TECHNISCHE UNIVERSITÄT DRESDEN

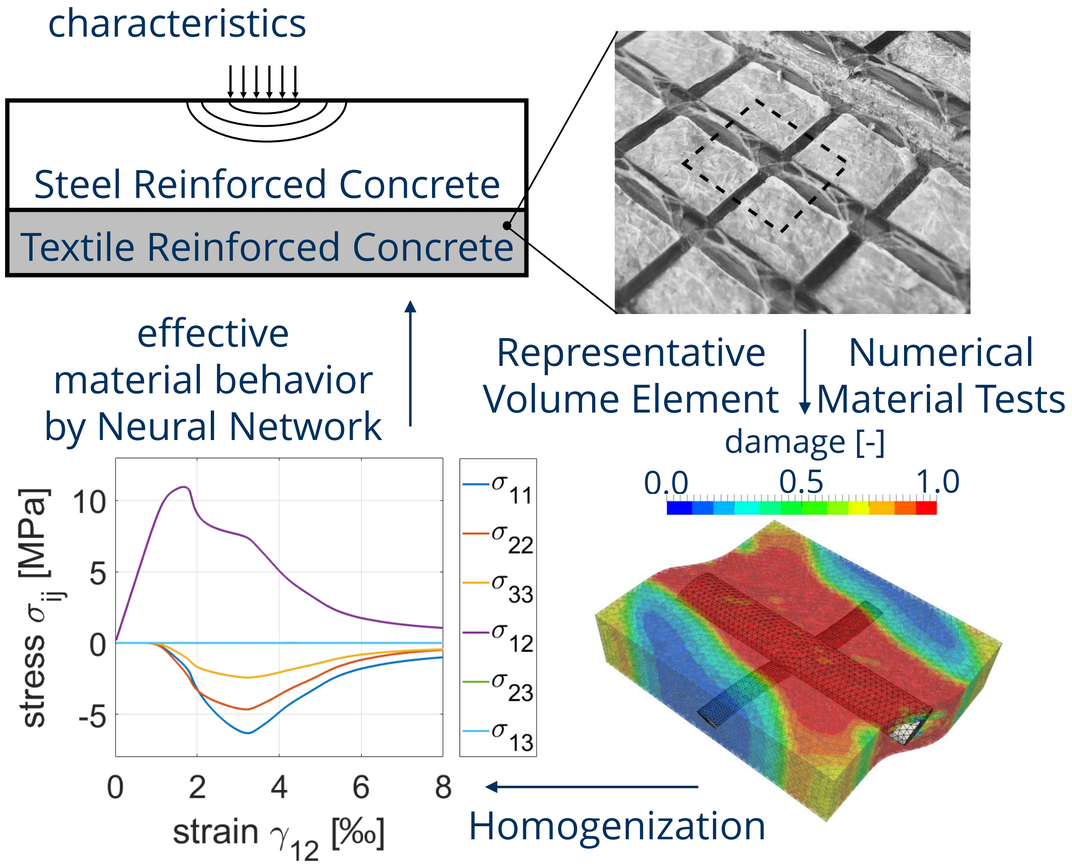
DFG GRK 2250 – Mineral-bonded composites for enhanced structural impact safety

