



Our research strategy

Casting and forming of metallic materials are the two major production engineering focus areas at our chair. This interlocking of two different technologies forms an excellent starting point for synergetic research activities and aims to strengthen the position of Europe as a business location in a tough environment, especially after the corona crisis.

In both research and teaching, we strive for a balanced mix of **basic research** and **application-oriented development** in partnership with innovative industrial companies. From the very beginning, our research strategies focus on **industrial process chains**, so that even our fundamental developments can later prove their **practical feasibility**. Of course, this only works with **motivated and committed employees**. Thanks to the positive and friendly atmosphere at our chair, our employees have excellent opportunities to turn their creativity and ideas into specific projects.

Currently our research focuses on:

- Sheet metal forming and blanking technology
- Free-form bending
- AI and machine learning in metal forming and casting technologies
- Characterisation of materials for sheet metal and casting
- Continuous and compound casting
- Development and characterisation of moulding materials



Just ask us – we'll research the answer

Our services for you:

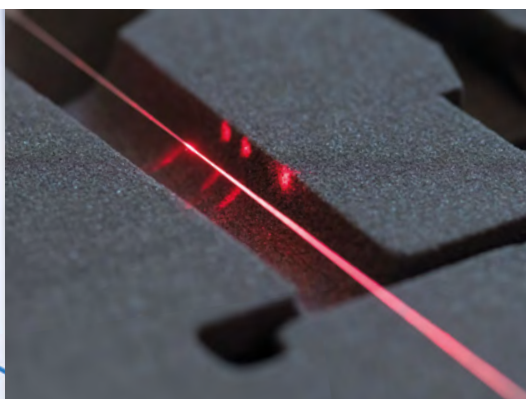
- Creative **process innovations** for application-oriented projects
- Intelligent **material analysis** with the latest measuring technology for the development and validation of novel material models
- Precisely fitting **simulations** with the corresponding implementation using available software tools

We have gained an excellent understanding of manufacturing process chains through our intensive exchange with many industry partners. This experience puts us in a position to creatively identify potential for improvement and implement this in our research. In general, we cover the entire spectrum of basic research, through joint industrial research to bilateral development projects.

We take care of your needs:

You identify a need for research or development; a discussion with us reveals possible solutions, feasible types of cooperation, and the expected investment. The goal of our cooperation is to solve the problem and introduce innovation to the company or the market.

- For our **contract research projects**, we define clear goals, work packages and milestones with the aim of delivering directly realisable results for your company.
- **Collaborative research** is suitable for complex questions, which are answered in cooperation with other partners and through publicly funded projects.
- In our **strategic partnerships**, you benefit from our expertise and we conduct research with your machine and plant technology.



1968

- The Chair of "Fertigungstechnik B" is established
- Appointment of Prof. Dr.-Ing. habil. Fritz Fischer to the chair as its first director
- The chair is renamed "Lehrstuhl für Verformungskunde und Gießereiwesen"
- "Technische Hochschule München" becomes "Technical University of Munich" (TUM)

1970

1978

- The chair moves from Munich City to Garching right next to the nuclear research reactor

1985

- Construction of the first experimental hall

1993

- The chair is renamed for the second time as "Lehrstuhl für Umformtechnik und Gießereiwesen"
- Appointment of Prof. Dr.-Ing. Hartmut Hoffmann after the retirement of Prof. Fischer

1997

- Second structural extension of the chair
- The Department of Mechanical Engineering moves from Munich to Garching

2001

- Third structural extension of the chair
- Election of Prof. Dr.-Ing. Hoffmann as dean of the Department of Mechanical Engineering

2006

- TUM is named a University of Excellence

2011

- Appointment of Prof. Dr.-Ing. Wolfram Volk to the chair as its third director

2012

- Prof. Hoffmann is appointed as TUM Emeritus of Excellence

2016

- The Fraunhofer Institute for Casting, Composite and Processing Technology IGCV is established with Prof. Volk as member of management

