FraMCoS XII

April 23-25, 2025 | Vienna, Austria

12th International Conference on Fracture Mechanics for Concrete and Concrete Structures

Dedicated to the Legacy of Prof. Kaspar Willam

Conference Programme

Editors: Bernhard Pichler, Christian Hellmich, Philipp Preinstorfer

IA-FraMCoS

SPONSORS & EXHIBITORS

MEETING DESTINATION VIENNA
NOW ◆ TOGETHER

Stadt Wien

ATENA
Reinforced Concrete Modeling

CONFERENCE APP

The Conference4me smartphone app provides you with the most comfortable tool for planning your participation at FraMCoS XII.
Browse the complete programme directly from your phone or tablet and create your very own agenda on the fly.
The app is available for Android, iOS, and Windows Phone.
To download the mobile app, please scan the QR code or visit http://conference4me.eu/download .

CONFERENCE OFFICE

Martina Pöll
Technische Universität Wien (TU Wien), Institute for Mechanics of Materials and Structures
Karlsplatz 13, 1040 Vienna, Austria
Tel: +43-1-58801-20211
Email: framcos-12@tuwien.ac.at
Web: https://framcos12.conf.tuwien.ac.at/

WLAN INFORMATION

At the conference venue, WLAN access is available to all participants. Access codes are available inside your badge. Alternatively, you may use your personal eduroam access.

CONFERENCE CHAIRMEN

Bernhard Pichler TU Wien, Austria
Christian Hellmich TU Wien, Austria
Philipp Preinstorfer TU Wien, Austria

IA-FRAMCOS BOARD OF DIRECTORS

Bernhard Pichler (TU Wien, Austria) - President
J.M. Chandra Kishen (Indian Institute of Science, India) - Past President
Jia-Liang Le (University of Minnesota, USA)
Günther Meschke (Ruhr University Bochum, Germany)
Erik Schlangen (Delft University of Technology, Netherlands)
Zdenek P. Bažant (Northwestern University, USA) - Honorary President

SCIENTIFIC COMMITTEE

Syed-Yasir Alam (École Centrale de Nantes, France)
Mark Alexander (University of Cape Town, South Africa)
Nemkumar Banthia (The University of British Columbia, Canada)
Joaquim Barros (University of Minho, Portugal)
John Bolander (University of California, Davis, USA)
Tinh Quoc Bui (Duy Tan University, Vietnam)
Ignacio Carol (Universitat Politécnica de Catalunya, Spain)
Alberto Carpinteri (Politecnico di Torino, Italy / Shantou University China)
Jan Cervenka (Cervenka Consulting s.r.o., Czech Republic)
Eleni Chatzi (ETH Zürich, Switzerland)
Gianluca Cusatis (Northwestern University, USA)
René de Borst (University of Sheffield, UK)
Giovanni Di Luzio (Politecnio di Milano, Italy)
Peter Grassl (University of Glasgow, UK)
Günter Hofstetter (University of Innsbruck, Austria)
Xiaozhi Hu (The University of Western Australia, Australia)
Tony Jefferson (Cardiff University, UK)
Milan Jirásek (Czech Technical University in Prague, Czech Republic)
Minoru Kunieda (Gifu University, Japan)
Christian La Borderie (Université de Pau et des Pays de L'Adour, France)
Eric Landis (University of Maine, USA)
Kefei Li (Tsinghua University, China)
Yann Malecot (Université Grenoble Alpes, France)
Enrico Masoero (Politecnico di Milano, Italy)
Ippei Maruyama (The University of Tokyo, Japan)
Jacky Mazars (Université Grenoble Alpes, France)
Khalid Mosalam (University of California, Berkeley, USA)
Byung Hwan Oh (Seoul National University, South Korea)
Anna Pandolfi (Politecnico di Milano, Italy)
Gilles Pijaudier-Cabot (Universite de Pau et des Pays de L'Adour, France)
Jishen Qiu (Hong Kong University of Science and Technology, Hong Kong)
Frederic Ragueneau (École Normale Supérieure Paris-Saclay, France)
Agathe Robisson (TU Wien, Austria)
Jan G. Rots (Delft University of Technology, Netherlands)
Gonzalo Ruiz López (Universidad de Castilla-La Mancha, Spain)
Jacqueline Saliba (American University of the Middle East, Kuwait)
Beatriz Sanz (Universidad Politécnica de Madrid, Spain)
Branko Savija (Delft University of Technology, Netherlands)
Surendra P. Shah (University of Texas at Arlington, USA)
Volker Slowik (Leipzig University of Applied Sciences, Germany)
Alfred Strauss (University of Natural Resources and Life Sciences, Austria)
Jacek Tejchman (Gdańsk University of Technology, Poland)
Miroslav Vořechovský (Brno University of Technology, Czech Republic)
Jing Yu (The University of Hong Kong, Hong Kong)

PLENARY LECTURES

Session | Date | Time | Room | Page Programme

PL1 | Wed, April 23 | 09:30-10:10 | EI 7 | 5
Zdenek P. Bažant (Northwestern University, USA)
Sprain energy and gap test consequences for damage localization and fracture mechanics

PL2 | Wed, April 23 | 13:30-14:10 | EI 7 | 9
Gilles Pijaudier-Cabot (Université de Pau et des Pays de L'Adour, France)
Lattice and continuum damage modeling for fracture of concrete

PL3 | Thur, April 24 | 09:00-09:40 | EI 7 | 15
Laura De Lorenzis (ETH Zurich, Switzerland)
Phase-field modeling, X-ray tomography and in-situ testing of fracture in concrete

PL4 | Thur, April 24 | 13:30-14:10 | EI 7 | 19
Timon Rabczuk (Bauhaus University Weimar, Germany)
Introduction of dual-horizon peridynamics and nonlocal operator method

PL5 | Fri, April 25 | 09:00-09:40 | EI 7 | 25
Pania Newell (The University of Utah, USA)
Fracture investigation in heterogeneous porous materials across scales

PL6 | Fri, April 25 | 15:00-15:40 | EI 7 | 31
J.N. Reddy (Texas A&M University, USA)
Modeling of fracture in brittle and quasi-brittle materials using graph-based finite element approach

LIST OF MINI-SYMPOSIA & SESSIONS

Session | Date | Time | Room | Page Programme

LIST OF MINI-SYMPOSIA & SESSIONS

Session | Date | Time | Room | Page Programme

CONFERENCE AGENDA

Wednesday, April 23, 2025

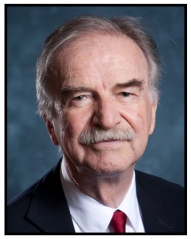
Opening / Plenary Lecture Session

B. Pichler — EI 7

09:00-09:30

Opening Session - Welcome Address

B. Pichler

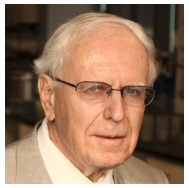


Obituary Prof. Kaspar Willam

H. A. Mang

FraMCoS XII is dedicated to the legacy of Prof. Kaspar Willam, renowned for his commitment to interdisciplinary research and education, as well as for his pioneering contributions to the computational mechanics of concrete and concrete structures. His work particularly focused on predictive modeling of material behavior and structural failure. Elected to the National Academy of Engineering in 2004, Kaspar Willam's legacy includes the widely adopted 'Willam-Warnke' failure criterion, which will continue to inspire future generations of engineers and researchers.

09:30-10:10



Plenary Lecture 1

PL1 | 09:30-10:10

Sprain energy and gap test consequences for damage localization and fracture mechanics

Z. P. Bažant, H. Xu, A. T. Nguyen, Y. Zhao

Abstract: The smooth Crack Band Model (sCBM), conceived in 2021, incorporated a novel localization limiter that is imposed on the 'sprain' field, representing the second-gradient of displacement, to prevent spurious damage localization during fracture growth. A following study in 2023 presented an improved model, called the smooth Lagrangian Crack Band model (slCBM), in which the term "spress" was introduced as the force variable work-conjugate to the "sprain" tensor. More importantly, the numerical difficulty of the sCBM due to using the nodes of adjacent finite elements was overcome by treating displacement vectors and their gradients as independent fields with C0 continuity in finite element implementation, constrained by second-order tensorial Lagrange multipliers. Combined with the microplane model M7 for triaxial softening damage, our numerical validation of the gap test results using the slCBM demonstrates accurate reproduction of size effects under varying crack-parallel stresses. The same, though with path-dependence limitations, is achieved by a simple formula for predicting the crack-parallel stress effects on the fracture energy. Traditional line crack models, including their phase-field reincarnation, give errors of up to 100%. Further it is demonstrated that the existing strain-gradient theories, lacking the resistance to material rotation gradients, predict incorrect fracture patterns with load errors up to 55% error in the case of Mode II and III fractures and for Mode I fractures mixed with shear loading. The crack-parallel stress effect appear to be universal for all materials, including atomistically sharp crystal cracks. There are fundamental implications for the theory of fracture mechanics.

