



Design and Development of press tool for Hemming process

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Abstract---The work is about tool design for hemming process for a mudguard. Studied the present process which is done on a press machine. Tool and die which is used in present press machine are generating some defects which will affect the aesthetic and productivity of mudguard. Due this defects there will be more rejections. To eliminate the defects and to increase the productivity, tool, die machine is designed Based on work carried on this mudguard will increase the productivity and reduce the rejection rate. Press tool and die is designed by using solidworks software. Numerical simulation software is used for finding forces of press tool required for deforming the sheet metal edge.

Keywords---Mudguard, Press Tool and Die Design, Analysis, Tool Forces

I. INTRODUCTION

press tool and Die is used to produce particular product in large quantity. Forming of sheet metal is mainly depending on the press tool and Die design and its configuration. Hemming which is three step forming process used to get tight fit at edges. Application of hemming process is widely used in the automotive sector. In this work designed press tool for performing hemming process for sheet metal with zero defects and reduced steps

After forming of sheet metal into a mudguard from roll forming machine the mudguard sent for trimming operation. Completion of this operations hemming operation will be done on the mudguard. During this operation about 4.95mm sheet is bend and forming will be taken place inside.

Stage 1:90deg

Stage 2:145deg

Stage 3:180deg

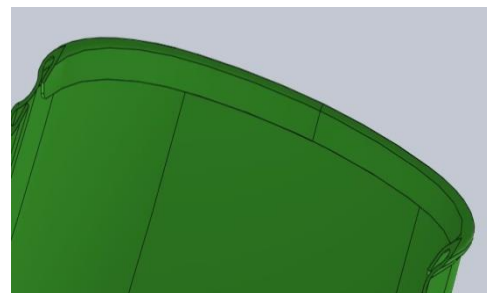
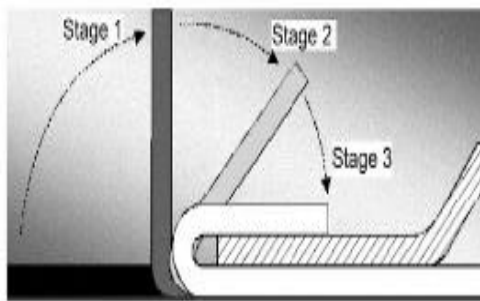


Figure1: Stages, Forming and bending in mudguard

Many researchers have been published a paper on the Hemming process and press tool. A detailed description of research papers is presented.

Zamzuri Hamedon, Ken-ichiro Mori, Yohei Abe[1] to make the hollow sections for the structured body sheet metal is used. The hollow sections which are joined presently by resistance spot welding have insufficient energy absorption because the joints are not continuous. Thus, to overcome this issue, hemming process is adopted for joining hollow section. The hemming of the high strength steel sheet was successfully implemented using punch with stopper.

Subramanyam Pavuluri, B.Rajashekar, B.Damodhar [2] Press tools which are used to produce a particular component in large amount, out of sheet metals where particular component produced depends upon press tool construction and its configuration. Generally metals having thickness less than 6mm is considered as strip. The different types of press tool constructions leads to different process namely blanking, bending, piercing, forming, etc.

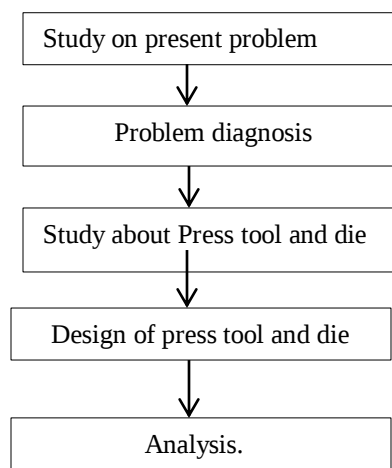
Rupali Chavan, Navneet Patil.[3] progressive die which performs a number of process like piercing, blanking, , etc in a single die at each workstation. Completed part is obtained at each stroke of press machine. This research deals with design of progressive tool having four workstations by using modelling software the parts and Quick press which is an add on software.

