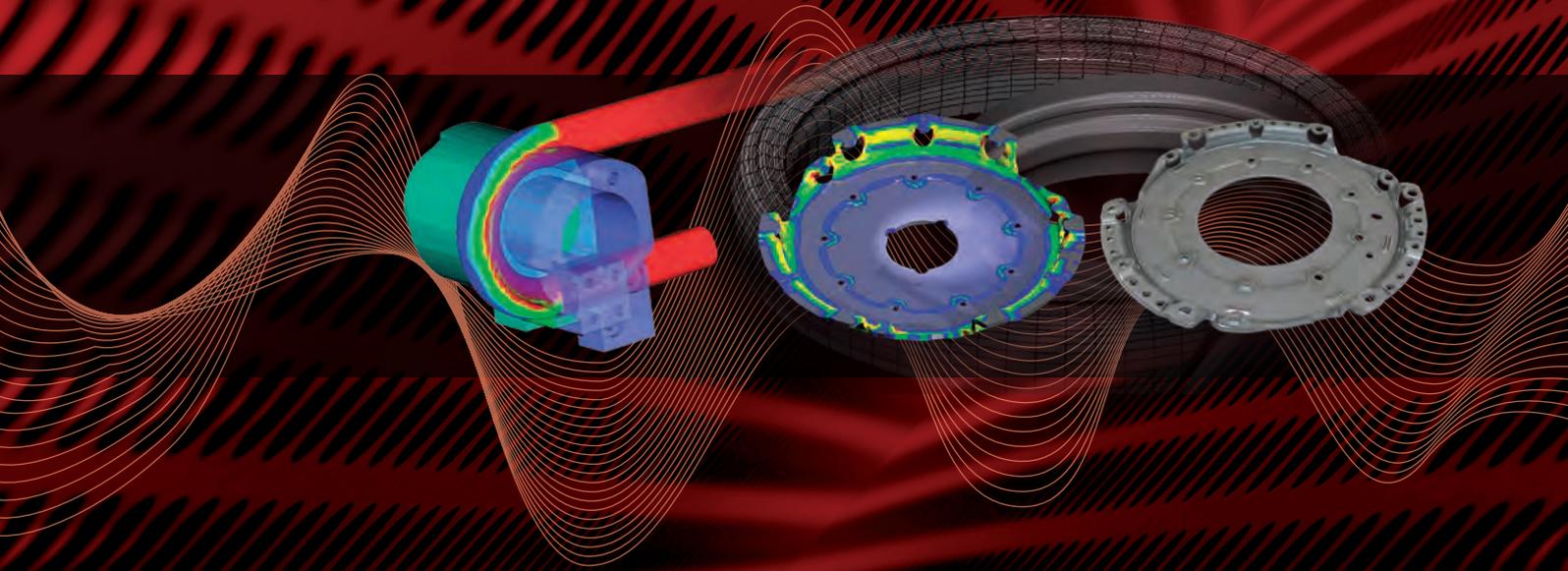


simufact.forming

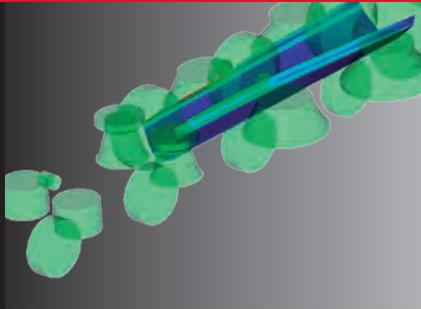
The simulation solution for  
bulk sheet metal forming



- Optimized forming processes –**
- Extended tool life time –**
- Efficient utilization of machine capacity –**
- Minimal material scrap and waste –**
- Less try out –**
- A reduced 'time to market' -**

Challenges that you are bound to meet every day. Simufact.forming, our software solution for virtual process development and –optimization, is designed to bring about solutions. Being a software company it is our commitment to optimize your production processes

by using the best software available, to make your business even more successful. We, at Simufact Engineering GmbH, combine the virtual world of simulation with the world of real production on the production line.



