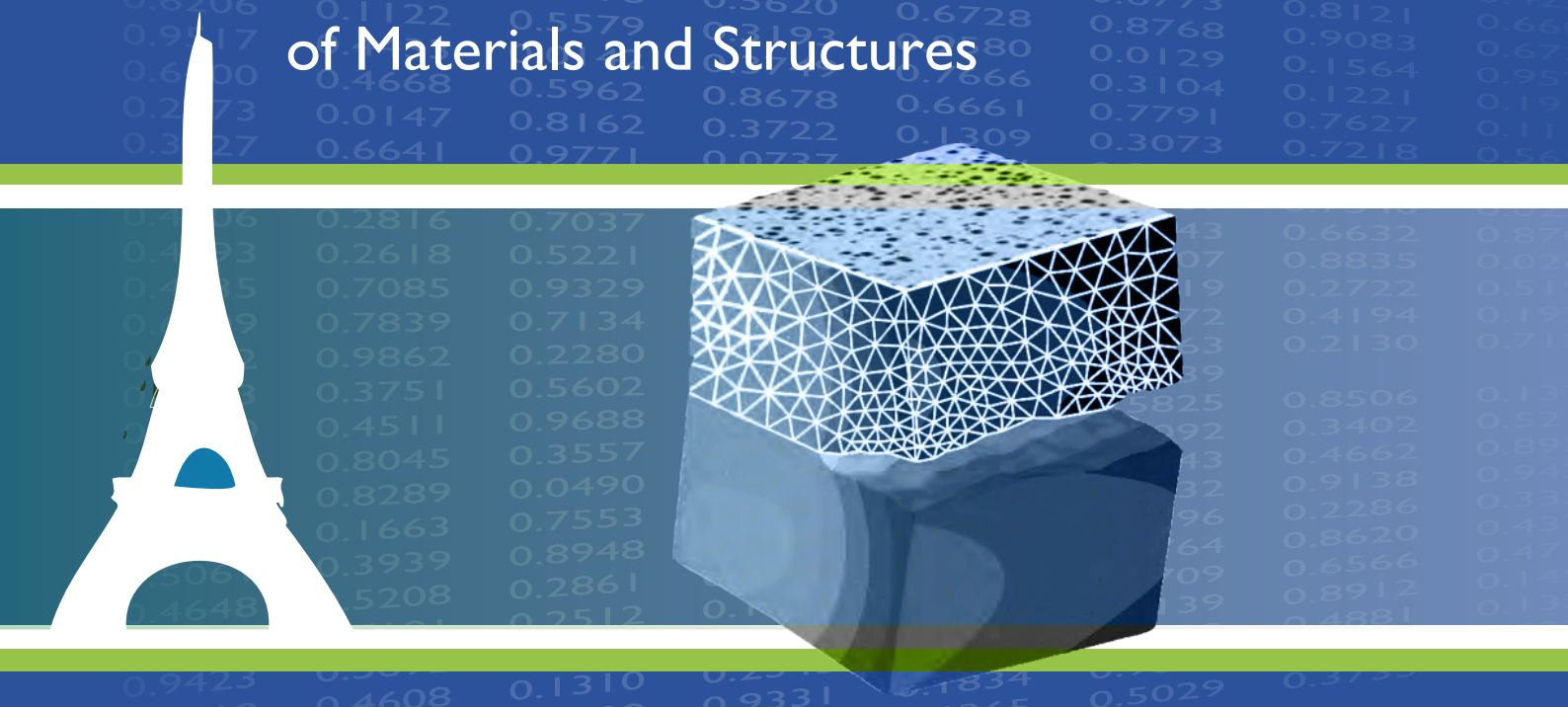
ECCOMAS
European Community on Computational Methods in Applied Sciences

CFRAC 2015

Fourth International Conference on Computational Modeling of Fracture and Failure of Materials and Structures



June 3-5, 2015 | Ecole Normale Supérieure de Cachan, France

Programme

thematic conference ECCOMAS

CFRAC 2015

Fourth International Conference on Computational Modeling of Fracture and Failure of Materials and Structures

École normale supérieure de Cachan, France
June 3-5, 2015

Table of Contents

Conference organization

Foreword

The increasing power of computers and the advent of numerical methods and simulation-based sciences have brought enormous changes in many scientific fields. Well-established paradigms in engineering sciences, based on analytical or experimental methods, are increasingly being replaced by computational methodologies that, though requiring intensive computations, supply detailed information and rapid answers to engineering problems, much beyond the dreams of the past decades.

