Extrusion Diagonal Loaded of Centered Hole Sheet Metal Simulation and Analysis

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Abstract: - This paper presents a simulation and analysis to diagonal load affects on aluminum centered hole sheet metal stress and strain distributions and also deformations are distinguished. Many applications of metal forming included diagonal loading of such case. In many manufacturing processes this case is applied. Solidworks is used here to analyze such loads and their effects. It is found that the stress and the strain have maximum values at the fixed edge while the displacement has maximum values at the free end of the plate.

Keywords: - *centered-hole metal sheet, deformation, diagonal loads, simulation strain, stress.*

I.   INTRODUCTION

This paper presents a simulation analysis for diagonal loading of sheet metal having a centered hole which can be found during extrusion or other manufacturing processes. Sheet metal extrusion differs from ordinary extrusion. Usually, the materials used in the process of sheet metal extrusion include mild steel and non-ferrous metal, and the thickness of the sheet metal plate suitable for extrusion is 2–20mm. The process is often an axisymmetric one. In that case, the diameters of the extrusion punch and the extrusion outlet are commonly greater than the thickness of the material. The extrusion ratio is generally no larger than 4.0. At the beginning, the sheet metal material is held tightly between the pressure ring and the die. Then, the punch penetrates the sheet metal material and extrudes it toward the outlet of the die. Not only extrusion but also penetration occurs during the sheet metal extrusion process. By contrast, only extrusion occurs in the ordinary extrusion process.

Although there has been a lack of analysis on sheet metal extrusion, the process has indeed existed and is developing quickly now. For example, the process can be used to manufacture a staged hole in the sheet metal material, or used in the combined fine-blanking and extrusion process. In order to develop the sheet metal extrusion process, it is necessary to clarify the theory behind the process. The model of sheet metal analyzed here is shown in figure (1) below.

A
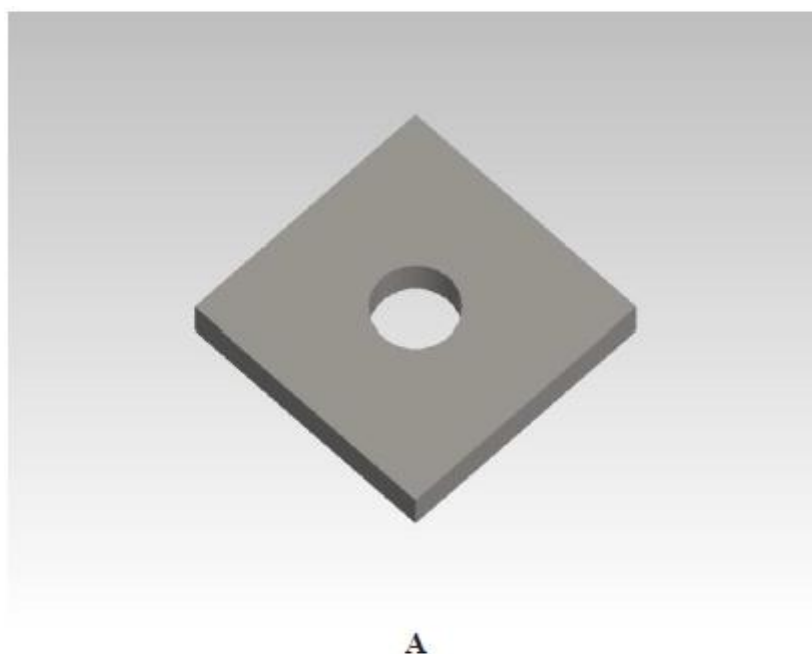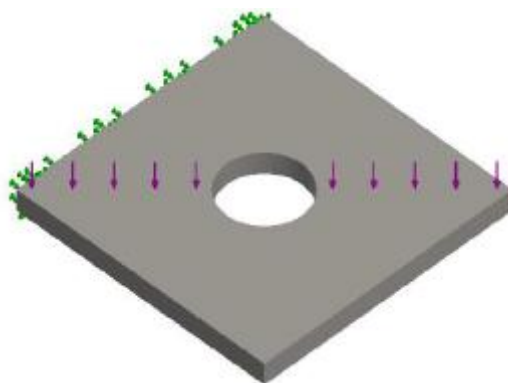
B
Fig. 1 a, b the studied sheet metal

