TECHNISCHE UNIVERSITÄT DRESDEN

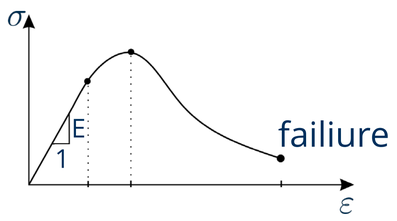
DFG GRK 2250 – Mineral-bonded composites for enhanced structural impact safety

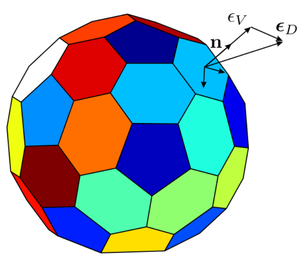
Aurel QINAMI – Doctoral Project B4/I

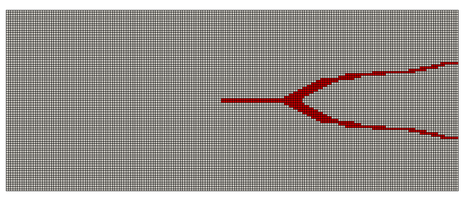
SIMULATION OF STRUCTURAL FAILURE

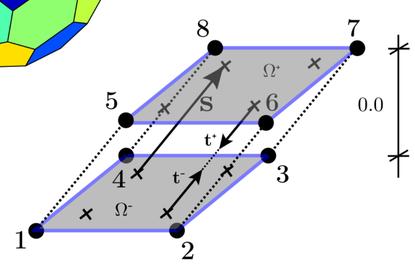
1 OBJECTIVES

- Constitutive modeling of concrete
- Failure modelling for inelastic media
- Bond slip behavior between concrete and ribbed reinforcement



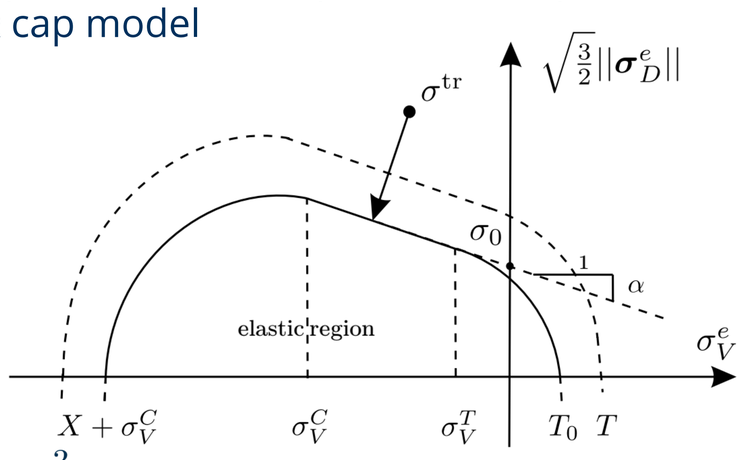






2 METHODS

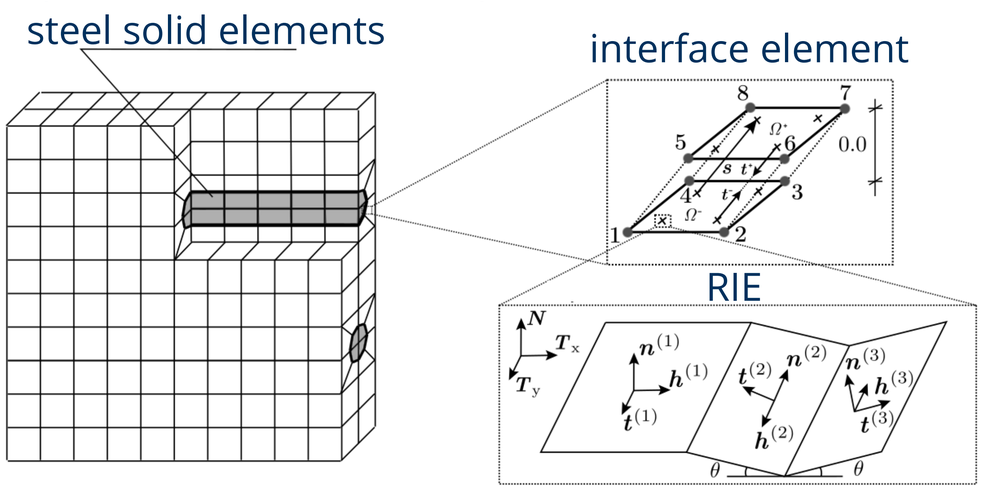
- Development of a microplane rate dependent DRUCKER-PRAGER cap model



