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Analysis of Single Punching Forging Press Setup by Using ANSYS

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Abstract **- The proposed work is concern to study single punching forging press setup by carrying out analysis and stress distribution on die. To Analysis of stress distribution on base plate. Experimental system is to be developed to achieve the stated objective which includes mainly at examining the deformation and stresses on all main parts of the forging press setup The main feature of press is forging. A forging is produced by the downward stroke of the ram when the punch moves towards and into the die block set.**
Keywords**: Forging press, ANSYS , CATIA software.**

I.INTRODUCTION

Forging is a deformation process of billet in which the work piece is compressed between two opposing dies so that the die shapes are imparted to the work piece. Deformation processes involve large amount of plastic deformation. The cross-section of work piece changes without volume change. The mechanical press has been the first choice of many press users for years but now a day by increasing demand of product. As modern hydraulic presses offer good performance and reliability. As Hydraulic press machine use several load capacity to convert billet into desired product. These presses come in manual mode of operation as per requirement. There are variations in load capacity of Hydraulic Press Machines. They depend upon user requirement. So by applying this load capacity on billet desired output is obtained but this capacity also has adverse effect. We worked on 100 ton Hydraulic Press Machine in the INDUSTRY. There are various products which are manufactured by the machine, so there is variation in the forces which are acting on machine. Due to such variation there are certain deformations and equivalent (von misses) stresses acting on the machine. So our aim is to reduce these deformations and equivalent (von misses) stresses for single punching press. This can be achieved by optimizing forging setup such as die. All the dimensions which were required during designing were taken directly from the machine itself. Then we imported the design to ANSYS. Which are- preprocessing, solution and post processing.

II.PROBLEM STATEMENT

Many Industries are mostly concern with manufacturing of pistons. They manufacture pistons of different shapes and sizes using same machines. Due to variation in shapes of product, force of different magnitude is required. Due variation in forces, there is deformation and change in equivalent (von misses) stresses which produce more maintenance cost of machine and produce defect in product. It is required to eliminate this effect. So we have use ANSYS workbench to optimized it.

III.SINGLE PUNCHING SETUP

For studying analysis of single punching press setup did the assembly of base plate, base plate holder and die as shown in fig.3.1. In this assembly base plate is made up of mild steel which is withstand under the pressure of MPa . The holder is made up of Mild steel placed over base plate, which holds the die. The material of die are Mild steel, stainless steel, Gray cast iron and carbide respectively.

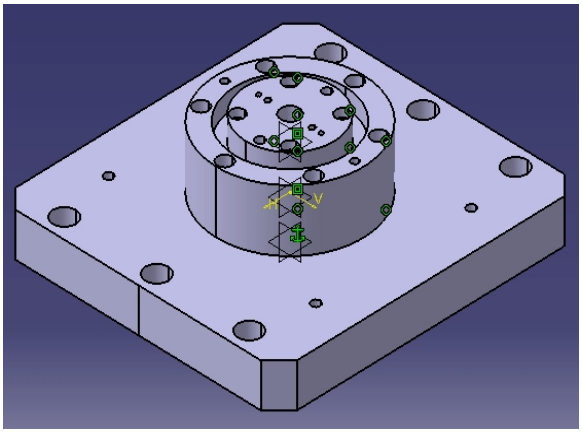

Fig 3.1: Pictorial view of Single punching base plate assembly

IV. PROCEDURE TO CONDUCT ANALYSIS FOR SINGLE PUNCHING PRESS SETUP

A.FEA OBJECTIVE

1. Finding the deformation and stress of single punching press setup.
2. Comparative study of different material for single punching.
3. Finding the deformation and von misses stress after changing the pressure and material.

B. ANALYSIS SINGLE PUNCHING SETUP

There are six basic steps for doing the simulation in press machine to predict the maximum stress and deflection by applying the press load.

Step 1- Create CAD model of single punching press setup.
Step 2- Import the CAD model in simulation software.
Step 3- Pre processing.
Step 4- Apply boundary conditions.
Step 5- Post processing.
Step 6 – Result and analysis.

C. MESHING

The accuracy of the FE model is highly dependent on the mesh employed. In general; a finer mesh will produce more accurate results where the increased mesh density fails to produce a significant change in the results. At this point the mesh is said to be converged. All components of press setup are meshed having mesh size 5 mm with fine relevance as shown in Figure 4.2.

D. FEA ANALYSIS OF FORGING PRESS SETUP

Figure 4.1 Created CAD model of single punching setup by using CATIA V5R16 and saved in IGES format. After that 3D CAD model is imported in ANSYS workbench, the extension of imported file format is IGES. The meshing of generated Cad model is done in workbench with the element size is 5 mm and the type of element is triangle for 2D and tetrahedron for 3D.

E. BOUNDARY CONDITIONS ARE GIVEN AS FOLLOWS:

Fixed support is given at the bottom face of base plate and the load is applied as pressure on the face of die which is uniform ally distributed.