10:10-10:40

Coffee Break

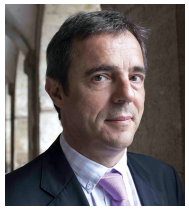
10:40-12:20	MS03-1: Monitoring of fracture in heterogeneous media D.G. Aggelis, N. Godin — EI 8	MS07-1: Environmentally induced microstructural evolution and mechanical deterioration/enhancement of concrete M. Wu — EI 9	MS09-1: Concrete and concrete structures in fire C. La Borderie — EI 2
	MS03-1:1 | 10:40-11:10 (Keynote Lecture) **Multilevel detection of damage and repair in healable polymer-matrix composites** G. Lacidogna, B. Chiaia, G. Piana, E. Silva Cezar, F. Vecchio	MS07-1:1 | 10:40-11:00 **Self-healing in reactive magnesia cement-based composites under different water-to-binder ratios** D. Kumar, G. Lei, E.-H. Yang	MS09-1:1 | 10:40-11:00 **Carbonate aggregate in concrete exposed to high temperatures** K. Mróz, M. Olbrycht-Kmak, I. Hager
		MS07-1:2 | 11:00-11:20 **Factors affecting the interfacial healing between a fiber and cement** R. N. R. Daguio, J. Qiu	MS09-1:2 | 11:00-11:20 **Fire spalling behaviour of heat-resistant repair materials under ring restrained condition** M. Ozawa, T. Koyama, Y. Kuwabara, R. Okura, T. Fukui
	MS03-1:2 | 11:10-11:40 (Keynote Lecture) **Monitoring of crack propagation in fiber reinforced concretes: comparison of non-destructive techniques** T. Bouillard, A. Turatsinze, J.-P. Balayssac, A. Toumi, O. Helson	MS07-1:3 | 11:20-11:40 **Self-healing strain-hardening concrete cover** S. He, M. Lukovic, E. Schlangen	MS09-1:3 | 11:20-11:40 **On the suitability of Eurocode 2 stress-strain model with implicit transient state strain for predicting fracture at elevated temperature** H. Lakhani, J. Hofmann
	MS03-1:3 | 11:40-12:00 **Role of aggregate packing in enhancing concrete fracture response: insights from in-situ high-speed imaging** N. Kanel, B. Baten, N. Garg	MS07-1:4 | 11:40-12:00 **Non-destructive detection of hollow-particle-mixed filler put into concrete cracks using infrared thermography and heat flux simulation** T. Hagiwara, T. Suzuki	MS09-1:4 | 11:40-12:00 **Analysis of temperature-induced degradation in the fracture behavior of polyolefin fiber-reinforced self-compacting concrete** P. Mazón, A. Enfedaque, A. Picazo, M. G. Alberti, J. C. Galvez
	MS03-1:4 | 12:00-12:20 **Advanced microstructural analysis of cement-based materials: integrating x-ray computed tomography and deep learning for enhanced crack growth understanding** C. Kuang, N. Bin Jamal M, A. Michel	MS07-1:5 | 12:00-12:20 **Enhancing carbonation curing of Wollastonite-Portland cementitious blends through 3D-printed vascular networks** Y. Ju, Y. Huang, T. Liu, Y. Li	MS09-1:5 | 12:00-12:20 **An approach for a novel multiscale partitioned framework for predicting collapse of buildings under fire loads** M. Rottmann, C. Kandekar, W. E. Weber
12:20-13:30	Lunch Break		

MS17-1: Durability mechanics of concrete at the various scales of observation. A tribute to the memory of Prof. K. Willam G. Xotta, I. Carol — EI 7	MS18-1: Recent advances in fracture modeling of concretes and structures G. Cusatis — EI 10	TT-C1: Computational modeling H. A. Mang, J. Planas — EI 5	10:40-12:20
MS17-1:1 | 10:40-11:00 **The effect of corrosion rate on corrosion-induced cracking in reinforced concrete** E. Korec, M. Jirásek, H. S. Wong, E. Martínez-Pañeda	MS18-1:1 | 10:40-11:00 **A mechanism-based random field projection for stochastic analysis of concrete structures and other quasibrittle structures** J.-L. Le, J. Vievering	TT-C1:1 | 10:40-11:00 **Smeared cracking and discrete crack dilatancy applied to tension-shear model problems** N. W. Kostense, Y. Yang, M. A. N. Hendriks, J. G. Rots	
MS17-1:2 | 11:00-11:20 **Constitutive response and consistency of Lee-Fenves Concrete Damage-Plasticity model under non-proportional loadings** D. Froio, R. Ferrari, E. Rizzi	MS18-1:2 | 11:00-11:20 **A novel continuum damage model for quasi-brittle materials: application to concrete** U. M M A. Sai Gopal, V. Prakash, D. Roy, A. Ramaswamy	TT-C1:2 | 11:00-11:20 **Comparative analysis of 2D and 3D mesoscopic simulations of an accelerated rebar corrosion test** Y. Li, X. Ruan, H. A. Mang, B. L. Pichler	
MS17-1:3 | 11:20-11:40 **Efficient macro-scale models for reinforcement corrosion modeling in reinforced concrete structures** J. Cervenka, M. Ahmad, J. Rymes, L. Jendele	MS18-1:3 | 11:20-11:40 **Comparison of conventional and localizing gradient enhancements for concrete damage-plasticity models** A. Dummer, M. Neuner, G. Hofstetter	TT-C1:3 | 11:20-11:40 **Numerical analysis of size-effect in UHPFRC beams in pure bending with focus on transition from single to multiple cracking** J. Planas, B. Sanz, J. M Sancho	
MS17-1:4 | 11:40-12:00 **Benchmark analysis of fracture simulation for steel fiber reinforced concrete slab subjected to punching shear** I. Rhee	MS18-1:4 | 11:40-12:00 **Efficiency of corner reinforcement detailing near small openings in RC deep beams** G. Appa Rao, B. Ashiq Hussain	TT-C1:4 | 11:40-12:00 **Fracture mechanism and interface behavior of prestressed segmental UFC beams with a circular cross section under bending** M. Rabotovao, T. Miki	
	MS18-1:5 | 12:00-12:20 **FE modelling of crack width in reinforced concrete beams supported by artificial neural network surrogate models** J. Kovar, J. Cervenka, D. Lehky, D. Novak, V. Cervenka	TT-C1:5 | 12:00-12:20 **Impact of aggregate shape on drying shrinkage cracking in concrete: a three-dimensional hydro-mechanical peridynamic model** Y. Sun, Y. Jia, J.-P. Carlier, T. Rougelot	
		Lunch Break	12:20-13:30

Plenary Lecture Session

E. Landis — EI 7

13:30-14:10



Plenary Lecture 2

PL2 | 13:30-14:10

Lattice and continuum damage modeling for fracture of concrete

G. Pijaudier-Cabot, J. Khoury, G. Cusatis

Abstract: Lattice modelling of quasi-brittle materials such as concrete is a discrete, meso-scale, description of the material in which constitutive relations are prescribed at a lower scale compared to the scale at which continuum-based constitutive relations are written usually. The mesostructure of the material is represented explicitly. Over the years, lattice models have become more and more efficient. Complex nonlinear responses at the macro-scale are obtained today, while keeping the constitutive model at the meso-scale simple compared to macro-scale ones. Prediction capabilities and accuracy of the description of the mechanical response at the global level are, in many cases, better than those obtained with continuum-based models, although at the price of an intensive computational effort. In this work, we intend to draw a parallel between the Lattice Discrete Particle Model (LDPM) and a macro-scale damage model. For this, we implement first a coarse graining approach based on averaging the equations of conservation to convert lattice results into coarse-grained, continuumbased, stress versus strain responses. Because stresses and strains are coarse-grained independently, their relationship yields a database of macroscopic continuum responses. These data are then used to calibrate a non-local damage model.

