Springback

Reduction of springback when cutting rolling profiles

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Duration	August 2014 – August 2016
Department	Profile Manufacturing Technology
Funded by	AiF | FOSTA | BMWK

Abstract

Roll forming is an important process for producing profiles from rolled starting material. While cutting the profiles after the forming process, shear and longitudinal residual stresses are released which cause the ends of the profile to collapse or crack at the point of separation. This so-called end-flare leads to deviations in dimensional accuracy which have to be compensated for by additional machining steps. This results in increased line times and thus higher machine and personnel costs.

Project description

At the beginning of the project, a finite element model was developed for mapping and predicting the end flare during roll forming. Based on an industrial survey, measures for reducing the end flare were investigated in a numerical parameter study to determine their effectiveness and their practical feasibility is tested experimentally. The results were used to derive design guidelines for the roll forming process with regard to minimizing residual stresses (Fig. 1).

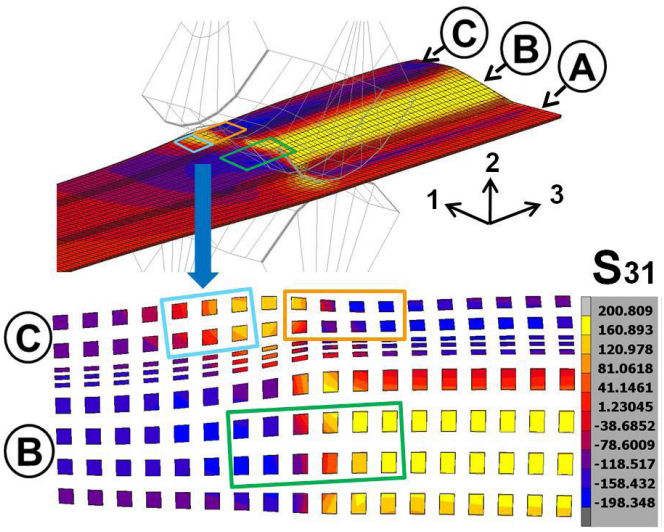
Results

In the course of the project, the influencing factors sheet thickness, material strength, forming per station, side rolls, pressure overlay, profile shape, stand spacing, profile height, profiling strategy, bending radius and roll diameter could be determined. Based on the deformation of the profile during cutting, conclusions could be drawn about the acting stress components and effective countermeasures could be worked out. Overbending and reverse bending proved to be universally applicable, as they reduce shear and longitudinal residual stresses. By superimposing compressive or longitudinal stresses, it was possible to reduce one component of the causal stresses in each case. Superimposing longitudinal stresses was shown to be effective when both ends of the profile were flaring in, while superimposing compressive stresses should be applied when both are flaring in and out.

Following the project, further results in this topic have been published internationally:

Moneke, M.; Groche, P.: The origin of end flare in roll formed profiles, International Journal of Material Forming, 2021 https://doi.org/10.1007/s12289-021-01640-w

Moneke, M.; Groche, P.: End flare of profiles with multiple bending zones, Procedia Manufacturing 15, 2018 https://doi.org/10.1016/j.promfg.2018.07.313



[1] Residual stress distribution in the profile

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Acknowledgement

The IGF project 18164 N of the Forschungsvereinigung Stahl Anwendung e. V (FOSTA) was funded by the Bundesministerium für Wirtschaft und Energie via the AiF (Arbeitsgemeinschaft industrieller Forschungsvereinigungen) as part of the program to promote Industrial Collective Research (IGF) on the basis of a resolution of the German Bundestag. Furthermore, we would like to thank all industrial partners who supported the research project „Reduction of springback during the cutting of rolled profiles“:

- Stephan Dick Profile GmbH
- Gebhardt-Stahl GmbH
- Hussmann Profilrollen
- Tillmann Profil GmbH
- Voestalpine Krems GmbH
- LINDE+WIEMANN GmbH KG
- KURSCHAT GmbH
- Paul Hettich GmbH & Co. KG
- HÖRMANN Automotive Gustavsburg GmbH

Funded by

Forschungsnetzwerk Mittelstand

FOSTA

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag