Formability Analysis of Parabolic Cups drawn using Single Point Incremental Forming Process Using AA7049

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ABSTRACT

Single Point Incremental Forming (SPIF) emerges as a promising metal forming technique. SPIF involves localized deformation of a sheet blank using a simple spherical or hemispherical tool. This tool is affixed to a basic CNC machine equipped with three degrees of freedom (X, Y, and Z axes), allowing for precise tool movement along a predetermined path with vertical feed. This project discusses about the finite element analysis of single point incremental sheet forming (SPIF) process to form parabolic cups using aluminum alloy AA7049. ABAQUS 6.14 software code is used for finite element analysis. The process parameters of SPIF are maximum equivalent stress, strain, sheet thickness. Design of experiments was carried out as per Taguchi technique using L9 orthogonal array. ANOVA is done on the results of Taguchi trails.

CONCLUSION

In the present work, the finite element analysis is successfully implemented to incremental deep drawing process for the AA7049 alloy sheet. Sheet thickness is the major influencing parameter on the formability of Parabola cups of AA7049 alloy.

The two main factors influencing the effective stress for parabola cups made from AA7049 sheet 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.

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