Autor(en) des Beitrags:
Schilp, Hansjörg; Suh, Joungsik; Hoffmann, Hartmut

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Reduction of springback using simultaneous stretch-bending processes

Abstract:
Springback due to the elastic material behaviour can lead to shape errors that cause geometrical and dimensional inaccuracies in sheet metal forming processes, especially in bending operations. In order to reduce springback, the technique of integrating stretching with bending in sheet metal forming processes has been investigated. The object of this paper is to explain how to reduce the effect of the elastic component in the material behaviour using simultaneous stretching and bending so that a method is established for applying plastic forming during the main process, without changing the tool design. This study focuses on three main points: the stretching method, the stretching direction and the stretching length. In regard to swing- and v-bending processes, the springback factor is used as the standard evaluation to investigate these effects using Finite Element simulation. The springback factors are compared for four processes: Bending process without stretching (WS), pre-stretching and bending process (PB), pre-stretching plus simultaneous stretching and bending (PSB) and simultaneous stretching and bending (SB). The simulation results are then verified through experimentation. Based on the validated results, simultaneous stretching can then be subsequently applied to the existing stretch-forming process, which consists of pre-stretching and bending. Using this process, springback was successfully reduced which confirms the efficiency of SB process.