### The benefits

Your benefits when applying the Simufact.forming product line are clear: A significant increase in productivity, a considerable reduction in „time to market“, an evident cost reduction regarding the development of new processes as well as the optimization of current serial processes, because.....

... process simulation is a competition criterion.



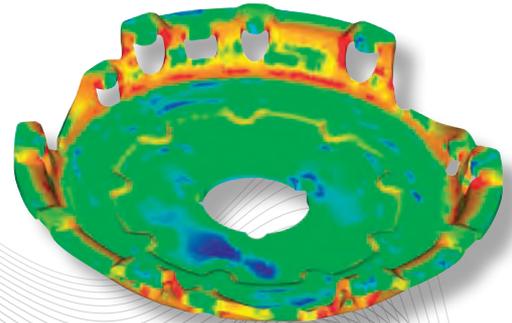
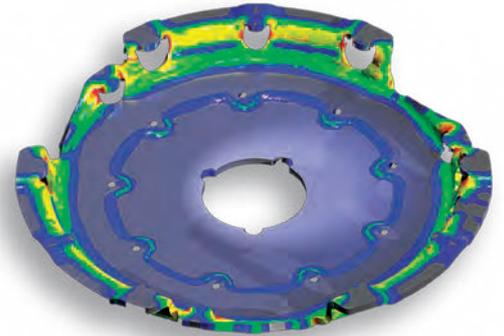
## When sheet metal becomes bulk ...

... the conventional approach of sheet metal forming simulation, as used e.g. for car bodies, no longer applies. However, sheet metal parts are not only used in car bodies. Structural components in vehicle construction, complex blanking and bending parts in progressive dies, sheet metal components with a material thickness of several millimeters – considered closely, these components will behave just as components of bulk forming. The criteria therefore are: tight draw radii in proportion to the sheet thickness, significant changes in material thickness (e.g. wall ironing or embossing processes) or the stiffness of a sheet metal structure. Conventional approaches of sheet metal simulation based on the shell and membrane theory offer no or insufficient solutions in these cases.

A continuum formulation, as in bulk forming,

is crucial here. Although always being more CPU intensive than a comparable shell approach, the results' quality and usability are convincing.

Applying the continuum formulation, elastic spring-back effects in particular, are represented with accuracy impossible with conventional thin shell approaches. In many processes, thermal effects, such as the rise in temperature due to the forming work must not be disregarded. Changed bending and drawing behavior due to temperature-sensitive material strength often occurs in practice. Many sheet metal forming processes with tight radii and complex forming changes show a tool strain which is often just as distinctive as in bulk forming.



## Bulk sheet metal forming – the solution

Simufact.forming special modules offer a customized solution to apply the continuum formulation to sheet metal forming, at the same time eliminating its disadvantages as far as possible. Specific upgrading and software adjustments allow the requirements of sheet metal forming simulation. This includes special meshing technologies for sheet metal structures, optimized element formulations and specific functionalities.

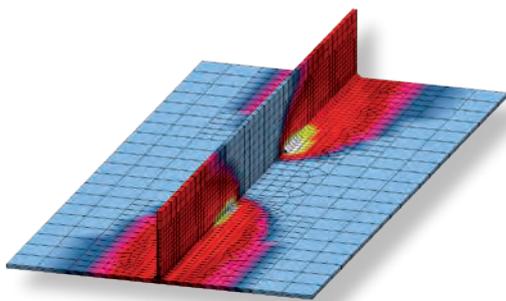
With the assistance of our customers and in partnership with well-know institutes we at Simufact Engineering GmbH constantly work on the further development and improved performance of Simufact.forming for sheet metal forming simulation.