Little of researches treat this issue, P.F. Zheng et al. (2005), presented the characteristics of the process and gives a detailed analysis of it with the finite element method. According to the results, the mesh distortion, the field of material flow, and the distributions of the stress and strain can be predicted. Analysing the results from simulation, it is proposed that the extruded material can be divided into five areas according to their different features of deformation. In addition, the material in the areas of deformation can further be divided into three parts according to their different features of compression and elongation. The location of the fracture has been predicted from simulations. Some experiments have been carried out to verify the simulated results.

J. R. RICE, 1968, analyzed the stress and strain beside a notch of a sheet metal and it is found that it has the same value for all paths surrounding the tip of a notch in the two-dimensional strain field of an elastic or deformation-type elastic-plastic material

II. RESULTS AND DISCUSSION
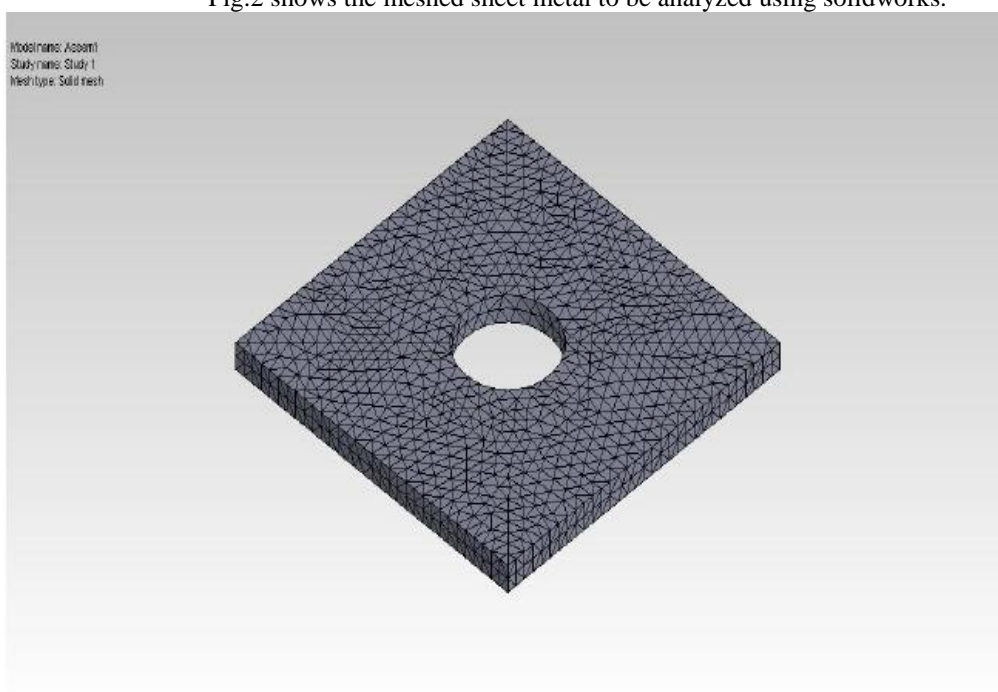Fig.2 shows the meshed sheet metal to be analyzed using solidworks.

