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# Modeling of ductile fracture in the blanking process

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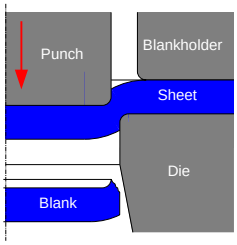
## Introduction

The metal blanking process is an industrially important process. One great problem in modeling this process is the prediction of initiation and growth of cracks, in which the deformation history is a very important aspect. As can be seen in the figure, the crack path determines the eventual product quality.




### Objectives

- Modeling ductile fracture
- Verification of crack initiation and growth in various experimental setups

## Material model

A stress - strain relationship has to be available up to the high strains (3-4) reached in blanking. This is obtained with twenty uniaxial tensile tests with a different predeformation imposed by rolling. Their true stress - true strain curves are plotted and a master-curve of the used *13% Cr steel* is fitted through their maxima ○.

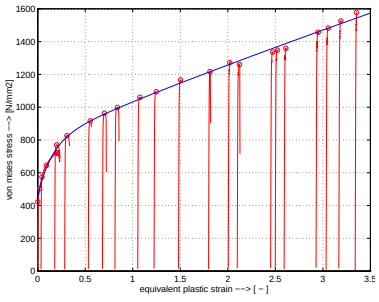



*Image 0*

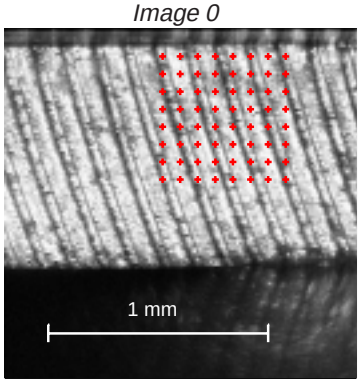



*Image 10*

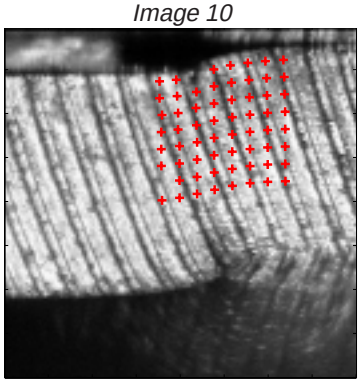


*Image 20*

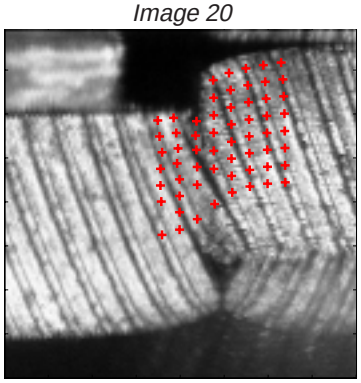
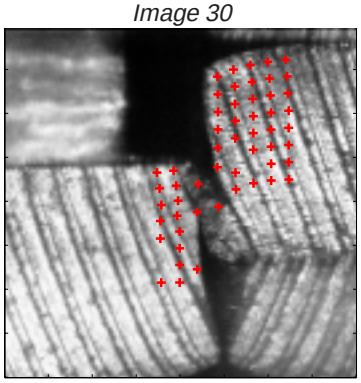
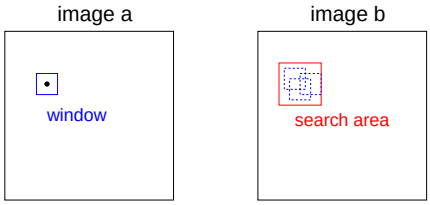


*Image 30*



## Experimental

In-situ observations of the blanking process were made and the displacements were measured, using digital image correlation on 31 subsequent images. 4 stages are shown in the middle.




- Method
  - Take two images
  - Choose point to follow
  - Define window around point
  - Define search area (max. displ.)
  - Calculate window position in search area with optimal correlation, based on existing contrast differences in one image
- Results
  - Optimization iterations do not always converge (1% drop out)
  - Accuracy: $2 \cdot 10^{-4}$ x image size

## Conclusion

Preliminary results suggest that digital image correlation can be used in the experimental verification of a FEM blanking process model.
Besides the experimental verification, work has to be done on modeling ductile fracture in a separate experiment.

## Acknowledgements

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