$$f^{mic} = \frac{3}{2}\boldsymbol{\sigma}^e_D \cdot \boldsymbol{\sigma}^e_D - f_1^2(\sigma^e_V, \kappa, \dot{\kappa}) f_c(\sigma^e_V, \kappa, \dot{\kappa}) f_t(\sigma^e_V, \kappa, \dot{\kappa}) = 0$$

A. QINAMI et al. IJNME (2020)

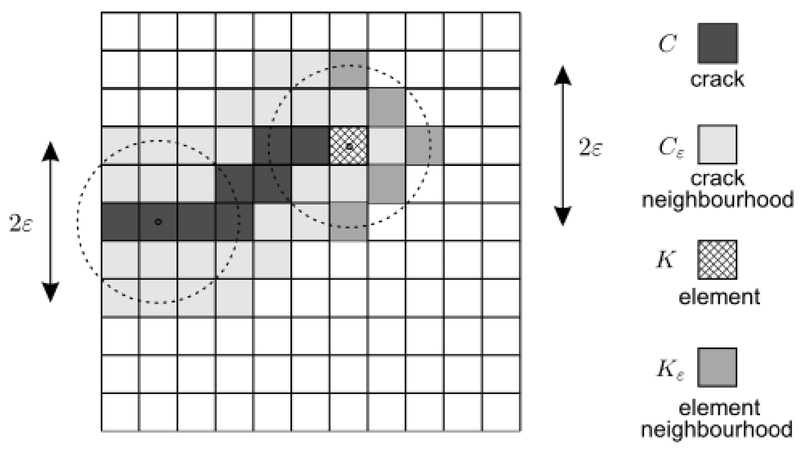
- Implementation of a microplane interface model



- Extension of variational eigenfracture scheme for inelastic problems

$$F_\varepsilon(u, \alpha) := \int_{\Omega \setminus \Gamma} W(\nabla u, \Gamma, \alpha) \mathrm{d}V + f(\alpha) \frac{G}{2\varepsilon} |(S_u)_\varepsilon|$$

