Ústav stavební mechaniky
Stavební fakulta
Vysoké učení technické v Brně

Institute of Structural Mechanics
Faculty of Civil Engineering
Brno University of Technology

Pozvánka na přednášku / Lecture Announcement

Název / Title

New advances in the fatigue modeling and lifetime prediction

Přednášející / Lecturer

Alfonso Fernández Canteli
University of Oviedo (Campus Gijón), Spain

Jazyk / Language English

Wednesday 17. 8. 2022, 9:30 h
FCE BUT, Brno, Veveří 331/95,
budova / Building C, místnost / Room 421
zasedací místnost ústavu STM

Abstrakt / Abstract

A methodology, based on probabilistic phenomenological models is proposed, to achieve a more advanced fatigue characterization of materials. It encompasses a dual approach according to the specific type of experimental data collected.

The first approach is concerned with the assessment of single random results corresponding to the fatigue lifetimes. It implies the analytical derivation of the probabilistic three-dimensional σM-R-N model, which allows the influence of the stress ratio, *R*, to be included in the S-N characterization of the material, for σM being taken as the reference driving force. The new model signifies a relevant improvement contribution to the components' design. The model is then extended to the LCF domain.

The second approach is concerned with continuous records of stochastic phenomena representing some damage evolution providing a phenomenological solution based on sample functions, which when normalized may be identified as cumulative distributions functions, preferably, of the extreme value family.

Přednášející / Lecturer

Alfonso Fernández Canteli is an emeritus professor of the University of Oviedo, Spain. He is Mechanical Engineer from the University of Basque Country and performed post-graduate studies at the Civil Engineering Department fo the ETH Zurich, where he worked as research assistant. He got his PhD in Mech. Eng. from the Polytechnic University Madrid. His research interest is focused on the probabilistic modeling in fracture and fatigue of metals, polymers and quasi-brittle materials.

Organizátor / Organizer
doc. Ing. Stanislav Seitl, Ph.D., tel. +420 541 147 362; e-mail: seitl.s@fce.vutbr.cz

Projekty / Projects
- projekt Mobilita zahraničních pracovníků na VUT – RP 1.15

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Pozvánka na přednášku / Lecture Announcement

Název / Title

Fracture behaviour of ultra-high-performance concrete reinforced with carbon microfibers

Přednášející / Lecturer

José David Rios Jiménez

Escuela de Ingenierías Industriales. University of Extremadura, Badajoz, Spain

Jazyk / Language English

Wednesday 17. 8. 2022, 10:00 h

FCE BUT, Brno, Veveří 331/95,
budova / Building C, místnost / Room 421
zasedací místnost ústavu STM

Abstrakt / *Abstract*

The use of concrete is experiencing a significant increase in the field of renewable energies for the construction of wind turbine towers. These tubular structures are exposed to continuous cyclic wind loads. If not properly taken into account, the higher amplitude load cycles can lead to high tensile stresses. These loading conditions require the concrete to be as resistant as possible to alternating fatigue and especially to tensile stresses.

In this work, the effect of the addition of different types of carbon microfibres on the fracture behaviour and tensile strength of an ultra-high performance concrete has been analysed. Experimental tests have been carried out on notched prismatic specimens using three types of carbon microfibres and different carbon microfibre contents (0-20 kg/m^3). All fibres have the same diameter (7 μm) and different lengths. The tensile strength of the carbon microfibres is 4200 MPa, which significantly reduces the probability of fibre breakage failure mechanism.

Přednášející / Lecturer

José D. Ríos is an Assistant Professor from the University of Extremadura, Badajoz, Spain. He defended his PhD. thesis in Engineering Mechanics, at University of Seville, Spain in 2019. His thesis was entitled "Microstructural analysis of heated ultra-high-performance fibre-reinforced concrete under cyclic loading". He is an expert in fracture mechanics of concrete since his thesis's advisor, Prof. H. Cifuentes, has worked with Prof. B. Karihaloo. José has researched in fatigue behaviour of UHPFRC with Prof. Fernández-Canteli (U. of Oviedo), fatigue behaviour of HSC with Prof. G. Ruiz (U. of Castilla-La Mancha) and nano-reinforcement of cement-based materials with Prof. S. Shah at Northwestern University, USA.