14:10-14:20

Transition to Parallel Sessions

14:20-16:00	MS03-2: Monitoring of fracture in heterogeneous media E. Landis, N. Godin — EI 8	MS04: Phase field approach to fracture: from materials to structures L. Carreras Blasco — EI 2	MS07-2: Environmentally induced microstructural evolution and mechanical deterioration/ enhancement of concrete E.-H. Yang — EI 9
	MS03-2:1 | 14:20-14:40 **Acoustic emission for monitoring of fracture in cementitious sandwich panels and fresh concrete** E. Korda, N. Ospitia, D. G. Aggelis	MS04:1 | 14:20-14:40 **Direct calibration of phase-field models for cohesive fracture and transport** M. Jirásek, M. Šmejkal, E. Korec	MS07-2:1 | 14:20-14:40 **Enhancement of cement mortar hydration by carbonation activator induced by organic additives** S. Liu, K. Zhao, S. Zhang, C.-S. Poon
	MS03-2:2 | 14:40-15:00 **Determination of fracture process zone in hybrid fiber reinforced ultra-high performance concrete using acoustic emission entropy** M. Adil Ahmed, S. Dutta	MS04:2 | 14:40-15:00 **Role of the weak interface on thoughening in layered brittle materials: a coupled phase field-cohesive zone model approach to fracture** A. Najmeddine, R. Moini	MS07-2:2 | 14:40-15:00 **Exploring carbonation-induced volume changes and their relationship to microstructure development in reactive magnesia cement** P. R. Quiatchon, J. Qiu
	MS03-2:3 | 15:00-15:20 **Fracture assessment of small and large-scale steel fibre reinforced concrete specimens using acoustic emission and digital image correlation techniques** R. Ramanathan, K. Kirupakaran	MS04:3 | 15:00-15:20 **A phase field damage model for micropolar continuum undergoing finite rotation: application to concrete** V. Prakash, A. K. Behera, M. M. Rahaman, D. Roy	MS07-2:3 | 15:00-15:20 **Cement degradation in CO_2-saturated water and the impact of liquid to solid ratio: an experimental and thermodynamic modelling study** X. Shi, M. Wu
	MS03-2:4 | 15:20-15:40 **Fractal micro-cracking features in concrete under fatigue and monotonic loading** A. Mandal, J. M. Chandra Kishen	MS04:4 | 15:20-15:40 **Finite Element modelling of cracking behaviour of reinforced concrete tensile members using a combined phase field and cohesive zone modelling approach** M. D. Barahona, C. Barris, L. Carreras	MS07-2:4 | 15:20-15:40 **Saltwater flooding-induced corrosion and lateral strength of reinforced concrete structures** E. W. Benson, R. Ranade, P. Okumus, N. Elhami-Khorasani, O. Francis, R. Paci-Green
	MS03-2:5 | 15:40-16:00 **Precursors for detecting impending fracture in cementitious composites using natural time analysis of acoustic emission** K. Naukhez, R Vidya Sagar, J. M. Chandra Kishen	MS04:5 | 15:40-16:00 **Modeling toughening mechanisms in concrete using multiscale phase field approach** A. Surendran, J. M. Chandra Kishen	MS07-2:5 | 15:40-16:00 **Effects of brine and CO_2 exposure on the mechanical and chemical properties of class G cement in oil well applications** A. Viana Neves, V. Nogueira Lima, F. de Andrade Silva
16:00-16:30	Coffee Break		

MS17-2: Durability mechanics of concrete at the various scales of observation. A tribute to the memory of Prof. K. Willam G. Xotta, I. Carol — EI 7	MS18-2: Recent advances in fracture modeling of concretes and structures G. Cusatis — EI 10	TT-G: Fatigue & dynamic loading G. Ruiz López, P. Hala — EI 5	14:20-16:00
MS17-2:1 | 14:20-14:40 **Effect of water-cement ratio and current density on accelerated corrosion-induced cracking** I. Aldellaa, P. Grassl	MS18-2:1 | 14:20-14:40 **Fluctuation-based damage mechanics: a statistical approach to fracture in concrete** A. Attias, F.-J. Ulm	TT-G:1 | 14:20-14:40 **Influence of fiber reinforcement on the blast resistance and fracture behavior of high-strength concrete slabs** D. A. Cendón, F. Gálvez, G. Ruiz López, X. Zhang	
MS17-2:2 | 14:40-15:00 **Multiscale simulation of the thermomechanical behavior of containment buildings of nuclear power plants** L. Jason	MS18-2:2 | 14:40-15:00 **Numerical recreation of gap test** M. Szczecina, A. Winnicki	TT-G:2 | 14:40-15:00 **Influence of protective layers on the resistance of concrete structures under blast and impact loading** A. Měrková, P. Kheml, P. Hála, R. Sovják, L. Leicht, P. Máca, B. Beckmann	
MS17-2:3 | 15:00-15:20 **Effect of crack patterns induced by different accelerated temperature on mechanical behavior of ASR-damaged concrete** H. E. Joo, X. Ji, Y. Takahashi	MS18-2:3 | 15:00-15:20 **Interface modelling in nonlinear finite element analysis of prestressed girder with a continuous cast-in-situ deck slab** M. Petrangeli, D. Addessi, N. Kostense, J. Rots	TT-G:3 | 15:00-15:20 **Tensile fatigue endurance in UHPC reinforced with steel and carbon fibers using advanced monitoring techniques** V. W. Masih, G. Ruiz López, H. Cifuentes, C. Leiva	
MS17-2:4 | 15:20-15:40 **Meso-level HPC analysis of concrete specimens subject to external sulfate attack, and computational aspects** C. Biscaro, C. M. López, G. Xotta, D. Garolera, I. Carol	MS18-2:4 | 15:20-15:40 **Modeling of the fracture propagation in heterogeneous material based on reconstructed microstructure** G. Jaiswal, R. Sharma	TT-G:4 | 15:20-15:40 **A linearized toughness model for fiber reinforced concrete using multiscale approach** S. Shirin K., Shafiya A., S. K., K. M Simon, B. Raj J	
MS17-2:5 | 15:40-16:00 **Residual mechanical performance of concrete under various expansion deterioration states based on crack morphology and substance** Y. Takahashi, H. E. Joo, X. Ji	MS18-2:5 | 15:40-16:00 **Novel 2.5D layered model to simulate discrete crack growth in concrete specimens** B. Kondys, J. Bobiński	TT-G:5 | 15:40-16:00 **Prediction of fatigue crack growth in rock-concrete interface** V. Chander Sharma, K. Pervaiz Fathima	
		Coffee Break	16:00-16:30

16:30-17:50	MS03-3: Monitoring of fracture in heterogeneous media D. G. Aggelis, E. Landis — EI 8	MS07-3: Environmentally induced microstructural evolution and mechanical deterioration/enhancement of concrete Y. Li — EI 9
	MS03-3:1 | 16:30-16:50 **Voids detection in bonded metal/composite or concrete/composite assemblies using acousto-ultrasonic method: contribution of simulation** A. Doitrand, C. Sarr, S. Chataigner, L. Gaillet, N. Godin	MS07-3:1 | 16:30-16:50 **Comparison of bond strength to aggregate between reactive magnesia cement (RMC) and portland cement (PC)** B. Wu, W. Tianyu, J. Qiu
	MS03-3:2 | 16:50-17:10 **Characterising flexural behaviour of coarse aggregate-based 3D printed concrete beams using acoustic emission technique** S. B. Ghodke, S. R. Chowdhury, B. Singh	MS07-3:2 | 16:50-17:10 **The microstructural response of recycled concrete after high temperature exposition and rapid cooling** C. Paglia, A. Moscatelli, C. D'Erme
	MS03-3:3 | 17:10-17:30 **Insights into the fracture mechanism of concrete with polypropylene fiber through acoustic emission technique** R. L. Riyar, S. Bhowmik	MS07-3:3 | 17:10-17:30 **Amine-modified biochar saturated with CO_2 as internal carbonation curing activator for enhancing mechanical property of cement paste** R. Wu, S. Zhang, C. S. Poon
18:15-21:00	**Welcome Cocktail** The Welcome Cocktail takes place at Cupola Hall in the Main Building of TU Wien - see area map at page 39.	

