PRESS RELEASE

Applied research for the automotive industry

Optimizing final inspection in the series production of airbag inflators with intelligent software from Fraunhofer

Fraunhofer IGD has developed the AEOLIA software package for the optical final inspection of airbag inflators, thereby economizing on time and effort in the quality management process. It is now being used at ZF Airbag Germany GmbH in Laage (Mecklenburg-Vorpommern/Germany) and is currently being rolled out at other locations worldwide.

Well over 100,000 airbag inflators leave the ZF Airbag Germany GmbH plant in Mecklenburg-Vorpommern every day, from where they are dispatched to customers around the world. As a safety-critical component, the inflators are subject to strict quality controls. Until now, the visual final inspection in the factory consisted of the conventional image processing procedures supplemented by manual inspection carried out by the production staff. Deviations from standard, such as minor damage or foreign objects that impair the functioning of the airbag, were flagged up by the system for manual image inspection. If the suspected defect was confirmed, an employee would extract the part and check it by hand. With more than ten production lines delivering a finished inflators every four seconds, this put the employees under enormous pressure. Delays in the process and rechecks cost time and money.

The Fraunhofer Institute for Computer Graphics Research IGD in Rostock was commissioned to undertake a research project, which involved conducting a feasibility study and presenting options for the optimization of final inspection. The solution proposed by IGD met with the approval of ZF Airbag Germany GmbH, and the research team set to work designing software for industrial use. The result was AEOLIA – Automatic End of Line Image Audit.

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Optimized quality assurance

The software supplied for this quality inspection is required to work with a 100 percent detection rate, so that no defective component leaves the factory. In addition, the false alarms (i.e. false positives shown up on the images), must be reduced to a minimum, as the rechecking of every suspected defective component slows down production. With AEOLIA, these false alarms has been reduced to under 0.1 percent. Another important criterion is that the software must be able to check the images at high speed – effectively in real time. This is the basic prerequisite for a quality management system that is a good fit for fully automated production processes. As soon as the Fraunhofer software identifies a potentially defective part, it communicates online with the programmable controller of the production line and the part is diverted away from the next processing step to secondary inspection. "We are constantly striving to ensure that our products leave the plant in top condition," says Sven Wachs, AEOLIA project manager at ZF in Laage. "The AEOLIA software, which works with artificial intelligence, is an important component in our quality control."

Intelligent and flexible software

AEOLIA is based on a special variant of a Gaussian mixture model, i.e. a statistical model for calculating probabilities. The software learns which variations in the appearance of a product are normal and specifically homes in on deviations, marking only really relevant parts for manual inspection. The templates required for this are taught with image data of correct images. The advantage of this is that the software can be easily adapted to new variants. If one changes or a new one is added, the technicians in charge can teach and manage it independently. Despite the innovative nature of the software, the employees did not have to adapt to a completely new process, because a basic requirement of the job specification was seamless integration into the existing technical processes on the line. Fraunhofer IGD also programmed the interface for the communication between software and PLC unit. The production line could continue to use all the existing software and hardware, which had positive implications for the acceptance of the new software solution. Tom Krause, project manager at Fraunhofer IGD: "At an on-site visit, we were approached by an employee from production who wanted to thank us for the helpful software. That is obviously the best praise we could wish for as developers."

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In use around the world

After successful piloting, AEOLIA was validated in the factory for almost two years to ensure that the stringent performance specifications were met. Step by step, it supplemented the software used up to then and is now in productive use on multiple assembly lines at the plant in Laage. ZF Airbag Germany GmbH is currently setting up the application at its factories in Mesa (USA), Xian (China) and Aschau am Inn (Germany). Fraunhofer IGD is advising on the roll-out, making the necessary local adaptations and will also be providing support for service requests in the future.

Image (M): The AEOLIA software package from Fraunhofer IGD supports automotive supplier ZF in quality control. (@ ZF/Fraunhofer IGD)

For more information:

www.igd.fraunhofer.de/en/projects/final-inspection-series-production-airbag-inflators

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About Fraunhofer IGD

Founded in 1987, the Fraunhofer Institute for Computer Graphics Research IGD is the world's leading institute for applied research in visual computing—computer science based on images and 3D models. We turn information into images and images into information. Keywords are human–machine interaction, virtual and augmented reality, artificial intelligence, interactive simulation, modeling, 3D printing and 3D scanning. Around 180 researchers at three locations in Darmstadt, Rostock and Kiel in Germany develop new technology solutions and prototypes for industry 4.0, digital healthcare and the smart city. In cooperation with its sister institutes in Graz, Austria and in Singapore, they also take on international relevance. With an annual research volume of €21 million, we use applied research to help in the strategic development of industry and the economy.

About ZF

The ZF Group manufactures airbag inflators for the automotive industry at its factory in Laage (Mecklenburg-Vorpommern/Germany).
ZF is a global technology company supplying systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. ZF allows vehicles to see, think and act. In the four technology domains of Vehicle Motion Control, Integrated Safety, Automated Driving, and Electric Mobility, ZF offers comprehensive product and software solutions for established vehicle manufacturers and newly emerging transport and mobility service providers. ZF electrifies a wide range of vehicle types. With its products, the company contributes to reducing emissions, protecting the climate and enhancing safe mobility.
In fiscal year 2020 ZF reported sales of €32.6 billion. The company employs more than 150,000 associates at approximately 270 locations in 42 countries.

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