Alexander Fuchs – Doctoral Project B3/I

ON THE NUMERICAL MULTISCALE ANALYSIS OF MINERAL BASED COMPOSITES USING MACHINE LEARNING

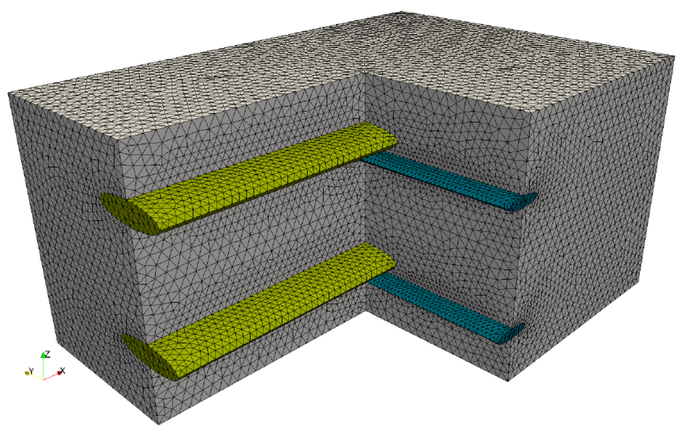
1 OBJECTIVES

- Computational framework for numerical multiscale analysis of Textile Reinforced Concrete (TRC)
- Investigation of mesoscopic damage and load bearing characteristics



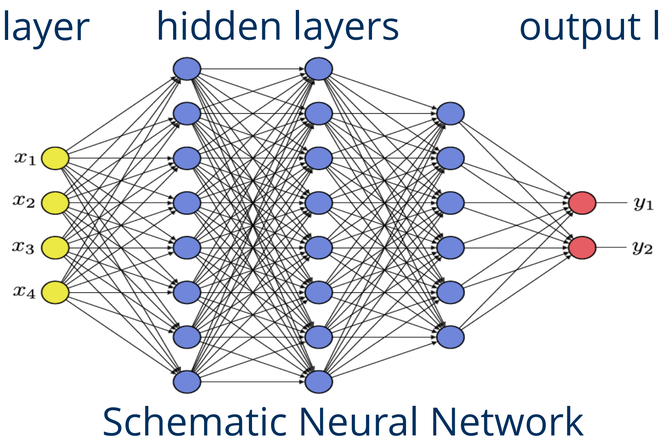
2 METHODS

- Finite element model of Representative Volume Element (RVE) for TRC
- Development of constitutive models for constituents and material interface
- Validation and calibration of material models
- Numerical Material Testing (NMT)



Finite-Element Model of TRC-RVE

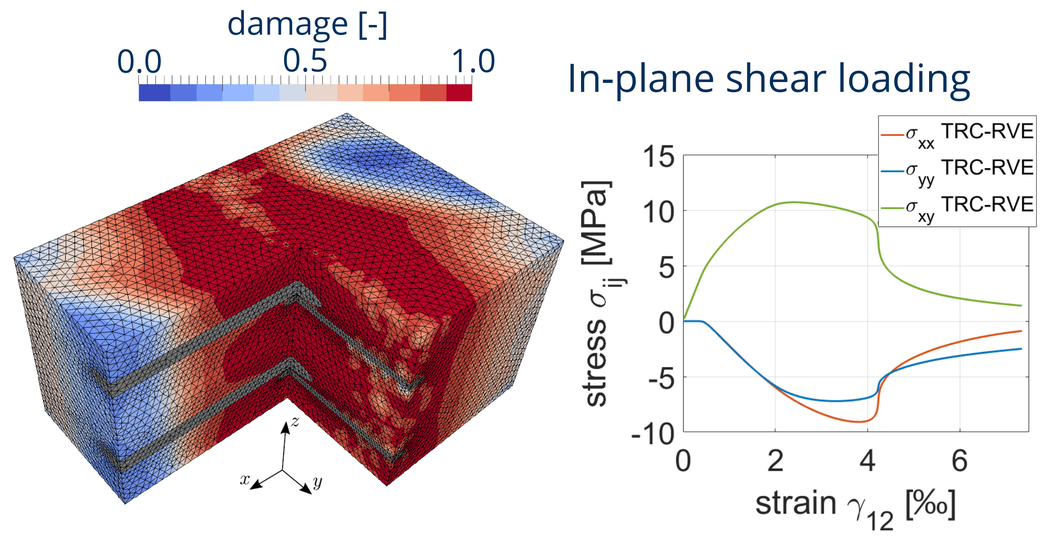
- Neural Network based homogenization framework
- Deep reinforcement learning based hyper-parameter optimization approach for neural networks



