TECHNISCHE UNIVERSITÄT DRESDEN

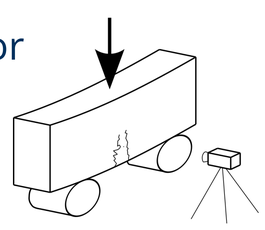
DFG GRK 2250 – Mineral-bonded composites for enhanced structural impact safety

Frank Liebold – Doctoral Project C1/I

PHOTOGRAMMETRIC METHODS FOR CRACK DETECTION AND ANALYSIS IN CIVIL ENGINEERING MATERIAL TESTING

1 OBJECTIVES

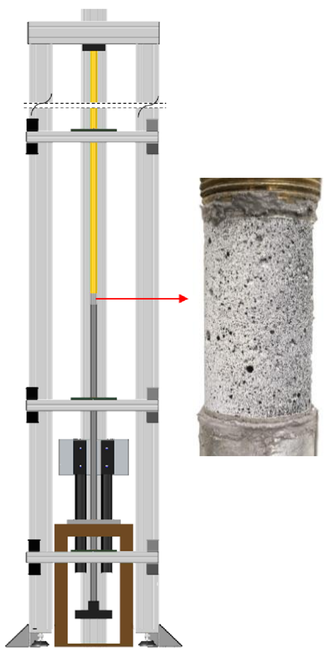
- Developing photogrammetric methods for deformation analysis in material testing
- Considering brittle matrix composites
- Analyzing of (multiple) crack patterns



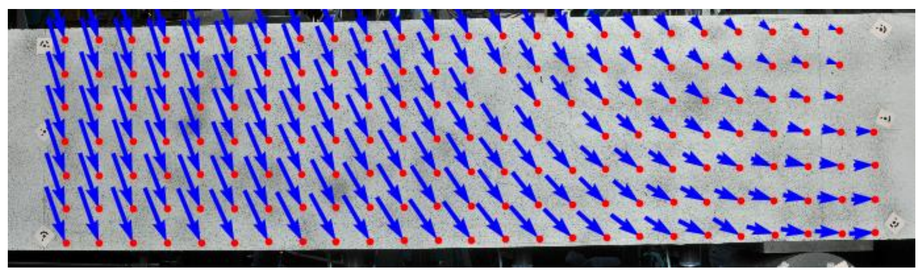
2 METHODS

- Recording of monocular or stereo image sequences
- Applying digital image correlation techniques in order to compute displacement fields
- Triangulation of the matching points
- Triangle mesh shape analysis