His professional interests: Specialised in the fracture mechanics characterisation of concrete, designs of ultra-high-performance and high-performance concrete, prediction of fatigue life, multi-scale and nano-reinforcement of cement-based materials, modelling of concrete behaviour, X-ray computed tomography analysis, microstructural analysis and thermal effects in concrete.

Organizátor / Organizer

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Projekty / Projects

- Erasmus+ programme for teaching activities funded by University of Extremadura, Spain.

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Pozvánka na přednášku / Lecture Announcement

Název / Title

Accuracy of existing theoretical models on the assessment of the design shear capacity of RC beams reinforced with steel and GFRP bars without stirrups

Přednášející / Lecturer

Renata Kotynia
Lodz University of Technology, Poland

Jazyk / Language English

Wednesday 17. 8. 2022, 10:30 h
FCE BUT, Brno, Veveří 331/95,
budova / Building C, místnost / Room 421
zasedací místnost ústavu STM

Abstrakt / Abstract

The presentation is devoted to the shear of slender concrete beams without transversal reinforcement flexurally reinforced with two types of reinforcement: steel and GFRP (glass fiber reinforced polymer). The research program included 29 single-span, simply supported T-section beams (b = 400 mm, b_w = 150 mm, h_f = 60 mm, h_{tot} = 400 mm) with the axis span of 1800 mm. The three-point loaded beams (with the load located at a distance of 1100 mm from the support) had the shear span to depth ratio a/d in the range of 2.9-3.0 referring to the slender beams. The four times lower elasticity modulus of the GFRP reinforcement caused a mild, progressive shear tension failure mode, opposite to the abrupt failure mode peculiar to the RC beams. The difference in the elasticity modulus of both types of reinforcement resulted in the increase in the shear capacity of the RC beams in the range between 30% and 66% compared to the shear capacity of the GFRP reinforced beams with the same reinforcement ratio. The paper presents a comprehensive analysis of the test results in relation to the design shear capacity according to the selected theoretical models. The generalized assessment of computational analysis indicated that the predicted shear capacity values calculated according to selected models gave good agreement with the experimental results.

Přednášející / Lecturer

Renata Kotynia – Lodz Univuersity of Technology; Full Professor. SC Discipline: Civil and Transport Engineering; Publications: 70 (7 books); H-index: 12; number of citations: 420; Scopus Author ID: 35275335000; ResearcherID: A-5757-2008; ORCID: 0000-0002-7247-1229. Awards: The IIFC Distinguished Young Researcher Award, Zurich, Switzerland (2008); IIFC Fellow (2016); Awards of the Rector of TUL for achievements in scientific and teaching activities (every ear). Member of ACI Committee 440 (FRPR); fib Task Group 5.1; fib Committee T3.4 8.1; RILEM TC 234-DUC; CEN/TC 250/SC 2 (WG1 and WG4); Council IIFC; Vice-President of IIFC (2010-2016).

Organizátor / Organizer
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Projekty / Projects
- projekt Mobilita zahraničních pracovníků na VUT – RP 1.15

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Pozvánka na přednášku / Lecture Announcement

Název / Title

Polynomial chaos expansions for uncertainty quantification of high-dimensional quantities

Přednášející / Lecturer

Lukáš Novák

Vysoké učení technické v Brně

Jazyk / Language: English

Wednesday 17. 08. 2022, 11:00 h

FCE BUT, Brno, Veveří 331/95,
budova / Building **C**, místnost / Room **421**
zasedací místnost ústavu STM

