Numerical Investigation on the Robustness of the Roller Clinching Process

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Abstract. The automotive sector is currently faced with new strict limitations regarding emissions and energy consumption. The advancement of lightweight construction is mandatory to accomplish the new requirements, which are caused by these limitations. Thereby new innovative joining technologies and especially technologies without using any additional joining elements are interesting. Translational clinching is one of these joining technologies and a lot of research was already done in this field. But to avoid the problem of a discontinuous sheet metal feed, which is typical for translational clinching, roller clinching was developed at the Technical University of Munich. At this process, punch and die are mounted on rotating rollers and hence continuous joining is possible, whereby joining forces are reduced. Despite these advantages of roller clinching there are challenges due to complex tool kinematics resulting from the asymmetrical formation and quality of the clinchpoint. To further optimize this process, it is mandatory to have detailed knowledge regarding the robustness, respectively the reliability of the process. Within this study a numerical investigation of these aspects is shown. It focusses on different effects of fluctuations in sheet thickness and material parameters as well as on different friction conditions. Furthermore, tool wear and tool inaccuracies are examined. Therefore parameters and tool geometries are varied in the FE simulation model and its impact on the clinchpoint quality, respectively the values of neck thickness and undercut, is evaluated. Interactions of these parameters are investigated and tolerances, respectively limits of the process are shown.