### Sheet metal forming simulation is not an island

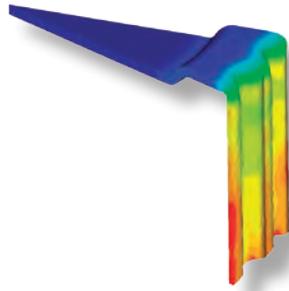
Development of modern and complex sheet metal structures always requires sophisticated engineering. Nowadays structural analysis aided by high-performance CAE tools belongs to the standard repertoire of innovative product engineering. Simufact.forming also offers a special solution here. The forming simulation's results, such as e.g. production caused work hardening or residual stresses, can be taken as initial and boundary conditions in a structure analysis with MSC.Marc. Thus, continuous simulation guarantees distinctly better results in the final product's design. Furthermore Simufact.forming is fully

compatible with Simufact's particular welding simulation solution Simufact.welding, which is also Marc-Solver based. A welding simulation can also be carried out based on a virtually formed sheet component. When including all tools and solutions that Simufact offers, it becomes possible to establish a „simulation chain“, thus providing the conditions for innovative engineering.

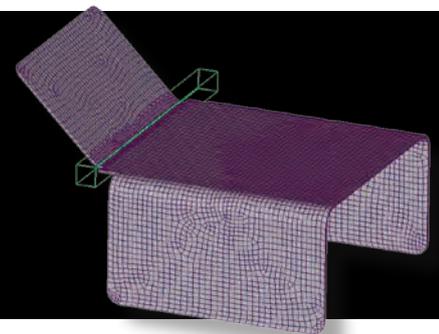
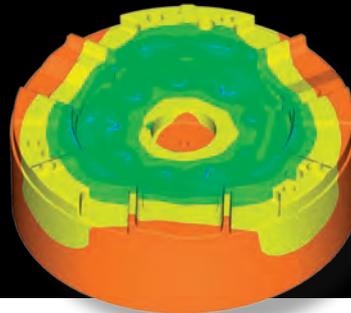
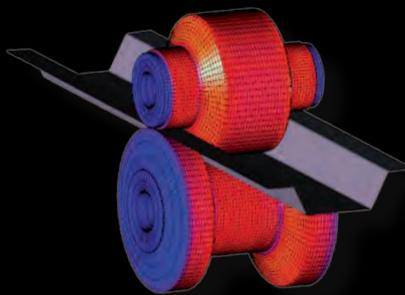


### About Simufact Engineering

Simufact Engineering is an internationally operating software company. Our headquarters are in Hamburg, Germany. Simufact develops process simulation software for both design and optimization of manufacturing processes in metal forming.



## The Simufact product family – a summary



### Simufact.forming basic

Simufact.forming is the standard-software-environment for simulating forming processes. It allows drawing-, bending-, embossing- and punching processes to be modeled, analyzed and visualized. Simufact.forming is easy to use and has been designed to support production engineers and tool design engineers in their daily work.

#### Simufact.forming offers the following advantages:

easy-to-use windows environment, project and object-trees, pull-down menus, 'drag and drop' etc.,

high performance Solver Technology – based on the leading CAE solutions Marc and Dytran issued by MSC.Software.

material formulation for elastic– plastic material behavior – indispensable for the precise prognoses of elastic spring-back effects and the tool analysis

fully coupled thermal-mechanical analysis – important for many forming processes of thick metal sheets with tight draw radii,

predefined machine kinematics, easy to define machine library,

arbitrary user-defined springs easily modeled to support complex tool concepts,

easy modeling of progressive tools,

varying flexible friction modeling is possible,

various failure criteria in bulk forming that are indispensable with thick metal sheets,

