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# One Step Formability Analysis of Chain Guide Mounting Bottom Bracket Using Siemens NX10

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## ABSTRACT

*Demands for complicated products have increased dramatically over the last few years taking into consideration of sheet metal parts in automobile, aeronautical and engineering applications. For reliable product development and stable production process, the use of analysis is necessary to analysis part before manufacturing. This paper deals with the One Step*

*Formability analysis simulation of press tool component with the help of Siemens NX Software. The analysis of the component is also done to analyze stress strain deformation and spring back test solution of the component. The application of various CAD/CAE design is explained for the component with techniques practically should cover the full product development cycle. The purpose of carrying out analysis is to prevent the costly tryouts and thus optimize the time.*

**Keywords** - Press tool, CAD/CAE, One Step Formability Analysis in NX-10.

## 1. INTRODUCTION

Press tool is a device used for producing sheet metal components in large volume by applying an external force with the help of a machine tool called press. Press tools are mainly manufactured for high rate of component production. Generally these tools are cold working and manufactured to improve the productivity of the component qualitatively and quantitatively. A component should be designed with proper tolerance such that it may not impasse in any way its desired quality, function, life, appearance, etc. These tools are economical when the requirement of the components is high and the time required to produce the batch of components is less and the quality of the products required is high. The principle operations of sheet metal stampings include cutting operations like shearing, blanking, piercing, etc. and forming operations like bending, drawing, bulging etc. sheet metal items such as automobile parts, components of aircrafts, etc. are manufactured by press tools.

Forming operation is the main work in chain guide mounting bottom bracket .Forming operation takes place along non linier axis rather than straight axis as in bending, forming dies often considered in the same class with bending dies. They are classified as tools that form or bend the blank along a curved axis instead of straight axis. The internal movement or the Plastic flow of the material is localized and had little or no effect on the total area or thickness of the material. The first consideration in analysing a stamping is to select the class of die to perform the work. Next to be considered is the number of stamping or the formed parts required, and this decides the amount of money to be spent in the design and building of the tools. A forming die may be designed in many ways and produce the same results. At this point the cost of the tools, safety of operation, and also the repairing and the reworking must be considered.

## 2. ONE-STEP FORMABILITY ANALYSIS

One-step Formability analysis command to flatten all or some faces of a sheet metal part using FEM analysis and calculate the thinning, stress, strain, and spring back to predict the risk of forming. Perform complete or intermediate unforming, or flatten a Sheet Metal part.

Output the flattened profile or spring back faceted bodies for complete part unforming. You can also specify the target region and the unformed region from a different sheet body.

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Define different constraint types, both geometry and process, to control unforming.

One Step Formability analysis is highly demanded for sheet-metal designers in order to improve the design quality to meet requirements from modern manufacturing industry. CAD user now can reach this capability with NX10, an integrated solver inside called "one-step formability solver". Usability has been taken into account with very high priority by automating the analysis process and streaming-up multiple tasks. "One-step" is a computational algorithm of state-of-the-art technology with an ease of use capability, in contrast with "incremental method" which provides more controllable accuracy, mostly for a skilled CAE user.

Analysis environment allows analyzing assembly or part design and evaluating different options quickly under different conditions, for example using materials and constraints (boundary conditions) etc.

#### A. One-step Formability Analysis Workflow

1. Creating simulation and specify their properties.
2. Excluding components not required for simulation.
3. Assigning materials.
4. Adding constraints.
5. Specifying contact condition, an optional step.
6. Specifying and preview the mesh, an optional step.
7. Running the simulation of stress, strain and springback.
8. Viewing and interpreting the results.