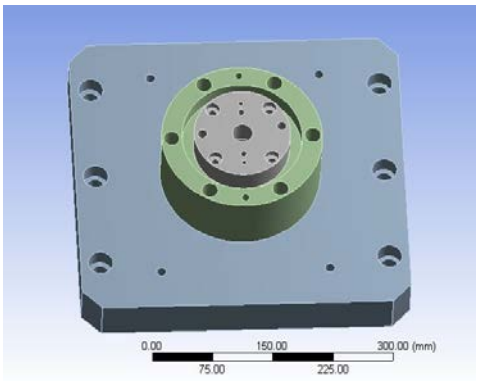

Fig.4.1.Imported the IGS file in ANSYS

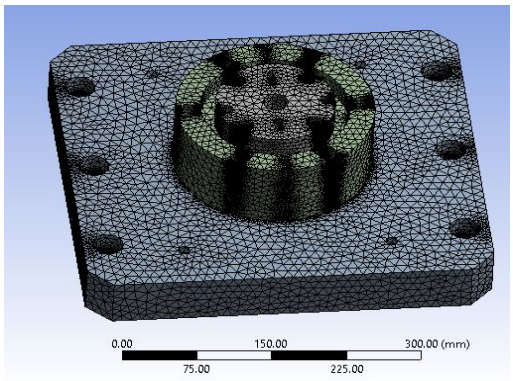

Fig 4.2.Mesh generation in ANSYS workbench

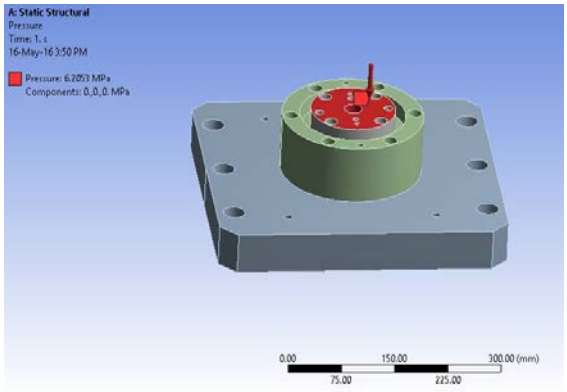

Fig 4.3. Applied body forces and constraints

Boundary condition

The boundary conditions defined on the model should realistically reflect the loading conditions on the structure .All nodes and elements of bottom side surface of base plate are fixed i.e. fixed support is as shown in Figure 4.3.

Loading conditions

Load is applied as a pressure in Mpa on upper face and periphery of die.

V.RESULT AND DISCUSSIONS

TABLE I CARBIDE

	= 5.515805MPa	5.860543MPa	6.205281MPa	6.550019MPa	6.894757MPa
Total deformation (mm)	3.43E-06	3.65E-06	3.86E-06	4.08E-06	4.29E-06
Directional deformation(mm)	7.77E-07	8.26E-06	8.75E-07	9.23E-07	9.72E-07
Eq elastic strain(mm)	1.50E-04	0.00015963	1.69E-04	1.78E-04	1.88E-04
Eq elastic stress(MPa)	2.29E+07	24.382	2.58E+01	2.73E-07	2.87E+07
Max principal elastic strain(mm)	6.21E-05	6.60E-05	6.99E-05	7.38E-05	7.77E-05
Max principal stress(MPa)	1.09E+07	1.16E+01	1.23E+01	1.30E-07	1.37E+07

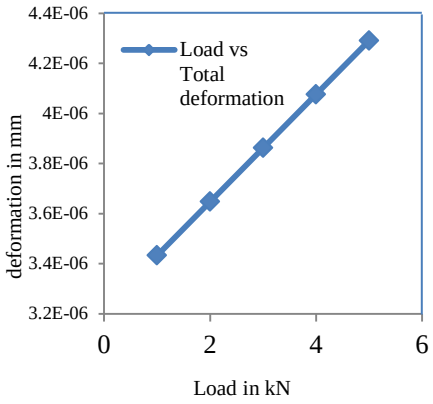

Fig5.1: Load vs Deformation

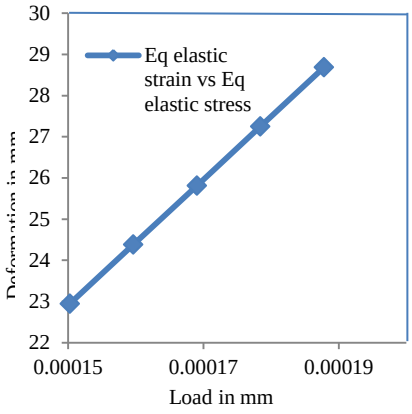

Fig5.2: Equivalent stress vs equivalent strain

FEA result:

