International Journal of Future Generation Communication and Networking
Vol. 13, No. 3s, (2020), pp. 1169–1175

Study of Effect of BHF on Springback-FEA Approach

Dr. Gawade Sharad [1], Dr. Nandedkar V. M.[2]
[1]Professor Someshwar Engineering College, Someshwar, 413606, India
[2]Professor S.G.G.S., Institute of Engineering and Technology, Nanded, 413606, India

Abstract

Sheet metal forming processes are widely used by automobile industry for forming of the components of vehicle body. When the sheet is formed by die punch setup and the punch is retracted, the formed components springback due to elastic stresses remaining in the bent up part. These elastic stresses try to relieve and in doing so there is a metal movement called springback. The desired size and shape is not obtained because of springback.

The springback is a complex phenomenon and is affected by many process and material parameters. In this paper the effect of processes parameters such as blank holder force and percentage thinning due to increase in BHF is investigated by using FEA.
Keywords- *Sheet metal forming; Springback; FEA; BHF; Percentage thinning.*

I. INTRODUCTION

Bending is a very widely used process in forming of the parts. Precision of the formed parts is affected by the elastic recovery during unloading. Due to the elastic recovery, final shape of the component is not as desired. This change in shape due to elastic stresses is called springback. Correct prediction of springback is therefore very important as it helps in the design of punch and die. Also it helps to obtain the desired shapes with accuracy. Measuring the springback by experimental process is costly and time consuming. In the recent years finite element softwares are very widely used for the prediction of the springback.

Jean-Philippe Ponthot et al. [1] investigated the influence of various parameters on springback by commercial code OPTRIS. S. K. Panthi et al. [2] studied the effect of load on springback, varying the thickness as well the radius of the die. M. Balshi-jooybari et al. [3] studied the effect of significant parameters including sheet thickness, sheet anisotropy and punch tip radius on springback in V-die and U-die bending processes. Gawade Sharad et al.

[4] investigated the effect of sheet thickness on springback and the FEA results are compared with experimental for U bending. Wenjuan Liu et al. [5] investigated the springback of the typical U shape bending, by using neural network and genetic algorithm, based on production experiment.

Aysun Egrisogut Tiryaki et al. [6] investigated springback of wipe bending process based on results obtained from FEA and prediction model of springback was developed by neural network. Ozgur Tekaslan et al. [7] studied the effect of different parameters on springback of stainless steel sheet metal in V bending dies. W. L. Xu [8] studied the effect of number of integration points, blank mesh size, and punch velocity on springback.

In this paper the effect of processes parameters such as blank holder force and percentage thinning due to increase in BHF is investigated by using FEA commercial code Hyperfom with radioss solver. The blank holder force is used to control the springback of formed components.

ISSN: 2233-7857 IJFGCN

II. NOMENCLATURE

R-die radius
t- sheet thickness
K-strength coefficient
n-strain hardening exponent
C-clearance between die and punch

III. MATERIAL PROPERTIES

The material used for the forming of U shaped component is IS513D. The material properties for this material are listed as below.

Material-IS 513D
Yield Strength-208 MPa.
Ultimate Tensile Strength-322 MPa.
Strength coefficient (K) = 551 MPa.
Strain hardening exponent (n)-0.21.

IV. FINITE ELEMENT SIMULATION

U bending process is simulated by using the Finite Element software Hyperform with radioss solver. Blank size is obtained in radioss one step. The die-punch set up shown in figures 1 (a) and (b). The die is modeled in the hyperform itself and punch is extracted from the die. The FE simulations are run for 1 mm sheet thicknesses by varying the blank holder force from 1 KN to 50 KN. The results obtained for these simulations are listed in table 1. The various parameters used during FE simulation are listed below.

Die radius-2 mm.
Punch radius-2 mm fixed.
Blank thickness-1 mm.
Blank Holder Force-Variable N.
Coefficient of friction-0.125