$$-\Delta F_K = -\Delta E_K - f(\alpha)\, G_c\, \Delta A_K$$

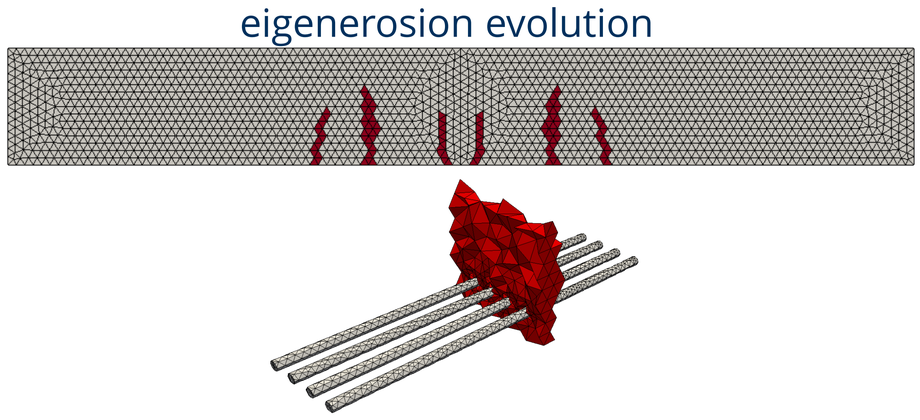


A. QINAMI PhD (2020)

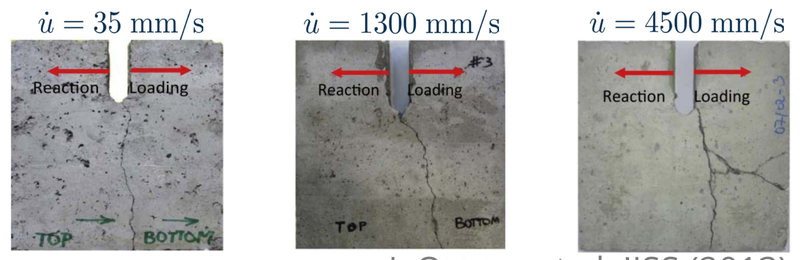
3 RESULTS

- Computation of shear and bending cracks in a reinforced concrete beam

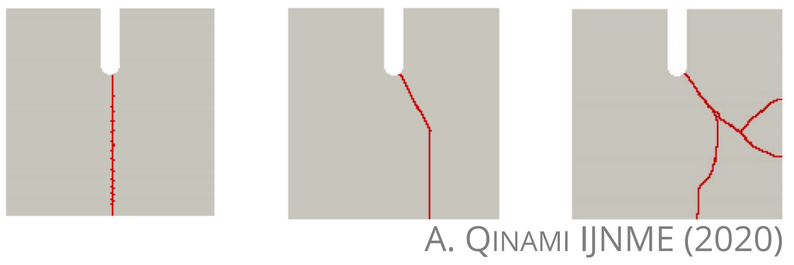
eigenerosion evolution



- Validation of rate effects on crack evolution for a Compact Tension Specimen



J. OZBOLT et al. IJSS (2013)



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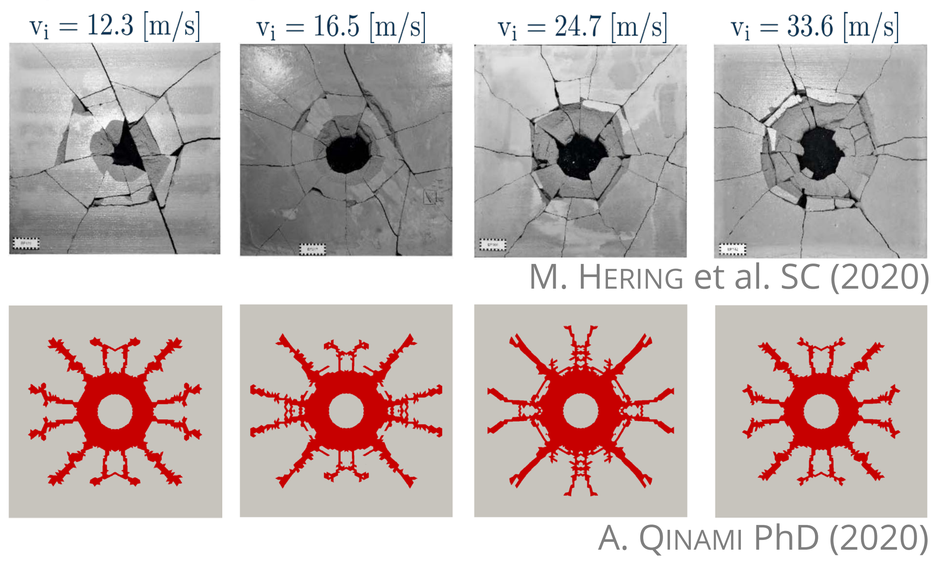
- Failure simulation of plates subjected to impact loading



M. HERING et al. SC (2020)

A. QINAMI PhD (2020)

4 COLLABORATIONS

- A. HERAVI (A4/I): project work, investigation of specimen's geometry effects on the wave propagation
- M. HERING (A5/I): small and big plate experimental results. HERING et al. BUST (2021)
- A. FUCHS (B3/I): discussions on material modelling. HERING et al. BUST (2021)
- C. STEINKE (Associate B4/I): discussions on fracture mechanics. Hering et al. BUST (2021)