Chair of Metal Forming and Casting
TUM School of Engineering and Design
Technical university of Munich

utg Newsletter Issue 12 06/2025

Chair of Metal Forming and Casting

“Every day you live, you make an impact.
You choose what kind of impact that will be.“

Jane Goodall, born 1934, british zoologist, primatologist and anthropologist

Editorial

Summer can come!

Dear readers,

After a very dry and warm spring, summer is now just around the corner. If some forecasts are to be believed, we are in for a very warm year. However, I am only moderately convinced by the accuracy of these forecasts.

Fortunately, our processes in casting and forming technology are much easier to predict than the weather. Therefore, we have once again compiled some hopefully interesting highlights from our research activities for you.

Along with reading the reports, I would like to extend two important invitations to you in the nearfuture:

From **July 7 to July 11, 2025**, we will be hosting the **NUMISHEET 2025**. With over 180 presentations from around the world and eight keynotes on currenttopics in the forming industry, we believe we have put together a veryexciting conference program. A particular highlight will bethe benchmarks, for which we have received a surprising number of contributions. Latecomers can still participate. (see page 10)

A week later, as usual, we at *utg* invite you to our **summer meeting** on the third Thursday in July (**July 17, 202**5). You will also find the invitation here in the newsletter. (see page 11)

We look forward to seeing you there.

With my best wishes for a wonderful summer and happy reading.

Yours sincerely,

Prof. Dr.-Ing. Wolfram Volk *Foto: Heddergott/TUM*

Cover:

The utg-Team Rollercaster, TUM Campusrun 2025
Photo: utg

utg News

TUM Campusrun 2025

What a day! Under bright sunshine, our Rollercaster team of 15 runners aged between 25 and 84 took part in this year's campus run.

With plenty of ambition, team spirit, and a great deal of fun, we took to the starting line together—and everyone reached the finish line! Whether it was a personal best or simply the experience of being part of a team, each and every one of us made a great contribution.

Team Rollercaster, Photo: utg

A huge thank you goes to Prof. Hoffmann for the pizzas, which allowed us to replenish our carbohydrate reserves afterwards.

We are proud of our diverse team and are already looking forward to the next run!

WGP Office Forum 2025

A strong network meets in Karlsruhe

The WGP Office Forum 2025 once again provided an excellent platform for exchange between the employees of the WGP institutes. Whether in workshops, discussions, or at dinner together, it was clear everywhere how important and valuable the network of scientific support staff is for the success of the institutes.

The wbk Institute for Production Technology at Karlsruhe Institute of Technology KIT hosted this year's WGP Office Forum.

As a special highlight, our hosts organized a tour of the **Federal Constitutional Court**. During an exclusive tour of the historic building, we not only gained an impression of the role and working methods of Germany's highest court, but also experienced the impressive architecture and atmosphere of the building.

The second day featured a practical presentation on the topic of "**Artificial Intelligence in Assistance**".
The presentation focused on specific applications of AI in everyday work—from word processing and scheduling to support in organizing complex projects.

The focus was particularly on questions such as:

- Which tools can make daily work more efficient?
- Where are the opportunities?
- Where are the limits?

The participants contributed their own experiences, discussed application examples openly, and reflected together on the requirements for future skills.

The two-day forum ended with new ideas, strengthened contacts, and a strong sense of community – and there is already great anticipation for next year

All participants together in the Grand Chamber of the Federal Constitutional Court, Photo: wbk

utg News

Research trip to Pilsen

Our forming research group set off on its annual excursion at the end of April. This year, the scientists were delighted to visit **Shape Corp**. at its production site in Pilsen.

The company's core competence lies in roll forming profiles for the automotive industry. However, downstream processes such as **free-form bending** are also part of the company's competence profile. Accordingly, there was an intensive exchange regarding our current research projects in the field of free-form bending. Building on the exciting discussions about current problems with the process in industrial practice, we were able to discuss promising opportunities for cooperation.

