Experimental Study and Performance of Spring Back of Metallic Sheet with various Thicknesses

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Abstract— springback has attempted to be expressed in handbook tables or in springback graphics. But both ways of giving expression to springback. Paper presents new springback graphics for air vee bent sheet metal parts. The developed experimental procedure has two main stages. First, the material identification by means of tensile test has been done. Next, bending tests for several specimens of different thicknesses have been carried out. This paper presents a study of spring-back in the V-bending metal forming process with one clamped end and one free end.
Key words: Sheet Metal, Bending, Punching Process

I. INTRODUCTION

Most sheet metals undergo a combination of bending, stretching, unbending and reverse bending during the forming process. Accurate estimation of spring-back in these industries is important. Demands in bend angles can be within a narrow range. A major problem in sheet metal bending techniques is spring-back. Several bending operations done on sheet metal are air bending, V-die bending, rubber die bending and U-bending. In V-bending, the material may exhibit negative and positive spring-back caused by deformation as the punch completes the bending operation. In the past, sheet metal bending processes are dependent on the designer's experience and involve trials and errors to obtain the desired result.

II. SHEET METAL MECHANICS AND TESTING METHODS

In addition to the standard tests for materials, (such as tension tests), there are tests that are used specifically to determine the formability of sheet metal. One common test is the cupping test. A specimen is secured over a round die cavity and a steel ball is pushed into the specimen until fracture of the material occurs. The greater the distance that the sheet metal can plastically deform before fracture, the greater the sheet's formability.

III. SHEET METAL CLASSIFICATION

There are 3 major classes of processes of sheet metal working.

A. Cutting:

Cutting is the use of shearing forces to remove material from a work piece. Technically not a metal forming process, but of extreme industrial importance.

B. Bending:

Bending is the forming of a sheet metal work about an axis.

C. Deep Drawing:

Deep drawing is the forming of a cup or box with a flat base and straight walls, from a sheet metal blank. Other Processes: Other sheet metal working processes such as ironing, spinning, rubber forming and high energy rate forming are also discussed in latter sections.

IV. EXPERIMENTAL PROCEDURE

The developed experimental plan consists of obtaining bend parts within an interval of 10°and 90°as bending angle. The experimental study consists of the material identification by means of tensile test. The adoption of a material model is important, because the material properties have influence over the bending process. The dimensions of the bending specimens are 150mm X 50 mm. Their thicknesses are 1 1.2, 1.4 and 1.6 mm for aluminum samples; and 1, 1.5, 2, 3,and 4mm for stainless sheet metals.

Fig. 1: Ferrous sheet metal

Fig. 2:.sheet metal with die

Fig. 3: Experimental setup

V. RESULTS

Sr. No.	Final Angle in Degree	Spring back Angle in degree
1	10	9
2	20	13
3	30	19
4	40	22
5	50	24

Table 1: spring back effect in 1 mm Stainless steel

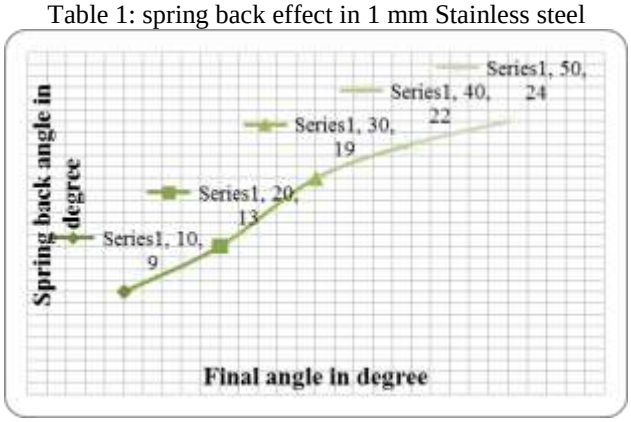

Fig. 4: spring back effect in 1 mm Stainless steel

Sr. No.	Final Angle in Degree	Spring back Angle in degree
1	10	11
2	20	17
3	30	20
4	40	26
5	50	22

Table 2: spring back effect in 1.5 mm Stainless steel

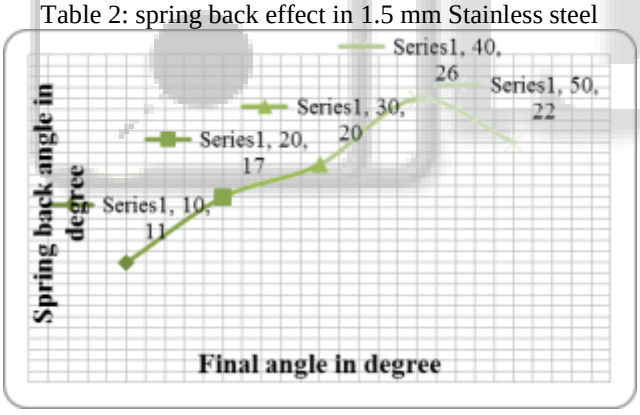

Fig. 5: spring back effect in 1.5 mm Stainless steel

Sr. No.	Final Angle in Degree	Spring back Angle in degree
1	10	8
2	20	15
3	30	17
4	40	19
5	50	21

Table 3: Spring back effect in 2 mm Stainless steel

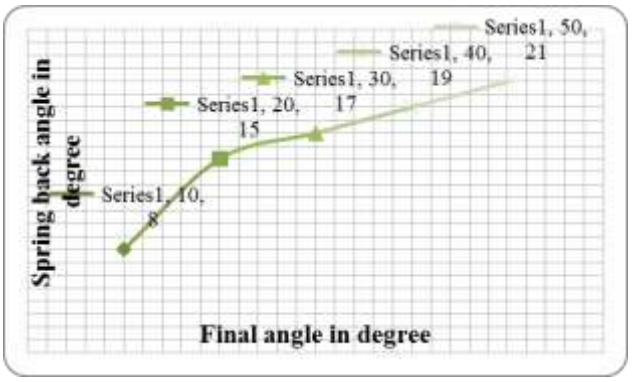

Fig. 6: spring back effect in 2 mm Stainless steel

VI. CONCLUSION

The experimental study has allowed observing of the rigid–plastic stage, although it continues being an easy way of approaching to the attempted final bending angle. springback needs small radius whereas bigger radiuses are preferred in consideration of the mechanical properties of the bending parts. Subsequently, it is necessary establish compromises between all the parameters to get the parts of the desired accuracy. We find out the maximum spring back angle are 26° with final angle of metallic sheet are 40° , which are shown in table .2.

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