MS18-3: Recent advances in fracture modeling of concretes and structures	TT-F: Structural concrete applications	16:30-17:50
G. Cusatis — EI 10	A. Rajprabhu, K. Watanabe — EI 7	
MS18-3:1 | 16:30-16:50 **Performance of novel 3D approach with explicit definition of fibres-concrete interaction in predicting the FRC/FRHPC response** I. Marzec, J. Bobiński	TT-F:1 | 16:30-16:50 **Evaluation of column-beam joints and optimization of reinforcing bars of RC viaducts by FEM** K. Watanabe, R. Suzuki, Y. Nakata	
MS18-3:2 | 16:50-17:10 **Multi-scale modeling of fiber-reinforced concrete structures** P. Pirmoradi, A. S. J. Suiker, P. Poorsolhjouy	TT-F:2 | 16:50-17:10 **Strut efficiency on shear strength, and ductility of RC deep beams with large rectangular openings in shear span** A Rajprabhu, G Appa Rao	
	TT-F:3 | 17:10-17:30 **Non-destructive detection of surface damage in hollow gravity type concrete dam by using passive infrared thermography data with deep learning method** T. Suzuki, K. Shibano, T. Hagiwara, N. Alver	
	TT-F:4 | 17:30-17:50 **Fracture propagation of concrete and ultra-high-performance concrete (UHPC) interface affected by repaired layer thickness** E. Mohamed, T. Miki	

Welcome Cocktail — 18:15-21:00

The Welcome Cocktail takes place at Cupola Hall in the Main Building of TU Wien - see area map at page 39.

Thursday, April 24, 2025

Plenary Lecture Session

G. Meschke — EI 7

09:00-09:40

Plenary Lecture 3

PL3 | 09:00-09:40

Phase-field modeling, X-ray tomography and in-situ testing of fracture in concrete

L. De Lorenzis

Abstract: We present and discuss very recent modeling, computational and experimental results on fracture in concrete obtained in the group of the speaker. In the first part of the talk, we focus on the mesoscopic cracking behavior of concrete. Experimentally, we combine stable wedge-splitting fracture experiments performed in situ in an X-ray tomograph and their analysis with digital volume correlation providing the full three-dimensional displacement field. On the modeling side, we calibrate a variational phase-field fracture model and use it to computationally predict the in situ experiments while applying the measured boundary conditions and resolving the imaged mesoscopic concrete geometry. The comparison between experimental and computational results in terms of both local and global quantities pinpoints strengths and weaknesses of the phase-field modeling strategy. Some of these weaknesses are addressed in the second part of the talk, where we focus on some fundamental aspects of the variational phase-field approach relevant for modeling of fracture in concrete. We discuss some ideas by which variational phase-field models can be endowed with sufficient flexibility to overcome the limitations of existing ones. We show some first results in this direction concerning fracture under multiaxial stress states.

09:40-10:10 — Coffee Break

10:10-12:10	MS03-4: Monitoring of fracture in heterogeneous media N. Godin, D. G. Aggelis — EI 8	MS09-2: Concrete and concrete structures in fire C. La Borderie — EI 2	MS10-1: Discrete modeling of mechanical and coupled processes in quasi-brittle materials J. Tejchman, G. Cusatis — EI 7
	MS03-4:1 | 10:10-10:30 **Advances in 3D image processing to evaluate damage and fracture of high-performance concrete** A. R. Carlson, E. N. Landis	MS09-2:1 | 10:10-10:30 **From curing to fire accident: a novel, comprehensive model for concrete's fire resistance** S. Dal Pont, G. Sciumé, M. H. Moreira	MS10-1:1 | 10:10-10:50 (Keynote Lecture) **Asymptotic homogenization of discrete models with rotational degrees of freedom** J. Elias, G. Cusatis
	MS03-4:2 | 10:30-10:50 **To measure cracks in reinforced concrete beam without prior detection, application to diffuse cracking evaluation** G. Ewald, Y. Malecot	MS09-2:2 | 10:30-10:50 **Constitution of an extensive experimental database for the challenge of spalling modelling** J. Mounier, G. Sciumé, J.-C. Mindeguia	
	MS03-4:3 | 10:50-11:10 **Improvement of the acousto-ultrasonic method using model anchor bases with controlled defects** R. Johannes, N. Godin, L. Gaillet	MS09-2:3 | 10:50-11:10 **Influence of polypropylene fibers on thermal-induced permeability changes in concrete** A. Muhammed, H. Carre, C. La Borderie, P. Pimienta	MS10-1:2 | 10:50-11:10 **Effects of aggregate fragmentation, free water and strain rate on fracture in compressive concrete with a coupled DEM-CFD approach** M. Krzaczek, M. Nitka, J. Tejchman
	MS03-4:4 | 11:10-11:30 **Damage due to microcracking in cementitious composites using AE frequency characteristics** N. Gupta, R. Vidya Sagar, J. M. Chandra Kishen	MS09-2:4 | 11:10-11:30 **Analysis of dehydration in high-performance concrete at high temperature using neutron radiography** T. Koyama, M. Ozawa, M. Kanematsu	MS10-1:3 | 11:10-11:30 **Computational analysis of size effect and failure modes in reinforced concrete beams** V. Gudžulić, G. Meschke
		MS09-2:5 | 11:30-11:50 **From crack initiation to instability at high temperature: a two-stage mechanism for fire-induced spalling in concrete** R. Yarmohammadian, R. Felicetti	MS10-1:4 | 11:30-11:50 **Exploring induced heterogeneity in elastic discrete mechanical models** J. Raisinger, Q. Zhang, J. E. Bolander, J. Eliáš
			MS10-1:5 | 11:50-12:10 **Two-way coupled multiphysics simulation of lattice discrete particle model** G. Cusatis, H. Yin, M. Troemner, W. Li, E. Lale, L. Yang, L. Shen, M. Alnaggar, G. Di Luzio
12:10-13:30	Lunch Break		

MS11: Coupling transport and cracking in concrete under harsh environments	MS13-1: Advances in the design and assessment of materials and structures for performance, safety, durability, and sustainability	TT-C2: Computational modeling	10:10-12:10
S. Y. Alam, G. Pijaudier-Cabot — EI 9	A. Strauss, T. Bittencourt — EI 10	B. Sanz, R. Kouhia — EI 5	
MS11:1 | 10:10-10:30 **Behaviour of reinforced cement concrete under coupled corrosion fatigue** V. Vishwakarma, S. Ray	MS13-1:1 | 10:10-10:30 **Computational and analytical modelling of carbonation-induced spalling of the concrete cover** A. DeKeyser, E. Verstrynge, R. Wan-Wendner, W. Botte, R. Caspeele	TT-C2:1 | 10:10-10:30 **Numerical study of Brazilian tests of UHPFRC by using elements with embedded cohesive crack and cohesive joint elements** B. Sanz, J. Planas, J. M. Sancho	
MS11:2 | 10:30-10:50 **Coupled reactive transport and poromechanics modelling of external sulfate attack in cementitious materials** S. Y. Alam, A. Soive, A. Loukili	MS13-1:2 | 10:30-10:50 **Effects of corrosion on tension stiffening and cracking behaviour of reinforced Engineered Cementitious Composite and concrete** L. Li, E Chen	TT-C2:2 | 10:30-10:50 **Tensorial continuum damage model for concrete** S. Dhakal, J. Hartikainen, R. Kouhia, T. Saksala, J. Vilppo, K. Calonius, A. Fedoroff, K. Kolari	
MS11:3 | 10:50-11:10 **Coupled transport-chemo-mechanical simulation of cement/aggregate samples affected by DEF at the aggregate scale. Effects of pre-cracked interface and comparison with experimental data** L. Braysh, C. Pelissou, F. Perales, A. Socié	MS13-1:3 | 10:50-11:10 **Comprehensive uncertainty quantification of damage-based modeling of cracking in reinforced concrete structures** H. Al Elani, D. Bouhjiti, L. Jason, B. Richard	TT-C2:3 | 10:50-11:10 **Advancements in modeling compressive fracture in concrete using condensed high aspect ratio interface elements** M. Gimenes, A. F. Villa Dos Santos, E. A. Rodrigues, T. N. Bittencourt, L. A. G. Bitencourt Jr., O. L. Manzoli	
MS11:4 | 11:10-11:30 **Gas transport behaviors of concrete designed for shielding nuclear structures** M. Choinska Colombel, D. Jozwiak-Niedzwiedzka, W. Kubissa	MS13-1:4 | 11:10-11:30 **Model uncertainties of concrete cracking resistance models based on probabilistic simulations** M. Słowik, D. Novák, D. Lehký, I. Skrzypczak	TT-C2:4 | 11:10-11:30 **Numerical investigation of the shear behavior of reinforced concrete beams with low shear reinforcement under different boundary and loading conditions** Y. H. Gedik, N. D. Tung	
MS11:5 | 11:30-11:50 **Poromechanical approach for prediction of fire-induced fracture and moisture transport of structural concrete** K. Iwama, K. Maekawa	MS13-1:5 | 11:30-11:50 **Quality control & numerical nonlinear material modelling for the load-bearing capacity of slender reinforced concrete columns - comparison of safety formats** A. Strauss, B. Täubling-Fruleux, M. Soliman, M. Tamimi, X. Ruan, L. Zhu, T. Zimmermann	TT-C2:5 | 11:30-11:50 **Blast loading effect of explosive weight distribution on RC columns** M. I. Mohnavi, G Appa Rao	
MS11:6 | 11:50-12:10 **Probabilistic service life prediction of chloride induced corrosion under sustained mechanical loading using multiphysical modeling** G. Wildermann, A. Schultheiß, R. A. Patel, F. Dehn			
		Lunch Break	12:10-13:30

