Chair of Metal Forming and Casting (utg)
TUM School of Engineering and Design
Technical University of Munich

Springback compensation for spring steels

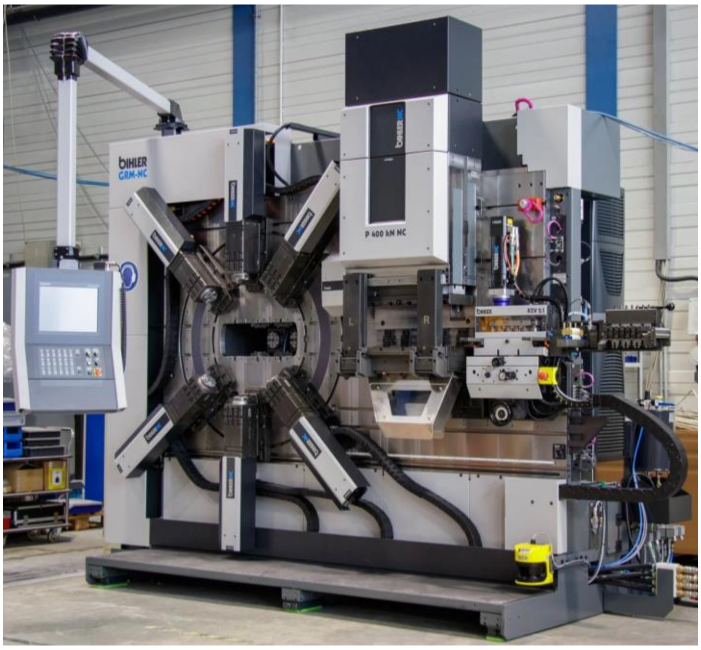
Reduction of scrap parts by inline material characterization

Motivation

For the production of metallic springs steel grades with particularly high yield strength, so-called spring steels, are used. The use of spring steel allows elastic elongations to be achieved that are 300-400% higher than those of conventional steels. However, the high elasticity also causes springback, which leads to considerable geometric changes after removal of the process forces. To compensate for the springback, spring steel components are therefore always overbent. Since springback is material-dependent, the influence of batch variations must be compensated which means a high time effort and also comes along with the production of scrap parts.

Aims

Within this project an industrial punching and bending process is realized on a bihler GRM-NC machine. It will be possible to react to batch variations automatically and thus reduce scrap.



Punching and bending machine GRM-NC of bihler in the workshop of the Chair of Metal Forming and Casting

Methods

At the beginning of the project, a free-form bending process for the automatic punching and bending machine is planned with which U-shaped test components can be produced. The required forming tool is developed in cooperation with bihler. The industrial spring steel material for the experiments is characterized beforehand in tensile tests, especially the modulus of elasticity is of high relevance for springback. The theoretic amount of springback can then already be calculated with FEM simulations. However, variations in sheet thickness and mechanical properties necessitate a continuous adjustment of the bending angle. In order to detect batch fluctuations during operation, a sensor unit is installed which measures both the sheet thickness and the magnetic properties (Barkhausen noise) of the strip. On the basis of a previously developed data base, which correlates tensile test results with magnetic measurements, mechanical properties can be derived inline from the sensor unit using machine learning methods. If batch fluctuations necessitate a change in the bending angle it will be corrected without interruption of the production process, based on an experimental database correlating bending angles and mechanical properties. Dimensional accuracy is controlled by an optical light micrometer at the end of the process. If the quality of the produced parts is not satisfactory, the optical measurement of the bending angle can be used additionally for process control.

Lucas Böhm, M.Sc.
Walther-Meissner-Str. 4
85748 Garching

Tel. +49 89 289 13 991
lucas.boehm@tum.de
www.utg.mw.tum.de

Founding:

Cooperation: