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Forming the limits of damage predictions
From fundamentals to application WP4

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Introduction

Damage and fracture are important criteria in the mechanical design of virtually every product and process. In most cases cracks must be avoided because they compromise the integrity and functionality of the product. Some products and processes, however, also rely on the controlled growth of damage and/or cracks in order to obtain a certain functionality or shape.

Objective

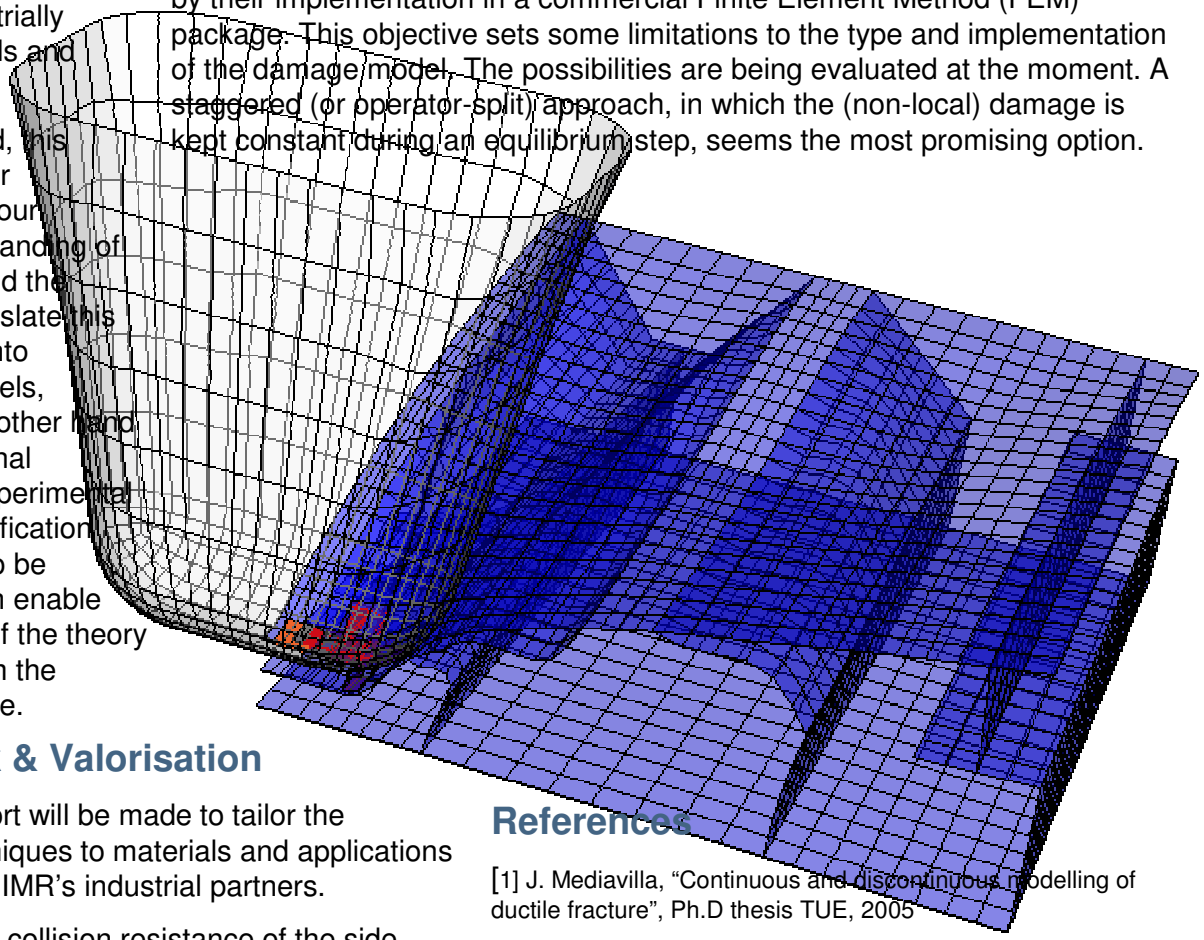
The objective is to develop computational tools which allow one to make quantitative predictions of ductile damage and fracture in industrially relevant materials and applications.

On the one hand, this requires a further development of our physical understanding of ductile failure and the capability to translate this understanding into constitutive models, whereas on the other hand new computational methods and experimental parameter identification methods need to be developed which enable the application of the theory to problems from the industrial practice.

Methods

The tasks defined for work package 4 aim to make the developments made in the other work packages and in the previous NIMR projects on ductile damage [1] available to the industrial partners.

The objective is to enable the industrial use of the developed damage models by their implementation in a commercial Finite Element Method (FEM) package. This objective sets some limitations to the type and implementation of the damage model. The possibilities are being evaluated at the moment. A staggered (or operator-split) approach, in which the (non-local) damage is kept constant during an equilibrium step, seems the most promising option.



Future work & Valorisation

A significant effort will be made to tailor the developed techniques to materials and applications put forward by NIMR's industrial partners.

For example the collision resistance of the side structure, shown in the background, and designed by the Royal Schelde [2] will be investigated.

References

[1] J. Mediavilla, "Continuous and discontinuous modelling of ductile fracture", Ph.D thesis TUE, 2005

[2] A.W.A. Konter, J. Broekhuijsen and A.W. Vredeveldt, "A quantitative assesment of the factors contributing to the accuracy of ship collision prediction with FEM", ICCGS Conference, 2004

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