DEFORM™ Application #106

Aluminum Impact Extrusion

Background:

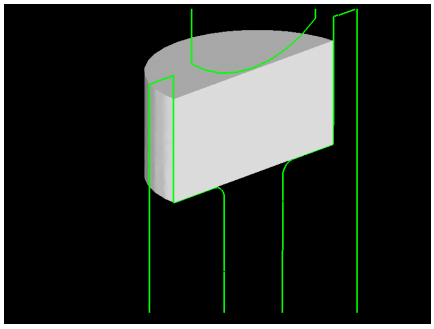
Process simulation is used to understand why a defect or problem occurs during the manufacturing process. In an ideal world, the design process would not allow these problems to ever hit the shop floor. Leading companies, such as JLO Metal Products in Chicago, Illinois have used DEFORM™ to analyze aluminum impact extrusions at the quotation stage.

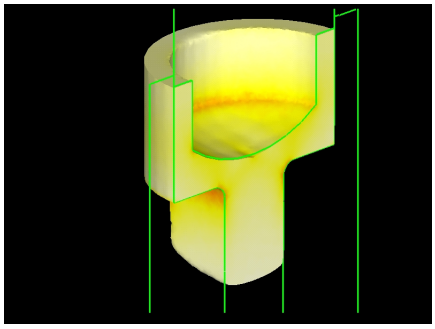
Design Alternatives:

A 6061 aluminum suspension component was simulated as an impact extrusion using DEFORM™-3D. The part was formed in one operation on a Herlan P12 mechanical press. The objectives were to minimize input material and produce a defect-free part.

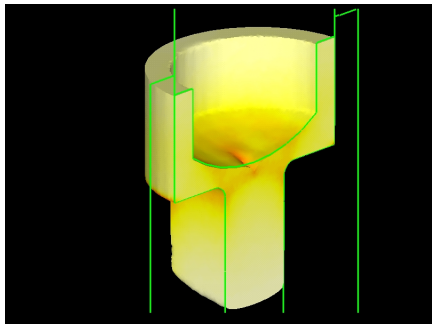
The simulation was run as a non-isothermal three-dimensional analysis using a rigid plastic material model. Fully automatic remeshing allows the model to continue without operator intervention when the mesh becomes distorted. Automated interpolation retains process field variables after remeshing.

The analysis indicated that flash would occur during the extrusion process due to the high extrusion ratio and clearance between the die and liner. This did occur in production. After the initial simulation was run, the flash formation was suppressed in order to minimize computer time. The simulation depicted a piping defect or cavity formation at the end of the punch stroke. This prediction was discussed with the final customer, who found it to be of no consequence. Thus parts were manufactured using this process. The actual parts matched the DEFORM™-3D prediction quite accurately.





The simulation results depict the formation of the piping area when the volume under the nose of the punch becomes thin. The images shown represent a section of the workpiece and it's interaction with the dies. The start of the process is shown above and the end of the forging stroke is shown on the right. The view to the upper right represents 70% of the punch stroke



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Summary:

According to Dan Rizzo, design engineer at JLO, “using the DEFORM™ simulation information, we were able to manufacture the part in one stroke, reduce raw material usage by about one third, give the customer a closer to net shape part and predict the defect (which was inconsequential to the customer).”

The part as extruded at JLO is shown. Note the flash on top (left) of the part.

The piping area is shown as a dark horizontal mark directly under the punch face.

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