Sachin.G, Yathish.G, Amar[4] Tool design is one of the important trades, which requires a complete detailed study, structural analysis and process planning before implementing with any practical work. The performance of any press tool is largely depends on the process and design analysis. Design analysis and overview of a press tool which is need for large production of sheet metal component. A systematic approach in tool production is therefore very essential. This research mainly depends on the various aspects of press tool.

Nilesh N. Patil1, Wasim Shaikh[5] metal forming operations like Bending, Shearing, Blanking, etc. Any type of applications of the material selection is major parameter in sheet metal. Material which is used for sheet metal manufacturing processes is the output of the rolling operation. Typically, sheets of metal are in the fort of flat, rectangular sheets of standard size. If the sheets are thin and very long, they may be in the form of rolls. So, by using various press tool designs and dies the designs of sheet metals are achieved.

Fissha Biruke ,Teshome Yonas ,Mitiku Degu[6] designing of combined press tool to be used in the manufacturing of the rice thresher blade, 2D and 3D modeling of the components, analyzing stress and displacement on the components are calculated. The design and selection of press tool components is carried out by following standard die design and analysis approach. The modeling and structural analysis of the components was carried out on SolidWorks software.

II. Methodology



In this work present press tool and die is studied for present problems. Present press machine which is generating more defects. To eliminate the defects by using new press tool and die concept. Forming and bending of sheet metal is mainly depending on the press tool and die.

III. DESIGN OF PRESS TOOL AND DIE

Material economy and the resultant reduction in weight and cost, high productivity, use of unskilled labor, and a high degree of possible precision have rendered press-work indispensable for. Many mass produced goods such as electronic appliances, steel furniture, utensils and vehicles. The entire top of a car can be finished to size from a single metal sheet. There is no need for further machining as for castings or forgings. It is possible to control dimensions of pressed components within the eighth grade without much difficulty. Even finer tolerances can be achieved through finishing processes such as sizing, burnishing. Increase in die clearance increases tool life. Doubling clearance from 2.5-5% (for mild steel worksheet) doubles the tool life. So when the requirements of blanks are not very high, it is convenient to keep die clearance more and remove the excessive tensile burr on the blanks manually.

3.1. Design of any press tool involves the following steps:

- 1) Determination of force (press tonnage) required for the operation.
- 2) Selection of press for requisite force, workpiece size and shape.
- 3) Determination of shut height of the tool.
- 4) Computing die thickness, and margins (minimum cross-section).
- 5) Drawing strip layouts and comparing material utilization.
- 6) Design of locating elements.
- 7) Selection of hardware.
- 8) Finding center of pressure.
- 9) Drawing die plan and selection of pillar die set.
- 10) Deciding punch length and mounting.

3.1.2. Design of Tool and die:

New tool and die is developed for hemming process based on the design considerations as shown in the figs:

- 1) Centre bead punch
- 2) Side bending punches
- 3) Centre bending punch
- 4) Closing bottom punch
- 5) Fixed Die

1) Center bead punch:

Centre Bead punch is moves towards the fixed die to for an initial bead on the mudguard and hold the component for the further operation.

2) Side bending punches:

This side bending punches is used to bend 90 degrees at sides of mudguard edge.

Side bending punches is divided into two:

1. Right hand side bending punch
2. Left hand side bending punch

3) Center bending punch:

The center bending punch will bend the center portion 90 degree with support of center bead punch form the bottom.

4) Closing bottom punch

Closing bottom punch is used to close the bend portion .

5) Fixed die:

In this die bead forming will take place.