Fig.2 meshed sheet metal

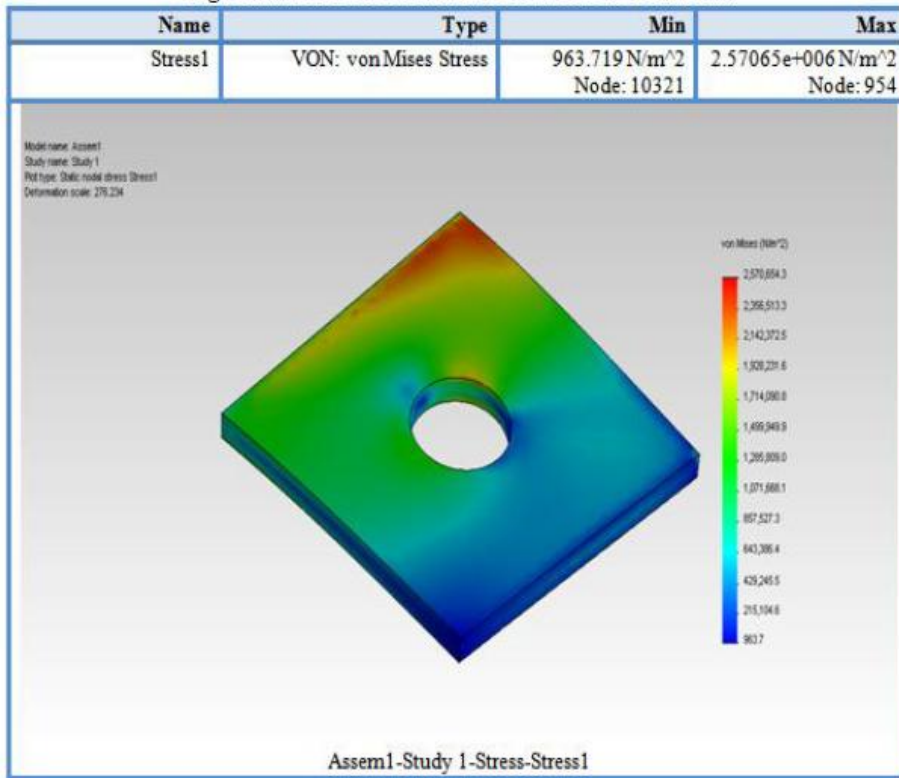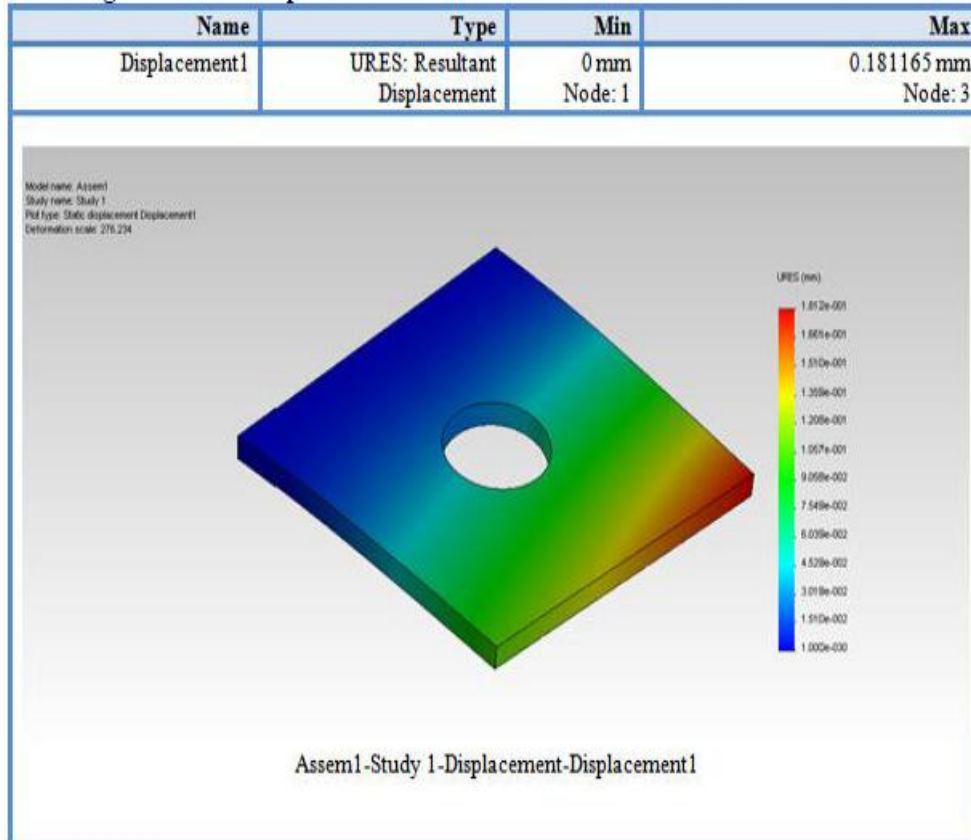**Fig.3 shows the stress distribution of the sheet metal.**

