International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor (2018): 7.426

Review of Spring Back for Rod Bending Machine

V. C. Patel[1], Kaushal Prajapati[2], Rathwa Harish[3], Rathava Falgun[4], Tadvi Hardik[5]

[1]Assistant Professor of Mechanical Engineering, GEC Godhra, India

[2, 3, 4, 5]Stu. of Government Engineering College Godhra, India

Abstract: ***The most sensitive feature of the sheet metal forming is the elastic recovery during unloading, called spring back. Sheet metal forming is one of the prominent methods to convert blank sheet material into a product. In sheet metal forming, proper allowance of its tools must be given to the elastic recovery, due to the nature of elastic property which is called spring back. So theoretically and practically experiment and analysis of bending material, the bending process depend on material mechanical properties like hardness, strength, flexibility, ductility, brittleness etc. and find proper angle maximum bending and material recover to require angle. Like we aspect 45 degree bending angle so, we will bend max of (45 degree LIKE 50 degree) so, 5 degree recover and we get 45degree angle. The angle made on die (suppose we get 45 degree and we produce die valley angle is 50 degree).***

Keywords: Elastic deformation spring back, Bar or rod of different material, plate, angle measurement tools (angometer)

1. Introduction

Problem Summary: The most sensitive feature of the sheet metal forming is the elastic recovery during unloading, called spring back. Sheet metal forming is one of the prominent methods to convert blank sheet material into a product. In sheet metal forming, proper allowance of its tools must be given to the elastic recovery, due to the nature of elastic property, which is-called-spring-back.**[1]**

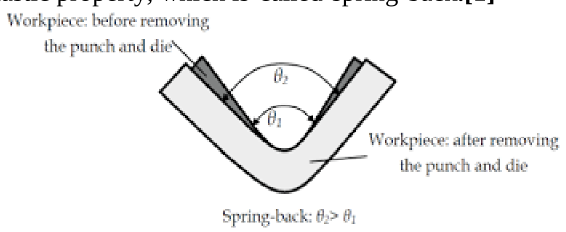

Figure: Spring back and actual angle

Analysis of bending angle for spring back effect. In industry the person makes the frame and any structure. She/he applied the force on bending bar or bending pipe for bend, but do not exact bending with proper angle. Spring back effect occurs in system so, material recover to its elastic limits. The most sensitive feature of the sheet metal forming is the elastic recovery during unloading, called spring back.

Sheet metal forming is one of the prominent methods to convert blank sheet material into a product.

In sheet metal forming, proper allowance of its tools must be given to the elastic recovery due to the nature of elastic property is called spring back.

2. Literature Review

Sheet metal forming is one of the prominent methods to convert blank sheet material into a product. In sheet metal forming, proper allowance of its tools must be given to the elastic recovery, due to the nature of elastic property which is called spring back. When stamped sheet components are removed from the forming tools, the internal stresses will rest, and a new equilibrium state will be reached. As a result, the final shape of the drawn part will deviate from the shape imposed by the forming tool. Therefore, it is very important that spring back be accurately predicted and compensated. In the industry, this is a costly and time consuming process of product shaping and redesigning the tools manually. The goal of this research is to develop a compensation procedure that can perform this optimization process, using the combination of Displacement Adjustment (DA) and Spring Forward (SF) methods. Both are based on an iterative procedure. The method is needed for guiding die design to compensate for spring back in a backward direction and then to compensate spring back in a forward direction. This new approach is then called Combined Method for Die Compensation (CMDC). The testing of CMDC has been conducted in 2D model of U-bending and 3D shape of S-rail model adopted from Numisheet 2008. The result shows that CMDC is able to reduce error in every cycle of the total five cycles. The result of reduction in shape deviation is 66% to 73% for the 2D model compensation, and for the 3D model, 55% reduction in shape deviation can be reached. The CMDC method can be further implemented and integrated in commercial FEM software to assist the optimization process to improve the precision of stamping product. **[2]**

In this paper plastic deformation and spring back for different cross-sectioned bar and for work-hardening and non-work-hardening material has been presented. Both work-hardening and non-work-hardening materials have been considered in this work and all essential information is presented in various aspects of spring back. Springbuck is the geometric change made to a section toward the finish of the forming procedure when the part has been discharged from the powers of the shaping device? Upon completion of sheet metal forming, deep drawn and extend stepped parts spring back and along these lines influence the dimensional precision of a completed part. The last type of section is changed by spring back, which makes it hard to create the part. Thus, the assembling industry is looked at some functional issues: Firstly, an expectation of the final part geometry after spring back and secondly, proper apparatuses must be intended to make up for these impacts. Keyword: spring back, elastic recovery, plastic recovery, and residual stress. **[3]**

The most sensitive feature of the sheet metal forming is the elastic recovery during unloading, called spring back. Spring-back is a critical phenomenon which is caused by the elastic redistribution of the internal stresses after the removal of deforming forces. The spring back is affected by the factors such as sheet thickness, material properties, tooling geometry etc. In this paper the finite element analysis followed by the experimental validation is done to evaluate the spring back effect. The model of the bracket is modeled using solid works & further analysis is carried out using ANSYS. This paper highlights the effective use of finite element analysis technique to analysis the spring back effect in the sheet metal forming operation so as to maintain the correct die valley angle by considering the spring back effect. Various parameters such as die valley angle, punch nose radius, depth of deformation etc. are considered to evaluate the spring back effect. **[4]**

3. Methodology of Project

We can select the material based on its properties like hardness, yield strength, tensile strength, of material (like bar or rod). We can find the spring back angle before and after spring back with help of manually bending machine and measure angle help of angometer. We can take 2 or 3 reading for same size and shape material and observe that spring back angle. Suppose, spring back angle equal for all reading. So, make addition of Primary bend angle and spring back angle.