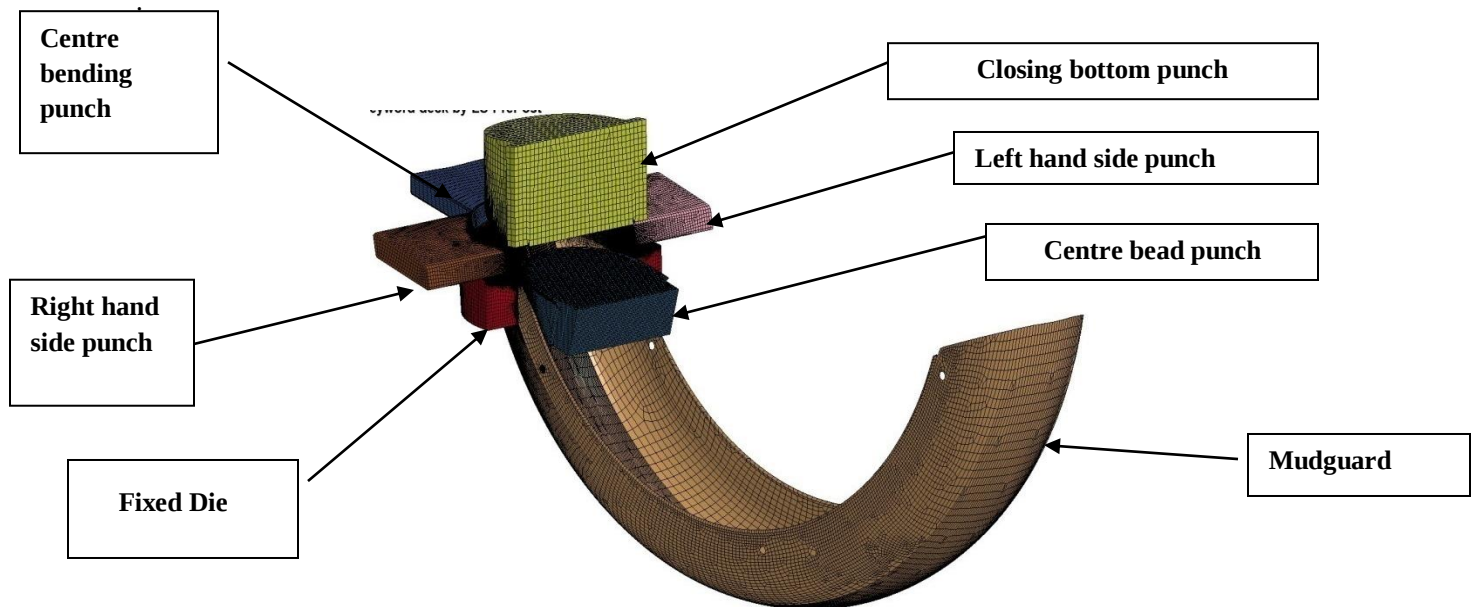


Figure 2: Tool and Die arrangement

IV. RESULTS AND DISCUSSION

Analysis is carried out on Mudguard for determining the forces required for bending and forming at edges. vonmises stress and deformation which is generated in mudguard is shown in fig.