Plenary Lecture Session

P. Preinstorfer **EI 7**

13:30-14:10

Plenary Lecture 4

PL4 | 13:30-14:10

Introduction of dual-horizon peridynamics and nonlocal operator method

H. Ren, X. Zhuang, T. Rabczuk

Abstract: This paper provides a concise introduction to the nonlocal theories of Dual-Horizon Peridynamics (DH-PD) and the Nonlocal Operator Method (NOM), including their primary concepts and fundamental governing equations. In addition, a dual-horizon bond-based peridynamics equipped with variational damage is derived. A numerical example is presented to explore their advantages in crack simulation.

14:10-14:20 **Transition to Parallel Sessions**

14:20-15:40	MS01-1: Next-generation reinforced concrete: brittle behaviour and fracture mechanics assessment F. Accornero — EI 10	MS02-1: Fatigue behavior of concrete and fiber reinforced concrete R. Chudoba, M. Vořechovský — EI 5	MS05-1: Application of advanced computational models to challenging engineering problems M. Neuner — EI 2
	MS01-1:1 | 14:20-15:00 (Keynote Lecture) **High-performance reinforced concrete structures: brittleness size-scale effects** A. Carpinteri	MS02-1:1 | 14:20-14:40 **Impact of fiber distribution on fatigue life variability in high-performance fiber-reinforced concrete** Á. Mena-Alonso, M. Á. Vicente, D. C. González, J. Mínguez	MS05-1:1 | 14:20-15:00 (Keynote Lecture) **An elastoplastic phase field model for fracture in concrete based on a generalized continuum formulation** S. Abrari Vajari, M. Neuner, C. Linder
		MS02-1:2 | 14:40-15:00 **A new approach to concrete fatigue S-N curves considering load application rate** M. Á. Vicente, A. Mena-Alonso, D. C. González, J. Mínguez	
	MS01-1:2 | 15:00-15:20 **Ductile-to-brittle transition in high-performance prestressed concrete beams: new standards for a safe and effective design** F. Accornero, D. Xie, B. Kumar, A. Carpinteri	MS02-1:3 | 15:00-15:20 **Fatigue damage assessment of concrete using wide-range experimental data** P. Miarka, J. D. Rios, S. Seitl, V. Bílek, H. Cifuentés	MS05-1:2 | 15:00-15:20 **Modeling concrete at high-loading rates: insights from the Material Point Method** O. A. Oropeza Navarro, J. Platen, A. Chihadeh, M. Kaliske
	MS01-1:3 | 15:20-15:40 **Ductile-to-brittle transition in GFRP-bar reinforced concrete: bar-roughness effect on pseudo-plastic rotation capacity** F. Accornero, D. Xie, A. Carpinteri	MS02-1:4 | 15:20-15:40 **Enhancing matrix-fiber bond and mechanical performance with high-performance plasticizers** J. D. Ruiz-Martínez, J. D. Ríos, E. M. Pérez Soriano, H. Cifuentes, C. Leiva	MS05-1:3 | 15:20-15:40 **On the numerical modelling of punching shear in flat reinforced concrete slabs by means of the finite element method** F. Suárez, J. C. Gálvez
15:40-16:10	Coffee Break		

14:30-17:00	RILEM TC-QPA meeting Meeting Room of Rectorate
	The RILEM Technical Committee QPA (Quality and performance assurance of additively manufactured cementitious composites by advanced non-invasive techniques) meeting takes place at the Meeting Room of the Rectorate in the Main Building of TU Wien - see area map at page 39.

MS06-1: Small scale testing of mechanical and time-dependent behavior of cementitious materials H. Zhang — EI 8	MS08-1: Advances in forward and inverse damage simulation of complex materials and structures S. Triantafyllou, J. Zhang — EI 9	MS15-1: Engineered/Strain-Hardening Cementitious Composites (ECC/SHCC) I. Curosu — EI 7	14:20-15:40
MS06-1:1 | 14:20-14:40 **Linearity and assessment of micro-scale creep in C-S-H via nanoindentation** J. Nemecek, J. Nemeckova, J. Nemecek	MS08-1:1 | 14:20-14:40 **A mesh adaptation algorithm to reduce mesh bias in 2D and 3D crack propagation analysis using cohesive zone models** K. Daadouch, V. Gudžulić, G. Meschke	MS15-1:1 | 14:20-14:40 **Experimental study on crack distribution of RC members with reinforcing bars coated with fiber reinforced cementitious composites** B. Song, N. Ueda	
MS06-1:2 | 14:40-15:00 **Fracture behavior of additively manufactured cementitious materials** M. Li, Y.-C. Wu, X. Wang	MS08-1:2 | 14:40-15:00 **Greyscale marker for the modeling of the fracture process of cement mortar considering heterogeneity of the microstructure** G. Jaiswal, R. Sharma	MS15-1:2 | 14:40-15:00 **Mechanical behaviour and 3D fracture morphology of sustainable engineered cementitious composites modified with boron nitride nanoparticles** E. Gurbuz, S. Erdem	
MS06-1:3 | 15:00-15:20 **Characterizing microstructural damage in cementitious composites reinforced with 3D-printed auxetic lattices using X-ray computed tomography** Z. Meng, B. Šavija	MS08-1:3 | 15:00-15:20 **Accelerated fracture simulations for the identification of fracture parameters** E. Gultekin, K. Agathos	MS15-1:3 | 15:00-15:20 **On the impact performance and crack behavior of steel-fiber reinforced concrete beams with SHCC and UHPC strengthening layers** F. R. de Souza, J. J. B. d. C. Nunes, V. N. Lima, F. d. A. Silva	
MS06-1:4 | 15:20-15:40 **Multi-material printing to simultaneously enhance interlayer and flexural performance in 3D concrete printing** F. Teng, J. Ye, J. Yu, Y. Weng	MS08-1:4 | 15:20-15:40 **Phase field fracture in fibre reinforced composites using embedded and virtual elements** G. Pissas, S. P. Triantafyllou	MS15-1:4 | 15:20-15:40 **Testing and modelling of fibre-matrix interface by microcube splitting** Y. He, S. He, E. Schlangen	
		Coffee Break	15:40-16:10

16:10-17:30	MS06-2: Small scale testing of mechanical and time-dependent behavior of cementitious materials J. Nemecek — EI 8	MS08-2: Advances in forward and inverse damage simulation of complex materials and structures S. Triantafyllou, J. Zhang — EI 9
	MS06-2:1 | 16:10-16:30 **X-ray and neutron imaging for steel corrosion in concrete: addressing challenges and revealing opportunities** A. Alhede, J. Dijkstra, K. Lundgren	MS08-2:1 | 16:10-16:30 **Multi-scale damage analysis for concrete using the Scaled Boundary Finite Element Method with High-Performance-Computing** J. Zhang, P. Liu, H. Fan, Z. Li
	MS06-2:2 | 16:30-16:50 **Use of convolutional neural networks for predicting the short-term creep modulus of cement paste** M. Liang, Y. Gan, E. Schlangen, B. Šavija	MS08-2:2 | 16:30-16:50 **Wood constitutive law implementation and parameter calibration using Bayesian inversion for finite-element modelling** M. Delage, D. Scantamburlo, G. Jacot-Descombes, S. Commend
	MS06-2:3 | 16:50-17:10 **Effect of fiber alignment on the mechanical and electrical properties of carbon fiber reinforced cementitious composites** S. Qin, N. Liu, J. Qiu	MS08-2:3 | 16:50-17:10 **Non-intrusive stochastic SBFEM for the uncertainty quantification of Stress Intensity Factors** G. Litainas, S. Triantafyllou, A. Egger, E. Chatzi
	MS06-2:4 | 17:10-17:30 **Monitoring crack propagation at the rock-concrete interface under different strain rates using digital image correlation technology** J. Yao, W. Dong, W. Yuan	MS08-2:4 | 17:10-17:30 **Phase field fracture over quadtrees using the Virtual Element Method** I. Chrysikou, S. Triantafyllou

17:30-18:30	IA-FraMCoS General Assembly EI 7
	All participants of FraMCoS XII are kindly invited to particate in the IA-FraMCoS General Assembly.

