Press Release

AutoForm Software at Daimler – Leading the Way in Tailored Tempering

Wilen b. Wollerau, Switzerland, May 16, 2013: Lightweight construction plays an important role in the automotive industry, particularly in the reduction of fuel consumption and CO_2 emissions. A considerable contribution to this end must therefore also be made by the body in white. This can be achieved by using suitable materials and processing them intelligently. Tailored Tempering of high-strength and ultra-high-strength steels is the key to success – but at the same time creates many tricky challenges. Daimler solves these through the use of computer simulation with software from AutoForm Engineering.

Determining what the particular forming tool should look like and how the process of Tailored Tempering should be carried out in detail are demanding tasks. They require a comprehensive understanding of material behavior, heat flow and the kinetics of phase transformation. In-depth insight into the structural transformation of material is necessary for the analysis and subsequent controlling of the Tailored Tempering process. It is precisely the complexity of this process that makes simulation-based process design on the computer so tremendously helpful. The simulation software, however, must be able to realistically represent the hot forming and quenching processes as well as reliably predict the final part properties and thereby delivers the tooling know-how for this special type of hot forming. Setting this challenging task as their objective, AutoForm Engineering GmbH succeeded in developing AutoForm-ThermoSolver, the software which includes a thermo-mechanical model.

Effectively, a temperature history can be delivered by this software for any material point in the sheet metal. As a result, insight into the material behavior during hot forming and, in particular, quenching is provided. All the relevant phenomena and their interaction must be modeled in order to make prediction with a reasonable amount of accuracy. On the thermal side, this concerns the heat flow between sheet, tool and environment, whereby radiation as well as convection must also be taken into consideration. In terms of mechanics, the plastic deformation of the sheet metal must be considered and from a metallurgical point of view, phase transformation has to be taken into account due to cooling.

As a result of experiments and tests, AutoForm has verified the thermo-mechanical-metallurgical model and identified other decisive parameters. In cooperation with Daimler AG, an experimental testing tool was developed, with systematic tests carried out in the Institute for Manufacturing Technology at the University of Erlangen-Nürnberg. AutoForm contributed with a pilot version of AutoForm-ThermoSolver. This collaboration resulted in the development of fundamental expert knowledge concerning the process window and the resulting material properties which are dependent on the relevant process parameters.

Daimler built a tool for a B-pillar in order to apply the latest results in the production of a real part and to check the quality of the simulation results. A small batch of B-pillars was then produced at the Sindelfingen plant and the mechanical properties were very closely and extensively examined. Samples from various areas on the part were tested in tensile tests and results were thoroughly discussed among the experts at Daimler and AutoForm. All physical influences which are decisive for the accuracy of the results had to be incorporated into the simulation model. Secondary influences were filtered out, which had a resulting positive influence on the speed of calculation. During the course of testing the collaborating partners came to the decision that the latent heat must be taken into account during the cooling process. The final part properties can then be calculated by AutoForm-ThermoSolver with extreme accuracy. Results such as tensile strength, tensile stretch, thickness and stress distribution, as well as hardness and martensite distribution can be clearly illustrated through graphics. The additional calculation time for the Tailored Tempering process compared to conventional forming equaled a mere 5% on average. This rather modest increase is, in any case, more than justified by the improved understanding of the process.

The objectives set for the collaboration between Daimler and AutoForm have been achieved. Following a one-year test phase, AutoForm-ThermoSolver has been in productive use at Daimler since 2012; Daimler is committed to the quality of the simulation. Even complex process strategies

can be calculated with AutoForm-ThermoSolver. Thermo-mechanical influences on material behavior during part production can now be better taken into consideration. The additional information regarding the metallurgical calculation model increases the validity and information content of the simulation. Last but not least, the intensive examination of the Tailored Tempering process also provides important insights for conventional press hardening. The need for further development concerning the calculation of thermal distortion was identified. As a result, intensive work has been carried out over the past few months. The next step in this collaboration is to verify the practical suitability of the latest development and to then release it as a future product version of AutoForm-ThermoSolver.

About AutoForm-ThermoSolver

AutoForm-ThermoSolver enables automotive manufacturers and suppliers to develop and define the processes involved in the hot forming of parts (reinforced sides, A-/B-pillars, front and rear bumper supports and other parts). The software simulates the direct and indirect press hardening and supports the Tailored Tempering process. The development of stamped parts with locally predefined strength properties is therefore possible. Accuracy in crash simulations also benefits since the simulation takes into consideration the real strength distribution in hot formed parts. AutoForm-ThermoSolver graphically illustrates the final part properties such as thickness distribution and stress distribution as well as hardness and martensite distribution. This offers engineers insight into the structural transformation of the material and allows for the control over them as well.

