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RESEARCH NEWS

MS Wissenschaft 2018: Customized large-volume production

Checking special design requests in real time

Industrie 4.0 promises manufacturers the ability to tailor large-volume products to a customer's unique requirements. But this will become a reality only if suitable methods ensure that a customized product design is feasible in practice. Fraunhofer researchers on the MS Wissenschaft (Motor Ship Science) 2018 will demonstrate a simulation solution that automatically determines whether or not a customer's preferred design can be translated into a real object.

The Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt, Germany has developed simulation software that instantaneously assesses the feasibility of customized designs. This creates new opportunities for customers and manufacturers to tailor high-volume products. Christian Altenhofen from the Interactive Engineering Technologies department at Fraunhofer IGD explains how the software adds value: "We've created a seamless transition from design to simulation. Manufacturers are generally unable to quickly verify whether they can make a new design a reality. Most sets of CAD data merely describe the dimensional characteristics of a product's surfaces; this data does not provide the interior volumetric geometries needed to execute simulations. The subsequent generation of such geometries is very prone to errors and typically entails manual reworking – which costs manufacturers a lot of money." This is where the software developed by the Fraunhofer researchers in Darmstadt can enable customers and manufacturers to themselves automatically create the simulations needed for checking geometries. As a result, they can quickly determine if computer-aided designs can, in fact, feasibly be used for production. If not, then this innovation will suggest which section of the desired product can be rendered more stable or its design improved. "This means customers still enjoy tremendous leeway in customizing their designs," says Altenhofen.

Simulating an object's internal structure

The software's algorithms utilize the mathematical concept of volumetric subdivision. On this basis, researchers can employ the finite element method to calculate physically based simulation models. In turn, these models quantify forces such as gravity and the weight of an object to determine its internal stress. Once software users know the magnitude and distribution of internal stress, they can verify whether or not the object in question will withstand loading or not. Subdivision approaches result in a consistent virtual model of an object's internal structure. In this regard, the IGD simulation soft-

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ware delivers results superior to conventional CAD information, which only describes the surfaces of a three-dimensional object without providing any insights into its interior.

"Our approach immediately pairs the product design's volumetric data with the 3D model's surface data. This means that, as early as the design phase, customers and manufacturers already have the information they need for simulations," says Altenhofen. Visitors to the floating science exhibition can use a 3D model on a monitor to custom-design holders for an espresso glass. IGD's simulation software then calculates whether the holder could support the glass when full of espresso; if necessary, the system will propose minor modifications. As soon as a design passes its feasibility test, production can commence.

If a customer modifies a product design using a computer, then IGD's simulation software can automatically determine whether the design can advance from theory to reality. © Fraunhofer IGD | Image in color and print quality: www.fraunhofer.de/en/press