MS15-2: Engineered/Strain-Hardening Cementitious Composites (ECC/SHCC)	TT-E: Novel cementitious and/or other quasi-brittle materials	16:10-17:30
J. Yu — EI 7	A. Z. Gierth, H. J. Bezemer — EI 10	
MS15-2:1 | 16:10-16:30 **Expertimental study on the contribution of fibers on the punching shear capacity of plain ECC slabs** C. Wu, Y. Su, M. Xu, C. Jin	TT-E:1 | 16:10-16:30 **Time-dependent tensile behavior of slag-based alkali activiated concrete** H. J. Bezemer, S. Mustafa, M. Lukovic	
MS15-2:2 | 16:30-16:50 **Self-healing properties of seawater sea-sand strain-hardening cementitious composites (SHCC)** J. Yu, F. Hu	TT-E:2 | 16:30-16:50 **Identifying interlayer fracture properties in 3D printed concrete specimens via multidirectional flexural tests** K. S. Kompella, M. Levi, L. Ferrara	
MS15-2:3 | 16:50-17:10 **Mechanical properties of low-carbon Engineered Cementitious Composites with limestone and calcined clay under uniaxial cyclic compression** K. Wang, J. Zhou, J. Zhao	TT-E:3 | 16:50-17:10 **Influence of additives on the fracture mechanical properties of reactivated cement paste** A. Z. Gierth, M. Elies, S. Helmich, N. Noel, T. Mielke, D. C. Lupascu	
	TT-E:4 | 17:10-17:30 **Statistical modeling of fatigue crack growth in geopolymer concrete beams** S. S. Thakur, K. M. Pervaiz Fathima	

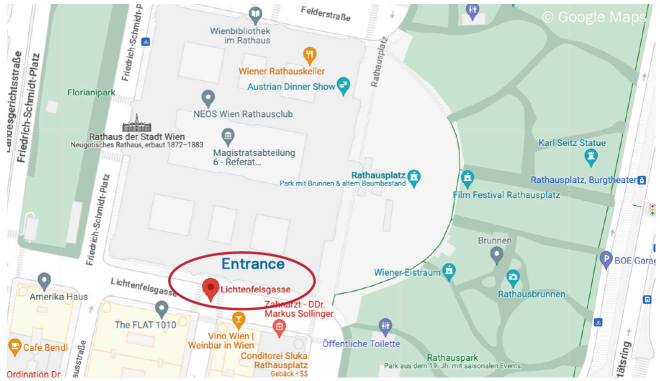
Conference Banquet

19:30-23:00

Volkshalle, City Hall

Location: Volkshalle inside the City Hall of Vienna, Lichtenfelsgasse 2, 1010 Vienna

Please use the side entrance at Lichtenfelsgasse 2 and make sure you have your banquet voucher with you. Entrance: 19:00, Beginning: 19:30



How to get there

Please take metro U2 (direction Seestadt) and exit at “Rathaus”. Alternatively, you can take trams 1, 71, or D and exit at “Rathausplatz, Burgtheater”.
The entire journey will take about 15 mins from the conference venue.

Friday, April 25, 2025

Plenary Lecture Session

E. Schlangen — EI 7

09:00-09:40

Plenary Lecture 5

PL5 | 09:00-09:40

Fracture investigation in heterogeneous porous materials across scales

R. Nielsen, P. Newell

Abstract: Heterogeneous porous materials, characterized by variations in porosity and pore distribution, exhibit complex mechanical behavior, particularly when subjected to fracture. Here, we present a numerical method using phase-field fracture technique in FEniCSX to study how changes in porosity and pore distribution impact the fracture behavior of cementitious materials. The results demonstrate that not only porosity but also pore morphology plays a significant role in fracture propagation and the overall response of cement-mortar. These findings highlight the importance of considering both the quantity and spatial arrangement of pores when assessing the mechanical performance and durability of cement-based materials.

09:40-10:10 — Coffee Break

10:10-12:10	MS01-2: Next-generation reinforced concrete: brittle behaviour and fracture mechanics assessment Y. Yu — EI 10	MS02-2: Fatigue behavior of concrete and fiber reinforced concrete M. Vořechovský, R. Chudoba — EI 5	MS05-2: Application of advanced computational models to challenging engineering problems P. Gamnitzer — EI 2
	MS01-2:1 | 10:10-10:30 **Fracture mechanics-based model for the flexural behavior of steel fiber-reinforced concrete with longitudinal reinforcement** Á. De La Rosa Velasco, G. Ruiz López, J. Ruiz Carmona	MS02-2:1 | 10:10-10:50 (Keynote Lecture) **Nonlinear creep of concrete: the driving role of viscoelasticity and cracking-induced damage** R. Diaz Flores, C. Hellmich, B. Pichler	MS05-2:1 | 10:10-10:30 **Fluid-solid coupled crack propagation simulation of concrete microstructure** D. Eum, S.-Y. Kim, T.-S. Han
	MS01-2:2 | 10:30-10:50 **Influence of tensile softening properties on shear behavior of R/FRC beams** N. Ueda, Y. Nakamichi		MS05-2:2 | 10:30-10:50 **Numerical simulation of flexible rockfall barrier post foundations subjected to impact** P. Hofer, L. Wimmer, M. Neuner, R. Hofmann, G. Hofstetter
	MS01-2:3 | 10:50-11:10 **Scale effects investigation on the mechanical behaviour of steel-fibre and steel-bar (hybrid) reinforced concrete beams** B. Kumar, C. Wang, Y. Liu, S. Zhou, Q. Ou, J. Liu, Y. Yu, F. Accornero, A. Carpinteri	MS02-2:2 | 10:50-11:10 **Experimental investigation of the fatigue behavior of 3D printed steel fiber reinforced concrete** J. H. Sørensen, H. Stang	MS05-2:3 | 10:50-11:10 **Accelerating fatigue induced crack propagation modeling in concrete using a time homogenization approach** R. Pina-Torres, D. Zhao, M. Kaliske
	MS01-2:4 | 11:10-11:30 **Preparation and fracture properties of different types of aligned steel fiber reinforced concrete** L. Qing, R. Mu, M. Li, M. Bi, X. Wang	MS02-2:3 | 11:10-11:30 **Numerical study of bond behavior in single-lap shear test at meso-scale** Y. Wang, J. Vorel, C. Carloni, J. Belis, R. Wan-Wendner	MS05-2:4 | 11:10-11:30 **Numerical simulation of BubbleDec type reinforced concrete slabs subjected to punching loading conditions** J. Barros, W. Nicácio, A. Ventura-Gouveia, F. P. Figueiredo
	MS01-2:5 | 11:30-11:50 **Load deformation response of concrete having alternate reinforcement forms** Himanshu, B. Pal, A. Ramaswamy	MS02-2:4 | 11:30-11:50 **Structural compressive fatigue simulated via lattice discrete and microplane models** M. Aguilar, M. Vořechovský, A. Baktheer, R. Chudoba	MS05-2:5 | 11:30-11:50 **Application of 3D-RBSM integrated with machine learning to estimate RC corrosion distribution from surface cracks** T. Shao, J. Luo, K. Nagai
	MS01-2:6 | 11:50-12:10 **Stiffness degradation and fracture behaviour of textile reinforced concrete under quasi-static cyclic loading** N. Basumatary, K. Kirupakaran	MS02-2:5 | 11:50-12:10 **Modeling of temperature- and rate-dependent fatigue behavior of concrete capturing the thermo-viscoplastic effects on material degradation** R. Chudoba, M. Vorechovsky, M. Aguilar, A. Baktheer	MS05-2:6 | 11:50-12:10 **Effect of notch size and orientation on the fracture of concrete interface: an MD simulation study** M. Gupta, S. Bhowmik
12:10-13:30	Lunch Break		