About AutoForm Engineering GmbH

AutoForm offers software solutions for the die-making and sheet metal forming industries along the entire process chain. With 250 employees dedicated to this field, AutoForm is recognized as the leading provider of software for product manufacturability, tool and material cost calculation, die face design and virtual process optimization. All of the Top 20 automotive OEMs and most of their suppliers have selected AutoForm as their software of choice. Besides its headquarters in Switzerland, AutoForm has offices in Germany, The Netherlands, France, Spain, Italy, USA, Mexico, Brazil, India, China, Japan and Korea. AutoForm is also present through its agents in more than 15 other countries. For detailed information please visit: www.autoform.com

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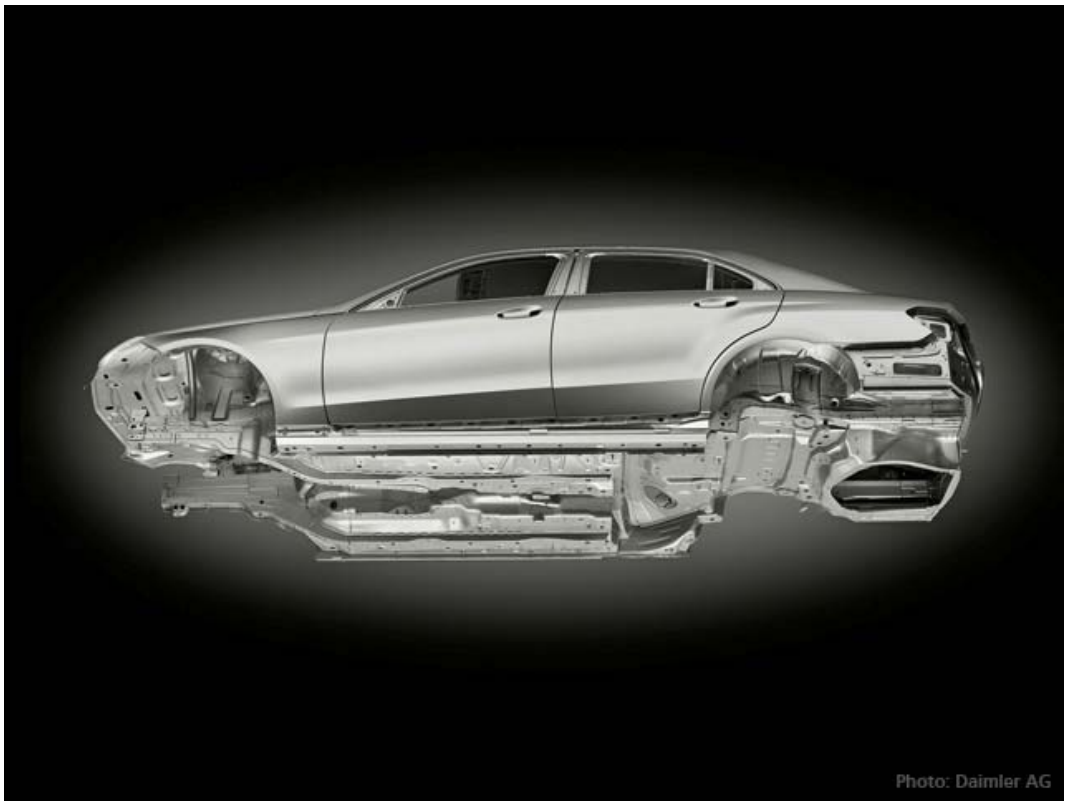
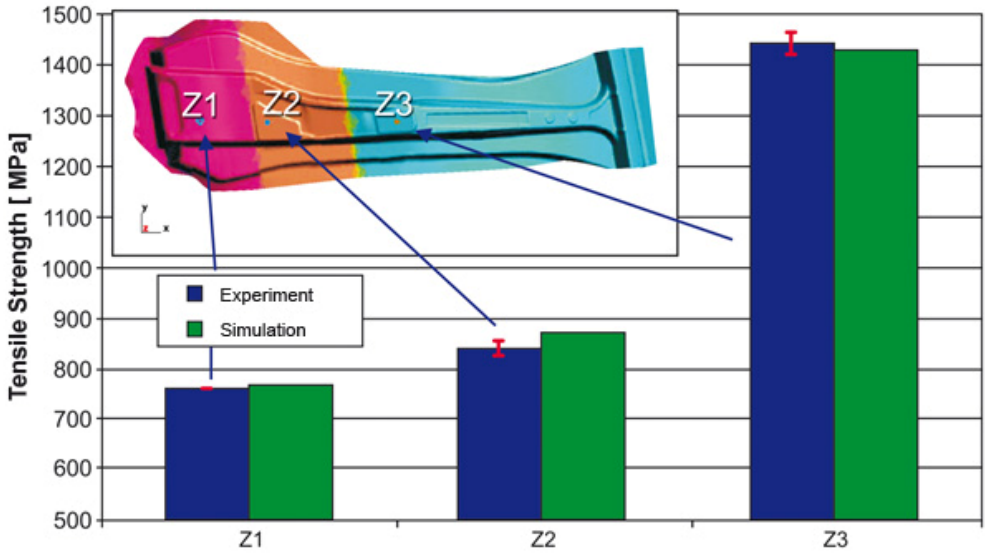


The amount of high-strength and ultra-high-strength steels used in the manufacturing of the new Mercedes-Benz E-class puts it in the lead.



A comparison of measurement with simulation results demonstrates that AutoForm-ThermoSolver accurately calculates tensile strength.

If you need a high resolution image, please contact us.