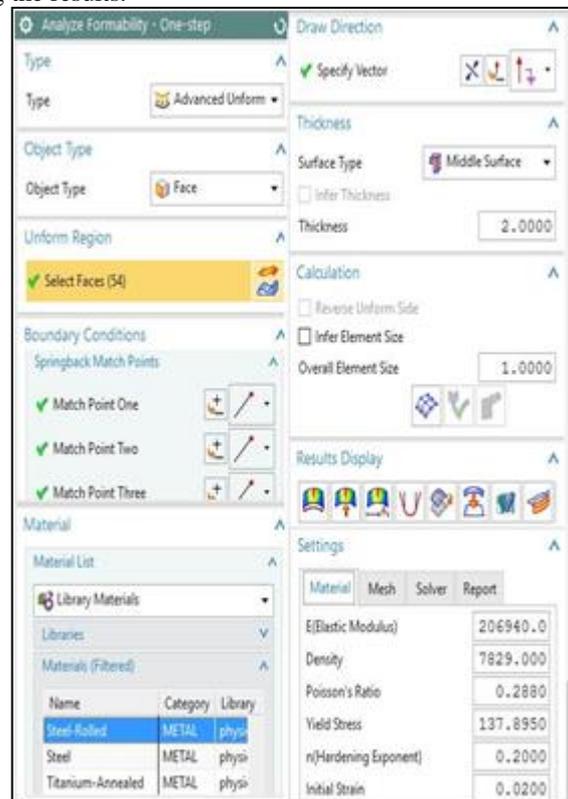


Fig 1: Analysis Step.

By using One Step Formability analysis method, simulation of design can help to predict errors and modification can be done at early stage before tool manufacturing. Subsequently the labor cost and time lost can be reduced. Therefore One Step Formability analysis methods will gradually replace manual trial-and-error design iteration with sophisticated numerical simulations in the future. It can be seen that the increasing demands of using One Step Formability analysis method in the manufacturing process (especially in the pre-processing analysis stage) will greatly enhance the efficiency and saving of time and manpower.

### 3. GEOMETRY AND FE MODELLING

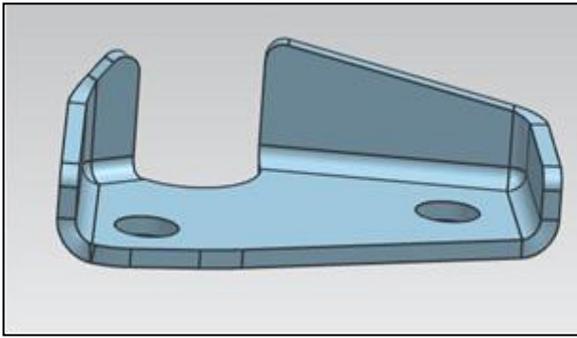


Fig 2: Chain guide mounting bottom bracket [Component].

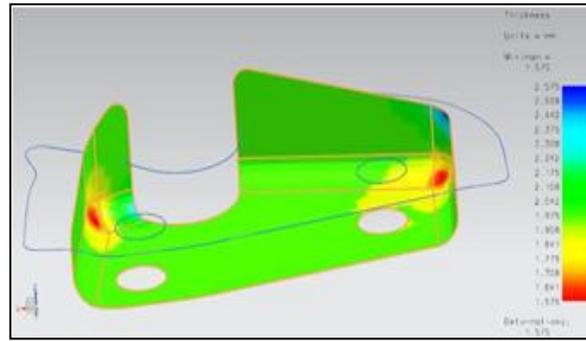


Fig 3: Thinning.

Above fig 3 shows the thinning analysis. Thinning of sheet metal occurs when excessive pressure is exerted on the sheet metal and the clearance is less. Here the maximum thinning is occurring in the corners of the forming zone. Red mark shows the maximum thinning occurring zone.

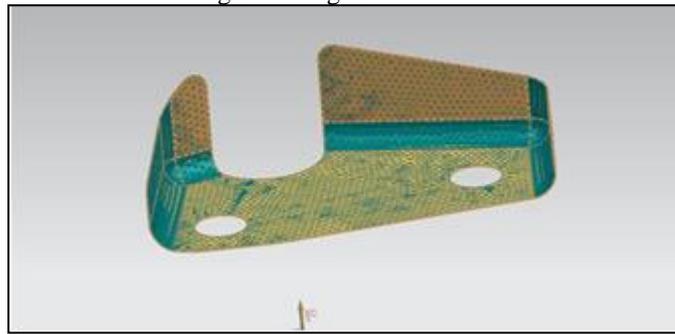


Fig 4: FE Mesh.

