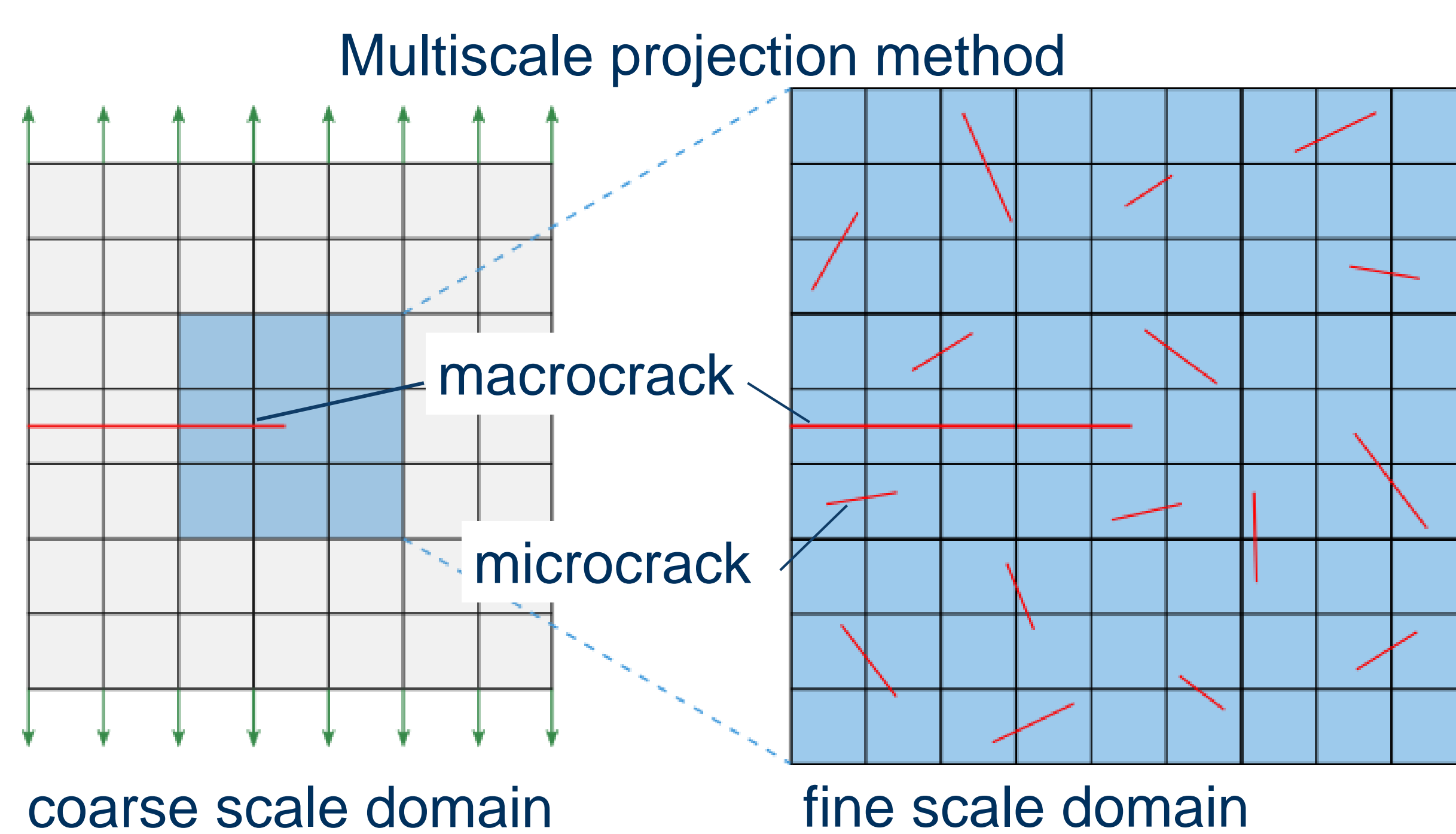


Hannah KNOBLOCH – Doctoral Project B1/II

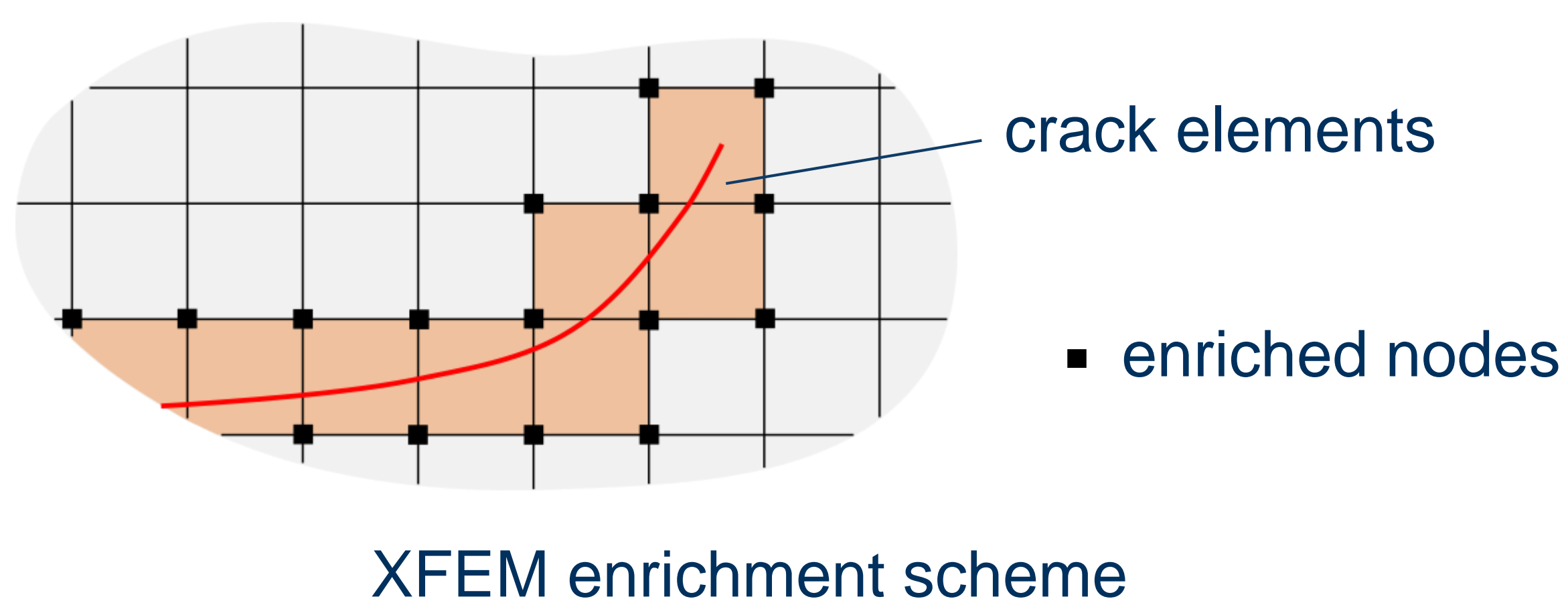
MULTISCALE SIMULATION OF THE FRACTURE BEHAVIOR OF FIBER-REINFORCED CONCRETE UNDER IMPACT LOAD

1 STATE OF THE ART

- Essential to take into account material behavior on the micro-scale in simulations of fiber-reinforced concrete
- Multiscale projection method (MPM): possibility to simulate the interaction of micro- and macro-cracks