We would like to take this opportunity to express our sincere thanks to Shape Corp. for the warm welcome and the exciting tour.

Professional exchange at Shape Corp. in Pilsen, Photo: utg

In addition to the purely technical component, the excursion has always served to create a relaxed atmosphere for in-depth exchanges between colleagues. This was implemented in the internal group workshop. A lively discussion ensued, including technical exchanges, knowledge transfer, and a stronger sense of group identity.

And finally, the cultural component was not to be missed. In addition to the beautiful old town, the group was able to visit the birthplace of Pilsner beer, the **Pilsner Urquell brewery**. There we had the opportunity to learn a lot about the historical history of the city and the beer, as well as the process behind it.

There was also a lot to learn during the tour of the Pilsner Urquell brewery. Photo: utg

Students visit MAN factory

Excursion to MAN Truck & Bus at the end of the lecture “Production Management in the Commercial Vehicle Sector”

The final highlight of Prof. Dr.-Ing. Carsten Intra's popular lecture is always a full-day excursion to MAN Truck & Bus.

This time, 39 students took part, who first gained an exclusive insight into truck assembly. Here, they were able to experience the impressive variety of vehicles manufactured live.

Afterwards, things got interactive: in small groups, the participants playfully optimized a vehicle production process simulated with LEGO® bricks – in line with the LEAN concept and the one-piece flow principle. In this friendly competition, the focus was on having fun as well as achieving optimization success.

The highlight of the day came at the end: on the MAN test track, the students had the opportunity to get be-

hind the wheel of a commercial vehicle and, with the support of driving instructors, drive both a loaded semi-truck and a bus.

How does it feel to drive a modern coach? TUM students on the test track at MAN, photo: utg

An all-around successful excursion that gave participants practical insights into the world of production at MAN and the topic of production management!

We would like to express our special thanks to all MAN employees who took so much time for us.

The excursion to MAN Truck & Bus is a highlight of the lecture "Production Management in the Commercial Vehicle Sector" held by Prof. Carsten Intra, photo: utg

Visit to BRUDERER AG

The Cutting and Blanking Research Group was delighted to receive an invitation from Bruderer AG to visit the company's headquarters in Frasnacht, Switzerland. A varied program made the visit a win-win for both sides.

We began by presenting our current research topics in cutting and stamping technology. This led to a lively exchange of experiences and opportunities for cooperation.

We then gained insights into the design and layout of high-speed presses and the wide variety of machines available for different areas of application. Of course, a tour of the production halls was also a must. Starting with the machining of individual parts, through the paint shop, to assembly, we followed the process of creating high-speed presses and gained exciting insights into the inner workings of the machines.

We have been working closely with Bruderer AG, Switzerland, and Bruderer GmbH, Germany, for many years. Two Bruderer automatic punching machines are an essential part of our equipment pool. They are used to carry out numerous research projects in cutting and punching technology.

Bruderer AG also supports us in teaching students about the exciting technology behind Bruderer high-performance automatic punching machines.

We would like to thank Bruderer once again for their hospitality and excellent support throughout the day.

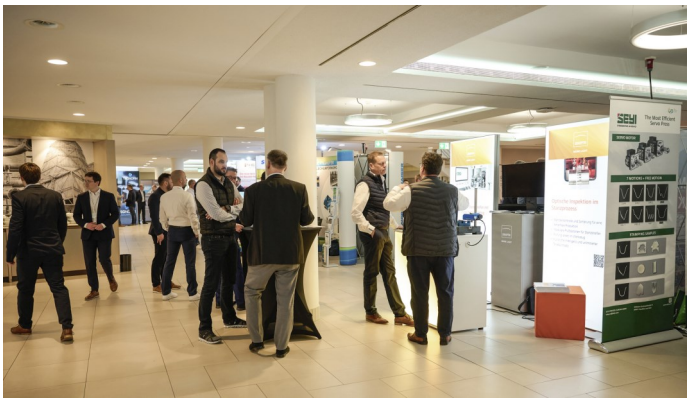
The Cutting and Stamping research Group during their visit in Switzerland, Photo: utg

2025 Stamping Technology Congress

Review of the industry gathering with a new strategic focus

In April 2025, the stamping technology industry gathered for the 15th annual Stamping Technology Congress at the Westfalenhallen in Dortmund. Around 190 trade visitors took the opportunity to discuss current challenges, technological developments, and digital communication.