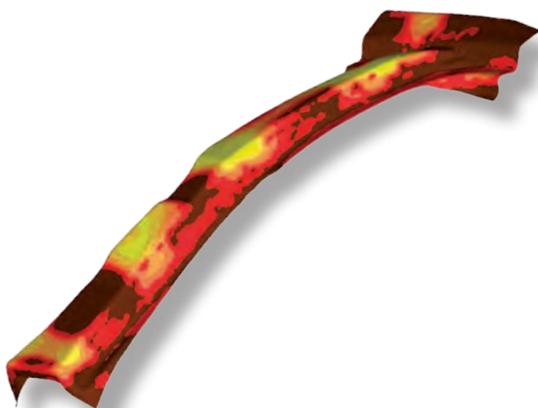
tool data easily imported via standard STL or IGES interfaces,

further CAD interfaces are optionally available (standard interfaces as well as native interfaces),

integrated and fully automated CAD repair and de-featuring for tool data,

simple and intuitive analysis of results by means of videos, xy-diagrams, cross section views (animated cross section views as well) – all relevant process factors can be depicted and evaluated: required force, stresses, strains, temperature, tool wear and many others,

tool load can be analyzed.



### Simufact.forming sheet metal

Based on the basic module, Simufact.forming offers sheet metal functionality designed to make the simulation of sheet metal forming processes even more efficient and easier:

The hexahedral meshing module allows the effective and simple meshing of sheet metal structures with premium hexahedral-elements that guarantee a topmost quality of results.

### Simufact.forming for sheet metal forming does not stop at temperatures

Simufact.forming generally operates as a mechanical-thermal coupled system. This guarantees highly realistic results in conventional sheet metal forming with fast blanking-bending-operations, including a process-related rise in temperature that might certainly influence production. This technology, however, is especially important when it comes to modeling for hot sheet metal forming, as e.g. press har-



So called „solid shell elements“ are available. These are modeled in the same way as shell elements, however, they also come with the features of volume elements, especially offering the possibilities of double sided tool contact.

Precise analysis and visualization of the metal sheets' thickness are indispensable with production processes involving sheet metal thinning or material thickening.

dening and roll form hardening. Based on thermal coupled material modeling including the available microstructure simulation, Simufact.forming here offers the key to analyze these innovative production processes, that gain increasing importance in structural components in automotive engineering as well as other applications.

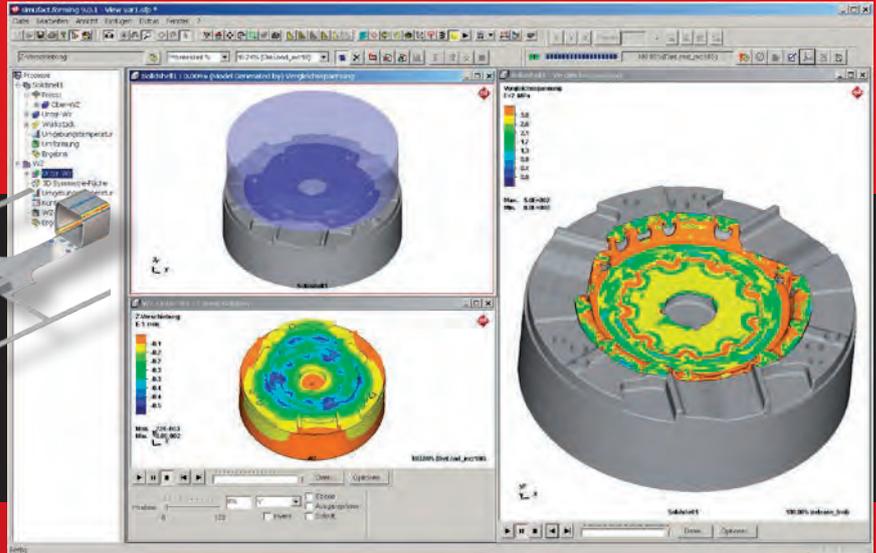
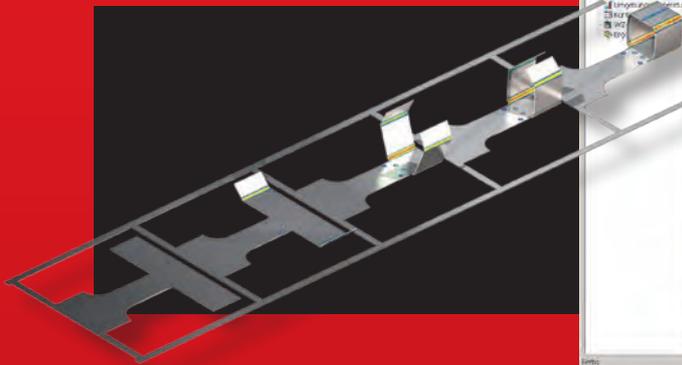
### Simufact.forming CAD

