Press release

Quality testing for additive manufacturing

IPH develops optical measuring system for controlling 3D printing processes

Hannover, July 18th, 2019. Quality control of parts during a 3D printing process: This is the goal of researchers at the Institut für Integrierte Produktion Hannover (IPH) gGmbH. Within the scope of the research project "Quali3D", they develop an optical measuring systems which is integrable in a 3D printer. The task: constant control of the printing process and an automatic error detection.

Future protheses and implants will be produced with a 3D printer, the same applies to parts for aircraft and special-purpose machines. With additive manufacturing processes, it will be possible to produce single pieces tailored to the respective application. But particularly for high-quality products, e.g. in medical or mechanical engineering, quality comes first. Up to now, quality testing in additive manufacturing processes is very difficult. Therefore, many companies still shy away from using 3D printers.

Apart from the outer geometry, the inner structure is another critical aspect for part quality. The lightweight and robust design of 3D-printed parts is often achieved with honeycomb structures. To detect imperfections or voids in the inner structure, parts have to be X-rayed presently.

"Up to now, there exists no functioning process-integrated control for 3D printing processes that are based on the principle of material extrusion ", says Alexander Oleff of the Institut für Integrierte Produktion Hannover (IPH) gGmbH. The mechanical engineer is responsible for the research project "Quali3D – Optical quality control for extrusion 3D printing".

In future, it will be possible to control part quality already during the printing process. Oleff and his colleagues at IPH are developing an optical measuring system which is integrable into an extrusion 3D printer. This method is also suitable for processing high-quality plastics for medical engineering, electrical engineering or aircraft applications.

The heart of the optical measuring system is a camera which takes pictures of each printed layer. An image processing algorithm analyzes the images automatically and detects errors. Errors might occur, for example, due to vibrations caused by excessively fast motions or when the material supply of the 3D printer is disturbed.

The researchers' greatest challenge: Quality testing must be done without references, i.e. without reference images. "3D-printed parts are often unique pieces ", explains Oleff. "Therefore, there are mostly no reference images – e.g. tomographs of an identical part already printed out without errors – to which the algorithm could compare the print result. "

A possible approach is to use texture analyses for error detection instead. Here, the algorithm analyzes the images mathematically and detects irregularities. Another alternative is to read out the machine code. From this, it can be derived the amount of material to be applied to which position. Finally, the planned print result can be compared to the actual part.

The project “Quali3D“ runs until summer 2021 – giving the researchers two years to develop the optical measuring system and the respective algorithm. The results are meant for users as well as for manufacturers of 3D printers. The results help manufacturers to refine their machines and improve the quality standard of material extrusion.

The researchers assume that this development will increase the acceptance of 3D printing, especially in the field of medical engineering and with respect to specific safety-critical applications. In future, users will be able to control the production process of every single product, enabling them to guarantee their customers tested quality – even for unique pieces. Another benefit is a potential reduction of manufacturing costs: Error detection throughout the printing process allows an early readjustment or interruption of the process. This saves energy, material and time.

Companies interested in process-integrated control of extrusion 3D printing have still the opportunity to join the research project. A kick-off meeting is scheduled for the end of August. Interested companies may get in contact with Alexander Oleff via email (oleff@iph-hannover.de).

The research project “Quali3D“ is funded by the Federal Ministry for Economic Affairs and Energy. For further information please refer to www.quali3d.iph-hannover.de.

About the IPH

The Institut für Integrierte Produktion Hannover (IPH) gemeinnützige GmbH (which literally translates into Hannover institute of integrated production) is a service provider for production technology and was established in 1988 at the Leibniz University in Hannover. The IPH offers research and development, consultation and qualification concerning the subjects of process technology, production automation, logistics and XXL products. Its customers include companies from the sectors of tool and mould construction, machine and plant construction, aerospace and the automotive industry, electro industry and forging industry.

The business has its headquarters in the science park Marienwerder in the northwest of Hannover and currently employs about 70 people, of which about 30 are scientific personnel.

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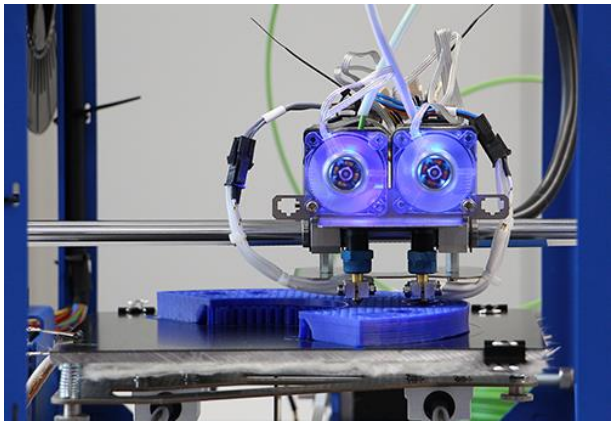
Photo material



IPH develops an optical measuring system for quality testing of additively manufactured products already during the printing process. (Source: IPH)