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Siemens Digital Enterprise Virtual Summit

Industrialization of additive manufacturing enables mass production of customized helmets

- **Siemens supports Hexr in the mass customization of additively manufactured bicycle helmets**
- **Digital Enterprise portfolio offers integrated software and automation solutions for additive manufacturing**
- **Additive Manufacturing Network – an online order-to-delivery collaboration platform for the industrial additive manufacturing community, helps streamline the AM production process**

Bicycle helmets made to measure and in an affordable framework for everyone - what was unthinkable a few years ago is now becoming reality thanks to digitalization and additive manufacturing. The head is simply scanned with a smartphone app and the process for the custom-made helmet is initiated. Siemens, together with EOS, has supported this vision of the bicycle helmet manufacturer Hexr. Siemens' Digital Enterprise portfolio consists of software and automation solutions that optimize process steps along the entire value chain of additive manufacturing. This holistic approach is unique in the field of the industrialization of additive manufacturing. With the help of end-to-end solutions, Siemens has created the digital twin of an industrialized additive manufacturing factory, helping to optimize the design and streamline the production processes for customized bicycle helmets even before production begins. By combining simulation, design optimization and a high degree of automation in production, the costs per part could be predicted and significantly reduced, allowing Hexr to scale the scan-to-print application to mass production.

End-to-end solutions with the Digital Enterprise portfolio

Whether Powder Bed Fusion, Directed Energy Deposition, Material Extrusion or Jetting all processes have in common that workpieces are built up layer by layer based on digital 3D design data. This makes it possible to produce highly complex structures that can be both light and stable at the same time and can also be economically manufactured individually in batch size 1. Progressive digitalization offers the possibility of optimizing additive manufacturing processes. With its Digital Enterprise portfolio, Siemens offers integrated solutions for additive manufacturing. The holistic approach, which covers the entire value chain, leads to sustainable competitiveness. More than 60 OEMs worldwide are already industrializing with automation from Siemens. Siemens itself today operates more than 200 industrial AM machines at over 45 locations and thus also occupies a leading position as a producer. An expert pool for AM design through to factory planning offers customers value-add services.

End-to-end workflow

With NX software, a leading integrated solution for computer-aided design, manufacturing and engineering (CAD/CAM/CAE), Siemens offers functions specifically for additive manufacturing. In an integrated workflow, NX covers the entire process from development and design, through preparation of the construction job, to generation of the machine code for the 3D printing system. The entire digital process chain is represented in a single, integrated, associative software environment and can be operated via a uniform user interface. This eliminates error-prone data conversion with possible loss of information content. This increases process reliability and efficiency and enables users to mass-produce high-quality products even with complex printing processes.

PLC and CNC automation solutions for production

Intelligent automation of production systems plays a decisive role in the industrialization of additive manufacturing. Totally Integrated Automation (TIA), the industrial automation from Siemens, stands for the efficient interaction of all automation components. With Simatic, the core element of TIA, users rely on a maximum of consistency. The basic automation with Simatic, the Sinamics drive system and the Simotics motors for moving the mechanical units of the machine for Powder Bed Fusion and Jetting brings benefits to users. Thanks to their scalability, these solutions can be adapted to actual requirements in an extremely flexible and economical manner. Integrated engineering and efficient programming in the TIA Portal reduce the time-to-market and diagnostic functions are projected instead of complex programming. Sinumerik's multi-axis technology opens up a high degree of freedom for Material

Extrusion or Directed Energy Deposition. In conjunction with Sinamics S120 and Simotics motors, the CNC allows precise and dynamic multi-axis motion control.

Siemens Advanta with planning services for the digital AM factory

Siemens Advanta, the IoT integration branch of Siemens, supports the industrialization of AM technology with a modular approach - starting with strategy development, optimization of product design, design of the manufacturing process, piloting and profitability analysis, through to the planning and realization of a turnkey AM factory. Based on the digital twin, a flexible and scalable manufacturing concept will be developed and validated, which will already meet the requirements of a classical serial production with regards to productivity and costs before the start of production and will allow an early certification

The Additive Manufacturing Network - a digital platform for the AM ecosystem

The Additive Manufacturing Network from Siemens creates an online platform based on partnership, offering on-demand design, engineering know-how and production capacities for industrial 3D printing worldwide. The network immediately connects qualified members with each other to foster collaboration and process orchestration between engineers, procurement and suppliers of 3D printed parts. Parts buyers and manufacturing service providers benefit from the network because it gives them the opportunity to collaborate, bid, purchase and track orders. As a result, it simplifies the development of innovative additive manufacturing products and physical inventory can be replaced by digital inventory. The network also contributes to the Siemens vision of reducing the risks that can arise when entering additive manufacturing.

Additive Manufacturing Experience Center (AMEC)

Siemens has an interactive Additive Manufacturing Experience Center (AMEC) in Erlangen, Germany, where the integrated, seamless additive manufacturing process chain and AM-related products from Siemens are demonstrated. The AMEC provides an overview and insight into the various industrial AM technologies as well as information on the demanding industrial requirements for AM design, simulation and production. So far, 4,500 visitors have taken part in interactive workshops at the AMEC. Since the opening of the digital AMEC in mid-May, over 1,500 interested people have already visited the AMEC virtually. The AMEC demonstrates Siemens' experience as a producer and solution provider.



Siemens supports Hexr in the serial customization of additively manufactured bicycle helmets

This background information and a press picture can be found at <https://sie.ag/3eepOCz>

Further information on Siemens Additive Manufacturing can be found at www.siemens.com/additive-manufacturing

Contact for journalists

Katharina Lamsa

Tel.: +49 172 8413539

E-mail: katharina.lamsa@siemens.com

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Siemens Digital Industries (DI) is an innovation leader in automation and digitalization. Closely collaborating with partners and customers, DI drives the digital transformation in the process and discrete industries. With its Digital Enterprise portfolio, DI provides companies of all sizes with an end-to-end set of products, solutions and services to integrate and digitalize the entire value chain. Optimized for the specific needs of each industry, DI's unique portfolio supports customers to achieve greater productivity and flexibility. DI is constantly adding innovations to its portfolio to integrate cutting-edge future technologies. Siemens Digital Industries has its global headquarters in Nuremberg, Germany, and has around 76,000 employees internationally.

Siemens AG (Berlin and Munich) is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for more than 170 years. The company is active around the globe, focusing on the areas of power generation and distribution, intelligent infrastructure for buildings and distributed energy systems, and automation and digitalization in the process and manufacturing industries. Through the separately managed company Siemens Mobility, a leading supplier of smart mobility solutions for rail and road transport, Siemens is shaping the world market for passenger and freight services. Due to its majority stakes in the publicly listed companies Siemens Healthineers AG and Siemens Gamesa Renewable Energy, Siemens is also a world-leading supplier of medical technology and digital healthcare services as well as environmentally friendly solutions for onshore and offshore wind power generation. In fiscal 2019, which ended on September 30, 2019, Siemens generated revenue of €86.8 billion and net income of €5.6 billion. At the end of September 2019, the company had around 385,000 employees worldwide. Further information is available on the Internet at www.siemens.com.