

## Towards stable three dimensional crack propagation simulations : element development and Remeshing

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# Towards stable three dimensional crack propagation simulations: Element development and Remeshing

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## Introduction

A proper understanding of damage and fracture phenomena gives us the capability to:

- Predict metal behavior in extreme loading cases
- Avoid using limited empirical knowledge

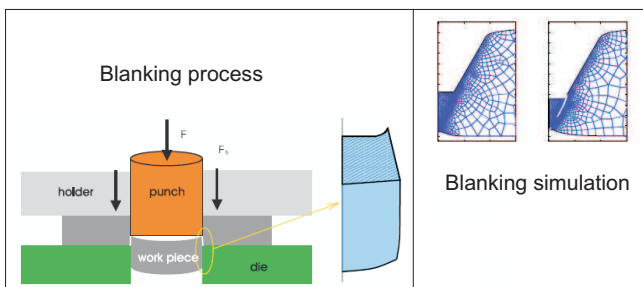


Fig. 1 (Left) a blanking process and (right) numerical simulation to predict the shape of the blank [1].

This understanding consists of:

- Relevant microscopic phenomena (obtained in a parallel project)
- Macroscopic phenomena: geometrical and physical softening of the material, crack initiation and propagation and finally complete fracture

## Objective

Developing fully three dimensional computational predictive tools for damage and crack propagation.

## Methods

Hexagonal elements are superior to tetrahedra because of their performance when dealing with nearly incompressible materials.

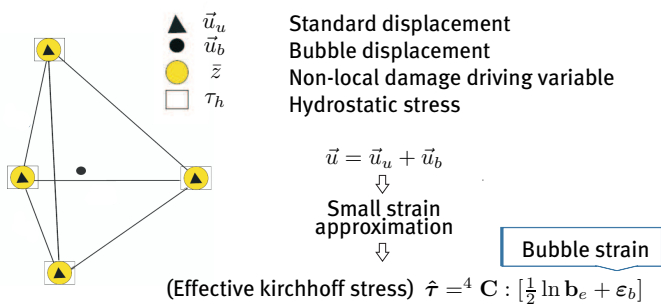


Fig. 2 (Left) the developed element and (right) the used (Bubble enrichment) methodology.

However they are incapable of (re)meshing three dimensional complex shapes, which makes the use of tetrahedra inevitable. Tetrahedral elements may show locking behavior when used for incompressible materials. First an element tailored to deal with (nearly incompressible) plasticity has been developed for large strain elasto-plastic damage behavior -see Figure 2.

## Results

The second necessary step towards crack propagation simulation is developing a stable and consistent algorithm for transferring history data from one mesh to another- see Figure 3.

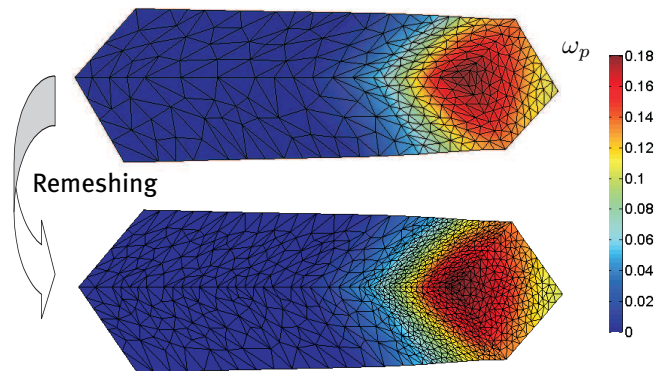
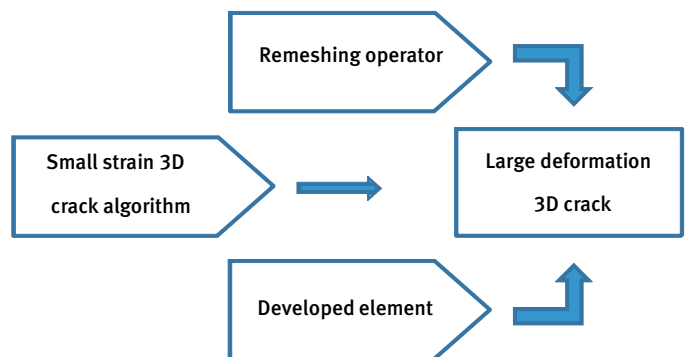


Fig. 3 Transferring damage values from a coarse (top) to a fine (bottom) mesh.

## Future work & Valorization



## References

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