Friction during profile rolling

Increasing the simulation accuracy of roll forming processes through an in-depth understanding and realistic description of friction

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Abstract

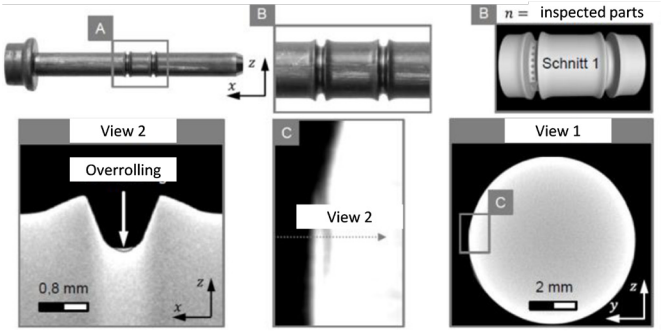
While the use of FEM in the design process is already state of the art for many cold forming processes, FEM simulation of roll forming is limited to feasibility studies and currently has no industrial application. In this project, FEM simulation was fundamentally investigated in terms of simulation accuracy and friction. In addition to the development of a simulation model, experimental investigations were also carried out to identify friction-related process limits that lead to defective components in the industrial environment. Tribometer tests carried out show a strong direction-dependent anisotropy of the friction during profile rolling. Based on the project results, the FEM simulation can be extended and optimized and thus its usability in the design process can be further advanced.

Project description

In addition to the creation of the FEM model of the profile rolling, the process forces were measured using a specially developed sensory die holder for the validation of the simulation model. The force measurements in the industrial environment also enabled the detection of the process limits due to overrolling as well as the rotational loss of the workpiece. The analysis of the tribological system as well as comprehensive sliding compression tests were able to provide information on the occurrence and characteristics of these process limits.

Results

In the project it could be shown that by means of implicit FEM simulation a very good agreement between FEM and experiment regarding geometry and forces can be achieved. The tribological loads show a strong inhomogeneity over the contact area with local adhesion and sliding components, which additionally exhibit a strong direction-dependent anisotropy. Furthermore, it was shown that the use of liquid lubricants cannot reduce the occurrence of friction-related process failure.



[1] Computed tomographic analysis of the groove root of a specimen with overrolling

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