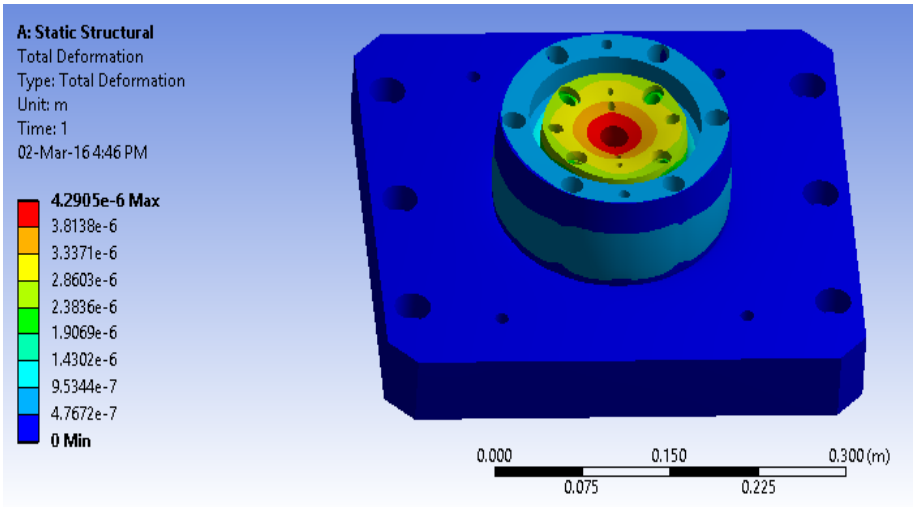

Fig 5.3 Total deformation result for single punch

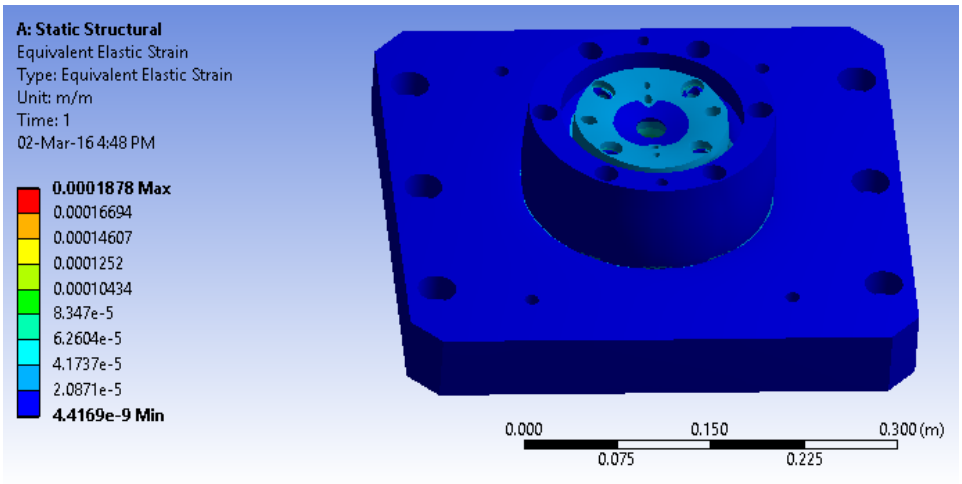

Fig 5.4 Equivalent Elastic strain result for single punch

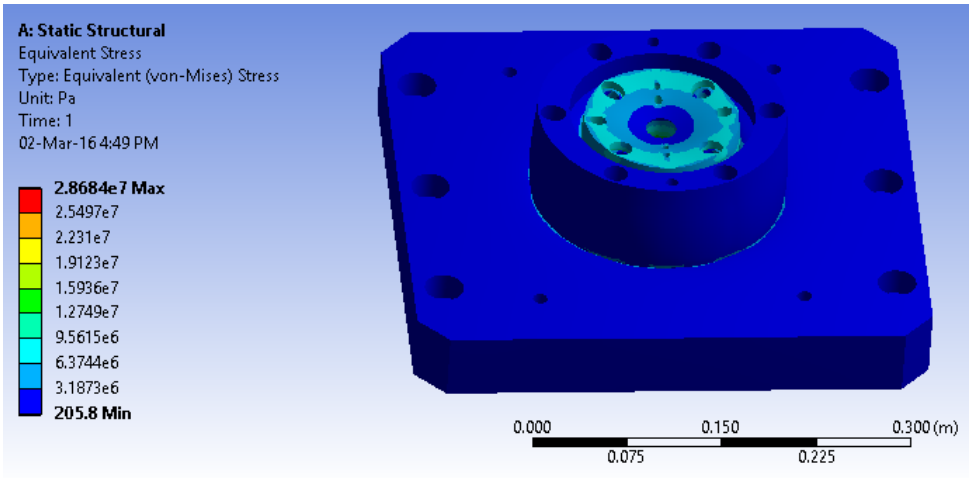

Fig 5.5 Equivalent stress result for single punch

VI.CONCLUSIONS

The conclusion of experiment and Pre- stressed modal analysis of single punching setup are as follows.

1. Form the discussion of graph load VS deformation for single punching, we chosen the carbide material for die in case of single punching setup.
2. In case of single punch press setup the deformation for model is 0.00429 mm. This minimum deformation amongst all models. The stress for this model is 28.7 MPa.

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