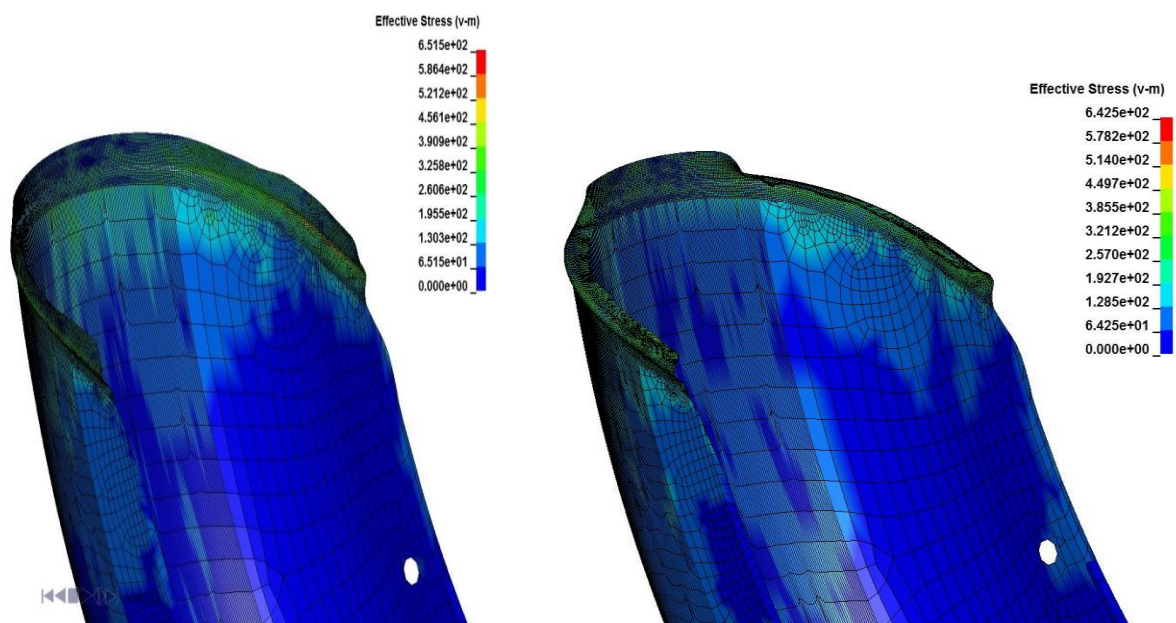


Figure 3: von mises stress developed due to Centre bead punch and Side bending punches

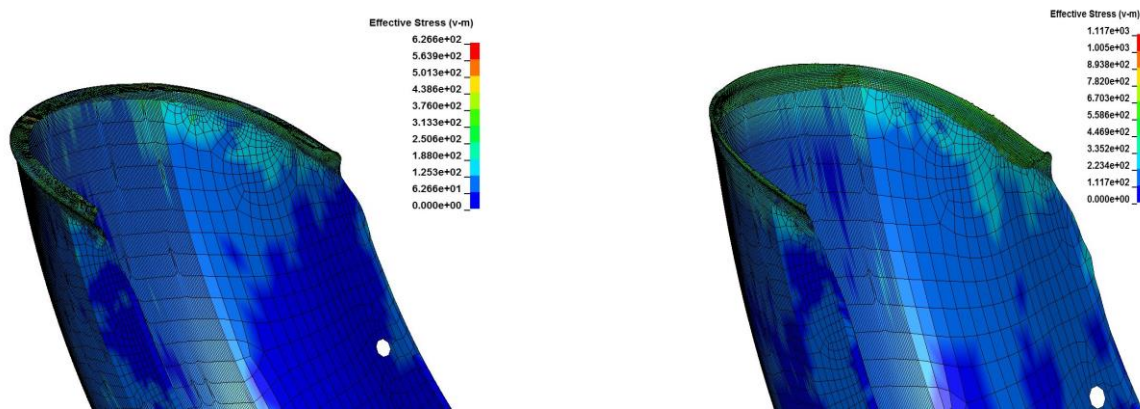


Figure 4: von mises stress developed due to Center bending punch and Bottom punch

4.1. Forces:

Forces required for bending and forming the edge of Mudguard is generated from the LS dyna software. Given Displacement and Time is given to the Press tool as input. Forces which is generated is shown in the graphs.