Fracture mechanics is not being alien to this process and the emerging field of *Computational Material Fracture* is attracting increasing attention of researchers, both from traditional areas of fracture mechanics and from the computational mechanics community, which envisage in that discipline an appealing and challenging scientific field. New industrial applications of fracture mechanics also appear in this context, which often require the development of innovative computational material failure methods. Those methods can then be applied at the structural scales in civil, mechanical, aerospace and naval industries, among others giving responses to problems which were considered as out of reach only few years ago. One of the objectives of those researches is to help designers of engineering structures who have to propose answers to the ever increasing requests on performance in terms of safety, reliability, durability, low cost and low energy consumption. As new materials and new applications arise, traditional design rules and conventional testing methods become insufficient or inapplicable, which strengthens the role of computational methods in the design process.

We hope that, as for the previous CFRAC conferences, CFRAC 2015 will facilitate the exchange of ideas in topics of mutual interest and serve as a platform for establishing links among research groups in Europe and worldwide in the fascinating area of fracture. Finally we would like to express our gratitude to all the Mini-Symposium Organizers who are in fact co-organizers of the conference and who have been able to build such an interesting program.

O. Allix, N. Moës, J. Oliver and M. Jirásek
Chairmen of the Conference

Supporting institutions

- CSMA French Computational Structural Mechanics Association
- ECCOMAS European Community on Computational Methods in Applied Sciences
- ENS Cachan Ecole Normale Supérieure de Cachan
- GeM Ecole Centrale de Nantes / Université de Nantes / CNRS
- CIMNE International Center for Numerical Methods in Engineering
- LMT-Cachan Laboratoire de Mécanique et Technologie
- CNRS Centre national de la recherche scientifique
- UPC Technical University of Catalonia
- Université Paris-Saclay

Plenary lectures (Marie-Curie Amphitheater)

- Wednesday 9:45-10:30 — **M. Ortiz** (Caletch, USA)
  Distributed damage and enhanced permeability in confined brittle materials under triaxial compression
- Thursday 9:00-9:45 — **C. Comi** (Politechnico di Milano, Italy)
  Multi-phase modeling of chemo-mechanical degradation in concrete
- Thursday 9:45-10:30 — **K. Ravi-Chandar** (University of Texas, Austin, USA)
  Experiments and numerical simulations of initiation and growth of cracks under mixed mode I + III loading
- Friday 9:00-9:45 — **C. Miehe** (University of Stuttgart, Germany)
  Phase feld modeling of brittle and ductile fracture in multi-field Environments
- Friday 9:45-10:30 — **E. Van der Giessen** (University of Groningen, Nederlands)
  On toughening in polymer-rubber blends

List of mini-symposia (organized by the member of the scientific committee)

- **MS1 Advanced finite element technology for discontinuities and evolving interfaces**
  J. Alfaiate Instituto (Superior Tecnico, Lisbon, Portugal), L. J. Sluys (Delft University, Netherlands),
  D. Dias-da-Costa (University of Sydney, Australia)
- **MS2: Advances in the Experiment-Modeling Dialog**
  S. Roux (ENS Cachan France), J. Réthoré (LAMCOS, France)
- **MS3: Cracking due to coupled processes, including durability mechanics and hydraulic fracture**
  I. Carol (UPC Barcelona, Spain), K. Willam (University of Houston, Texas, USA)
- **MS4: Ductile fracture, modeling of shear bands and necking**
  P.-O. Bouchard (CEMEF Sophia Antipolis, France), J. M. A. César de Sá (U. of Porto, Portugal),
  R. H. J. Peerlings (TU Eindhoven, Netherlands)
- **MS5: Dynamic fracture, fragmentation and impact**
  A. Combescure (INSA Lyon, France), J. Ožbolt (U. of Stuttgart, Germany)
- **MS6: Fracture and contact, fretting, cohesive interface models**
  F. Gatuingt (ENS Cachan France), J-F Molinari (EPFL, Switzerland)
- **MS7: Fracture and damage of composites and laminates**
  P. P. Camanho (U. of Porto, Portugal), S. Hallett (U. of Bristol, United Kingdom), J. Remmers (TU Eindhoven, Netherlands)
- **MS8: Fracture of thin structure**
  P. Areias (Univesidade de Evora, Portugal), T. Rabczuk (Institute of Structural Mechanics Bauhaus-University of Weimar, Germany),
  M. Bezzeghoud (Univesidade de Evora, Portugal)
- **MS9: Industrial applications**
  J. C. Gálvez (U.P. Madrid, Spain), C. Huchette (ONERA, France), P. Massin (LAMSID-EDF, France), Ph. Pasquet (Consultant, France)
- **MS10: Innovative trends and applications in fracture mechanics**
  O. Allix (ENS Cachan, France), M. Jirásek (Czech Technical University in Prague, Czech Republic), X. Oliver (TU Catalonia, Spain),
  N Moës (ECN Nantes, France)
- **MS11: Modeling of cutting, puncturing, blanking and similar processes**
  U. Perego (Politechnico di Milano, Italy), J-P. Ponthot (Université de Liège, Belgium)
- **MS12: Modeling of data uncertainty in failure analysis**
  M. Kaliske (TU Dresden, Germany)
- **MS13: Multi-scale analysis**
  M. G. D. Geers (TU Eindhoven, Netherlands), A. E. Huespe (Universidad Nacional del Litoral, Argentina),
  S. Loehnert (U. of Hannover, Germany), X. Oliver (TU Catalonia, Spain), P. Wriggers (U. of Hannover, Germany)
- **MS14: Nonlocal damage models and other regularized approaches & transition from damage to fracture**
  C. Miehe (U. of Stuttgart, Germany), M. Jirásek (Czech Technical University in Prague, Czech Republic),
  N. Moës (ECN Nantes, France)
- **MS15: Quasi-brittle failure with applications to concrete and fiber-reinforced concrete**
  I. Carol (UPC Barcelona, Spain), G. Pijaudier-Cabot (U. of Pau, France)
- **MS16: Theory of fracture, crack propagation criteria, and crack tracking algorithms**
  A. Pandolfi (Politecnico di Milano, Italy), M. Ortiz (Caltech, USA)

