

Influence of contact and material models on springback simulation in sheet metal forming

Mohsen Safaei

Supervisor: Wim DeWaele

I. INTRODUCTION

Springback or elastic recovery occurs upon removal of the external loads in sheet metal forming. Finite element (FE) simulation is a well-established tool used to evaluate the resulting deviation of the designed product geometry. The aim of this study is to determine the optimal contact and material hardening models for the FE simulations. A U-shape bending experiment [1] has been selected for this study.

II. FINITE ELEMENT SIMULATIONS

As a first verification of the developed FE model, simulation results for an aluminum alloy sheet have been compared to experimental springback test data.

A. Contact modeling

A first contact definition (called type A) that has been implemented is tangential behavior with a coulomb friction coefficient of 0.165. Secondly, a “penalty” type of constraint enforcement method and hard pressure-overclosure function was defined to add normal contact interaction to the previously implemented tangential coulomb friction (type B). The third type (C) of contact definition is a softened constraint enforcement method by applying an exponential pressure-overclosure function.

B. Material hardening laws

Various isotropic hardening laws (Hollomon, Ludwig, Swift, Voce and combined Swift-Voce) have been evaluated. This from the viewpoint of accuracy in

predicting the stress-strain behaviour before and especially after the onset of necking.

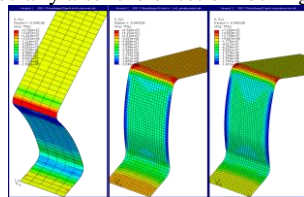


Figure 1. Springback of Aluminium

III. CONCLUSIONS

Considering the accuracy of the contact models, the type B definition combined with a very fine mesh was found to produce the best accuracy.

With respect to the hardening laws, the Hollomon and the Ludwig laws were found not to be accurate enough neither before nor after UTS. The Swift and Voce hardening laws yielded better results. The best accuracy in representing the stress-strain behaviour after the onset of necking was reached by using an equation based on a combination of Voce and Swift laws.

ACKNOWLEDGEMENTS

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REFERENCES

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