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Fracture studies of Ultra-High Performance Concrete using dynamic Brazilian tests

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Abstract

Ultra-High Performance Concrete (UHPC) is a new generation of concrete which shows improved performance and higher strength than traditional concrete. Despite of the huge potential in application, technical information about this material is still limited. This contribution presents a study on the dynamic fracture of UHPC.

Two different Brazilian discs, namely circular disc specimens and flat end specimens, are tested in a Split-Hopkinson-Pressure Bar (SHPB) setup. The Brazilian disc specimens are impacted by a pressure pulse which generates a strain rate of 30 s^{-1} . From the resulting forces the dynamic tensile strength is deduced and, in addition, the dynamic elastic modulus of UHPC material is determined.

A data acquisition system records the strain history during the test by means of strain gauges mounted on the bars and on the specimens. During the tests a high-speed photograph system is focused on the specimens and a subsequent fractographic analysis identifies the effect of the loading rate on the surface roughness. Additionally, a numerical fracture analysis using the extended finite element method has been performed and shows a good agreement with the experiments.

Keywords: Brazilian splitting test, Ultra-high Performance Concrete, Split-Hopkinson pressure bar, dynamic tensile strength, XFEM

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