The completed is meshed and has 2574 No of Nodes and 4897 Number of Elements which consumed 4.67s for computing the analysis.

The above fig 4 shows the meshing operation. Applying boundary condition like applying circular fix the faces on the component. The yellow marks on the component show that the face is placed on the die. The blue mark shows the press force applied to form the component.

### 4. RESULTS AND DISCUSSION

The stress distribution on the component is shown in fig 5. If the load is applied on component the deformation of the component takes place so that it takes the desired shape of forming. The red mark on the component shows that max stress is applied on that spot. This indicates that measurements should be taken care on that spot. Blue mark is minimum stress is applied on the component.

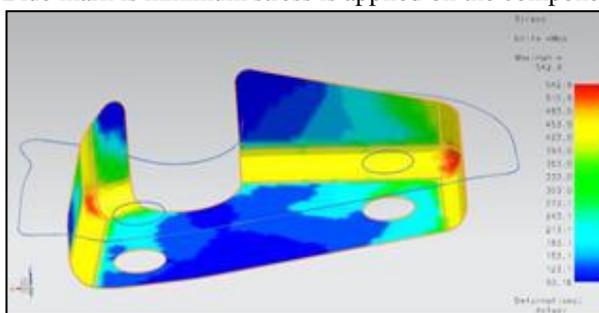


Fig 5: Equivalent Stress.

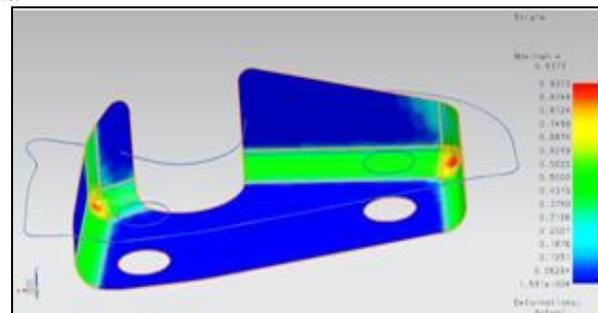


Fig 6: Equivalent Strain.

The strain equivalent component is shown in fig 6. If the load is applied on component the elongation of the component takes place so that it takes the desired shape of forming. The red mark on the component shows that max elongation is act on the spot. This indicates that measurements should be taken care on that spot. The green mark is elongation act on the component. Blue mark reason elongation acts is too low we can easily view in the above figs.

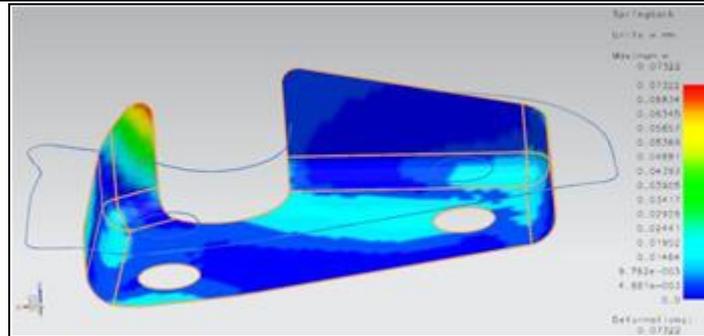


Fig 07: Spring Back.

The spring back effect results shown in the above fig 7. Spring back occurs when the material angularly tries to return to its original shape after being bent. When forming process on the press tool, it will over bend to the bending angle, which is angularly past the required bent angle, compensating for the spring back. Over bending to the bending angle allows the desired bent angle to be attained when the part is released from pressure

## 5. CONCLUSION

From the above trial of the chain guide mounting bottom bracket component the Iteration the stress is occur in the curved reason ,it may generate wrinkling or warping on the forming corner surfaces so by using analysis results we can easily avoided it .

In this component there are three operations are going Forming, Blanking and piercing. So we are considering only for the operation of Forming.

We can observe that were the stresses act and spring back results. Stress analysis serves as a very important tool for behavior prediction of designed model in working conditions.

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