Evaluation of Process Parameters of Conical Cups in Incremental Deep Drawing using AA6061

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ABSTRACT

Incremental deep drawing is an advanced sheet metal forming technique and plays an important role in small batch production (or) rapid prototyping. In this process a series of small incremental deformation forces imposed on a sheet to form it into a final workpiece. The process is carried out on a CNC machine using round tipped tool and the path of the tool is controlled by the part program generated using MATLAB software.

Present work was focussed on the Finite Element Analysis of Incremental deep drawing process to form conical cups using AA6061 using Finite Element Analysis software code namely ABAQUS 6.14. The investigation was to optimize the process parameters such as Sheet thickness, Step depth, Coefficient of friction and Tool radius. Design of experiments are carried out as per Taguchi technique using L9 orthogonal array. ANOVA was performed on the results of Taguchi trails to know the significance of each process parameter and their influence on formability of cups.

CONCLUSION

In the present work, the finite element analysis is successfully implemented to incremental drawing process for the AA6061 alloy sheet. Sheet thickness is the major influencing parameter on the formability of conical cups of AA6061 alloy.

The two main factors influencing the effective stress for conical cups made from AA6061sheet are the sheet thickness and tool radius.

The strain rate was linearly increased with the sheet thickness and it is low for step depth of 1 mm. The strain rate was increased with the tool radius. And the effect of coefficient of friction on strain rate was very minimal.
The thickness reduction is greatly effected by sheet thickness. The majority of thickness reduction takes place in the walls of the cup but not in the bottom of the cup. The elements in the mid region of cup walls are elongated higher than bottom of the cup walls.

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