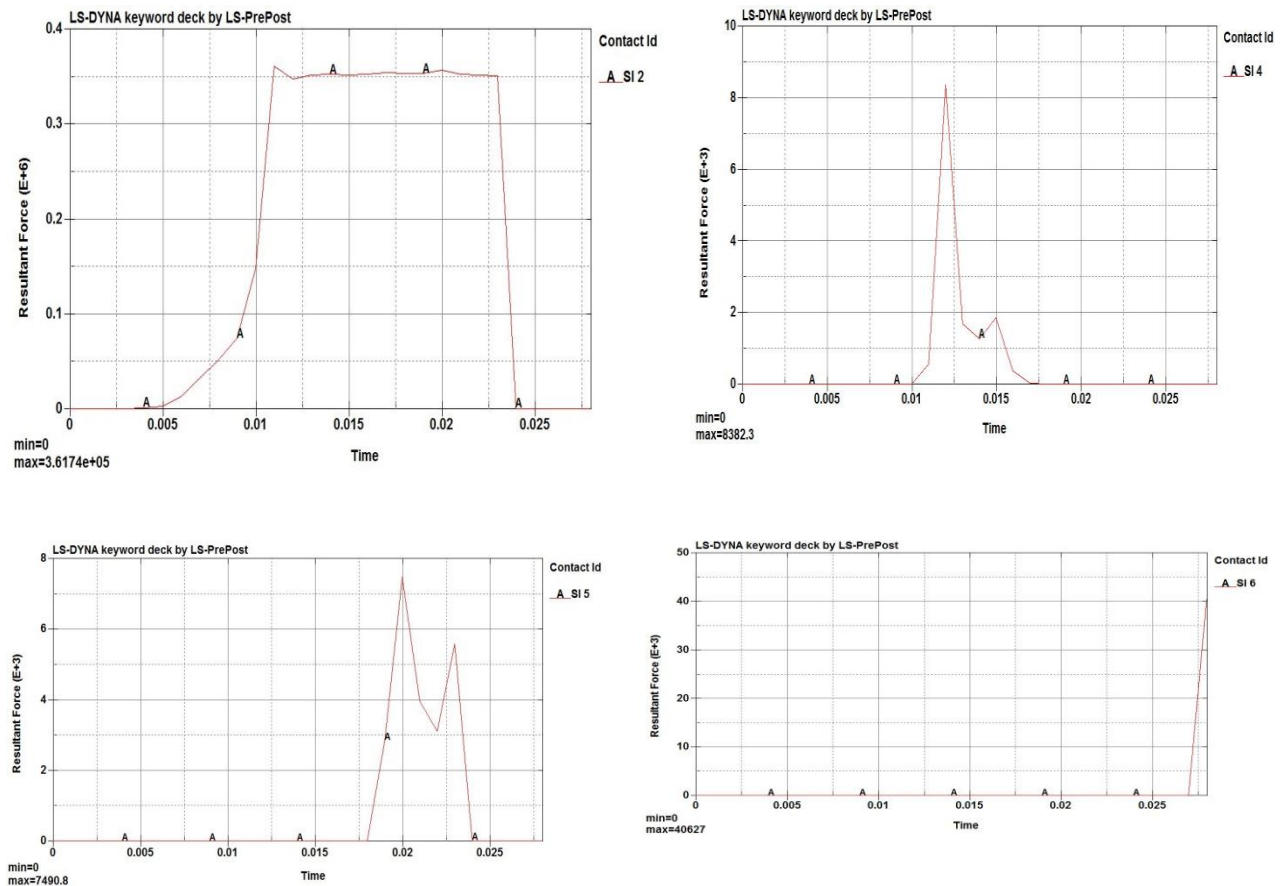


Figure 4: Resultant forces

S.No	Description	FORCE (N)
1	Centre bead punch	3.617E+5
2	Side bending punches	8382.3 (each)
3	Centre bending punch	7490.8
4	Closing bottom punch	40627
5	Fixed Die	2.2355E+5

Table 1: Forces generated during operation

4.1.1. Elimination of wrinkling defect:

Wrinkles from the hemming process are reduced by trimming the edges of the mudguard by 3.22 mm.