2018

- 50 years utg
- 150 years TUM and Department of Mechanical Engineering

2019

- Laying of the cornerstone of the new IGCV casting technology centre at the Garching campus

About us

More than 50 years of research and teaching in metal forming and casting technology

Research:

- 36 scientists in research
- 8 scientific support staff in technology and administration
- 30 ongoing research projects with a volume of 3.5 million euros together with industrial partners and public sponsors
- 25 Scopus indexed, scientific publications in international journals per year

Teaching:

- 11 different Bachelor and Master lectures per year
- 6 different internships per semester
- 40 supervised Bachelor and Master theses per year



Our research and test facilities

Modern **experimental facilities** are a basic requirement for **successful research** in the field of production engineering. Through many **years of cooperation** with leading plant manufacturers, we can rely on an **excellent infrastructure**. We would like to thank the companies Bihler, Bruderer, Feintool, Loramendi and Aurrenak, J. Neu, Schuler, Sys and ZwickRoell for their support.



Upper piston press by Dieffenbacher

We use the hydraulic top ram press for punching as well as for active and passive sheet metal drawing. The 40-ton system has a nominal press force of 3500 kN and a drawing cushion force of 1250 kN. Therefore it is also suitable for large forming parts. Due to the accessibility on both sides, the press can be used very flexibly for a wide range of applications and custom tailored processes.

Field of application: Description of pre-expansions in metal sheets for material testing, collar forming, special processes



Hydraulic fineblanking press by Feintool

Our fineblanking press has a total press force of 3200 kN. In combination with the guiding accuracy of the die, this press enables the production of extremely precise components with a high degree of dimensional accuracy. The cut surfaces of these components possess functional surface character without any post-processing. Sheet thicknesses up to 16 mm can be processed.

Field of application: Studies in the field of cold forming, normal- and fine blanking processes



Mechanical high-speed presses by Bruderer

Our high-performance punching machines with 510 kN respectively 1600 kN nominal press force with full mass compensation and adjustable stroke offer universal application possibilities for the most diverse research tasks. The systems allow investigations in single stroke as well as in continuous operation under real conditions.

Field of application: Tests of wear and tear as well as examination of process-related variables in forming and cutting tests



6-axis free-form bending machine by J. Neu

With only one tool set, we can bend tubes or profiles in all radii. As part of this process, the tube is pushed by a feed unit through a guide sleeve and then through a tube-specific bending die. The dynamic control creates a 3D tube geometry with seamless change of curvature and direction.

Field of application: Free-form bending of round steel and aluminium tubes as well as profiles of any cross-section



Our most important fields of **expertise** include **design, construction and application** of specific **test benches** at our industry-oriented production facilities. Among the key functions of these test benches is providing the crucial foundation for the **validation of new models**. We implement measurement technology, which is suitable for use in a demanding production setting, allowing us to break **new ground** in research.



Continuous casting plant by Demag Technica

Our continuous casting pilot plant allows academic scale processing of metallic materials into semi-finished products. The technical equipment corresponds to industrial plants and thus enables process-oriented research. The plant can be swivelled to enable horizontal, inclined or vertical casting.

Field of application: Continuous casting of aluminium and copper alloys, production of graded semi-finished products



Core blowing machine by Loramendi and Aurrenak

Core blowing describes a mechanical process in casting technology for the production of organically or inorganically bonded cores from sand. The moulding material, together with a binder, is shot into the core box by the sudden expansion of a volume of compressed air in less than a second.

Field of application: Production of inorganically bound sand cores, test specimen and water jacket cores



Sheet metal testing machine by ZwickRoell

We use the BUP1000 for the characterisation of various sheet metals with regard to formability and strength. Its modular design allows the installation of different tools, the optical measuring system GOM ARAMIS 4M and a high oven temperature up to 950°C.