MS06-3: Small scale testing of mechanical and time-dependent behavior of cementitious materials J. Qiu — EI 8	MS10-2: Discrete modeling of mechanical and coupled processes in quasi-brittle materials G. Pijaudier-Cabot, J. Elias — EI 7	MS13-2: Advances in the design and assessment of materials and structures for performance, safety, durability, and sustainability D. Novák, J. Cervenka — EI 9	10:10-12:10
MS06-3:1 | 10:10-10:30 **Micromechanical characterization of the interfacial transition zone in recycled brick concrete by means of combined nanoindentation and SEM** F. Li, F. Kleiner, C. Rößler, L. Göbel, E. Linß	MS10-2:1 | 10:10-10:30 **Steady-state subcritical fracture growth of parallel natural cracks in shale governed by osmotic gradient and fluid diffusion** Z. P. Bažant, H. T. Nguyen, Y. Zhao	MS13-2:1 | 10:10-10:30 **Multiphysics modelling for 3D concrete printing: from printability to hardened properties** M. Pierre, S. Ghabezloo, P. Dangla, R. Mesnil, M. Vandamme, J.-F. Caron	
MS06-3:2 | 10:30-10:50 **A method for measuring inter-particle Hamaker constants in mineral materials using atomic force microscopy** H. Q. Yuan, Z. Ge, H. Z. Zhang	MS10-2:2 | 10:30-10:50 **Hydro-thermal-mechanical coupling properties and mesoscale simulation of concrete-rock composites** G. Di Luzio, L. Feng, G. Cusatis, K. Yu, E. Lale, X. Chen	MS13-2:2 | 10:30-10:50 **Failure behavior of RC beams by means of 3D concrete printing** M. Kunieda, S. To, T. Kato, A. Miyajima	
MS06-3:3 | 10:50-11:10 **Microstructure-property relations in the mechanics of dental cement paste of type "Biodentine"** C. Hellmich, P. Dohnalik, L. Zelaya-Lainez, B. Pichler, G. Richard	MS10-2:3 | 10:50-11:10 **A novel DEM-based coupled 3D thermo-hydro-mechanical mesoscopic model for cracked porous materials** M. Krzaczek, J. Tejchman	MS13-2:3 | 10:50-11:10 **On FPZ for mixed mode I-II fracture in concrete after sustained loading using DIC technique** M. Yang, W. Dong, W. Yuan, B. Zhang	
	MS10-2:4 | 11:10-11:30 **Comparison of Lattice Discrete Particle Model (LDPM) implementations: lessons learned and future work** E. Lale, K. Yu, M. Troemner, M. Pathirage, G. Pijaudier-Cabot, J. Khoury, I. Koutromanos, J. Elias, M. Stredulova, T. Xue, M. Alnaggar, G. Di Luzio, G. Cusatis	MS13-2:4 | 11:10-11:30 **Damage evolution and fracture behavior of under-reinforced concrete beams using acoustic emission technique** M H Prashanth, J. M. Chandra Kishen	
	MS10-2:5 | 11:30-11:50 **A step toward flow simulation through cracks in beam-particle models** O. Najjar, T. Heitz, C. Oliver-Leblond, J.-L. Tailhan, G. Rastiello, F. Ragueneau		
	MS10-2:6 | 11:50-12:10 **Computationally efficient, discrete mechanical models of grid-reinforced cement-based composites** Q. Zhang, A. Fascetti, J. E. Bolander		
		Lunch Break	12:10-13:30

13:30-14:50	MS01-3: Next-generation reinforced concrete: brittle behaviour and fracture mechanics assessment F. Accornero — EI 10	MS02-3: Fatigue behavior of concrete and fiber reinforced concrete M. Aguilar, M. Vořechovský — EI 5	MS05-3: Application of advanced computational models to challenging engineering problems G. Hofstetter — EI 2
	MS01-3:1 | 13:30-13:50 **Implementation of the Cohesive Crack Model with the Finite Particle Method for failure analysis of reinforced concrete beams** Y. Yu, H. Chen, F. Accornero, A. Carpinteri	MS02-3:1 | 13:30-13:50 **Effect of stress level on high cycle fatigue behavior of high strength strain hardening cementious composite (HS-SHCC) in compression** Z. Dong, J. Zhou, J. Zhao	MS05-3:1 | 13:30-13:50 **Objectivity issues in numerical modeling of cracking in RC beams based on enhanced section kinematics** L. Parente, D. Addessi, B. Izzuddin, E. Spacone
	MS01-3:2 | 13:50-14:10 **Numerical simulations of the transition from flexural cracking to shear to flexural crushing failures in pre-notched reinforced concrete beams** H. Chen, Y. Yu, C. Li, F. Accornero, A. Carpinteri	MS02-3:2 | 13:50-14:10 **Impact of concrete moisture on the fatigue resistance of high-performance concrete under various load types** M. Markert, H. Schiewe, H. Becks, R. Chudoba, M. Classen	MS05-3:2 | 13:50-14:10 **Deterministic behavior of an anchoring plate and sensitivity study** M. Le Noir de Carlan, L. Jason, L. Davenne
	MS01-3:3 | 14:10-14:30 **Fractal patterns for failure modes of ultra-high performance concrete** Z. Jiang, Z. Zhu	MS02-3:3 | 14:10-14:30 **Corrosion fatigue in reinforced concrete beams: accounting for the synergistic effects of corrosion and cyclic loading** M. A. Dar, K. M. Pervaiz Fathima	MS05-3:3 | 14:10-14:30 **Influence of the compressive fracture energy on the predicted breakout failure of fasteners** J. Holder, H. Lakhani, J. Hofmann
		MS02-3:4 | 14:30-14:50 **On the correlation between the stable rate of deformation growth and the fatigue life in concrete** W. Kerkeni, A. Baktheer, M. Aguilar, H. Becks, M. Classen, R. Chudoba	MS05-3:4 | 14:30-14:50 **Mesoscale FEM model of concrete** J. Mašek, P. Miarka
14:50-15:00	Transition to Plenary Session		

MS10-3: Discrete modeling of mechanical and coupled processes in quasi-brittle materials J. Elias, G. Cusatis — EI 7	MS13-3: Advances in the design and assessment of materials and structures for performance, safety, durability, and sustainability D. Lehký, M. Słowik — EI 9	TT-B: Experimental methods J. M. Chandra Kishen, M. Weiß — EI 8	13:30-14:50
MS10-3:1 | 13:30-13:50 **Mesoscale mechanical discrete model for cementitious composites with microfibers** L. Shen, Q. Ren, G. Di Luzio, G. Cusatis	MS13-3:1 | 13:30-13:50 **Early-age strength development of cement pastes made of CEM I, limestone, and calcined clay: the governing role of OPC hydration** S. Schmid, M. Königsberger, B. Pichler	TT-B:1 | 13:30-13:50 **Direct tension test on large concrete specimen: monotonic versus fatigue loading** Y. R., K. Anand, J. M. Chandra Kishen	
MS10-3:2 | 13:50-14:10 **Numerical simulation of 3D printed ultra high-performance concrete using the lattice discrete particle model** B. Ayhan, E. M. Irizarry, E. Lale, K. Yu, M. Troemner, G. Cusatis	MS13-3:2 | 13:50-14:10 **Non-linear digital twin-based performance and service life assessment** A. Strauss, B. Täubling-Fruleux, D. Novák, L. Novák, D. Lehký	TT-B:2 | 13:50-14:10 **Transformation of singular joint deformations into multiple cracks in carbon reinforced concrete pavements** M. Weiß, I. Curosu	
MS10-3:3 | 14:10-14:30 **Calibrating a damage model from lattice discrete results** J. Khoury, G. Pijaudier-Cabot, G. Cusatis	MS13-3:3 | 14:10-14:30 **Reliability assessment of historical reinforced concrete bridge piers based on nonlinear fracture mechanics modelling and safety formats** D. Novák, L. Novák, D. Lehký, A. Strauss, B. Taubling-Fruleux	TT-B:3 | 14:10-14:30 **Influence of crack orientation on propagation behavior of concrete by acoustic emission in compression test** K. Shibano, M. Mukai, T. Suzuki	
MS10-3:4 | 14:30-14:50 **Does printing direction influence the bond between 3D printed polymeric reinforcement and cementitious matrix?** R. J. M. Bol, Y. Xu, M. Lukovic, B. Šavija	MS13-3:4 | 14:30-14:50 **Crack patterns and bond effects in the progressive collapse of local prestressed concrete substructures** T. Qu, B. Zeng, C. Wu, L. Huang, J. Wu	TT-B:4 | 14:30-14:50 **A fracture failure criterion for concrete-concrete interface under mixed mode loading condition** Z. Abbas, K. M. Pervaiz Fathima	
		Transition to Plenary Session	14:50-15:00

Plenary Lecture / Closing Session

C. Hellmich — EI 7

15:00-15:40

Plenary Lecture 6

PL6 | 15:00-15:40

Modeling of fracture in brittle and quasi-brittle materials using graph-based finite element approach

S. Velayudhan, A. R. Srinivasa, P. Thamburaja, J.N. Reddy

Abstract: A thermodynamically consistent model for modeling fracture in brittle and quasi-brittle plates is presented. In particular, using the graph-based (GraFEA) approach of the authors to model fracture in two and three-dimensional elastic problems, a GraFEA model that describes the bending kinematics of plates using the first-order shear deformation theory (FSDT) is developed. The fundamental idea of this model is the presence of multiple microcrack planes traversing through a material point on the top and bottom surfaces of the plate. The state of a crack plane evolves based on the probabilistic description of microcracks at the top and bottom half of the plate. An elastic correctorfracture predictor method and a velocity-verlet algorithm are used to solve the equations governing the bending of plates. It is shown that the proposed formulation compares well with the numerical results from the GraFEA 2D and GraFEA 3D simulations as well as experimental results found in the literature. Complex fracture patterns of plates under static and dynamic loads are predicted within a few minutes on a laptop computer as compared to several hours or days on a supercomputer for a full 3D simulation. A number of numerical examples of plate bending are presented to show the model's robustness.

