Stereo vision for airbags

A new method allows for the creation of a 3D model of the airbag expansion process without the need for locally identifiable pattern codes

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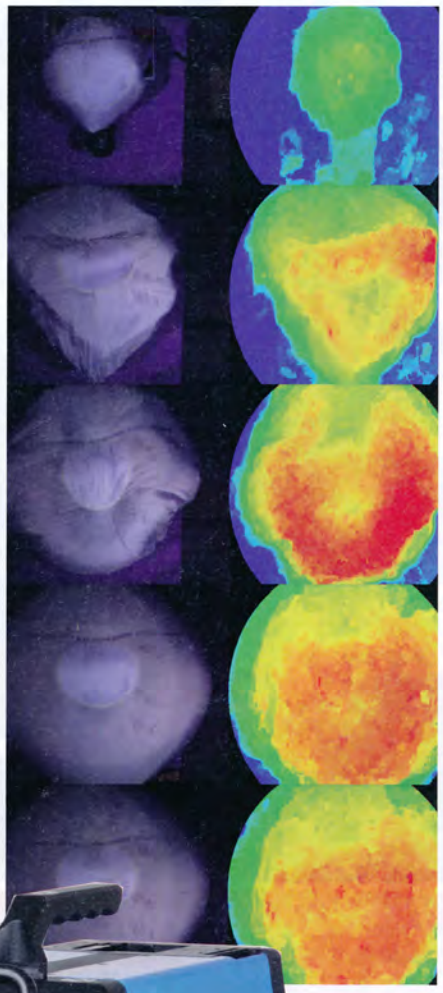
The expansion of an airbag is one of the fastest technical processes where controlled geometry of the moving object is of major importance. In the event of an accident, the airbag position within the automobile and its form must be well defined to guarantee its safety performance. The volume of the airbag and its position in space can be approximately derived by using simple contour measurement techniques with three or more cameras (top view and views of both sides).

An analysis in full 3D based on two cameras in a stereo setup has rarely been used until now. The existing approaches use stochastic or sinusoid patterns, which are projected to the airbag's surface during measurement; or coded points, which are applied to the airbag skin before unfolding it. Prepared in one of these ways, all stereo-type vision methods offer good 3D results.

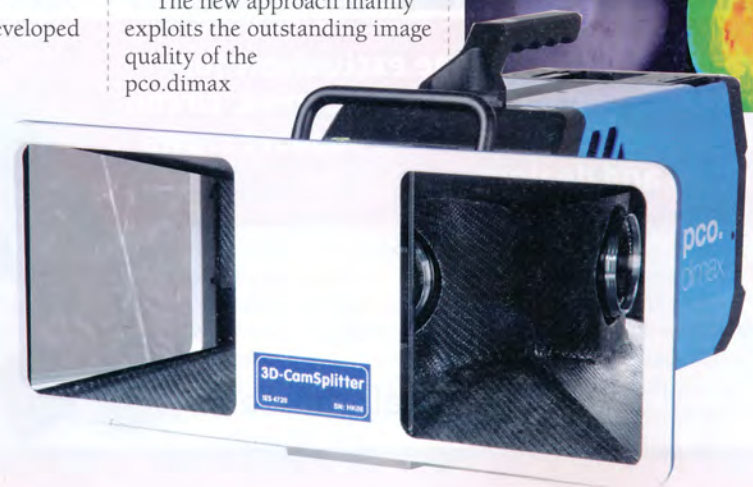
SOLVing3D has developed a new method, which does not require a special pattern on the airbag surface. Furthermore, while the existing stereo vision methods all work locally, the new SOLVing3D method is based on a global mathematical analysis of the whole image information. This allows for the creation of a 3D model of the airbag expansion process without the need for locally identifiable pattern codes (pictured right).

With this new approach, it is also possible for the first time to draw control samples from the serial production of airbags, which can be analyzed – therefore, quality control is no longer limited to specially prepared individual pieces of the pre-series. For the airbag development, additional information from the 3D analysis is available without extra effort. Another advantage of the new approach is that the images can be analyzed quantifiably as 3D film. This option can already justify the investment in a second camera or a 3D-CamSplitter (shown below). Beyond this, the SOLVing3D method offers additional facts in the form of point clouds in 3D which can be used for a proper evaluation process.

The new approach mainly exploits the outstanding image quality of the pco.dimax high-speed cameras. Their high image quality, excellent dynamic range and low noise level – even for short exposure time slots and high image frame rates of more than 5,000 frames/second – allow for precise local matching, which represents the basis of the new global stereo method for detailed 3D models. ❮



LEFT: Image sequence of the airbag inflation and the corresponding color coded distance map



BELOW LEFT: The 3D-CamSplitter system