Save time by importing entire tool structures and assembly groups with various single tools. Avoid having to administer those, many different files of the single tools by applying powerful native CAD interfaces, that are available for Pro/Engineer, Catia V4 and V5, CADD5, Siemens/Unigraphics, Inventor and Solid-Works. Furthermore, standardized import-formats such as STEP, Acis, Parasolid, VDA and DXF/DWG are supported in addition.



# Simufact.forming in the field

Our customers regard three areas of successful virtual process development:



- feasibility study of the forming process
- estimation of cracks and component failure by means of failure criteria
- determining of the exact layout

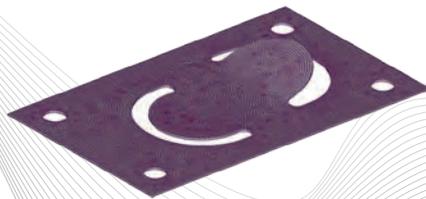
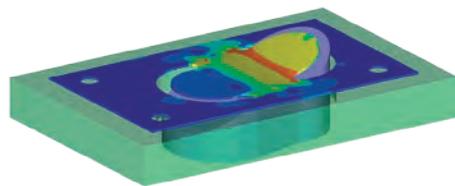
<b>Formerly-</b>	construction was carried out based on the assumption how things could work.
<b>Today-</b>	aided by simulation, the function of every bending station is analyzed.
<b>Formerly-</b>	laser cut layouts were used for first shop floor try out.
<b>Today-</b>	entire cutting stations are manufactured directly as the virtually determined layout fits.
<b>Formerly-</b>	the reasons for cracks could only be identified by extensive experiments.
<b>Today-</b>	material stress and maximum load are known beforehand due to simulation.
<b>Formerly-</b>	parts produced showed considerable pressure marks as well as variations in metal sheet thickness and thus had to be reworked with considerable effort.
<b>Today-</b>	components of supreme quality are produced.



## Experience and achievements

Optimize your development and production processes by cooperating with Simufact and using state-of-the-art technology with Simufact.forming.

**Make sure that you remain competitive. Benefit from our know-how at Simufact Engineering GmbH.**



*Simufact.forming is a tool that offers the user satisfactory precise prognoses on the capability of the design – at every stage in product development.*

*The design engineer is put in the position to constantly improve the understanding of tool load and their influence on the quality of the components. In most cases it will no longer require complex and expensive experimental tools but will be able to analyze and evaluate directly required improvements with the help of the material- and tool strain data.*

**Siegfried Peters**

*Leiter Validierung Lehneneinsteller,  
Keiper GmbH & Co.KG*

*The advantages of simulation are obvious: We run „virtual conditioning“, i.e. transferring the experimental try-out to the computer and we simulate, rather than having to modify costly tools as it was done formerly.*

**Erich Köhnert**

*Manager DIE Design,  
Tyco Electronics AMP GmbH*

*By applying Simufact.forming we are now in the position to fathom unsatisfactory tool life time arising from tool load. Inexplicable variations within processes become explainable through a detailed insight view of the process run. It is also of great importance for us that negative influences of product- and process variation can be identified in advance.*

**Thomas Baier**

*Leiter Technologieentwicklung  
Umformtechnik,  
ZF Sachs AG*

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**[www.simufact.com](http://www.simufact.com)**



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