Extended Abstract

Review and Research: Journal of Engineering And Technology

2021

Vol. 10 Issue 8

Investigation of spring angle of sheet metal with rolling angle of 45o in V-die bending process

Kamil Ozdin
Hittite University, Turkey SILVERLINE, Turkey

Abstract:
Structural elements made from steel sheet metal have a great importance in today's industry. One of the biggest problems with the parts bended by using dies is the spring angle because it destines bent sheet metal out of manufacturing tolerances. So, it is vital to know a part’s spring angle properties in advance which are mainly dependent on the properties of the sheet metal and bending conditions. This study aims to investigate the effects of bending angle and punch radius on spring angle of sheet metal with rolling angle of 45o in V-die bending process. After being removed from the bending dies spring-back rates of the specimens were measured by using optical goniometer. At a constant load with respect to the bending angle and punch radius values, spring angle shaded off into spring-back angle or spring-go angle. In this study, it was observed that the spring angle is 0o when the appropriate value for punch radius or bending angle are taken depending on the other bending conditions. The components made of steel sheet metal very important in today’s industry. In order to be useful, those parts must comply with the design tolerances, such as shape, position and dimensions. The largest problem with the parts bended by using dies is the springing, because it violates the manufacturing tolerances. Therefore, it is vital to know a parts spring back and spring go properties in advance, which is mainly dependent on the properties of the sheet metal and bending conditions. In this study, 0.9 mm AISI 400 S steel sheet metal was bended using V dies (30°, 45°and 60°) and punches (2 mm, 4 mm and 6 mm). After being removed from the bending dies, spring back rates of the specimens were measured by using optical goniometer. With respect to the bending angles and punch radii, spring back and spring go properties of the specimens were recorded by using a spreadsheet software and some figures are obtained. The forming steps by permanent deformation controlled by the tools generate a distribution of stresses inside the material which directly depends on the work hardening properties of the latter. The change in boundary conditions following the removal of the tools imposes the material to redistribute the stresses in the sections in a manner compatible with the new boundary conditions. This new distribution necessarily operates by local elastic deformations that result globally in a general change of shape called spring back. This geometrical deviation can be minimized by the meticulous focus of the tools, but it cannot generally be completely annihilated due to the influence of several parameters. For this reason, the study of the influence of the different technological factors and physic metallurgical parameters on the spring back for the different metals is very important to design and properly realize forming tools. The main objective of this work is to find solutions to problems encountered in sheet metal forming such as the problem of spring back. Our work has two essential purposes: the first is summarized in an experimental study based on theoretical analyses. To this end, much effort is made to add a new design of parts for a U-type stretch-bending device and adapt it to a tensile testing machine. This design has the advantage of modifying and assembling all parameters affecting spring back at the same time and also of carrying out several forming processes on the same device. The second goal is the experimental and numerical prediction of spring back, and the study of the effect of various stretch-bending process parameters such as punch velocity, the orientation of the sheet (anisotropy), hold time and punch-die clearance on spring back behavior under heat treatment of aluminum alloy sheets with three different rolling directions (0°,45°,90°). A finite element (FE) model of stretch-bending has been established by utilizing ABAQUS/CAE software. From this analysis, it can be concluded that the spring back is affected by the anisotropy of the sheet and the heat treatment in the stretch-bending process. The obtained experimental results were compared with the numerical simulations found in good agreement.

This work is partly presented at 2nd International Conference and Exhibition on Industrial Engineering | November 16-18, 2015 Dubai, UAE