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RESEARCH NEWS

Hannover Messe 2018: digitalization in manufacturing

A forming press goes Industrie 4.0

Digitalization in manufacturing will mean that "smart" machines learn to communicate with one another and function autonomously. Yet many manufacturers are uncertain about what to expect. How will this new connectivity work? And what benefits will it bring? Fraunhofer researchers at Hannover Messe (April 23–27, 2018) will be on hand to answer these questions. With the help of a miniature-forming press and its digital twin, they will demonstrate the leverage that digitalization can bring to manufacturing.

Life without a smartphone? Today this is inconceivable for many people. How will you hook up with friends, when you're out and about? And how will you know when the next bus is coming? Or check out the traffic on the highway? In the world of industry, digitalization is also set to usher in major changes. It is a process that's already well under way in certain sectors of business as well as in society as a whole. Yet in the world of manufacturing, many companies are uncertain what it will mean for their everyday operations. And that's not really surprising. After all, manufacturing companies are good at manufacturing, but not necessarily at IT.

Increasing machine availability, extending service life

Researchers from the Fraunhofer Institute for Machine Tools and Forming Technology IWU will be in Hannover to showcase their Maschine 4.0 concept. In a live demonstration featuring a fully operational miniature-forming press and its digital twin, they will show how manufacturing can become highly successful with digitalization. Standing two meters tall and weighing in at 1.5 metric tons, the forming press operates at a force of 15 metric tons to punch, deep draw and cut to size all manner of components. Digitalization brings considerable advantages to this type of machining. "It provides seamless monitoring of the process, the machine and the tool itself," explains Dr. Tino Langer, division director at Fraunhofer IWU. "This, in turn, can deliver substantial increases in machine availability and service life as well as a significant reduction in tool setup times."

Real and virtual sensors

Sensors mounted on various parts of the forming press measure variables such as forces, machining paths and expansion rates. In effect, this means that the machine monitors itself. Rather than being separately analyzed – as is customary – this data is

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fed into a software module by the name of Smart Stamp. This generates a digital duplicate of the forming press, i.e., a virtual twin, where the data is fused and analyzed. Is the press operating smoothly? Or is the ram, where the upper tool is mounted, slightly tilted, so that the workpiece is not being properly formed or the tool is wearing out more quickly? "Sensor data from discrete sources is often not particularly meaningful," Langer says. "But data fusion gives us a precise answer to these questions." Various technologies provide machine operatives with relevant data on the production process. This includes the use of augmented reality (AR) and virtual reality (VR), which provide – via a tablet held next to the Maschine 4.0 module – an intuitive and real-time overview of key data on the current status of the forming press.

However, it is impracticable to mount sensors in some areas of the press, either for reasons of inaccessibility or because the installation would be too complicated and expensive. This may mean critical gaps in data on the process or production machinery. But here, too, Fraunhofer researchers have come up with a solution: virtual sensors, which exploit the readings provided by real sensors mounted at different places on the machine. On the basis of this data, an algorithm calculates the reading that a real sensor would have delivered, were it installed in a relevant but inaccessible location. This kind of virtual sensor is very good at depicting the degree of bending in the press frame, for example. "In the EU project iMain, we showed that the readings calculated with our virtual sensor correspond very closely to those of a real sensor," Langer says.

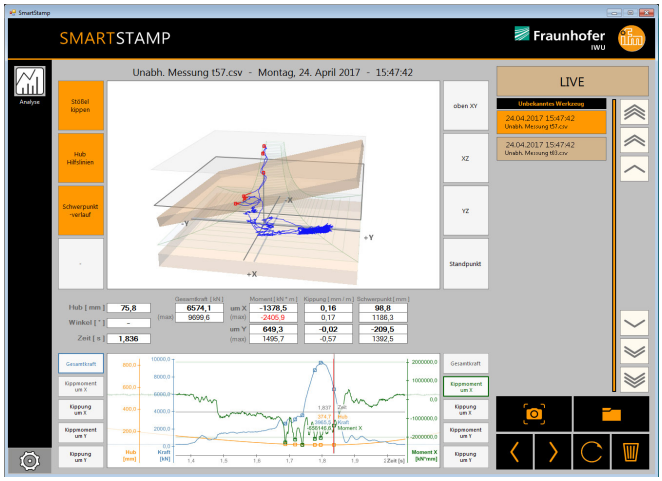
Thinking in process chains

The Maschine 4.0 concept involves thinking in terms of a process chain. With respect to a forming press, this means first analyzing the material being processed, since properties such as thickness or strength may vary. The second stage is the actual forming of the material in the press. Lastly, an image-analysis software known as XEIDANA, which was also developed by Fraunhofer IWU, runs various quality controls on the finished component. "We check the material properties, the forming parameters and other press-related properties, and product quality," Langer explains. "And at a future date, we want to be able to feed this information back into the machine's control unit." Various automotive manufacturers are already using individual elements of the Maschine 4.0 concept. And, in a further development, researchers are now working on ways of using sensor data for products machined in a process chain. In this way, should the finished component have any quality defects, it will be possible to trace the source of the problem and quickly take appropriate action.

Maschine 4.0 live at Hannover Messe

In a live demonstration of the concrete benefits of digitalization to the manufacturing industry, Fraunhofer researchers will be showcasing Maschine 4.0 and an actual forming press-demonstrator at Hannover Messe (Hall 2, Booth C22).

Digitalization provides seamless monitoring of the process and the machine. This can deliver substantial increases in machine availability and service life as well as a significant reduction in tool setup times. © Fraunhofer IWU / Ronald Bonss | Image in color and print quality: www.fraunhofer.de/en/press.



Smart Stamp: a virtual twin of the actual forming press determines the degree of ram tilt. © Fraunhofer IWU | Image in color and print quality: www.fraunhofer.de/en/press.