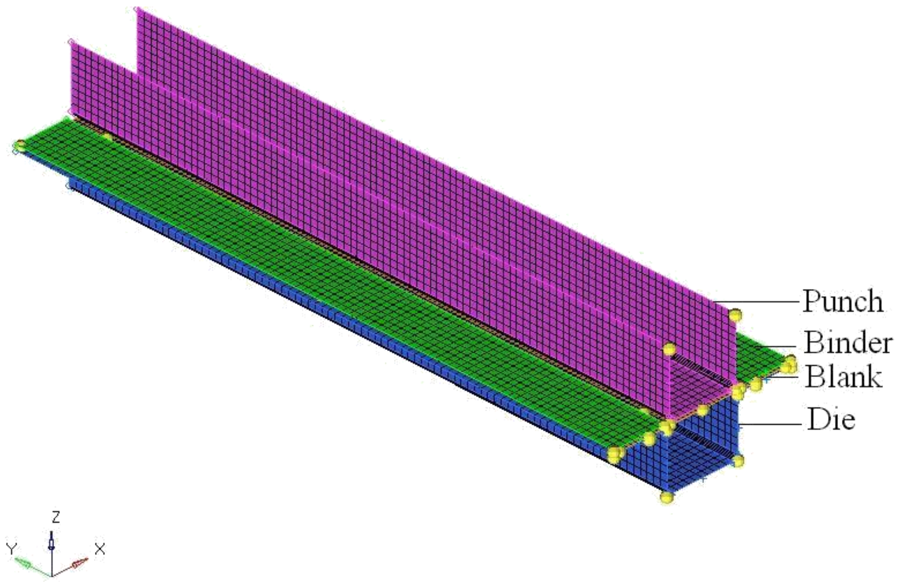

Figure 1 (a) Die Punch Setup

ISSN: 2233-7857 IJFGCN

2

ISSN: 2233-7857 IJFGCN

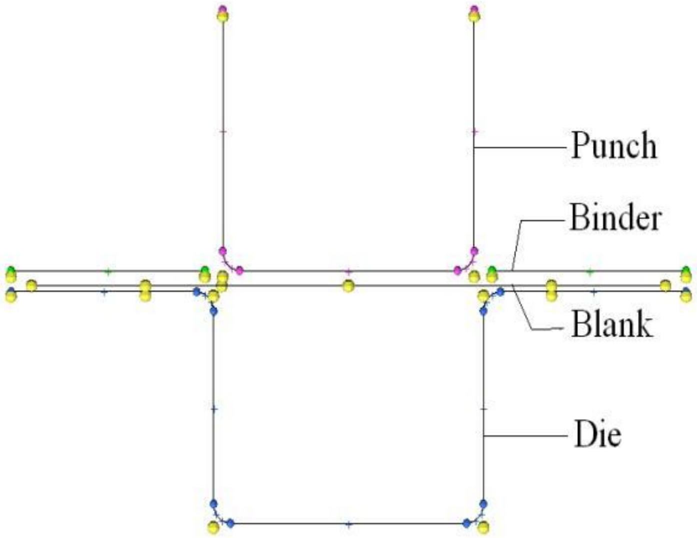

Figure 1 (b) Die-punch set up

Table 1: Springback and percentage thinning for different Blank Holder Forces

Sr. No.	BHF (KN)	Springback (Degree)	Percentage thinning
1	1	0.762	2.663
2	2	0.940	3.557
3	4	0.993	6.053
4	7	1.005	7.698
5	8	1.304	7.296
6	10	1.613	8.506
7	20	1.379	7.463
8	40	0.658	10.34
9	50	0.562	11.54

V. RESULT AND DISCUSSION

A. Effect of Blank Holder Force on springback

To investigate the effect of blank holder force on springback, finite element simulations were run for various blank holder forces from 1 KN to 50 KN and the results obtained are tabulated in the table 1 and these results are plotted in the figure 2.

ISSN: 2233-7857 IJFGCN

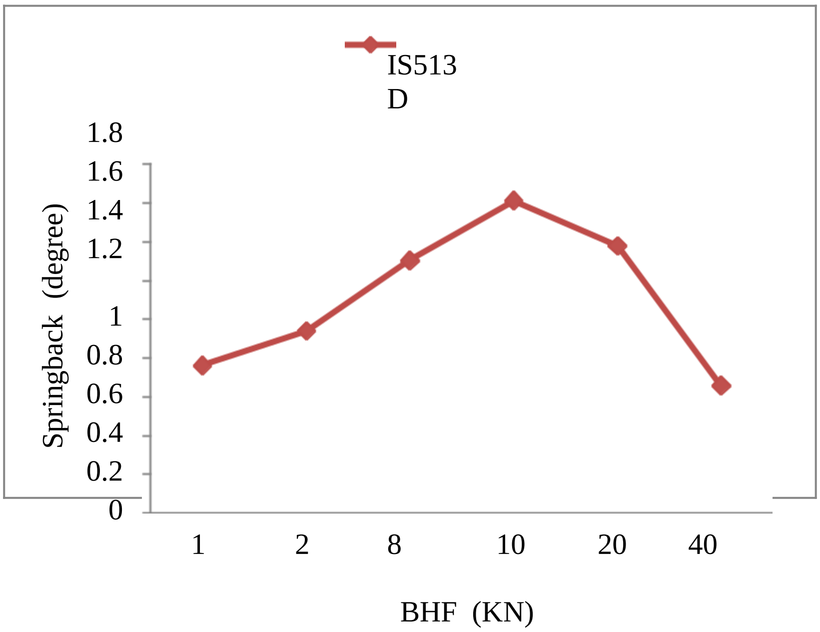

Figure 2 Effect of BHF on springback

From figure 2, it is clear that springback increases with increase in BHF initially with small BHF but after certain limit springback decreases with increase in Blank Holder Force i.e. for larger BHF. This is because initially with low BHF punch induces mostly bending stresses, but as the BHF increases bending stresses becomes mostly tensile due to the firm grip of binder force. If we compare the results obtained in figure 2 with the earlier published results by Jean-Philippe Ponthot et al. [1], it is seen that the pattern of the result is same.