Local organizing committee

- E. Baranger
- A. Benallal
- P.-A. Boucard
- C. Cheveaux (website)
- F. Gatuingt
- P. Gosselet
- P.-A. Guidault
- F. Hild
- L. Matijevic (secretary)
- D. Néron
- F. Ragueneau
- S. Roux

Overview of the programme

Wednesday

- 08:00-09:15 — **Registration** and **Breakfast** (Hall Villon)
- 09:15-09:45 — **Opening** (Marie-Curie)
- 09:45-10:30 — **Plenary lecture M. Ortiz** (Marie-Curie)
- 10:30-10:45 — **Coffee break**
- 10:45-12:45 — **Parallel sessions MS14, MS16, MS1, MS2, MS9, MS6**
- 12:45-13:45 — **Lunch** (Hall Villon)
- 13:45-15:45 — **Parallel sessions MS14, MS16, MS1, MS2, MS9, MS10**
- 15:45-16:00 — **Coffee break**
- 16:00-18:00 — **Parallel sessions MS14 MS16, MS15, MS7, MS10**

Thursday

- 08:00-09:00 — **Registration** and **Breakfast** (Hall Villon)
- 09:00-09:45 — **Plenary lecture C. Comi** (Marie-Curie)
- 09:45-10:30 — **Plenary lecture K. Ravi-Chandar** (Marie-Curie)
- 10:30-10:45 — **Coffee break**
- 10:45-12:45 — **Parallel sessions MS14, MS16, MS13, MS15, MS7**
- 12:45-13:45 — **Lunch** (Hall Villon)
- 13:45-15:45 — **Parallel sessions MS14, MS4, MS13, MS5, MS3**
- 15:45-16:00 — **Coffee break**
- 16:00-18:00 — **Parallel sessions MS14, MS4, MS13, MS5, MS7**

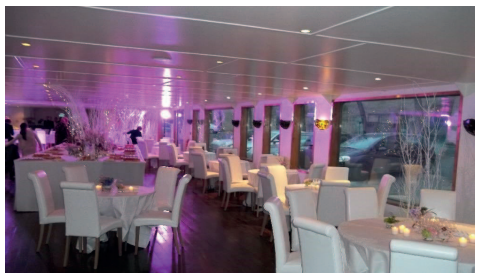
- 19:30-23:30 — **Banquet** on the River Seine

Friday

- 08:00-09:00 — **Registration** and **Breakfast** (Hall Villon)
- 09:00-09:45 — **Plenary lecture C. Miehe** (Marie-Curie)
- 09:45-10:30 — **Plenary lecture E. Van der Giessen** (Marie-Curie)
- 10:30-10:45 — **Coffee break**
- 10:45-12:45 — **Parallel sessions MS14, MS4, MS13, MS5, MS3**
- 12:45-13:45 — **Lunch** (Hall Villon)
- 13:45-15:45 — **Parallel sessions MS4, MS13**
- 15:45-18:00 — **"Wine and Cheese"** (Hall Villon)

