

1. FATIGUE BEHAVIOUR OF CRACKED SFRC ON SINGLE FIBRE PULL-OUT TESTS

Description

Investigation on the behaviour of steel fibres subject to cyclic pull-out loads (fatigue). The study focuses on characterizing the performance of steel fibres subject to pull-out cycles within small pull-out strains (e.g. 0.1-0.5mm), and evaluating the extent and development of localized damage at the fibre-matrix interface using X-ray micro-tomography.

Aim and objectives

The aim of this project is to characterize the residual mechanical performance of cracked SFRC under cyclic fatigue loading in tension, and identify and understand the local damage mechanisms at the fibre-matrix interface. The following objectives are defined:

- 1- Summarize and categorize the existing literature on tensile-fatigue performance of SFRC, focusing on the pull-out behaviour of single fibres.
- 2- Optimize the design, construction and operation of an existing tailored test-setup for the execution of fibre pull-out testing.
- 3- Characterize the pull-out performance of commercial fibres under cyclic tensile-loading (fatigue), at several damage levels (i.e. fibre pull-out of 0.1-0.5mm).
- 4- Evaluate the local damage at the fibre-matrix interface (fibre hook) using x-ray tomography.

Methodology

In order to fulfil the abovementioned aim and objectives, the study will comprise the following tasks:

- 1- Literature review: Identification, classification and summary of scientific literature
- 2- Macro-scale experimental study: Pull-out testing on standard test-rig at 119
- 3- Micro-scale experimental study: Pull-out testing on tailored test-rig inside CT-scanner
- 4- Analysis of results: Descriptive statistics of the experimental data, image analysis and exploration of x-ray scans (tutorials will be provided).

Minimum requirements

The project is oriented to MSc education level, preferably a group of 2 students. The students are expected to be able to work independently on theoretical, organizational and practical level (introduction to tasks will be provided). The specific requirements for accessing this project are:

- 1- Proficient English level on a technical basis, and understanding of scientific and technical literature
- 2- Intermediate-level programming skills (e.g. Matlab, Python) and intermediate-advanced informatics skills (text processing, excel etc.)
- 3- Intermediate-level on statistics (exploratory statistics at BSc/MSc level)
- 4- Basic understanding of electronics and mechanical components
- 5- Advanced understanding of concrete technology and mechanics of materials

Remarks on experimental project: Students will need to have a reasonably free schedule, and will have to prioritize project activities over other obligations. Extra ECTS may be added to the project upon agreement.

Recommended literature (background)

- Bentur, A., Mindess, S., 2006. Fibre Reinforced Cementitious Composites, Second Edition, Second. ed. CRC Press.
- Neville, A.M., 2012. Properties of Concrete, IV. ed. Prentice Hall, Harlow, UK.
- Mehta, P.K., Mehta, P.K., Monteiro, P.J.M., 2006. Concrete: microstructure, properties, and materials, III. ed. McGraw-Hill, Berkeley, California.
- Bozik, Simon. 2016. "Single Fiber Pullout of Steel Fibers from Concrete, Enkelt Fiber Tilbagetrækningen Af Stålfibre Fra Beton."