WHY WORK WITH US?

The Fraunhofer IWM uses the latest materials science and technology findings to increase material and component performance levels and create innovative functionalities and to improve manufacturing processes.

The institute uses its understanding of material behavior to assess materials and components under a wide range of environmental conditions and loads: this leads to increased durability, reliability and availability of components, systems and entire plants.

The well-established link between experimentation and simulation at the Fraunhofer IWM provides an excellent basis for solving materials technology issues, particularly where resource or energy savings during manufacture and in use are concerned.

For the virtual development and assessment of materials and components, the institute works with advanced multiscale simulations on the nano, micro and macro level or develops the appropriate models.

The development of and changes to material properties along a chain of different manufacturing stages can be predicted for entire manufacturing processes.

FRAUNHOFER INSTITUTE FOR MECHANICS OF MATERIALS IWM

As research partner for industry and public bodies, Fraunhofer IWM develops solutions that can improve energy and resource efficiency during manufacture and use of materials and components and can reduce losses involved in the production, conversion and storage of energy. The solutions lead to greater component durability, longer service life and improved reliability as well as more cost-efficient processes.

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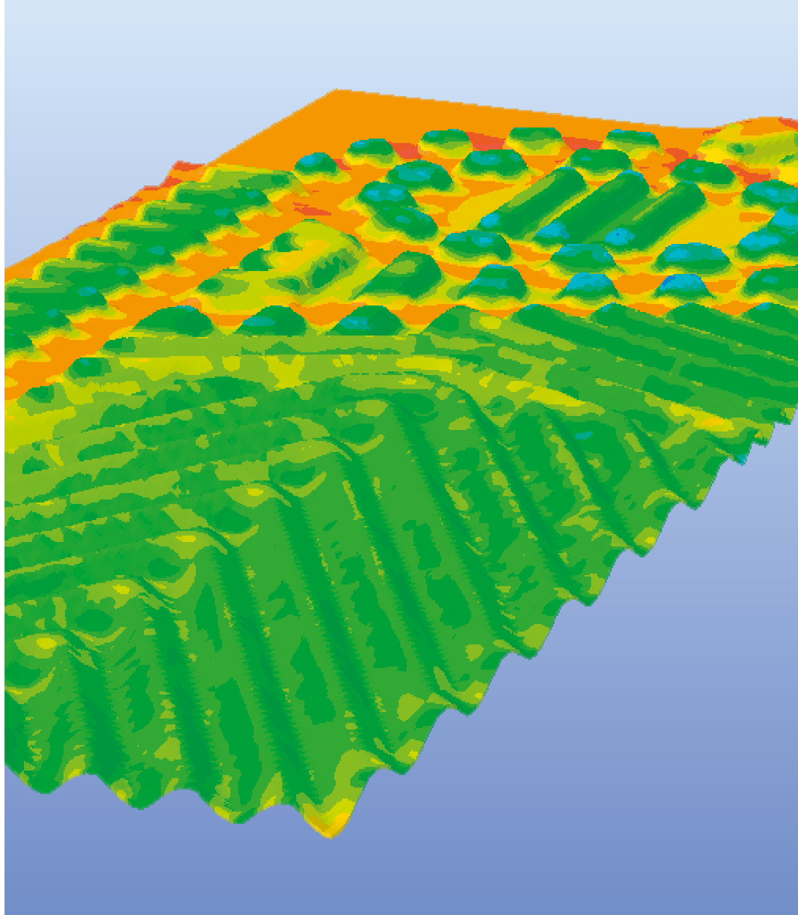
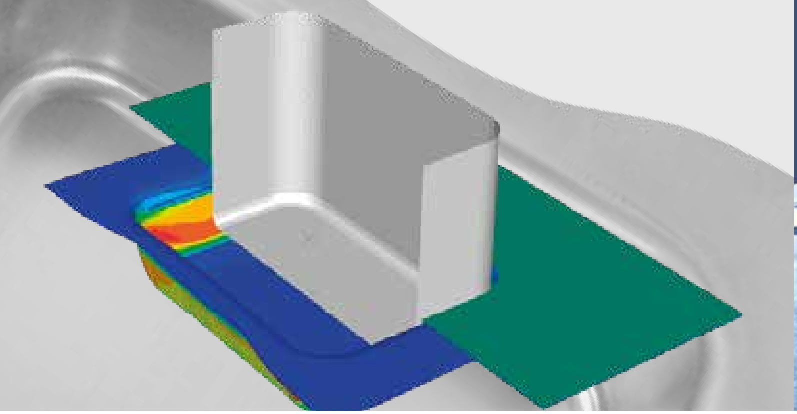
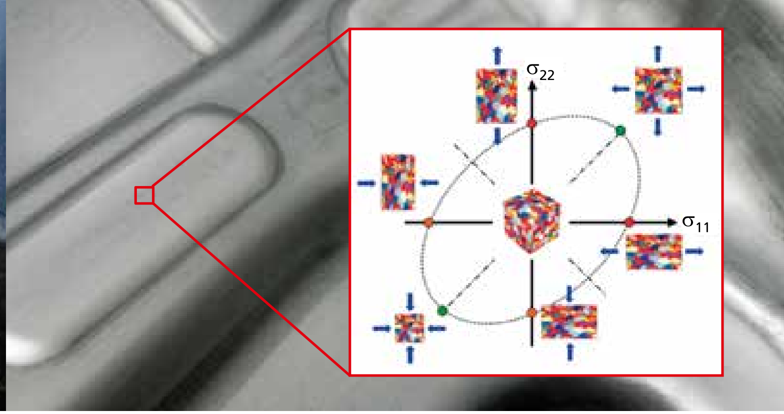
SIMULATION OF SHEET METAL FORMING







