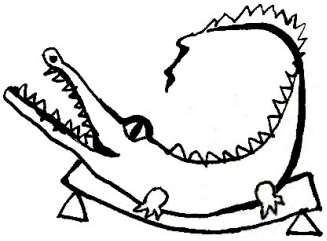
Structural Mechanics Seminar

Thursday, January 22, 2026 from 10 a.m.
BUT, Faculty of Civil Engineering, Veveří 95, Brno, roo-m C421



Characterisation of Concrete Fracture Under Multiple Loading Cases and Environmental Conditions

Petr Miarka *Ústav fyziky materiálů Akademie věd České republiky*

Fracture testing of concrete has a long and rich history dating back to the 1970s. Today, advances in imaging techniques, data acquisition, and computational processing allow us to revisit this topic with unprecedented precision. This invited lecture will present recent, primarily experimental, results on the characterisation of concrete fracture development. Particular emphasis will be placed on the integration of modern imaging approaches, including 3D and 4D techniques, inverse analysis, and data-rich testing strategies to more accurately identify, quantify, and interpret fracture and damage processes. The talk aims to demonstrate how these methods facilitate the characterisation of concrete fracture processes under cyclic loading, hydration heat evolution, and mixed-mode I/II loading scenarios.

Reliability Assessment of Design Resistance Using Eurocode-based Procedure

Martin Vild *VUT v Brně, Fakulta stavební, Ústav kovových a dřevěných konstrukcí*

Assessment of reliable design resistance using testing of elements with the same geometry and material properties is well established in EN 1990, Annex D. However, covering a wide range of geometries and material properties is significantly more complicated. The European RFCS project SAFEBRICTILE addresses this issue by providing a unified guideline for such assessments, with the explicit recommendations for the statistical variability of material and dimensional parameters. These assumed variabilities were since subsequently accepted into EN 1993-1-1:2024 or, for example, EN 1993-1-14:2025. The above mentioned reliability assessment is presented on a steel column web panel in transverse compression, considering (i) the standard Eurocode design procedure and (ii) predictions of a deep neural network trained on a set of finite element models. Furthermore, the reliability of a numerical design calculation based on the Component-Based FEM, as implemented in the IDEA StatiCa software, is evaluated using the net-section tensile resistance derived from a large experimental database. Finally, key challenges in the reliability assessment of design methods are discussed, including the definition of statistically consistent batches, tail fitting of resistance distributions, and acceptance levels of a safety factor.

Predicting SCC Drying Shrinkage via Short-Term Experiments and FE Simulations

Petr Havlásek *ČVUT v Praze, Fakulta stavební, Katedra mechaniky*

Self-compacting concrete (SCC) utilizes high binder and fine aggregate content to enhance workability, which unfortunately amplifies drying shrinkage. Furthermore, replacing Portland cement with supplementary cementitious materials introduces significant variability in mechanical properties and shrinkage magnitude. Consequently, modern guidelines—such as the fib Model Code 2020 and the second generation of Eurocode 2—emphasize the necessity of short-term testing to refine initial shrinkage predictions for SCC. Standard specimens require at least one year to determine reliable ultimate shrinkage strains, a duration that is impractical for engineering practice. Smaller specimens can significantly accelerate these experiments but three major obstacles emerge: (i) a potential loss of specimen representativeness relative to the maximum aggregate size, (ii) the "wall effect" causing non-homogeneous material properties near the mold, and (iii) the inherent size-effect on drying shrinkage. This talk addresses these aspects through a combined experimental and numerical approach. Trends from 3-month experimental campaign on sets of prismatic SCC specimens of different sizes are discussed as well as a comparison with modern computational approaches.

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MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

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