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Literature Review on Sheet Metal Die for Deep Drawing Using Hyper form

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Abstract *- Hyper-form job is a comprehensive finite-element based sheet metal forming simulation framework. Hyper-form offers a high performance feasibility analysis tool in combination with parametric rapid draw die design capability and final process validation, optimization and results visualization. In this paper we highlights the preparation procedure of the sample die forming the sheet metals with hyper-form simulation process which is very useful and beneficial for the production that gets the perfect designed products.*
Keywords — *Punch Die, Sheet-metals, Hyper-form process*

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I. INTRODUCTION

Hyper-form is open ended and automation centric and is completely adjustable to the user environment. It comes with a set of predefined patterns in order to simplify the model setup

For standard processes, driving the user through the definition of even complex simulation models just in few mouse clicks. The all new auto process is a comprehensive until now spontaneous draw near the entire setup for various circumstances. Multistage manager is a utility that enables a hands-off approach to sequencing of multi-stage stamping

Simulation. Finally the hyper-form provides the user the ability to define even the complex optimization study just properly selecting few process variables

II. LITERATURE REVIEW

Laszlo Horvath, Imre J. Rudas [1] concluded that product design requires frequent modifications of earlier decisions moreover modifications of result of a decision often causes a need to modification of result of other decisions, it requires contribution of original decision maker or authorized engineer

Because live communication between engineers typically is not available. The only effective way is to describe their intent in product model to be modified Computer modeling should be extended to this area. The author purpose a computer method to assist the modifications of decisions by modeling of design intent, but intent of original designer is required to do this without loss of quality and functionality of component

Hitenkumar Patel [2] observed that achieving high standard quality products in almost no time with great economy in aerospace industry demands for a high technology that helps exceed the engineering requirement of products. This paper tells about use of hyper form, hyper form helped reducing the complete product development cycle to almost less than 40% of what it usually took using conventional methods. Lesser effort and ease to model the complete set up and important features with different design parameters. Improved the product development without compromising quality. The challenge was to develop the wrinkle free component restricting percentage thinning to 20%. Different design iterations were carried out to get the best possible product in minimum time. Design changes were done in the existing die design to make it time and cost effective by saving workmanship involved in its development. Simulation revealed the need of optimizing the blank apart from die modification, to get rid of the wrinkles.

Sung-Bo Sim, Sung-Taeg Lee [3] concluded that the FEM simulation increased draw ability of production part for this progressive die development of five step drawing. The results of fine quality of production part were accomplished without fail by tryout and its revision after die components making and assembling. The auto-feeding treatment with a relevant attachment was comparative effect for this production part material strip progression.

Peter kostka, Peter cekan [4] observed that ability to predict different process conditions in deep drawing is essential for die face designers, tooling, stamping and manufacturing engineers. These predictions in turn affect the speed, accuracy and cost of final produced products. This paper briefly discuss the possibilities of controlling the blank holder pressure distribution and shows some computer simulations done on DYNAFORM, with results being experimentally verified. Multi point cushion system, special tool concepts are necessary, to control the pressure between blank holder and draw ring and in this way we can also control the material flow. The modifications of pin forces have to result in corresponding modifications of the pressure between blank holders and draw ring in determined segment of the die. For this a new tool concept for multipoint cushion system has been developed. Using it a working range between wrinkles and tears can be increased enormously. So the forming process gets more robust and more complex parts can be manufactured.

Y. Park, J. S. Colton [5] has developed and verified a method for predicting the failure mode of a cylindrical cup drawing die fabricated from an ATH-filled thermo set polyurethane tooling board Ren Shape™ 5166! The stress states in the die, which govern the failure, are not intuitive, and thus require computational simulations. The simulations were performed by constructing a FE model and obtaining the stress–strain responses. The possible failure modes in cylindrical cup drawing dies are fracture, wear, and plastic deformation. The damage parameters used were the maximum tensile principal stress for fracture and the maximum normal component of a traction vector on the die surface for wear.

Plastic deformation occurs primarily due to the wrinkles in the sheet metal when no blank holder is used. The drawing die fails when the maximum principal stress reaches the flexural strength of the die material. One important observation is that the peak in the drawing force curve does not correspond to the maximum stress, which necessitates the FEA of the process prior to selecting process parameters. A statistical analysis of the two-level fractional factorial design showed that sheet strength and thickness are the most dominant parameters, followed by draw ratio, punch–die clearance, and run-off. The analysis also revealed that several influential two factor interactions exist, including the punch corner radius-draw ratio, sheet strength-thickness, and die corner radius-run-off interactions. The experimental study showed that the punch corner radius must be selected carefully to prevent premature plastic deformation failure of the die.