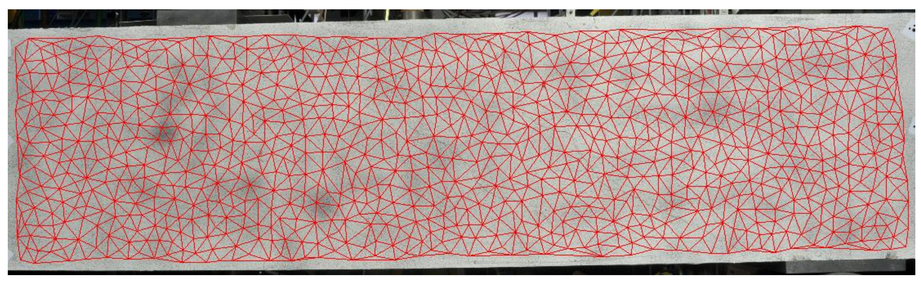
High-speed stereo camera system



Split-Hopkinson tension bar

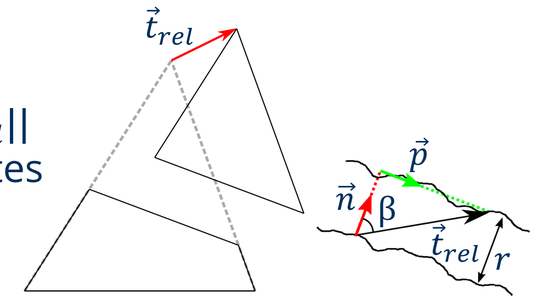


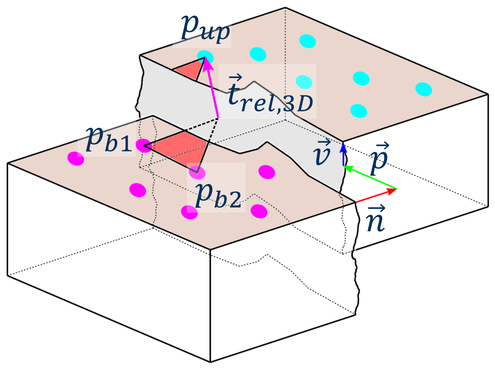
Displacement field using DIC techniques



Triangular network

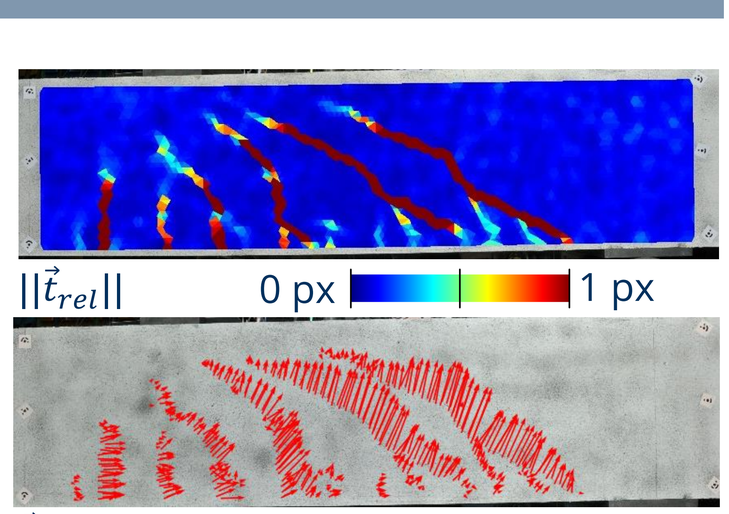
- Development of a new deformation quantity $||\vec{t}_{rel}||$ for brittle matrix composites
- Derivation of crack widths with sub-pixel accuracy
- Application and extension of the 2D algorithms to non-planar surfaces
- Analysis of 3D crack openings

