New senses for the placement head: Adaptive System enables high-precision CFRP production

Innovative robot gripper module made of fibre reinforced plastics for greater efficiency in the automotive production of tomorrow

CFRP technology in aerospace: PFH makes an important contribution to the research project DESICOS
AUTOMEX: More efficiency due to new software

TECOSIM, specialist for Computer Aided Engineering and Rhein-Main University of Applied Sciences completed their research project “AUTOMEX – automatic extraction of mid-surface outlines from 3D CAD volume models”. The result is a software application which remedy a shortcoming in the simulation of complex, thin-walled components. Hitherto existing programs were unable to calculate what are known as mid-surfaces in five to ten percent of all components. In these cases, engineers needed to create mid-surfaces by hand. This manual process took up 70 to 90 per cent of overall time for meshing. With the new software AUTOMEX, the time required will be reduced considerably. Potential time savings could be anything from a few hours to days, depending on the complexity.

For the layman, a radiator grill is a seemingly simple component. However, development engineers know that the thin-walled, ribbed structure made of composite or cast metal parts poses a challenge during crash simulation or NVH analysis. They revert to what are known as surface models to minimise work when calculating such complex geometries during day-to-day project work. The component is represented by a surface located in its centre – the mid-surface. It is shown in a two-dimensional mesh, which contains all essential component and material features. Generating the mid-surface also has its limitations since existing commercial software solutions have only been able to map a mid-surface for 90 to 95 per cent of all components until now. Calculating the mid-surface for the remaining five to ten per cent generally highly structured, thin-walled components – involves time-consuming work for engineers. It may take several hours or even days if the component is highly complex. This is where the AUTOMEX application comes in and generates a complete mid-surface model. One click instead of five separate steps.

Reduced workload and competitive advantage

Both partners consider the developed software a complete success. “Using the software reduces the workload for TECOSIM engineers, particularly in cases where they previously needed to finish off the mid-surface by hand,” explains Professor Christian Glockner from the Rhein–Main University of Applied Sciences. “We anticipate great competitive advantages from automated mid-surface generation since we will be able to process orders more quickly and the potential for errors due to manual intervention is reduced,” adds Udo Jankowski, Member of the Management Board.
Medial axis
A component’s mid-surface can be determined using the medial axis. The medial axis of a volumetric object consists of all points within the object that have at least two points adjacent to the object’s boundary. However, precise mathematical calculation of the medial axis of a volumetric object is very time-consuming and unsuitable for project work on an everyday basis.

Scale Axis
The scale axis can be used to generate an approximate medial axis. The whole object is filled with spheres of different sizes for such a medial axis approximation. The centres of all the spheres then define the scale axis. A disadvantage of this method is that it may generate surface fragments with incorrect topology. These need to be filtered out in a subsequent step.

Valuable synergies
The project (HA project no. 300/11-45) was funded as part of the “Hesse model projects” scheme using resources from the LOEWE State Initiative for the Development of Scientific and Economic Excellence, Funding Line 3: Collaborative Projects for Small and Medium-Sized Businesses. The project got off the ground in early 2012 and featured a project life span of 24 months. The budget totalled 500,000 euros with TECOSIM providing 38 per cent of the amount using its own funds. The research team consisted of TECOSIM employees and employees from the Rhein-Main University’s Mechanical Engineering and IT departments. Useful synergies arose from the extensive exchange of information. The existing processes and algorithms were examined together and different scientific approaches to mid-surface calculation were evaluated and further developed based on everyday practical experience. Last of all, interdisciplinary collaboration with the Information Technology department enabled the team to use a state-of-the-art approach to transferring the jointly developed process into a software application.

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