Hannover Messe 2022: Intelligent software for 3D printing optimises properties of plastic components

3D printers are a flexible way to produce components. Researchers at Technische Universität Kaiserslautern (TUK) are also making use of this technology: In order to optimise the printing result for plastics, the researchers have developed software that can adjust parameters such as temperature and printing speed during printing. Temperature differences between the individual layers in particular, which occur during production, can negatively affect the properties of the plastic. The researchers can overcome these problems with their software. They will be presenting their work at the Hannover Messe from 30 May to 2 June at the Rhineland-Palatinate research stand (Hall 2, Stand B40).

In 3D printing, a component is printed layer by layer along a specified path. This technique allows companies to produce their goods without much effort. However, various parameters such as temperature, printing speed, printing direction, layer height and geometry of the component can influence the printing result.

At the Institute for Composite Materials headed by Professor Dr.-Ing. Alois K. Schlarb at TUK, the team is working on 3D printing technologies. One of the researchers’ goals is to optimise the properties of the printed products. “Once a layer is printed, it cools down. When the next layer is applied on top of it, it has a higher temperature than the one underneath, and the layer underneath heats up again,” explains Miaozi Huang, research assistant at the institute. “This contact temperature or local temperature between the printed part and the part to be printed influences the quality of the seam or the weld.” This plays a major role in the properties of the product. In the finished component, this is a weak spot, especially if the local temperature was not high enough when the seams were created.

This is where the work of the engineers from Kaiserslautern comes in: The team has developed a software which during printing ensures that various constants such as the temperature of the print nozzle or the printing speed can be flexibly changed - depending on the shape of the component and the plastic used. “The aim of our technology is to optimally exploit the material properties,” says Alexander Schlicher, who is involved in implementing the concepts at the institute. “Similar processes do not yet exist.” What is special about the software is that the researchers can flexibly change the parameters for each individual movement of the printing process.

They have already tested the new procedure in the laboratory. Two samples, one printed with conventional software, the other with the new technique, differ in their structure, as can be observed under the microscope. “There is also a difference in the properties, especially in the tensile strength across the direction of printing,” adds Miaozi Huang. “This method allows the weak points in the printed products to be eliminated.” For example, with this method it is possible to keep the contact temperatures between two strands in the optimal range for the respective moulded part geometry.

Such optimisations are important, for example, for increasing the service life of a component. The method used by the team from Kaiserslautern allows weak points in the plastic to be avoided.
The engineers will present the project at the Hannover Messe.

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Klaus Dosch, Department of Technology and Innovation, is organizing the presentation of the researchers of the TU Kaiserslautern at the fair. He is the contact partner for companies and, among other things, establishes contacts to science.  
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Miaozi Huang’s team uses intelligent software in 3D printing to optimize the properties of plastic components.
Credit: TUK/Koziel