This year's trade exhibition featured 35 exhibitors, representing toolmakers, press manufacturers, and the industry's most important associations.



35 companies showcased their expertise at the exhibition.

One highlight was the **keynote speeches** by Markus Schnöll, Otto Bihler Maschinenfabrik GmbH & Co. KG, and Timm Rotter, IAN In A Nutshell GmbH, on the **importance of social media in corporate strategy**. The subsequent panel discussion explored the topic in greater depth, with **perspectives from HR, communications, and association work**.
Practical examples showed how companies use social media in a targeted manner to attract skilled workers, strengthen their brand presence, or promote knowledge transfer between generations.

The technical presentations were divided into three subject areas, with the current economic and political situation and the current challenges facing stamping technology being the focus of attention for all participants.

Innovative production technology is fundamental to sustainable production in Germany, which was presented in the two thematic blocks "**Tools as the key to economic success**" and "Intelligent **and innovative quality assurance**."

On stage: from left Timm Rotter, Ralf Dürrwächter, Laura Popp (ANDRITZ Schuler Pressen GmbH), Markus Schnöll, Wolfram Volk

This year, there were a number of changes in the organization and strategic orientation of the congress.
The congress advisory board was reorganized and heavily involved in the preparation of content: **Mathias Bihler**, Otto Bihler Maschinenfabrik GmbH & Co. KG; **Ralf Duerrwächter**, Association of German Tool and Mold Makers (VDWF & FDWF); **Patrick Großhaus**, Egon Großhaus GmbH & Co. KG; **Dr. Michael Hagedorn**, Association of the German Spring Industry (VDFI); **Bernhard Jacobs**, Industrial Association for Sheet Metal Forming (IBU); **Achim Kuhli**, Bruderer GmbH; **Markus Schaltegger**, Qcision AG

The *utg* organized the congress for the first time in cooperation with "Strategie X GmbH." Together, we are pursuing the goal of further developing the Stamping Technology Congress as a forward-looking platform for dialogue between research and practice.
We would like to thank all speakers, exhibitors, board members, and guests for their commitment and look forward to the 16th Stamping Technology Congress on April 20 and 21, 2026.

All photos: Cube Photo / Sylvia Meyborg

Current Research at *utg*

Casting

Molten Metal Jetting - Fabrication of multi-material components

Motivation

Multi-material components enable locally adapted properties within a single part by purposefully combining different materials. Conventional manufacturing methods already allow the production of material composites but reach economic and/or technological limits when dealing with complex geometries and small batch sizes.

Additive manufacturing processes can be a solution here. Powder- and laser-based processes are currently widely used. However, these consume a lot of resources due to powder production and the complex separation of the powder for recycling.

Molten Metal Jetting uses wire as a feedstock and enables material changes from droplet to droplet through the layer-by-layer deposition of molten metal. This allows for the resource-efficient production of complex, filigree multi-material components.

Approach

With our research project, we want to prove that molten metal jetting is fundamentally suitable for producing multi-material components with controlled composite quality. The plan is to process copper (Cu-ETP) and copper-tin bronze (CuSn8) in a single printing process, with the material change taking place at a resolution in the range of a drop size.

To this end, a suitable print head has been developed at *utg* that enables the simultaneous processing of both materials. To determine suitable process parameters, components are manufactured using different parameters and then characterized.