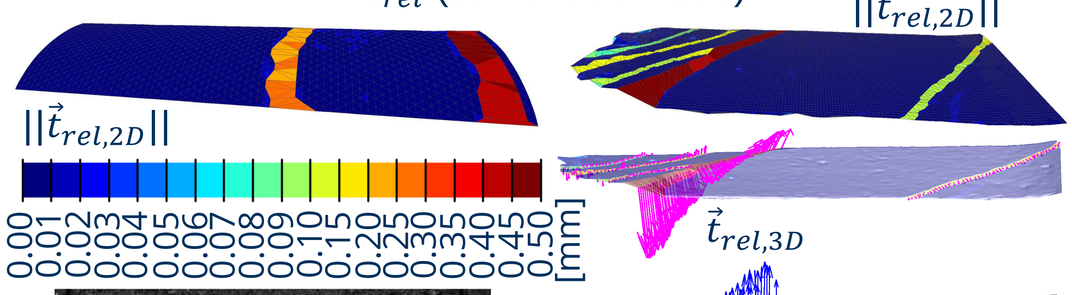




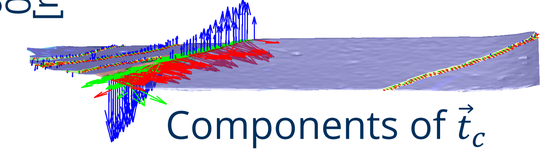
3 RESULTS

- Deformation map of the quantity $||\vec{t}_{rel}||$ for a bending test



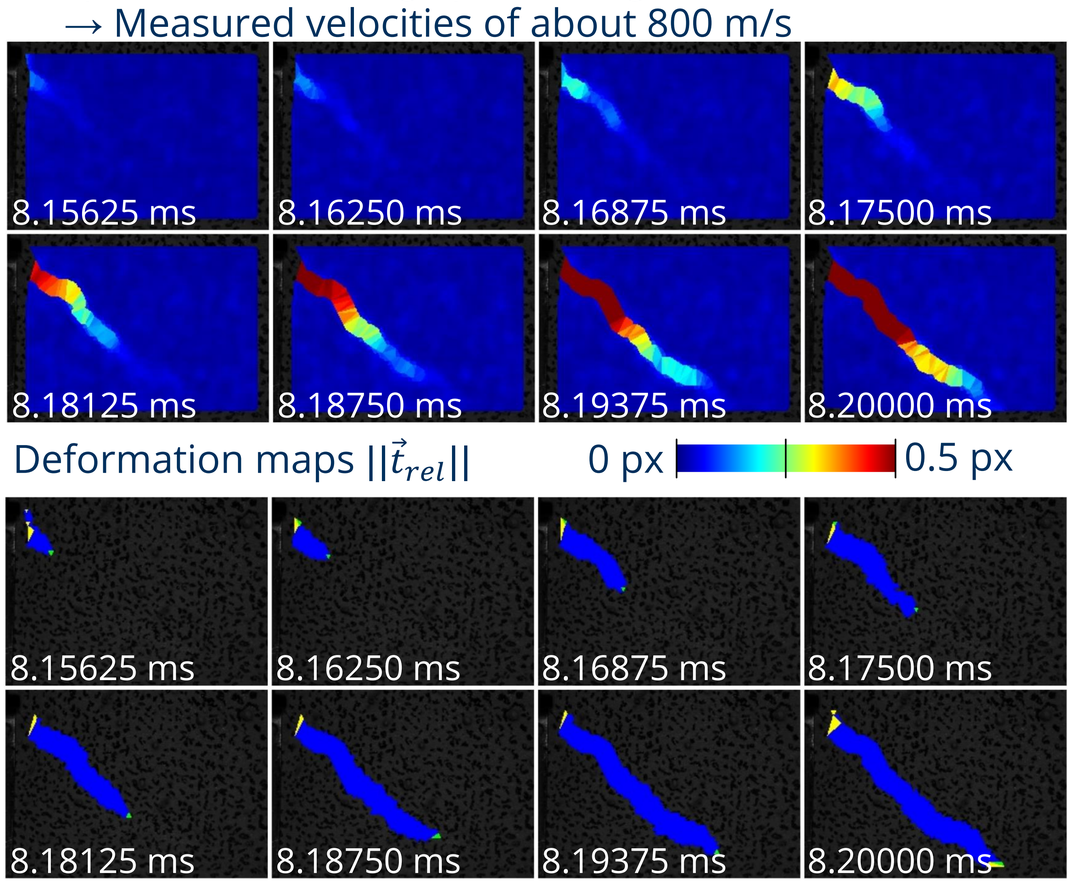


Cylindrical specimen in a tension test



Analysis of 3D crack openings for a torsion test

- Crack propagation velocity determination by high-speed camera image processing (160,000 Hz)
  → Measured velocities of about 800 m/s



Extracted crack triangles with highlighted borders and tips

4 COLLABORATIONS

- A. A. Heravi (A4/I), O. Mosig (associated to M. Hering (A5/I)): Measuring crack propagation velocity
  Liebold et al. Materials (2020)
- T. Gong (A3/I), I. Curosu (Postdoc): Crack analysis of TRC under impact tensile load
  Gong et al. Materials (in preparation)
- A. A. Heravi (A4/I): Crack analysis of non-planar surfaces Liebold et al. ISPRS Archives (2019)