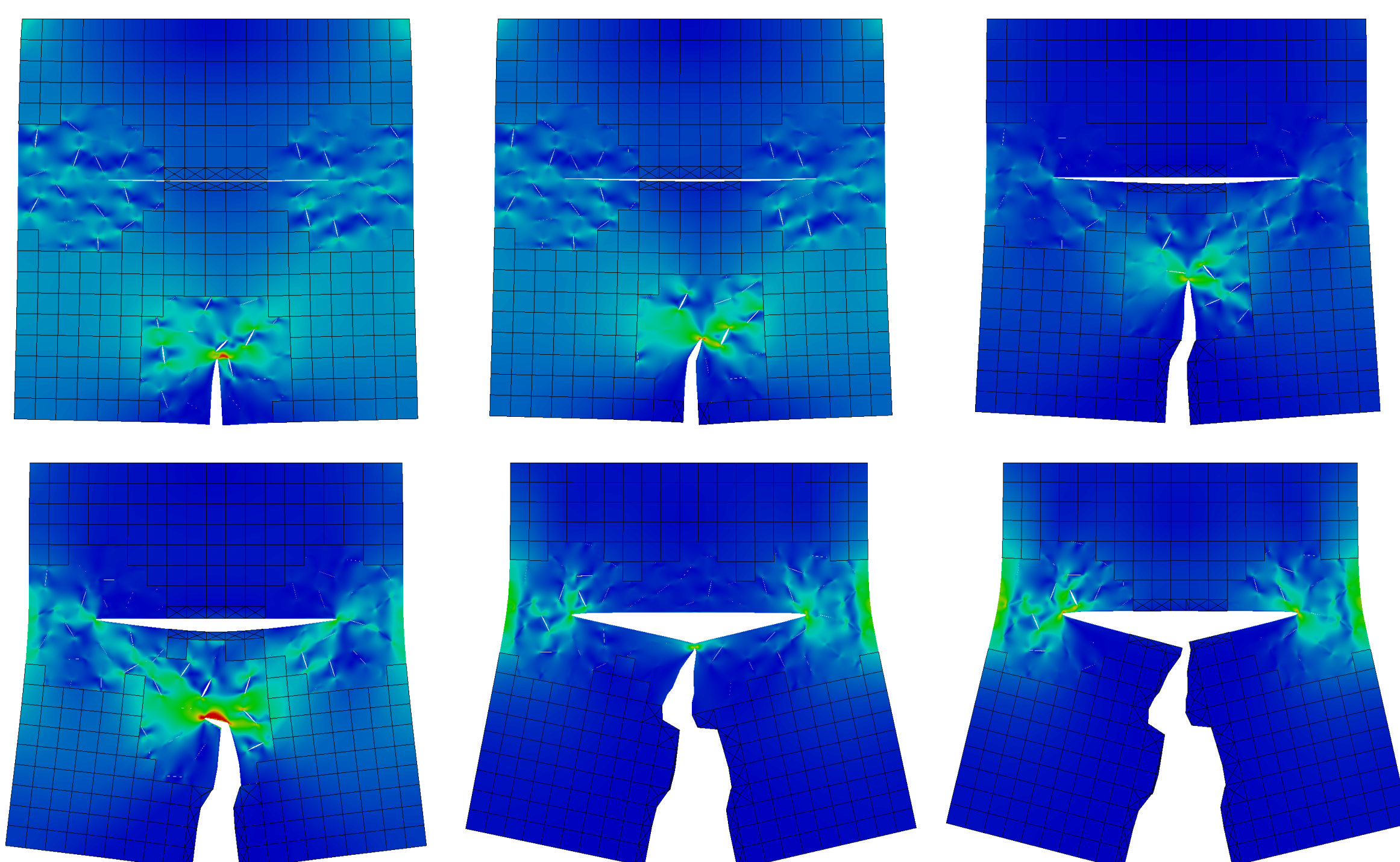


- Simulation of fractures with the extended finite element method (XFEM) for an accurate approximation of displacement discontinuities in relatively coarse meshes



