

# A Method for Producing Burr-Free Shearing Surfaces to Increase Part Quality through Two-Stage Counter-Cutting

Sergei Senn<sup>1, a)</sup> and Mathias Liewald<sup>1, b)</sup>

<sup>1</sup> *Institute for Metal Forming Technology, University of Stuttgart, Holzgartenstraße 17, 70174 Stuttgart.*

<sup>a)</sup>Corresponding author: sergei.senn@ifu.uni-stuttgart.de

<sup>b)</sup> mathias.liewald@ifu.uni-stuttgart.de

**Abstract.** Shear cutting is a widely used mass production process, with which almost every technical product is processed at least once in its production chain. The major criterion for the quality of such shear cutting processes is defined by the portion of smooth cut in the final cutting surface. Normally, smooth cut surface only can be manufactured by using fine cutting or trimming technology. Regarding an economic supplement to this technology, current research work is investigating whether burr-free workpieces can be manufactured by dividing the shearing process into individual stages. Here, the so-called counter cutting is used, in which the first step is an embossing process and the second step is a shearing process in the opposite direction. This special shearing process prevents the formation of burr and thus increases surface quality. However, the interactions of the cutting parameters during counter cutting are very complex and cut surface quality of parts are significantly influenced by these parameters.

The objective of the study reported about in this paper was to investigate the shearing parameters of counter cutting in relation to burr-free part surfaces during punching. An extensive numerical investigation was performed using DEFORM 2D and subsequently experimentally validated for optimised conditions. The investigated process parameters were the embossing depth, the cutting clearance in the embossing stage, the cutting clearance in the cutting stage, the sheet thickness and the sheet metal material. The results obtained showed, that the process range, in which high cutting quality is achieved, is very small. Nevertheless, it is possible to stabilize the process by selecting appropriate cutting parameters. The study presented shows that the use of special parameter settings for two-stage counter cutting results in a burr-free shearing surface with a high clean cut portion up to 80%.