STUDY ON DIE SHOULDER PATTERNING METHOD (DSPM) ONTO MINIMIZING SPRINGBACK OF U-BENDING

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I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Lenturan bentuk U (U-bending) adalah salah satu proses pembentukan tekan yang telah banyak digunakan dalam industri pembuatan semasa yang melibatkan produk logam lembaran. Fenomena springback selalu berlaku dalam proses pembentukan. Selepas dihasilkan, komponen bengkok tersebut cenderung untuk 'bergerak' kembali kepada bentuk asal yang dikenali sebagai springback. Ini mempengaruhi ketepatan dimensi bahagian yang terbentuk. Banyak penyelidikan telah dilakukan untuk menyelidiki parameter yang membantu mengurangkan kesan springback pada bahagian yang terbentuk. Walau bagaimanapun, tidak ada kajian mengenai membuat corak pada permukaan bahu mati. Tesis ini memperkenalkan kaedah baharu bagi mengurangkan kesan springback pada bahagian terbentuk. Prestasi sebenar membuat corak pada permukaan bahu mati dalam tingkah laku springback masih belum jelas. Oleh itu, penyelidikan ini berusaha untuk mengkaji kesan membuat corak pada permukaan bahu mati terhadap tingkah laku springback. Masa penekanan akhbar, Pt (saat) dan lebar spesimen, w (milimiter) untuk kesan springback juga dikaji. Penyelidikan ini juga merangkumi interaksi antara pelbagai corak permukaan dan masa penekanan tekan pada kesan springback. Dengan menggunakan ketiga-tiga parameter tersebut, eksperimen makmal telah dilakukan, dan pengaruhnya terhadap tingkah laku springback telah diselidiki. Didapati bahawa corak permukaan oleh corak 2 telah menunjukkan lebih tinggi cenderung mempunyai jumlah springback yang lebih kecil pada bahagian yang terbentuk. Lebih-lebih lagi, masa penekanan tekan yang lebih lama membantu mengurangkan kesan springback. Didapati bahawa DSPM P2 dengan saiz pic 2 mm dan jarak pic 1.5 mm cenderung mempunyai jumlah springback yang lebih kecil pada bahagian yang dibentuk mempunyai pertumbuhan pra-strain yang lebih banyak untuk berubah bentuk dengan bantuan masa pegangan tekan yang lebih lama untuk mengedarkan aliran bahan secara seragam. Ia juga didapati bahawa tidak ada interaksi antara corak permukaan dan masa penekanan tekan dan lebar spesimen untuk kesan springback.

ABSTRACT

U-bending is one of the press-forming processes that has been widely used in the current manufacturing industry that involves sheet metal products. Springback phenomenon always tends to occur in the forming process. After being produced, the bent component tends to 'move' back to its original shape, which is known as springback. This affects the dimensional accuracy of the formed part. Much research has been done to investigate the parameters that help in minimizing the springback effect on the formed part. However, there is less research on friction provided directly by the Die Shoulder Patterning Method (DSPM) at the corner die shoulder to produce the minimize springback of hat-shaped parts. The actual performance of DSPM in springback behavior remains unclear. Hence, the research attempts to investigate the impact of four DSPM to the springback behavior. The press holding time, Pt (s) of blank and the blank width, *w* (mm) in the springback effect is studied too. The research also covers the interaction between DSPM, blank width and press holding time in the springback effect. By utilizing these parameters, the laboratory experiment is conducted, and their effects in springback behavior have been investigated. It is found out that P2's DSPM with 2 mm pitch size and 1.5 mm pitch distance tends to have a smaller springback amount on the formed part. Moreover, a longer press holding time of blank helps in reducing the springback effect. Then, P2's has more pre-strain growth to deform with the help of longer press holding time to distribute the material flow uniformly. It is also found out that there is no interaction between DSPM and press holding time to the springback effects. Based on ANOVA, the hypothesis of interaction between DSPM and blank width to the springback effects was rejected as it has minor impact on the experiments value.

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