Precise Industrial 3D Metrology

ARGUS

Optical Forming Analysis

Thickness Reduction
Forming Limit Diagram
Verification and Optimization of Numerical Simulations

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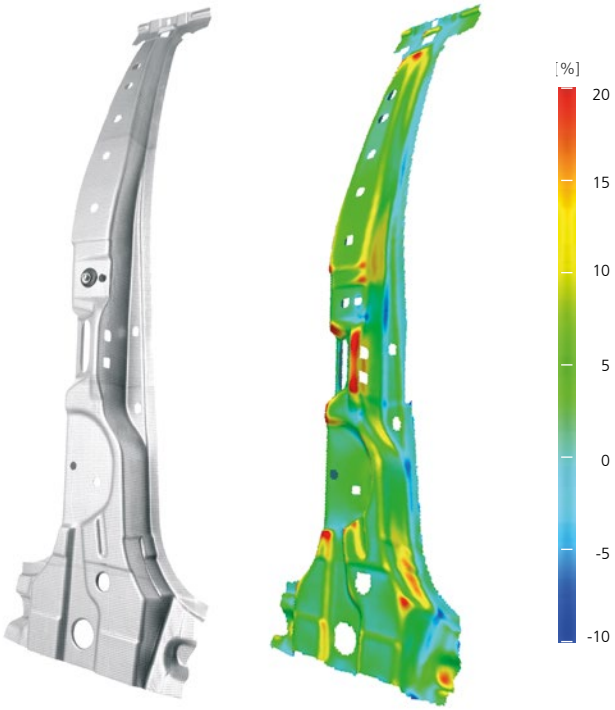
Optical Forming Analysis

The optimization of the sheet metal forming process taking into account the correct material selection and the optimization of tools is a decisive factor for competitiveness, particularly in the automotive industry.

The forming analysis system ARGUS supports such optimization processes particularly by convincing and precise results of the forming distribution on the components. In addition, it provides full-field results for the verification of numerical forming simulations.

The results from the ARGUS system provide fullfield information about:

- 3D coordinates of the component's surface
- Form change (major and minor strain)
- Thickness reduction
- Forming Limit Diagram (FLD)
- Sheet metal hardening



All results are presented in a fine resolution mesh created from the determination of the 3D coordinates and reflecting the surface of the measured object. These results are graphically displayed and may be exported as ASCII data set. In the Forming Limit Diagram the measured deformations are compared to the material characteristics of the blank (Forming Limit Curve).

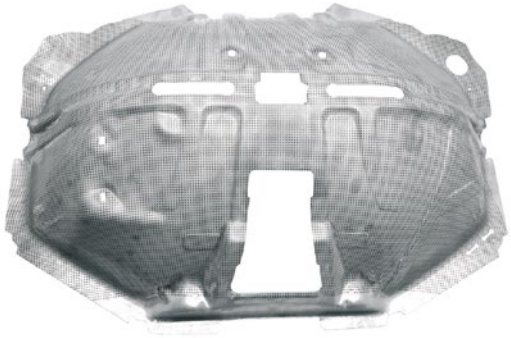
ARGUS takes up conventional and proven methods of the forming analysis which are based on the structuring of the blank. The measuring system operates independent of the material. It can be used to analyze components made from flat blanks, tubes or other components manufactured by an internal high pressure forming process (IHPF).

The optical forming analysis using ARGUS has become a proven tool for evaluating forming processes and verifying simulations. In particular, the precise, accurate and user-independent measuring procedure as well as the surface representation of deformation distributions strengthened the acceptance of this measuring technology. This unique possibility to measure complex sheet metal parts with a high scanning density opens up new aspects for the verification of forming simulations.

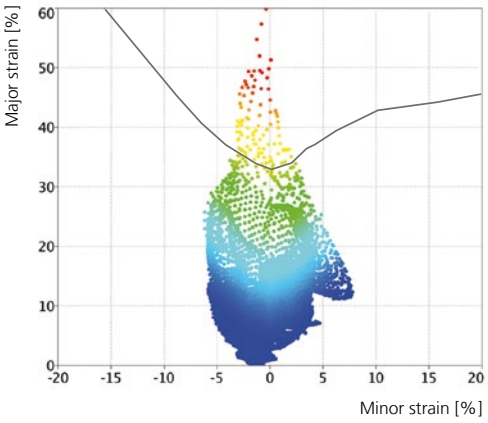
Technology

The specimen is recorded by means of high-resolution images which are then evaluated using the ARGUS software. With the help of point finding algorithms and a mathematical adjustment computation, a precise model is automatically calculated from ray intersections, camera positions and lens distortions. The resulting 3D object coordinates on the component's surface are arranged in a fine resolution mesh which corresponds to the pattern applied to the blank. The mesh reflects the surface of the test object.

From the 3D coordinates of the object points, the actual results of the forming and the sheet metal thickness are calculated taking into account the component's geometry and following the rules of the plasticity theory. These calculations may also be carried out for the center of the sheet metal as may be suitable for thicker sheet metals or smaller radii. First, the form changes are displayed in a false-color 3D mesh of up to one million points. Labels help to represent special points on the surface with their respective measuring values. In diagrams, any sections can be represented.



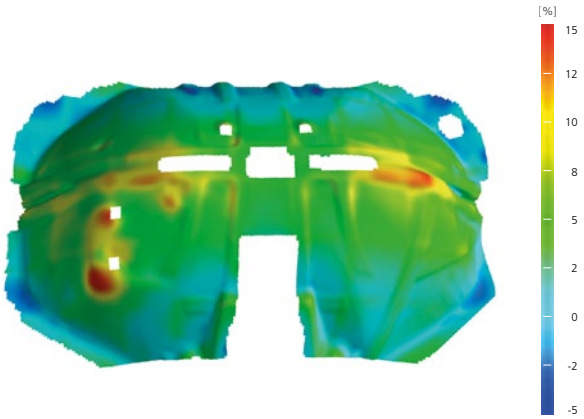
A Forming Limit Diagram can be created from the forming results in which imported Foming Limit Curves allow the evaluation of the forming behavior. Freely definable reports provide for a time-effective creation of measuring reports. For repeated measurements, the complete evaluation and the creation of the measuring report can be carried out automatically at the push of a button. The entire measuring, evaluation and documentation process is built on an easy, safe and fast workflow. The system is self-calibrating, thus a complicated calibration is not required. In the industry, ARGUS is an established and proven measuring system for forming analysis.



Applications

ARGUS provides full-field results with high local resolution for small as well as for large components. Therefore, it is ideal for numerous sheet metal forming tasks:

- Detection of critical deformation areas
- Solving complex forming problems
- Optimization of forming processes
- Verification of tools
- Verification and optimization of numerical simulations



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