Material and tools requirement
Material used in project generally like Aluminum, cooper, iron, steel, etc.

Rods:
A stick, wand, staff, or the like, of wood, metal, or other mat erial. The rod or bar used in building construction, making frame, home decoration, industry and other uses with or without bending. Different material rods are available like iron, aluminum, steel, copper etc.

Pipe: A hollow sticks are available in market. It is used in old TV antenna, many part making in different field, it is made also different material and specification like diameter, material hardness, and as per used in field.

Aluminum:
- Tensile strength 280MPa
- Elongation 9 to 10%
- Ultimate tensile strength 510 to 540MPa
- Yield strength 430 to 480MPa

Copper:
- Tensile strength: 360N/mm^2
- Elongation: 5%
- Yield strength : 320MPa
- Hardness: 2.5 to 3

Steel:
- Tensile strength: 370MPa
- Elongation : 15%
- Yield tensile strength: 370MPa
- Hardness : 5 - 8.5

Iron:
- Tensile strength : 360MPa
- Elongation : <1%
- Hardness : 160-210BHN
- Yield strength : 276MPa

Calculation Methodology
When the rolled strain is discharged the work piece unwinds and opens up faintly. The spring back-factor, normally signified by Ks, is the relation between the initial angle and final angle. A spring back-factor of Ks=1 implies there is no spring back, where an estimation of 0 implies the total spring back

Ks = Initial angle/Final angle

Where, Ks = spring back factor

$$Ks = [\{2(R_i)/T\} +1] / [\{2(R_f)/T\} +1]$$

Where, Ks = spring back factor
(R_i) = initial radius
(R_f) = final radius
T = material thickness **[5]**
Bending angle=desired bend angle+ bending angle allowance

$$\mathbf{A_1=A_2+BA}$$

Where; A_1=bend angle
A_2=desired bend angle
BA=spring back angle difference by practical

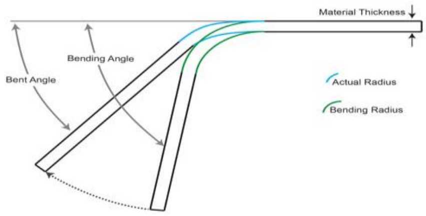

Figure: Actual and final bending angle)

Elements affecting Springback
- Metal thickness - the thicker the metal the less the spring back.
- Grain direction - dependably move against to what would be expected.
- Mechanical properties of the metal being rolled-some alloyed steels have more spring back than mellow steel e.g. Stainless steel
- Size of inside radius - the bigger within radius the more spring back, as more surface area is pressed and extended. **[6]**

4. Features

This analysis is different from other analysis and its give proper or desired angle for bending and other analysis is give radius, material used and its other specification but, this analysis use for only bending angle and load requirement of bending.

5. Conclusion

From the results obtained by theoritically and experimental validation of spring back effect can conclude that

1) The spring back effect (elastic recovery) of sheet metal varies with the initial angle, load requirement and size of material
2) With the increase of the initial angles, spring back, stress, contact pressure and plastic strains are increasing.
3) To maintain the desired angle is the spring back angle (by practical) is subtracted from bending initial angle.

References

[1] Ravindra E. Gite[1], Kiran S. Phad[2], Dipak s. Bajaj[3] "SPRING BACK EFFECT ANALYSIS OF BRACKET USING FINITE ELEMENT ANALYSIS'' IARJSET International advanced research journal in science, Engineering and Technology

[2] Agus DWI Anggono"COMBINED METHODS FOR DIE COMPENSATION IN SHEET METAL FORMING" Faculty of mechanical and manufacturing engineering university tun Hussein onn Malaysia.

[3] Rajneesh Kumar[1], Dr. Radha Krishna Lal[2] "A REWIEW ON SPRINGBACK ANALYSIS" International conference on new horizons in science, Engineering and managements and humanities IIMT College of engineering, Greater Noida (India)

[4] Ravindra E. Gite[1], Kiran S. Phad[2],Dipak s. Bajaj[3] "SPRING BACK EFFECT ANALYSIS OF BRACKET USING FINITE ELEMENT ANALYSIS'' IARJSET International advanced research journal in science, Engineering and Technology

[5] Rajneesh Kumar[1], Dr. Radha Krishna Lal[2] "A REWIEW ON SPRINGBACK ANALYSIS" International conference on new horizons in science, Engineering and managements and humanities IIMT college of engineering, Greater Noida (India)

[6] Rajneesh Kumar[1], Dr. Radha Krishna Lal[2] "A REWIEW ON SPRINGBACK ANALYSIS" International conference on new horizons in science, Engineering and managements and humanities IIMT college of engineering, Greater Noida (India)