Name	Type	Min	Max
Stress1	VON: von Mises Stress	963.719 N/m^2 Node: 10321	2.57065e+006 N/m^2 Node: 954

Assem1-Study 1-Stress-Stress1

Fig. 3 stress distribution

Fig.4 shows the displacement and the strain distributions of the sheet metal.

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0 mm Node: 1	0.181165 mm Node: 3

Assem1-Study 1-Displacement-Displacement1

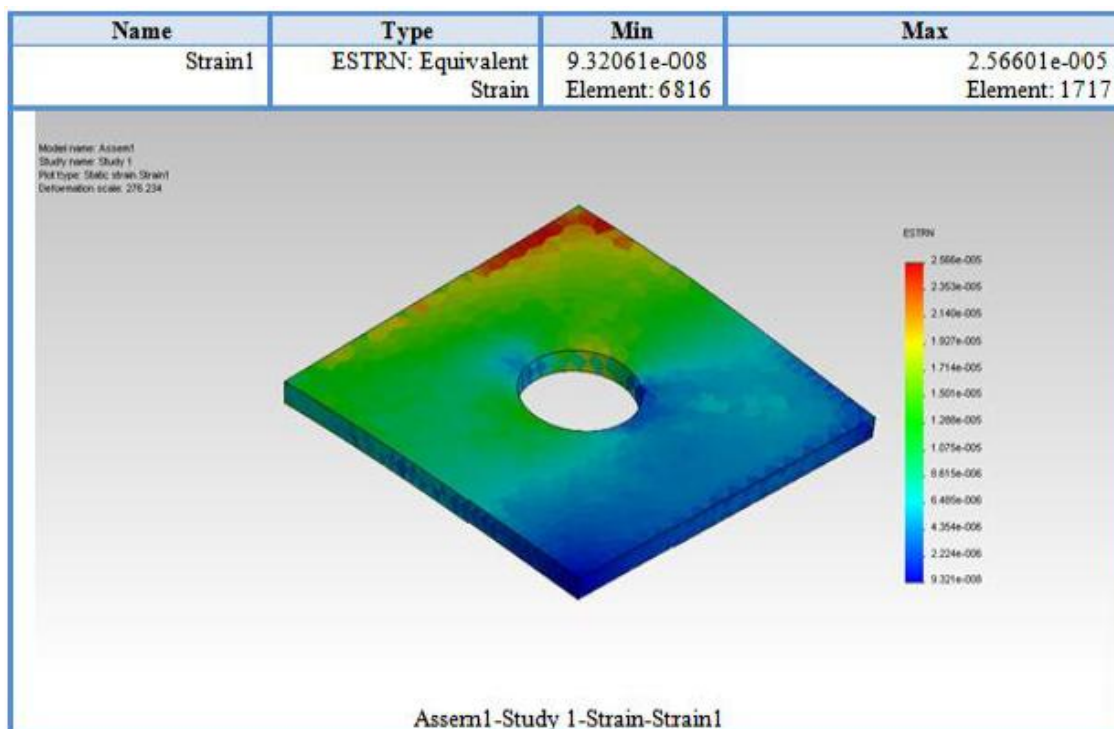| Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	9.32061e-008 Element: 6816	2.56601e-005 Element: 1717

Fig.4 displacement and strain distributions

III.   CONCLUSIONS

The stress, strain, and displacement distributions are studied here, it is found that the stress and the strain have maximum values at the fixed edge while the displacement has maximum values at the free end of the plate

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