15:40-16:00

Young Researcher Best Paper Award Ceremony & Closing Session

B. Pichler

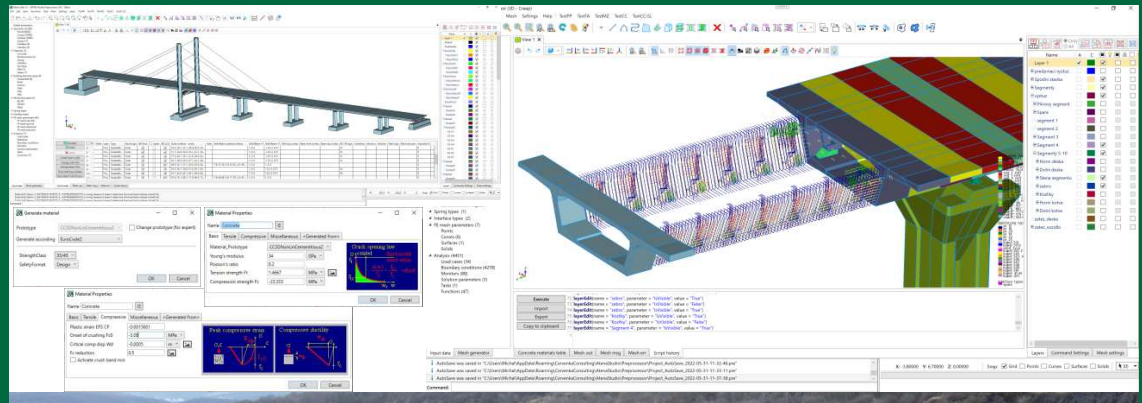
AUTHOR INDEX

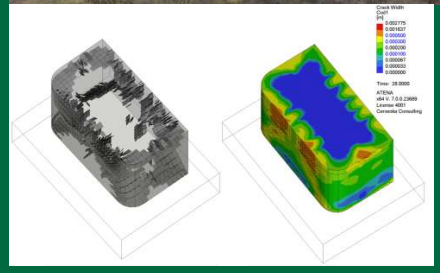
ATENA® 2025

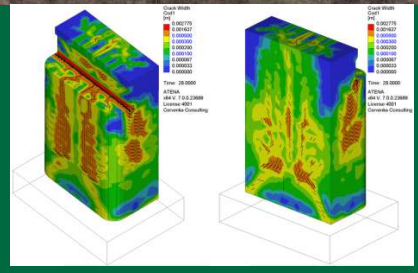
TEST YOUR STRUCTURE BEFORE YOU BUILD IT

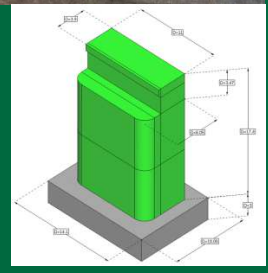
ČERVENKA CONSULTING
Concrete Engineering & Software Solutions

Design and verify complex concrete structures with precision, efficiency and confidence!









ATENA 2025 new and unique features:

- 2D and 3D modelling in a single user friendly environment
- Verification of structural capacity, deflections or crack width
- Thermal analysis of fresh concrete hydration and fire modelling
- Construction process modelling
- Unique run-time visualization
- Unique concrete crack display
- Durability models for reinforcement corrosion, ASR
- Python scripting
- NURBS lines and surfaces
- CAD import: BIM/IFC, GiD, IGES
- 64-bit technology and parallel processing

Červenka Consulting, s.r.o.
Na Hřebenkách 55, Prague 5, Czech Republic
cervenka@cervenka.cz
www.cervenka.cz

MAPS

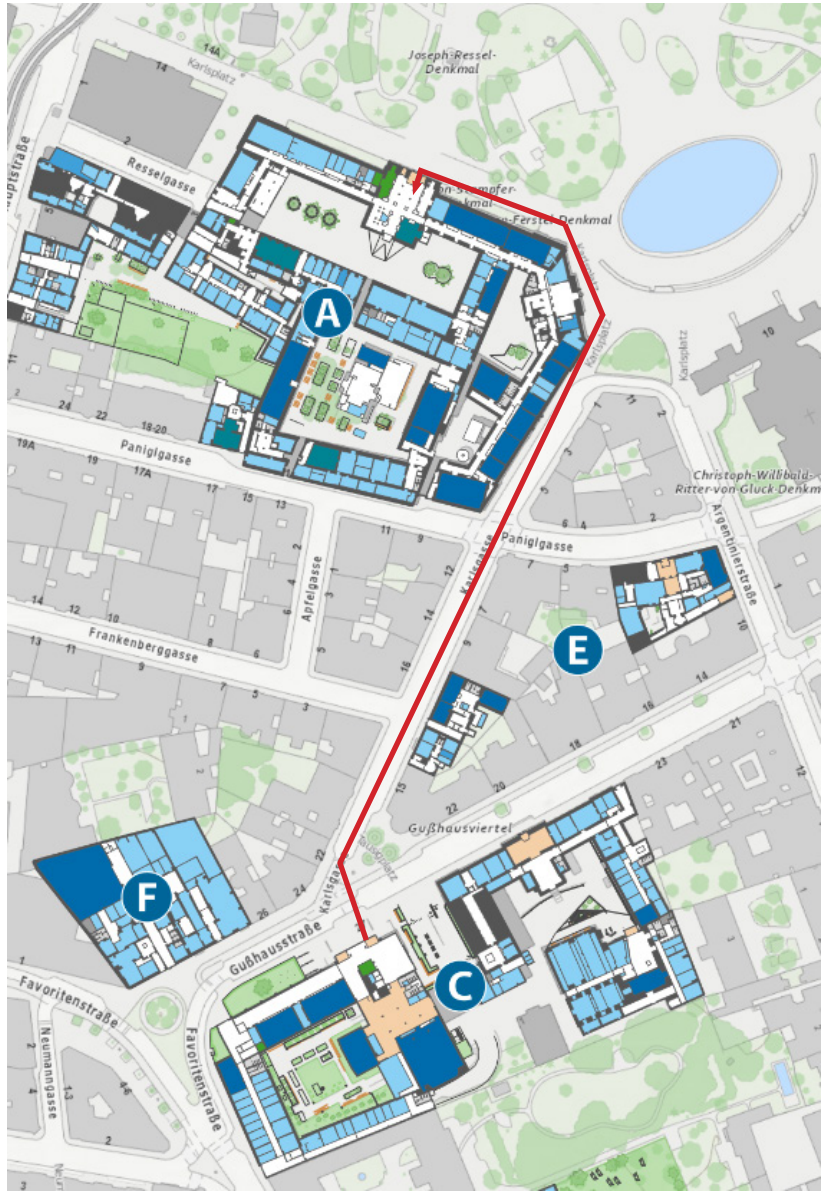
AREA MAP

© TU Wien

(C) Campus Gußhaus
Venue of **FraMCoS XII**

© Matthias Heisler

(A) Main Building of TU Wien
Venue of **Welcome Cocktail**
Venue of **RILEM TC-QPA meeting**



your way to the Main Building of TU Wien
from the Conference Venue

CAMPUS GUSSHAUS – GROUND FLOOR

CAMPUS GUSSHAUS - SECOND FLOOR

FraMCoS XII
12th International Conference on Fracture Mechanics
for Concrete and Concrete Structures

April 23-25, 2025
Vienna, Austria