Control of component quality and production processes

In the automotive industry sheet metal forming simulation plays an essential role in the design of forming tools and in the conception of the forming processes. Helping to avoid wrinkling and cracking as well as to compensate spring-back the simulation of the forming process efficiently assures the rapid and cost-effective development of new components.

Recent developments in forming simulation try to include in the models also the interaction of the forming tools with the sheet. Thus, temperature rise in sheet and tools may be considered, including alterations in the material properties, as well as local variations of friction behavior and wear. Lastly, the still very time and cost extensive adjustment of new forming tools will be made easier.

We offer support and cooperation in all aspects of the forming process. In addition to various bilateral projects with partners from industry, we continously enhance our competencies by initiating of and participating in public research projects.

Our service

On the basis of material related modeling concepts and advanced simulation methods we analyze, evaluate and optimize the forming processes of sheet metal, considering the influence of production steps upstream and downstream as well as other operational requirements.

Our focuses are on the assessment of forming limits, the description of spring-back and anisotropy and on the prediction of the evolution of relevant material properties during the forming process. We describe the interaction of formed sheets with the forming tools and, thus, assess friction and wear. In the »virtual lab« we combine microstructural quantities with macroscopic material properties in order to simulate the evolution of the material properties during production and, hence, to improve process control.

Simulation of forming processes

- Support in planning, design and adjustment of forming tools
  - Wrinkle formation, tearing, spring-back
  - Temperature evolution, friction, wear

Material characterization for the simulation

- Determination of material properties in dependence of temperature
  - Elastic-plastic deformation behavior including the Bauschinger effect
  - Thermomechanical and thermophysical properties
- Experimental investigations of spring-back behavior
- Characterization of friction and wear

Enhancement of suitable simulation models for the description of relevant phenomena

- Non proportional deformation behavior
- Forming limits
- Interaction of tools and parts
- Influence of microstructure (»virtual laboratory«)

Determination of the appropriate model parameters

- Isotropic-kinematic hardening
- Anisotropic description of yield locus
- Ductile damage
- Friction and wear