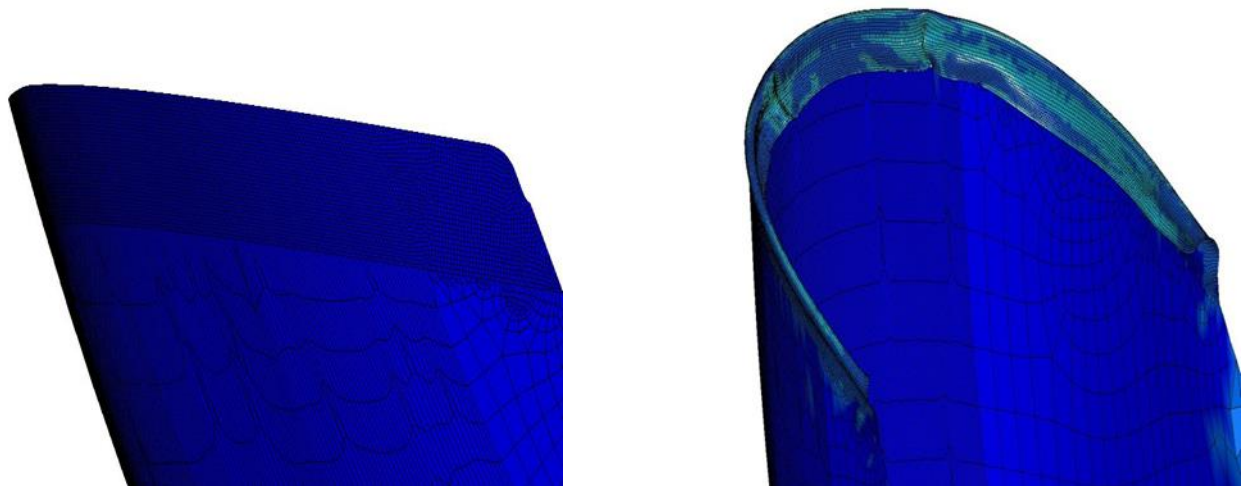


Figure 5: with wrinkles

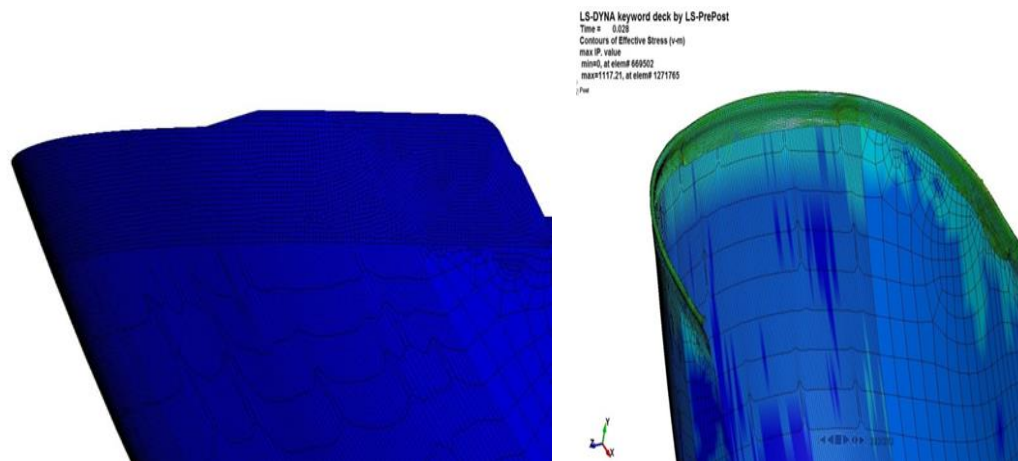


Figure 6: without wrinkles
V. CONCLUSION

Press tool and die which is in existing mechanical press machine have more stages and generating more defects like wrinkling. To increase the productivity and also to reduce the rejection rate a new press Tool and Die is developed. Flexibility and efficiency is very much better than the existing press Tool and Die. Reduction of hemming process steps from 12 steps to 2 steps both sides. Defect free process during hemming operation .Completely elimination of secondary operations like hand graining and buffing .Cycle time reduced from 22 sec to 10 sec.Greater productivity and reduction in rejections. Cost of mudguard during hemming operation is reduced.

VI. REFERENCE

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