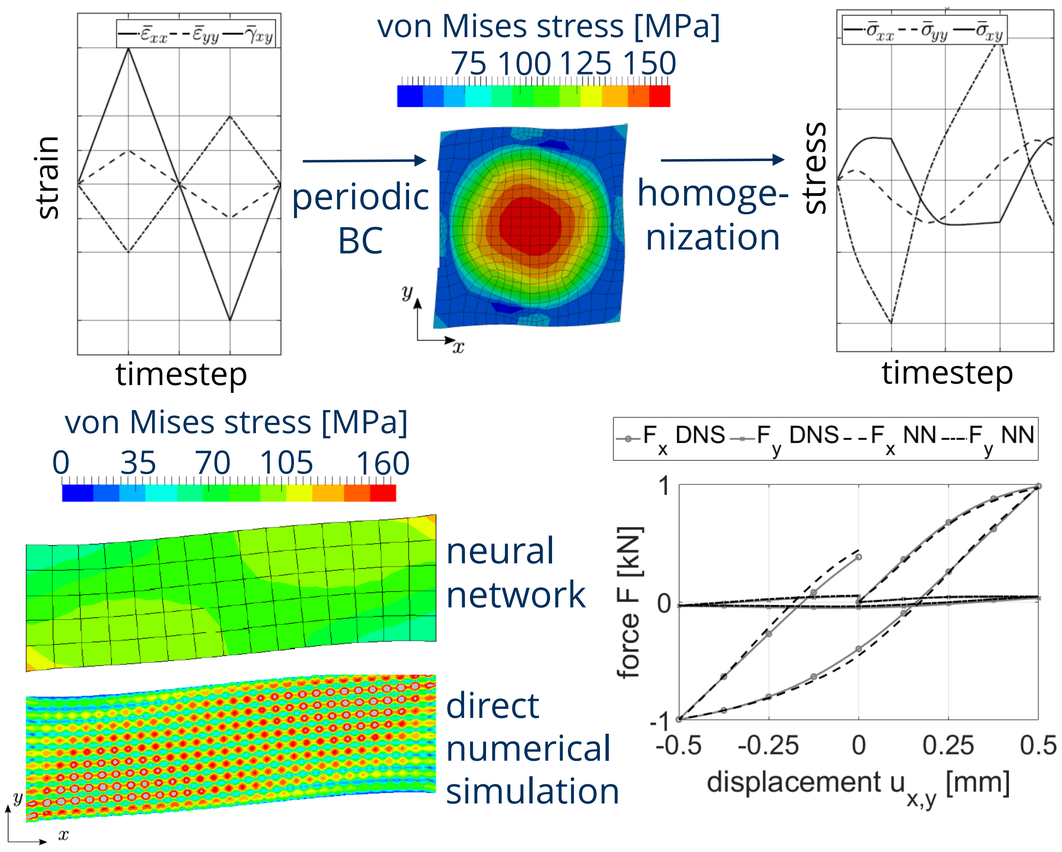
Schematic Neural Network

3 RESULTS

- Numerical mesoscale analysis of RVE in several representative loading scenarios
- Identification of degradation mechanisms
- Effective mechanical behavior



- ‚Proof of Concept' of developed neural network based homogenization framework



4 COLLABORATIONS

- I. Curosu (Postdoc), T. Gong (A3/I): experiments on concrete matrix and concrete-yarn-interface Fuchs et al. Materials (2020)
- A. A. Heravi (A4/I): modelling wave propagation in planar samples Heravi et al. Cem. Concr. Comp. (2020)
- C. Steinke (assoc./I), A. Qinami (B4/I), M. Hering (A5/I): modeling of plate impact Hering et al. BUST (2021)
- M. Böttcher (assoc. B3/II): development of adaptive sampling strategy Böttcher et al. Advances in Engineering Software (under review)
- J. Stöcker (B3/II): knowledge transfer and developing approaches for increased accuracy of neural networks J. Stöcker diploma thesis