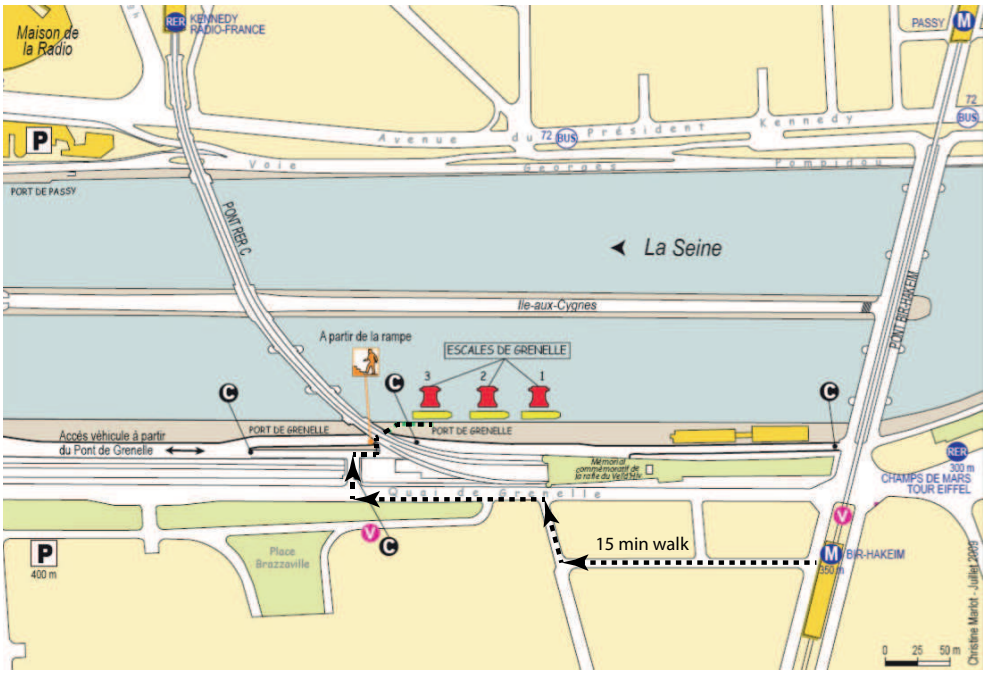
Information about the banquet

The conference banquet will be held on Thursday evening aboard the Boréas. The Boréas, authentic boat from the XXieth-century, is a luxurious cruiseship with a spacious panoramic deck and a pleasant terrasse.



With a capacity of up to 400 people, the captain will take you on board of one of the biggest cruise ships in Paris. Whilst cruising on the Seine and passing under some of the 36 historical bridges, you will admire the city of Paris with its stunning monuments. **Enjoy spectacular views as you glide down the Seine!**

- 19:30 — Welcome cocktail aboard the Boréas at Quai de Grenelle, 75015 Paris
- 20:15 — Boat departure
- 21:00 — Dinner
- 22:45 — Boat arrival
- 23:30 — Evening closure



Wednesday — Parallel sessions 10:45-12:45

MS14 — Chair: C. Miehe. M. Jirasek. N. Moes — Marie-Curie

Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
10:45 11:15	Study of crack front fragmentation using a phase field model (Keynote)	Hervé Henry
11:15 11:35	Phase-field modeling of dynamic instabilities in brittle fracture	Alain Karma
11:35 11:55	Algorithmic aspects of the efficient phase-field computing of fracture	Tymofiy Gerasimov
11:55 12:15	Nucleation, initiation, and propagation of cracks in gradient damage models	Corrado Maurini

MS16 — Chair: M. Ortiz — Condorcet

Theory of fracture, crack propagation criteria, and crack tracking algorithms

	Title	Authors
10:45 11:15	Recent progress and remaining challenges in the mathematics of sharp interface fracture evolution (Keynote)	Christopher Larsen
11:15 11:35	From micro- to macroscale fracture properties of highly heterogeneous interfaces: towards a perturbation-based numerical method?	Veronique Lazarus
11:35 11:55	Fracture models for elasto-plastic materials as limits of gradient damage models coupled with plasticity: the antiplane case	Rodica Toader
11:55 12:15	Effect of Non-Uniform Stress Field on Bi-dimensional Cohesive Crack Initiation and Propagation	Pham Tuan Hiep,

MS1 — Chair: B. Sluys. J. Alfaiate — Tocqueville

Advanced finite element technology for discontinuities and evolving interfaces

	Title	Authors
10:45 11:15	A new generalized finite element method for two-scale simulations of propagating cohesive fractures in 3-D (Keynote)	Armando Duarte
11:15 11:35	A stabilization technique for nearly singular extended finite elements used for static and dynamic crack analysis	Stefan Loehnert
11:35 11:55	Numerical modelling of load-sequence effects on fatigue crack growth	Lars Voormeeren
12:15 12:35	Modelling of Damage in Reinforced Beam-Column Elements with Embedded Discontinuities	Gelacio Juárez-Luna
11:55 12:15	Determination of the fracture parameters in three-dimensional structure by the finite element method	Lallam Mostefa