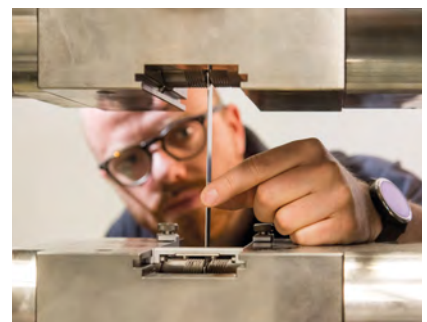
Field of application: Determination of forming limit and flow curves, Material Under Control (MUC test) - material card validation, mapping of non-linear strain paths



Static materials testing machines ZwickRoell 200 kN and 150 kN

Our static materials testing machines are suitable for testing applications in all areas. Their modular design offers maximum flexibility and expansion possibilities. They are controlled by the latest version of the testExpert software.

Field of application: Material characterisation with tensile, compression, flexure, shear, and torsion tests



Our measurement equipment

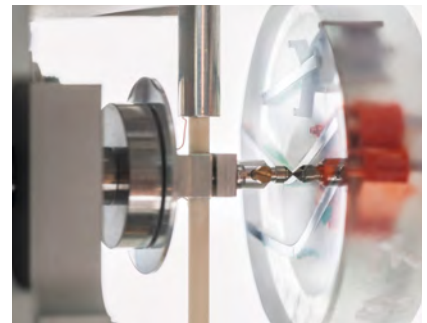
Successful **measurement technology** and excellent analytics thrive on **expertise** paired with many years of **experience**. Thanks to numerous basic and industrial cooperation projects, we at utg have access to a collection of exclusive and **very unique measuring devices**. We are continuously expanding these possibilities through new investments. Our measuring technology is also available in many cases for **bilateral direct orders**.



Hardness mapping using nanoindentation

Nanoindentation is an instrumented penetration test at nanoscale for the determination of material characteristics. The hardness and the elasticity of the material are determined locally on the sample surface. The low penetration depth of the test probe in the range of a few nanometres allows measurements at a grain size scale.

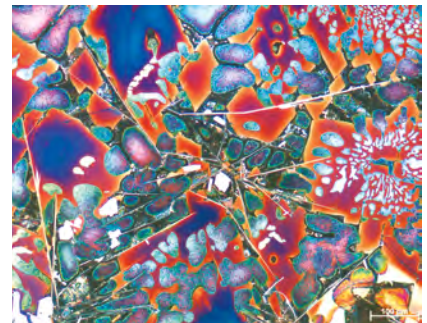
Field of application: Nano and micro hardness measurement, measurement of the Young's modulus, analysis of residual stresses



Structural analysis by means of metallographic microsections

We use the Axioplan light microscope for optical examination, analysis and documentation of metallographic sections. At a magnification of 25 to 1000, microstructures are visualised using bright field, dark field and polarisation contrast. The AxioVision software supports us in the evaluation and analysis of micrographs.

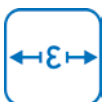
Field of application: Qualitative and quantitative structural analyses



Geometry measurement using optical 3D digitalisation

The GOM ATOS 3D Digitizer is based on the triangulation principle with a stereo camera setup integrated into the sensor head. The sensor projects precise fringe patterns onto the surface of the object, which are recorded by the two cameras. This results in a point cloud of 1.4 million measurement points for each measurement.

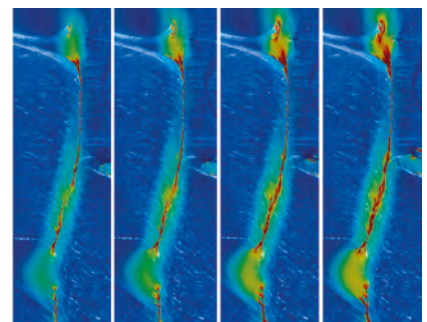
Field of application: Surface digitisation, reverse engineering, rapid prototyping, digital mock-up



Strain measurement using high-speed recordings

The digital high-speed camera in a compact design can be used for operations in the most demanding and inaccessible environments. The equipment with a wide data bus allows very high frame rates (up to 125,000 fps) as well as high transfer speeds to a solid state memory with a large capacity.

Field of application: High-speed tests, inverse material characterisation, materials testing



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