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# Numerical study of the compressive mechanical behaviour of rubberized concrete using XFEM

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## ABSTRACT

This paper presents a two-step computational model of a cross-section of a Rubberized Concrete (RuC) cubic specimen with the purpose of studying its behaviour when submitted to uniaxial compression. The first step consists of applying MATLAB Image Processing to obtain the geometry of the given RuC section, specifically the heterogeneous distribution of rubber aggregates within the concrete matrix. The second step consists of implementing the eXtended Finite Element Method (XFEM) in ABAQUS, to allow the initiation, opening and propagation of cracks within the concrete matrix upon loading, which ultimately lead to the failure of the RuC cross-section. This two-step procedure has been previous implemented by the authors to the study of a cross-section of a RuC cylindrical specimen subjected to splitting tensile loading. The motivation of this work was, therefore, to extend the procedure to the compressive behaviour of RuC. Firstly, the experimental programme conducted to characterize RuC's main mechanical properties is described. Then, the image-processing analysis is explained (i.e. step-one) and the numerical mechanical analysis (i.e. step-two) of the proposed model is described, including implementation of XFEM, and calibration and validation procedures based on experimental data. After that, the numerical results are presented and discussed and, lastly, some conclusions are drawn. It can be stated that the proposed two-step model accurately simulates the behaviour of RuC at a material level allowing a deeper understanding of the internal stress distribution and crack propagation.