A particular focus of research is on the production of components in which bronze is printed first, followed by copper. The lower solidus temperature of bronze compared to copper is the limiting factor in processing, so that the thermal energy required for droplet bonding must be provided by the newly impacting droplets. The experimental results are supplemented by a virtual representation of the printing process.

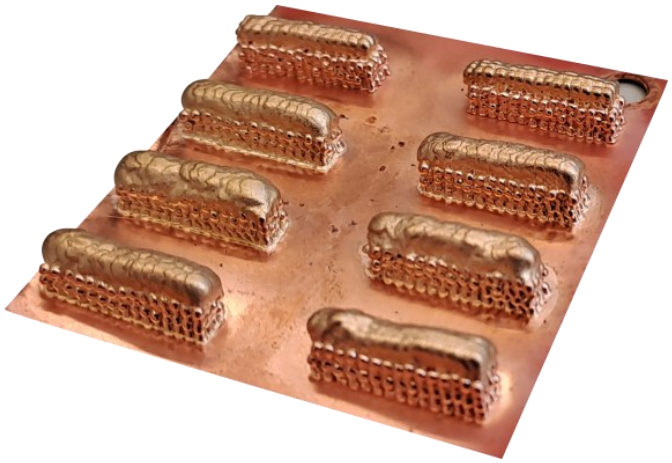


Figure: Multi-material components made from copper materials using Molten Metal Jetting

Outlook

Multimaterial molten metal jetting potentially enables the cost-efficient production of components with locally adapted functional properties. The knowledge gained from the processing of copper-based materials can serve as a basis for the development of composite components with alternative material combinations.

The project is funded by the **German Research Foundation (DFG)** under project number **524939160**.

The first scientific results are expected to be published at the end of 2025.

Contact: Maximilian Plötz, M.Sc.

Current Research at *utg*

Cutting and Blanking Technology

Data-driven process modeling in stamping and bending technology

Initial situation and motivation

Until now, the sequence of process steps for manufacturing stamped and bent components has been largely determined based on experience, with numerical simulations also being used increasingly. The quality of the components is directly related to the design of the process sequence. Analyses of the data measured on the system and on the finished part provide valuable insights for further investigation. If correlations between the data and the production of rejects become apparent, this can bring about lasting changes in manufacturing.

In this project, a machine learning model has already been trained with synthetic data. These have already been shown to represent the real process very well. In order to make the machine learning model even more meaningful, it must also be trained with experimental and numerical data.

Approach

As a basis, a stamping and bending process is designed on a GRM-NC automatic stamping and bending machine from Bihler with several consecutive process steps. The sequence of the process steps is varied during endurance runs. Simultaneously, disturbance variables are switched on and off, and displacement, force, and temperature measurements are performed.

The geometry of the finished part is visually measured at the end of the process chain, and the component data obtained is assigned to the experimental process data. In parallel, synthetic data is generated via a virtual laboratory to reflect the process with different process sequences.

As a third data source, the various production sequences are simulated so that numerically obtained data can also be used for comparison.

All the data obtained is used to train a machine learning model, which is then used to trace the origins of the geometric properties of the finished part. This is then subjected to a new, quantity-based conformity check.

Outlook

The results will be used to optimize the process sequence of stamping and bending processes in the future using the machine learning model. In addition, differences between the individual data sources in terms of their informative value will be highlighted and evaluated.

The project partner is the TUM Chair of Cyber-Physical Systems at the Department of Robotics, Artificial Intelligence, and Real-Time Systems.

The research project is part of the DFG SPP 2422 on *Data-driven Process Modeling in Forming Technology*,
DFG project no. 520459543

Contact: Maximilian Buchner, M.Sc.