In conclusion, this study provided a method to predict the failure mode of a cylindrical cup drawing die and the die design guidelines that can be employed in the preliminary design stage. The research identified the valid damage parameters for various die failure modes, based on the underlying failure mechanisms. Parametric studies were performed to identify influential parameters and interactions that contribute to die failure. The study laid the groundwork for tool failure and life prediction for general, low-ductility; powder-filled thermo set composite with applications in general sheet metal forming operations.

Hakim S. Sultan Aljibori, Abdel Magid Hamouda [6] The use of finite-element simulation in the better understanding of forming operations is becoming more important as it provides a cheap and efficient way to determine important process parameters. This paper presents a 2D finite element simulation study concerning the sheet metal forming process. Deep drawing analysis was carrying out and the effect of geometry towards sheet metal forming process has been studied. V-die bending was preformed and the effect of die radius towards force applied was observed. Several simulation tests were carrying out to obtain the most appropriate value for some of the parameter. An attempt base on computational experiments is made to explore the effect of process variables on stress distribution and punch load. An elastic-plastic finite element computational program was developed to simulate successive deep drawing process and V-die bending process. Satisfactory agreement between the loading test and the displacement test was obtained that verified the program.

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Reddy3 [7] the appearance of dimensional deviations of shape and position, of the defects in the metal sheets that have been subjected to a cold plastic deformation process (deep drawing), represents a critical problem for the specific industry, especially for the mass production, like the machine manufacturing industry. The aim of this publication is to present the principal aspects that effect of various factors like BHF, punch radius, die edge radius, and coefficient of friction on the wrinkling of cylindrical parts in deep drawing process. The initiation and growth of wrinkles are influenced by many factors such as stress ratios, the mechanical properties of the sheet material, the geometry of the work piece, and contact condition. It is difficult to analyze wrinkling initiation and growth while considering all the factors because the effects of the factors are very complex and studies of wrinkling behavior may show a wide scattering of data even for small deviations in factors. In the present study, the mechanism of wrinkling initiation and growth in the cylindrical cup deep drawing process is investigated in detail.

Kopanathi Gowtham, K.V.N.S. Srikanth & K.L.N. Murty

[8] This paper "SIMULATION OF THE EFFECT OF DIE RADIUS ON DRAWING PROCESS" is one of the most used Metal Forming Process within the industrial field. Different analytical, numerical, empirical and experimental methods have been developed in order to analyze it. This work reports on the initial stages of finite element analysis (FEA) of a Deep drawing process. The objective of this study is to determine the factors influencing a drawing process and analyzing the process by varying the Die radius and keeping the Friction, Punch radius and Blank Thickness as constant. In this paper Punches, blank thickness of same geometry and dies of various geometries were drawn by using CATIA software. And an effort is made to study the simulation effect of main process variant namely die radius using finite element analysis. As the FEM code, the commercially available software DEFORM-3D is used here Aluminum alloy 6061 is used for deep drawing with initial diameter as 56mm.

T.S. Yang* [9] Purpose: In magnesium alloy sheet products have been attracting more and more attention in recent years because of their application potentials as coverings of portable electrical devices and automotive panels. Thus this paper focus on the deep drawing process of magnesium alloy sheet.

Design/methodology/approach: The FEM software.
DEFORM-3D is used to investigate the material flow character during the elliptic cup deep drawing of magnesium alloy sheet at elevated temperatures.

Findings: Investigate the effective stress and forming load under various process parameter conditions, including the profile radius of die, the clearance between die cavity and punch, the blank holding force and working temperature during the elliptic cup deep drawing of magnesium AZ31 alloy sheet.

Research limitations/implications: The initial blank's shape design and forming limit analysis of the elliptic cup deep drawing of magnesium AZ31 alloy sheet will be continued for future research.

Originality/value: The original value of this paper is the finite element method is used to investigate the material flow character, forming load, stress and strain distribution during the elliptic cup deep drawing of magnesium alloy sheet at elevated temperatures.

A. Wifi* A. Mosallam [10] Purpose: This paper presents a finite element-based assessment of the performance of some non-conventional blank-holding techniques. This includes friction actuated, pulsating, and pliable blank-holding techniques.

Design/methodology/approach: A 3-D explicit-finite element analysis is used to investigate the influence of various blank holder force (BHF) schemes on sheet metal formability limits especially wrinkling and tearing rupture. The role of relevant parameters of each blank-holding technique are also investigated. Three non-conventional blank-holders are considered, namely friction-actuated, elastic and pulsating
blank-holders.

