FLOWING TRANSITION BETWEEN DESIGN AND SIMULATION

The individualized mass production up to the individual item is a promise of the future delivered by Industrie 4.0. It can only be implemented if there are suitable test methods for the feasibility of individual designs. At the Hannover Messe 2017 from April 24 to 28, 2017, Fraunhofer researchers will present a simulation solution that automatically determines whether the customer’s desired design can be realized.

The Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt has developed software that quickly tests the feasibility of individual design wishes. This offers customers and manufacturers new possibilities for individualized mass production. Christian Altenhofen from the Competence Center “Interactive Engineering Technologies” at Fraunhofer IGD describes the added value as follows: “We create a smooth transition between design and simulation. How to quickly determine whether an
individual design can be implemented is frequently an unresolved problem in industry today. In most cases, CAD data only describes the outer surface and does not contain the volumetric information required for simulations. Re-generating these is extremely time-consuming, usually requires manual reworking and costs the industry a lot of money. “The software of the Fraunhofer researchers from Hesse enables customers and manufacturers to automatically generate the required simulation themselves. This makes it easy to determine whether design proposals created on the computer can be implemented in reality. If this is not the case, the technology suggests how the design of the product can be improved. “The customer still has a lot of possibilities for individual design,” says Altenhofen.

Simulating the inner structure of an object

The algorithms use the mathematical concept of “subdivision volumes”. Based on this, the researchers use the finite element method to derive physically-based simulation models. Specifically, this means calculating the internal stresses of the model, based on boundary conditions such as gravity or forces induced by the weight of the object. Depending on the distribution and absolute values of the stresses, it is possible to judge whether or not an object is stable. “Subdivision volumes create a consistent virtual model of the inner structure of the object,” the Fraunhofer expert says in describing the technology. This means that the approach goes beyond the traditional CAD representations as they only describe surfaces of three-dimensional objects and do not allow any conclusions to be drawn about the interior. “Our approach directly includes the volumetric representation together with the surface information that defines the actual design. This means that customers and manufacturers have access to the necessary information for the simulation during the entire design process,” Altenhofen says.

For the Hannover Messe 2017, the researchers have developed a prototype of their simulation solution, which conveys the idea for possible applications or possible future developments: They manufacture individual plastic holders for espresso cups. Via an interactive use interface, the visitors can design their own cup holders. If the idea cannot be realized or does not withstand the later physical stresses, the visitors receive instructions which parameters they can change to prevent this. “Additive manufacturing is a powerful example of how our technology can be applied. In principle, however, our approach is applicable to many different manufacturing processes and different materials,” says Altenhofen.

Further information: https://fh-igd.de/hanover-fair
Joint Fraunhofer booth Simulation in hall 7 booth D11

AUGMENTED AND VIRTUAL REALITY:
KEY TECHNOLOGIES TO SUPPORT TECHNICAL STAFF

Assistance for complex assembly and maintenance work – Fraunhofer IGD uses augmented and virtual reality to support technical staff in their work and training. The Machine@Hand solution will be presented at the Hannover Messe 2017.

(Rostock/Darmstadt/Graz) As Industrie 4.0 moves forward, assembly and maintenance operations in the field of engineering are growing in complexity. The researchers at the Fraunhofer Institute for Computer Graphics Research IGD are implementing augmented and virtual reality to support technical staff with their complex tasks. The Machine@Hand solution immerses employees and trainees into a virtual working and learning environment.

With the help of visual instructions, augmented reality (AR) guides technical staff through maintenance or repair work. Data – such as texts, images, and videos – are superimposed on a literal camera image, showing objects in their correct positions. Assembly and maintenance instructions become reality-oriented and easy to understand. For education and training purposes, hands-on teaching facilitates comprehension of the complex functionality of action or maintenance flows. Using AR, trainees can look inside machines and watch individual movements at the right position.

With Machine@Hand, workplace-oriented learning is possible regardless whether the respective machines are available at the training location. The magic phrase is virtual reality (VR). Thanks to the high degree of immersion with VR, (i.e. the realistic feel of the virtual world), the experience gained on the training object is almost as authentic as when operating the actual machine. Trainees experience the work process directly and interactively.
Thanks to Machine@Hand, brainstorming sessions and group meetings can be held directly in virtual reality. Group members are able to discuss their proposals in real time. Using virtual notes (referred to as “pins”), participants attach information or comments directly to the respective objects.

“For example, this is useful if the staff comes up with good ideas during the assembly or training that they would like to share immediately. The functionality can also be used to document maintenance activities,” says Professor Bodo Urban of Fraunhofer IGD. In this way, the team can easily access the company’s knowledge base directly, and expand it speedily.

With Machine@Hand, creation and configuration of the respective virtual environment is intuitive and easy to implement. Machine@Hand features editor functions that enable both programmers and experts to create contents for AR training, AR assembly support, or VR training on the PC or directly in virtual reality. Machine@Hand and other assistant systems of Fraunhofer IGD will be showcased at the joint Fraunhofer Simulation at the Hannover Messe from April 24 to 28, 2017.

Further information: https://fh-igd.de/hanover-fair
Joint Fraunhofer booth Simulation in hall 7 booth D11

**Event Announcement on the Hannover Messe:**

**Press breakfast:**
- **When:** April 25, 2017, 10:00 a.m.
- **Where:** Joint Fraunhofer Booth Simulation, hall 7 booth D11
- **What:** “Numerical simulation in the product and process development” with Andreas Bublitz (speaker of the Fraunhofer Alliance Simulation)

**Tech transfer**
- **When:** April 27, 2017, 3:15 – 3:30 p.m.
- **Where:** tech transfer, hall 2 booth C04
- **Who:** Mario Aehnelt, Fraunhofer IGD
- **What:** “Work 4.0 – workplaces in the digital transformation”

**CloudFlow workshop**
- **When:** April 26, 2017, 2:00 – 5:00 p.m.
- **Where:** Convention Center, Room Heidelberg
- **Who:** Prof. Dr. André Stork, Fraunhofer IGD
- **What:** “What is CloudFlow? Why is CloudFlow generating added value?”

**Press release**

**YOUTUBE PODCAST**

Our Visual Computing Report is also available as a video podcast. We present our most exciting research projects once a quarter on Fraunhofer IGD’s YouTube channel. Stop by and have a look!
https://www.youtube.com/user/FhVCC
FLEXIBLE USE OF SIMULATION SOFTWARE AS CLOUD SOLUTION WITH PAY-PER-USE

The production of special dies is time-consuming and costly. A range of special software is required to control production processes. The CloudFlow platform now unites particular simulation programs in one place and makes them available to users online.

Further information: https://fh-igd.de/hanover-fair
Joint booth of the European Commission in hall 3 booth E02

ACQUIRE PRODUCTION DATA AT A GLANCE

Revolutions are accompanied by changes due to their very nature – the same applies to the fourth industrial revolution, known as Industrie 4.0. But how can companies handle big data that this revolution is producing? The Plant@Hand3D system offers a solution: it displays all key information at a glance, making decision processes easier. Fraunhofer IGD researchers will be presenting their newly developed Plant@Hand3D system at Hannover Messe 2017.

Further information: https://fh-igd.de/hanover-fair
Joint Fraunhofer booth Simulation in hall 7 booth D11