B. Percenage Thinning

To investigate the effect of percentage thinning, due to increase in BHF, finite element simulations were run for various blank holder forces from 1 KN to 50 KN and the results are tabulated in table 1 and plotted in the figure 3.

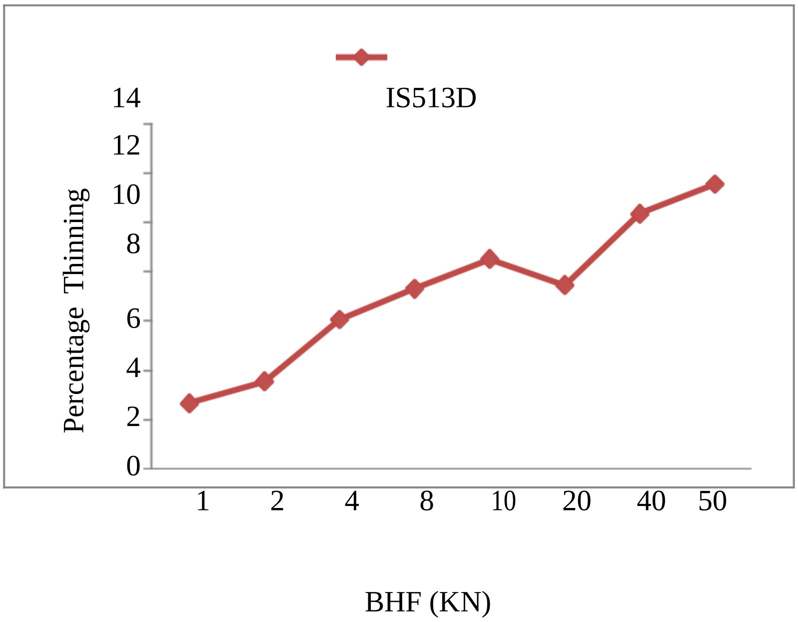

Figure 3 Percentage Thinning Vs. BHF

ISSN: 2233-7857 IJFGCN

ISSN: 2233-7857 IJFGCN

It is clearly seen from the figure 3 that the thinning percentage increases with increase in Blank Holder Force. Because of it, there is limitation on increase in BHF to control the springback. If the thinning percentage is increased the formed component becomes week in strength and the failure chances of component increases.

VI. CONCLUSION

The following conclusions can be made based upon the obtained results.

1. Springback increases with increase in BHF initially with small BHF but after certain limit springback decreases with increase in Blank Holder Force i.e. larger BHF. This is because initially with low BHF punch induces mostly bending stresses, but as the BHF increases bending stresses becomes mostly tensile due to the firm grip of binder force.

2. Thinning percentage increases with increase in Blank Holder Force. Therefore thinning percentage puts limitation on increase in BHF to control the springback.

REFERENCES

[1] Luc Papeleux, jean-Phillippe Ponthot, Finite element simulation of springback in sheet metal forming, Journal of Material Processing Technology, 126-126 (2002) 785-791

[2] S. K. Panthi, N. Ramkrishnan, K.K. Pathak, J. S. Chouhan, An analysis of springback in sheet metal bending using Finite Element Method (FEM), Journal of Material Processing and Technology 186 (2007) 120-124.

[3] M. Bakshi-jooybari, B. Rahmani, V. Daeezadeh, A. Gorji, The study of springback of CK-67 steel sheet in V-die and U-die bending process, Material and Design (2008).

[4] Gawade Sharad, V. M. Nandedkar, Investigation of springback using FEA, IDDRG 2012, 281-285.

[5] Wenjuan Liu, Qiang Liu, Feng Ruan, Zhiyong Liang, Hongyan Qiu, Springback Prediction for sheet metal forming based on GA-ANN technology, Journal of Material Processing Technology, 187-188 (2007) 227-231.

[6] Recep Kazan, Mehmet Firat, Aysun Egrisogut Tiryaki, Prediction of springback in wipe bending process of sheet metal using neural network, Material and Design 30 (2009) 418-423.

[7] Ozgur Tekaslan, Nedim Gerger, Ulvi Seker, (2008), Determination of springback of stainless steel sheet metal in V bending die, Material and Design 29, 1043-1050.

[8] W. L. Xu, C. H. Ma, C. H. Li, W.J. Feng, (2004), Sensitive factors in spring back simulation for sheet metal forming, Journal of Material Processing Technology, 151, 217-222

ISSN: 2233-7857 IJFGCN