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PHASE-FIELD MODELING, X-RAY TOMOGRAPHY AND IN-SITU TESTING OF FRACTURE IN CONCRETE

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Abstract: We present and discuss very recent modeling, computational and experimental results on fracture in concrete obtained in the group of the speaker. In the first part of the talk, we focus on the mesoscopic cracking behavior of concrete. Experimentally, we combine stable wedge-splitting fracture experiments performed in situ in an X-ray tomograph and their analysis with digital volume correlation providing the full three-dimensional displacement field. On the modeling side, we calibrate a variational phase-field fracture model and use it to computationally predict the in situ experiments while applying the measured boundary conditions and resolving the imaged mesoscopic concrete geometry. The comparison between experimental and computational results in terms of both local and global quantities pinpoints strengths and weaknesses of the phase-field modeling strategy. Some of these weaknesses are addressed in the second part of the talk, where we focus on some fundamental aspects of the variational phase-field approach relevant for modeling of fracture in concrete. We discuss some ideas by which variational phase-field models can be endowed with sufficient flexibility to overcome the limitations of existing ones. We show some first results in this direction concerning fracture under multiaxial stress states.