2 OBJECTIVES

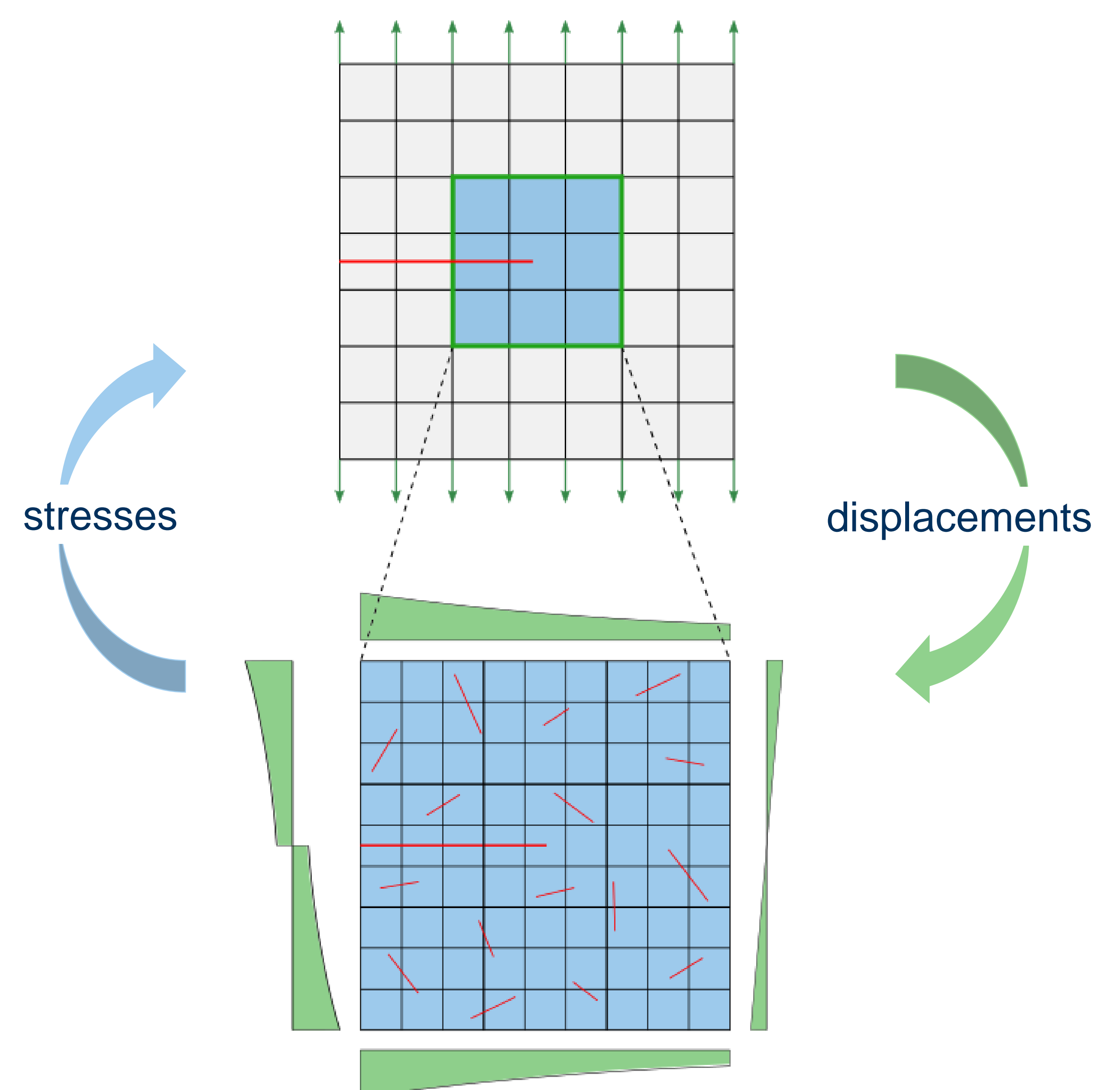
- Predict the macroscopic failure while taking into account defects, such as cracks on the micro-scale
- Accurately simulate crack nucleation, propagation and coalescence of cracks under impact loads



Multiscale crack propagation and coalescence
M. HOLL et al. Int. J. Numer. Meth. Engng. (2013)

3 CONCEPTS

- Multiscale projection method to capture localization effects mesh independently
- Projection of inertia terms and investigation of dynamic effects between the scales
- Handling of inner variables on multiple scales
- Suitable time integration scheme to capture highly dynamic effects
- Adjustment of material model for fiber-reinforced concrete
- Simulating crack face contact by implementing a suitable contact formulation
- Investigating the material behavior of fiber-reinforced concrete under impact tensile and shear loads



Coupling of fine and coarse scale

4 PLANNED COLLABORATIONS

- A. TAWFIK (A4/II): Shear failure simulations with the MPM
- J. STÖCKER (B3/II): Comparison of simulation results for hybrid reinforced concrete
- H. LE XUAN (A1/II): Comparison of experimental and numerical investigations of 3D reinforced concrete
- A. CHIHADDEH (B4/II): Formulation of effective material model on macro scale
- M. POPA (A2/II): Application of insights on fiber characteristics into numerical fine scale model
- A. FUCHS (B3/I) and A. QINAMI (B4/I): Material model developed in first cohort will be implemented
- V. KLEMP (B1/II assoc.): Further development and extension of the multiscale projection method