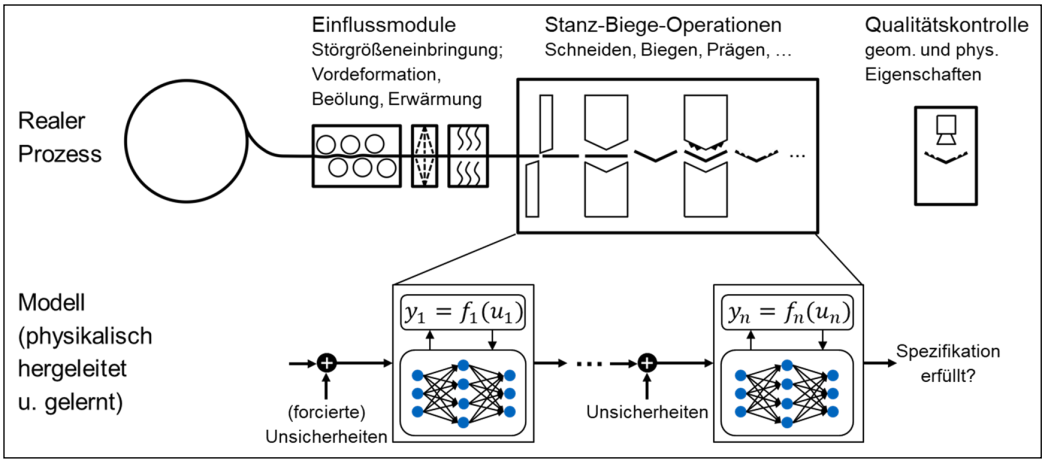


Figure:

Research model for training a machine learning model for a punching and bending process, ©utg

Current Research at *utg*

Forming Technology

Failure Assessment of Bending Operations with Pre-deformed Sheets (3D-BFLC)

Motivation

This project addresses a currently unresolved challenge in sheet metal forming: there is no established method for reliably predicting material failure during bending operations on pre-strained sheets.

While traditional forming limit diagrams (FLC) and advanced concepts such as the Generalized Forming Limit Concept (GFLC) have been developed for deep drawing processes, they are unsuitable for bending operations, as these do not exhibit characteristic thickness necking and are strongly influenced by the forming history and changes in sheet orientation. In industrial practice—particularly in the design of progressive dies—this often leads to unforeseen part failures, high scrap rates, and costly iteration loops.

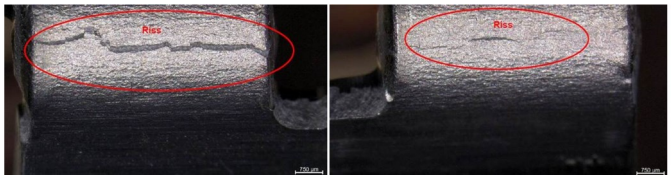


Figure 1: Cracking in components following the bending process

Approach and Results

The aim of the project is therefore to close this gap by developing a robust methodology for assessing the bendability of pre-strained sheets. To achieve this, systematic experimental investigations will be conducted to quantify the effects of pre-strain type, pre-strain level, and sheet orientation on the failure behavior of relevant materials (including dual-phase steels and aluminum alloys). Innovative measurement techniques such as digital image correlation will be employed. Based on the acquired data, a phenomenological meta-model will be developed that describes the remaining formability and allows for the prediction of maximum achievable bending angles and critical strains.

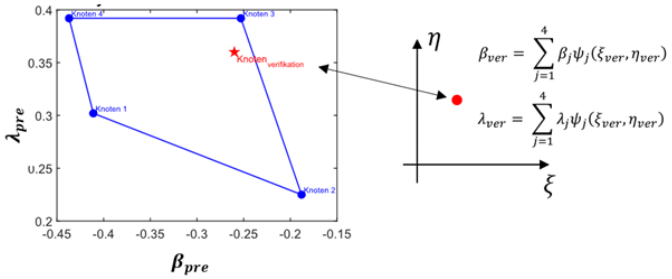


Figure 2: Meta-Modell

The model will be implemented in two versions: as a standalone tool for SMEs that do not use advanced simulation software, and as a subroutine for integration into common FE tools (such as AutoForm and LS-Dyna). This ensures efficient and practical applicability.

