

Intelligent straightening for roll formers

The intelligent straightening device developed by Dreistern assists the operator in quality control during the roll forming process. By continuously monitoring profile quality, it is designed to not only reduce the operator's workload but also enhance process transparency. The device recently won a "best Award," in the 'presses and forming technologies' category, at the Blechexpo/Schweisstec trade show in Stuttgart (October 2025).

Dr. Cornelia Tepper (Dreistern GmbH & Co. KG) and Johannes Hofmann, M.Sc. (PtU Darmstadt, Institute for Production Engineering and Forming Machines), outlined the benefits of the device for the roll-forming process.

"In industry, the pressure to design production processes that are resource-efficient, effective and sustainable is continuously increasing. This is driven by rising material and energy costs, stricter legal requirements and growing public expectations for sustainable production. Additionally, advancements in material science are leading to new materials being introduced into manufacturing, thereby increasing the complexity of existing forming processes. The automotive industry is one of the key examples in this field, as it is increasingly employing ultra-high-strength materials in sheet metal applications. This presents challenges for existing process chains in forming technology, for which the roll-forming process provides the ideal solution," they told *ISMR*.

"The range of applications for the roll-forming process is continuously expanding, driven by advances in forming, punching and welding technologies. This enables the processing of increasingly demanding materials in roll-forming lines. However, it also leads to greater overall process complexity. Smart components in the roll forming line, such as the intelligent straightening device and its integrated evaluation algorithms, assist the operator in process control and enhance overall process efficiency," they continued.



Dreistern's award-winning intelligent straightening device on display at Blechexpo/Schweisstec in Stuttgart.



The Dreistern team accepted a "best Award" for its intelligent straightening device at Blechexpo/Schweisstec in Stuttgart (October 2025).



Above and inset: Close-up of Dreistern's intelligent straightening device.

Challenges in the roll-forming process

In the roll-forming process, flat strip material is continuously formed into a defined profile geometry through multiple forming stages. Integrating additional processes such as welding, punching, embossing or forming into the roll-forming line allows a wide variety of profile shapes and sizes to be produced.

"Roll forming is a manufacturing process that combines several advantages including low energy consumption, low costs per part at high production volumes, high material utilisation and minimal heat transfer into the processed material. The full potential of these advantages can only be achieved under stable process conditions," commented Dr. Cornelia Tepper and Johannes Hofmann.

"In practice, maintaining such stability is often challenging. External influences on the process, such as material or temperature fluctuations, can lead to deviations in the profile geometry and consequently to scrap production. The straightening process at the end of the roll-forming line compensates for longitudinal profile deviations such as bow camber and twist. These deviations can arise during processing due to various factors including redundant deformations, changing material properties or incorrect tool adjustment," they continued.

To this end, the straightening device is adjusted to compensate for inhomogeneous longitudinal strains over the profiles' cross-section by superimposing a controlled bending deformation. Traditionally, the manual adjustment has been dependent upon the operator's experience as they regularly monitored the profile quality. However, due to demographic shifts and other factors (such as staff turnover), this expertise is gradually being lost in many companies. As a result, defects are often detected too late or not at all, which can result in several tons of scrap per day in the continuous roll forming process.

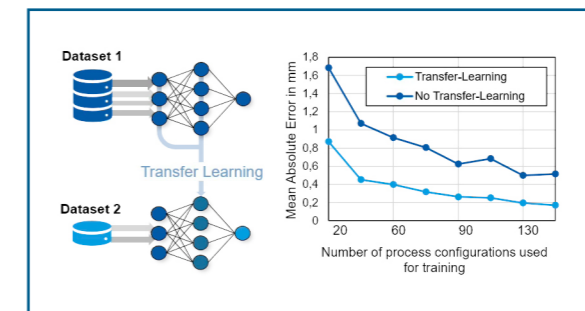
"Dreistern's intelligent straightening device addresses this challenge. Integrated sensors continuously capture reaction forces related to profile deviations. The measured signals are processed in real time by the machine control system and presented on the human-machine interface (HMI)," outlined Tepper and Hofmann.

"Should variations in profile quality occur, they are detected by the integrated sensor system and subsequently analysed and visualised through the evaluation algorithms. If the forces exceed the predefined tolerance range, automatic actions are triggered. These range from notifying and assisting the operator to stopping the machine. As a result,



Dreistern's award-winning intelligent straightening device.

fewer manual quality checks are required, since the operator is immediately informed when tolerances are exceeded. This approach reduces the risk of undetected quality deviations. The sensor data further allow for prediction of the optimal configuration of the straightening device, since the recorded data responds to adjustments by the device itself," they added.



Machine-learning assistance

In collaboration with the Institute for Production Engineering and Forming Machines at TU Darmstadt, Dreistern is currently developing a machine-learning-based assistance system to support operators in the precision adjustment of the device.

"To this end, convolutional neural networks are used to correlate the process forces and the current position of the straightening device with optimal positioning for a straight profile. This technology has already shown impressive results under laboratory conditions. However, the quality of data-driven approaches for industrial use are heavily dependent upon the quantity and diversity of available data sets. To address this challenge, strategies are currently being developed to transfer the knowledge stored in models from different applications to reduce the data requirements for the initial training of models for new use cases in industry. This transfer learning can be

implemented for data sets from different profile geometries and materials, as well as for synthetic data from numerical simulations," confirmed Tepper and Hofmann.

The developed data-driven approaches not only provide the basis for adjustment assistance but also enable the possibility of full automation of the straightening process, in combination with the straightening device.

"By integrating in-line sensors into the straightening device and leveraging Dreistern's evaluation algorithms in collaboration with the Institute for Production Engineering and Forming Machines at TU Darmstadt, the roll-forming process becomes both more transparent and more efficient. The intelligent straightening system enables even less experienced operators to reliably control the complex roll-forming

process. Consequently, the applicability of roll forming is further expanded, enabling companies with limited prior experience to successfully implement the process. Roll-forming therefore represents a viable solution to contemporary manufacturing challenges and is increasingly recognized as a key technology for future-oriented production concepts and process chains," concluded Dr. Cornelia Tepper and Johannes Hofmann. ■

About Dreistern

Founded in 1949, DREISTERN GmbH & Co. KG is a specialist in roll-forming machinery, units and technology and can provide complete process integration. More than 2,000 units from DREISTERN are in use, producing more than 8,000 different profiles, worldwide.