Findings: For the conditions considered in this study, comparison with fixed BHF scheme revealed that slight improvements in the formability are observed for the three BHF schemes under consideration.

Research limitations/implications: Only 5182 Al-alloy circular cups are considered. Further investigations should consider different materials and non-circular shapes because of their effect on sheet metal formability.

Practical implications: Cylindrical cups' drawing is responsible for the manufacture of billions of metal containers. This study can help improve working conditions leading to defect free products.

Originality/value**:** The 3D-explicit finite simulations presented for a number of non-conventional blank-holding techniques are useful in the assessment of their performance.

III. THE HIGHLIGHTS HYPERFORM WORKS

1) Auto-process setup for standard forming operations in one shot, including a comprehensive draw blob builder or editor.
2) Multi-Stage Manager for hands-off submission of sequential simulations, for increased throughput.
3) Major enhancement to surface quality of dies generated from the die module, for loss-free translation to other CAD tools.
4) Unique reverse engineering utility to parameterize, edit and integrate with the Die Module, addendum and binder geometry previously generated in external CAD systems.
5) Line tracking for monitoring feature line movement on blanks.
6) Complete tool and fast process setup utilities for complex tube bending and hydro-forming simulation.

7) Seamless data mapping from forming meshes to structural meshes for post-manufacturing performance studies.

IV. SHEET METAL FORMING DIE-WITH PUNCH BY HYPERFORM WORKS

In die forming with a punch, the shape zone covers the region between the projection of outer edge and the location where the drawing part leaves the drawing ring curvature and the mesh like hyper-form simulation diagram as shown in the fig.1. In contrast to stretch forming, the surface areas of the blank and the drawn part are about the same, so that the sheet thickness remains almost constant. The base of the drawing part is formed according to the principle of mechanical drawing.

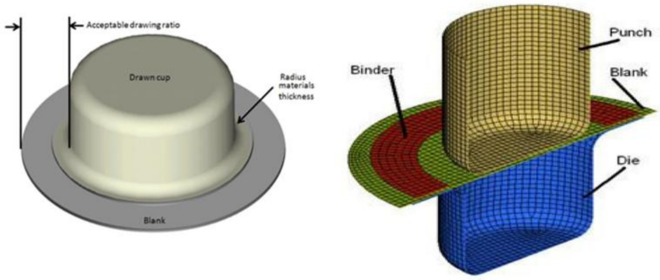

Fig -1: Die Forming Punch with Hyper-form simulation.

Before the die forming punch there is a necessary to calculate hyper forming simulation system on the computer with the SEM software design. The sample snapshot of the model forming hyper-form simulation process on the computer is shown in the Fig -2

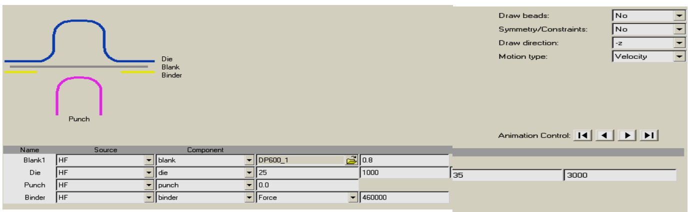

Fig. 2 Model forming hyper-form auto simulation process on computer.

V. BENIFITS OF HYPERFORM

1) Immediate Cost Savings a remarkable cost savings is driven by competitive pricing and the dramatic reduction of the overall product development cycle time.
2) Perfect and consistent work out.
3) The most accurate additional sheet metal forming solver on the market.
4) This work out allows the users to quickly predict wrinkles and splits prior to cutting steel, avoiding the unnecessary costs associated with die machining and press downtime.
5) Proficiently incarcerates the stamping process hyper form's open framework combined with an extensive built-in knowledge of the manufacturing domain efficiently captures the stamping process.
6) This further increases user productivity through a comprehensive collection of modified, process automations for virtually every stamping application.
7) Elastic user defined automations through TCL macro.
8) The fastest inverse work out in the marketplace one-step possibility analysis.

VI. DISCUSSION

Hyper-form comes with a set of predefined patterns in order to simplify the model setup for standard processes, it define even complex simulation models or the model which we have to simulate. It increases the performance studies from forming meshes to structural meshes for post seamless data mapping which is previously used. It is an all-new auto process which is a comprehensive until now spontaneous draw near the entire setup for v circumstances. Finally the hyper ability to define even the complex optimization in sheet metal forming process.

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