Outlook

Thanks to its scalability within material families, the required testing effort for new materials can be significantly reduced. The availability of the model will increase process reliability, lower development costs, and promote resource efficiency, ultimately enhancing competitiveness. Targeted knowledge transfer to industry will be achieved through workshops, publications, and training courses. In this way, the project makes an important contribution to the digitalization and sustainability of sheet metal processing.

The project is funded by the EFB – European Research Association for Sheet Metal Working and is nearing completion.

Contact: Tianyou Liu, M.Sc.

Events at *utg*

The 13th International Conference and Workshop on

Numerical Simuation of 3D Sheet Metal Forming Processes

takes place in Munich, July 7-11, 2025

It will once again be an international platform to discuss new ideas, strengthen existing relationships and establish new collaborations with leading researchers and industrial companies.

The **NUMISHEET 2025** will focus on key advancements in manufacturing and materials science.

NUMISHEET 2025 offers

- 8 highly interesting **keynotes**: https://numisheet2025.com/keynote-lectures/
- 11 **mini symposia** with 180 presentation in total: https://numisheet2025.com/mini-symposia/
- 2 **benchmarks** with challenging metal forming problems: https://numisheet2025.com/benchmarks/
- 5 exciting **company tours.** https://numisheet2025.com/technical-visits/

Where? Leonardo Royal Hotel, Munich, Germany

When? July 7 to 11, 2025

Register now and be part of this exciting event:

https://numisheet2025.com/registration/

Thanks to our main sponsor:

AUTOFORM

Forming Reality

Events at *utg*

July 17, 2025

Inhouse Fair „Summer at *utg*“

We cordially invite you to our traditional in-house exhibition! In addition to many interesting discussions, there will of course be plenty to eat and drink.

We want to make new contacts and cultivate old friendships together with you in a relaxed atmosphere.

Where? Chair of Metal Forming and Casting,
Walther-Meißner-Str. 4, 85748 Garching

When? July 17, 2025 - Begin 4.00 pm

To register by **July 5**, please use the registration link.

Personnel at *utg*

We extend a warm welcome to:

Maximilian Buchner, M.Sc. joined the cutting and blanking research group on 1 May 1 2025

Marios Demetriades, M.Sc. will be joining the forming research group on 1 July 2025

We wish all the best for the furture:

Florian Steinlehner left *utg* on 31 July 2024. He has moved to Fraunhofer IGCV as head of department.

Lukas Martinitz left *utg* on 31 May 2025.

New Dissertationa at *utg*

54 **Kindsmüller, Alexander**: Untersuchung und Vorhersage des Einflusses einer Blechvorumformung auf die Kantenrissempfindlichkeit bei Dualphasenstählen,
February 2025

55 **Schreyer, Sven**: Analyse der herstellungsbasierten Faltenbildung bei komplexen Tiefziehbauteilen - Ein geometrie- und metamodellbasierter Ansatz für ein CAD-integriertes Assistenzsystem,
March 2025

56 **Scandola, Lorenzo**: Free-Form Bending: From Process Design to Quality Monitoring,
May 2025

All publications and dissertations of the chair are listed on the website www.mec.ed.tum.de/utg

The dissertations appear printed in the *series Metal Forming and Casting*, ed. Prof. Dr.-Ing. W. Volk, Kollemosch Verlag & Kommunikation, ISSN: 2364-6942

Would you like to stay up to date? Then you can subscribe to the *utg*-newsletter here:

Subscribe here

Imprint

The *utg* Newsletter is published biannually by the

Chair of Metal Forming and Casting
Prof. Dr.-Ing. Wolfram Volk (v.i.S.d.P.)

TUM School of Engineering and Design
Technical University Munich

Walther-Meißner-Straße 4
85748 Garching near Munich

Editor:
Dipl.-Chem. Stefanie Prauser
stefanie.prauser@utg.de

Further information is available at:
www.mec.ed.tum.de/utg