Abstrakt / Abstract

Polynomial chaos expansion (PCE) represents a versatile tool for uncertainty quantification of mathematical models of physical systems. Although PCE is typically used only as a surrogate model of a black-box model, it also allows for the analytical derivation of statistical characteristics of a given quantity of interest (QoI). A combination of computational efficiency and strong theoretical background predetermines PCE as an ideal method for industrial applications. However, PCE was developed as an approximation of scalar QoIs and there is a high demand for its generalization allowing approximations of high-dimensional QoIs such as stress fields obtained from FEM or random fields. The lecture will summarize recent theoretical developments focused on sequential sampling for PCE approximating high-dimensional QoIs decomposed by principal component analysis. The second part of the lecture will be focused on the novel concept of active learning for PCE in the context of highly non-linear functions (possibly with discontinuities or singularities) and the decomposition of the design domain into smaller sub-domains approximated by local PCEs.

Přednášející / Lecturer

Lukáš Novák is an assistant professor at the Brno University of Technology, Faculty of Civil Engineering. He holds a Ph.D. and a Master's degree in Civil Engineering, Structural Mechanics. His research interests lie within the field of uncertainty quantification and structural reliability. He is particularly interested in polynomial chaos expansion, sensitivity analysis, and semi-probabilistic methods for the design and assessment of concrete structures.

Organizátor / Organizer

Ing. Lukáš Novák, Ph.D.
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Projekt / Project

The lecture summarizes result from stay of the lecturer with prof. Michael Shields at Johns Hopkins University, Hopkins Extreme Material Institute financially supported by project Mezinárodní mobilita výzkumníků Vysokého učení technického v Brně II (MeMoV II) under project No. CZ.02.2.69/0.0/0.0/18_053/0016962

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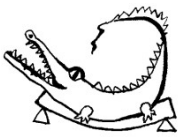

Institute of Structural Mechanics
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Pozvánka na přednášku / Lecture Announcement

Název / Title

On the Fracture process zone development and length assessment under the mixed-mode I/II loading.

Přednášející / Lecturer

Petr Miarka

Vysoké učení technické v Brně

Jazyk / Language: English

Wednesday 17. 8. 2022, 11:30 h

FCE BUT, Brno, Veveří 331/95,
budova / Building **C**, místnost / Room **421**
zasedací místnost ústavu STM

Abstrakt / Abstract

The fracture process zone (FPZ) of high-performance concrete (HPC) is investigated under mixed-mode I/II load conditions, and its formation is studied by applying digital image correlation (DIC). The experimental tests were performed on Brazilian disc specimens with central notch (BDCN) with two different initial notch lengths and various mixed-mode I/II load conditions. The traction-free crack ahead of notch tip was localised, together with the FPZ extent ahead of the crack. Analytical and linear elastic fracture mechanics (LEFM) methods for the critical strain of the FPZ are used to find the FPZ extension ahead of the traction-free crack. Additionally, the crack tip opening (CTOD) and crack tip sliding (CTSD) displacements are measured and analysed. Lastly, the classical analytical formulas used in the prediction of mode I FPZ lengths are adjusted to allow for the prediction of the FPZ length in whole range of mixed-mode I/II. The lecture will present and discuss the experimental results of different FPZ lengths.

Přednášející / Lecturer

Petr Miarka is an assistant professor at Institute of Structural Mechanics, Faculty of Civil Engineering, BUT. His research topics generally cover assessment of fracture and fatigue properties of construction and building materials. His main research activities includes experimental testing of fracture of concrete under the mixed-mode I/II loading with employment of the digital image correlation (DIC) technique.

Organizátor / Organizer

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Projekty / Projects

The lecture summarizes his post-doctoral stay at the Magnel-Vandepitte Laboratory at Ghent University, Ghent Belgium, which was financially supported by project: CZ.02.2.69/0.0/0.0/18_053/0016962 - International mobility of researchers at the Brno University of Technology II