturing processes like casting while adding major benefits of AM like just-in-time production and mass customization. In addition, we designed our systems to use MIM materials, which enables an ecosystem of high-quality alloys with the well studied process controls of metal injection molding. We do not infiltrate, we sinter to high density like MIM and other PM parts.

»Production System«
Based on Single Pass Jetting (SPJ) technology, Desktop Metal promises very fast production of metal components with the Production System. The system has a work area of 330 x 330 x 300 mm and »prints« both powder and a binding material in thin layers. According to Desktop Metal, it reaches a production speed of up to 8,200 cm^3 per hour. The parts then need to be chemically »debound« and sintered in an oven.

+ FURTHER INFORMATION:
» fon-mag.com

»OUTSIDE THE BOX«

A New Way of Thinking

Text: Thomas Masuch

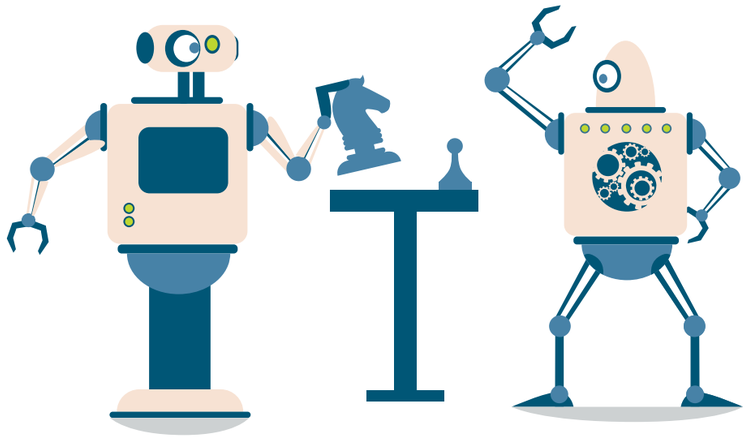


Illustration: iStock/gmast3r

In Europe, playing chess is a tradition that goes back around 800 years. For some, it's the undisputed king – or perhaps more appropriately, the queen – of all games. Others see it as nothing more than a waste of time. Regardless of one's own personal viewpoint, it's a fact that chess has produced no shortage of stories and myths.

Since 1996, however – when the computer Deep Blue defeated then-world champion Garry Kasparov in a game – a changing of the guard has taken place: The machines have left us humans further and further behind. These days, grandmasters no longer even consider taking on the most powerful chess programs. That's how unbalanced the playing field has become.

As many experts have tried to learn from the superiority of these computers, chess has grown more technical and analytical.

That said, a new era may have begun just a few weeks ago with Google's AlphaZero – a program that has brought something akin to human creativity back into the highest level of the game.

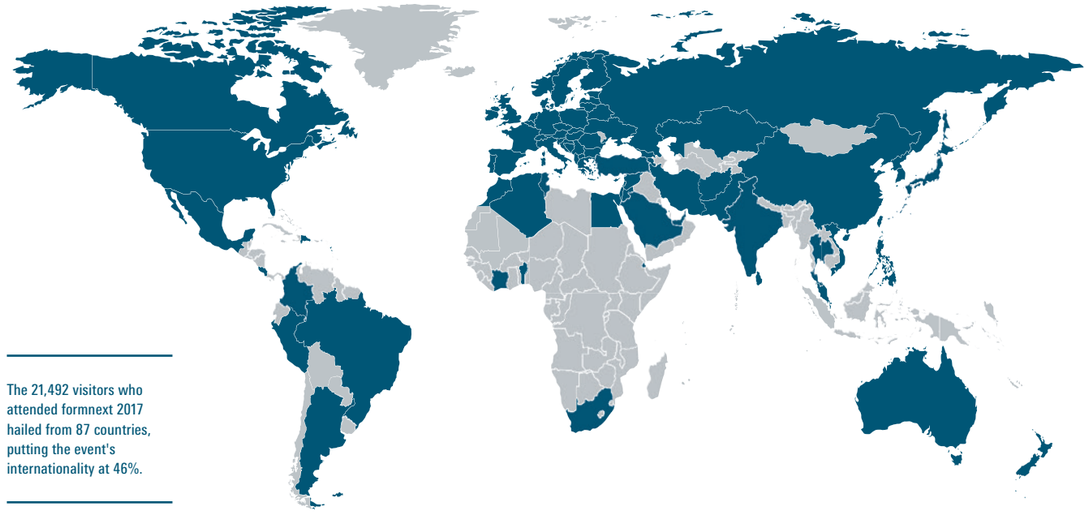
AlphaZero is a self-learning program that was developed by DeepMind Technologies. Upon being acquired for an estimated $500 million in 2014, the company received a new name (Google DeepMind) and a new stated objective: »solving intelligence«.

It took AlphaZero all of four hours to learn the game of chess by playing against itself. This past December, AlphaZero then went up against the previous year's world-champion chess computer, Stockfish, and came away with a clear victory. In and of itself, the triumph of this new artificial intelligence wasn't all that surprising given the tremendous processing power at AlphaZero's disposal; it was the more the manner in which it won. The program astonished observers with creative moves that previous computers hadn't even included in their calculations. In some respects, AlphaZero's style of play even challenged our very understanding of chess up to that point. Its developers' answer to the question of what makes it so good? The fact that the program no longer relies on human input.

This statement may be frightening; indeed, it's at least strangely exciting to watch as a new way of thinking emerges. And we're not talking about just chess, of course: In the future, what will cars, airplanes, or everyday products end up looking like when computers can learn from their mistakes and start getting creative? It seems almost certain that additive innovations will play a vital role in this process. After all, no other technology makes it so easy to turn creativity into reality.

formnext

VISITORS OF FORMNEXT 2017 CAME FROM THE COUNTRIES SHOWN ON THE MAP



The 21,492 visitors who attended formnext 2017 hailed from 87 countries, putting the event's internationality at 46%.

IMPORTANT FACTS:

» 13 – 16 November 2018
» Messe Frankfurt, Hall 3

» Further information: formnext.com

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