MS2 — Chair: S. Roux. J. Réthoré — 112

Advances in the Experiment-Modeling Dialog

	Title	Authors
10:45 11:15	Integration of Micromechanical Measurements to Support Microstructure-Based Modeling (Keynote)	Eric Landis
11:15 11:35	Mechanical behavior and failure of irradiated filled elastomer using molecular dynamics	Morgane Mahaud
11:35 11:55	Heterogeneity informed quantitative micromechanical approach of ductile fracture in 6xxx aluminium alloys.	Florent Hannard
11:55 12:15	Modelling of concrete fracture at aggregate level using FEM and DEM	Michal Nitka
12:15 12:35	Numerical modeling of propagating compaction bands in brittle granular media	Francois Guillard

MS9 — Chair: C. Huchette. J. C. Gálvez — 103

Industrial applications

	Title	Authors
10:45 11:15	Influence of residual stresses on lifespan and crack path assessment of a disk blade connection (Keynote)	Benoît Dompierre
11:15 11:35	Damage evolution in pearlitic steel specimens under tension by means of X-ray computed tomography	Jaime Galvez
11:35 11:55	Contribution of advanced and non linear material behavior law for sizing industrial composite structures	Cédric Huchette
11:55 12:15	Investigation in rolling contact fatigue crack growth in rails of SNCF network	Si Hai Mai
12:15 12:35	Numerical modelling of sheet-metal blanking using XFEM with ductile fracture	Spela Bolka

MS6 — Chair: F. Gatuingt. J-F. Molinari — Fonteneau

Fracture and contact, fretting, cohesive interface models

	Title	Authors
10:45 11:05	A 3D multiscale cohesive zone model accounting for friction, damage and interlocking	Marco Albarella
11:05 11:25	A quantitative investigation of the competition between cohesive and adhesive fracture at interfaces	Joris Remmers
11:25 11:45	Mesoscopic analysis of concrete failure behavior under high temperature effects	Guillermo Etse
11:45 12:05	Simulation of ductile fracture of aluminum alloy using a triaxiality dependent cohesive zone model	Anuradha Banerjee
12:05 12:25	A mesoscopic approach to study the influence of aggregates spatial arrangement on concrete dynamic behavior	Silvère Pierre
12:25 12:45	On the development of a cohesive model for crack propagation in wood under relative humidity variations	Ngoc Anh Phan

MS14 Chair: C. Miehe. M. Jirasek. N. Moes **Marie-Curie**
Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
13:45 14:15	A Geometry-Based Anisotropic Gradient-Enhanced Damage Model for Modelling Masonry Failure (Keynote)	Bram Vandoren
14:15 14:35	Modelling of microcracking in microtomography image-based models of cement materials using phase field method	Julien Yvonnet
14:35 14:55	A transient gradient damage model based on the homogenization of inter-granular failure	Leong Hien Poh
14:55 15:15	Nonlocal Regularization for Loss of Ellipticity in Inelastic Problems	Alejandro Mota

MS16 Chair: C. Larsen. F. Bobaru **Condorcet**
Theory of fracture, crack propagation criteria, and crack tracking algorithms

	Title	Authors
13:45 14:05	On the morphology of dynamic cracks surfaces and how to resolve them computationally	Florin Bobaru
14:05 14:25	Study of fracture patterns generated by different failure criteria in ordinary state-based Peridynamics	Giulia Sarego
14:25 14:45	Representation of stress in plane cracked solids with Laurent series	Gaetan Hello
14:45 15:05	Crack-surface based path-following control for phase-field modeling of brittle fracture	Nitish Singh
15:05 15:25	Mixed mode fracture separation in orthotropic media due to mechanical and thermal effects	Rostand Moutou Pitti

MS1 Chair: B. Sluys. J. Alfaiate **Tocqueville**
Advanced finite element technology for discontinuities and evolving interfaces

	Title	Authors
13:45 14:05	Mixed-mode fracture in strong discontinuities	Jorge Alfaiate
14:05 14:25	Cohesive crack with friction growing at the interface between dissimilar isotropic materials	Silvio Valente
14:25 14:45	An adaptive body-fitted monolithic method for modeling the fracture of heterogeneous microstructures	Modesar Shakoor
14:45 15:05	On the treatment of crack boundary conditions in phase field models of dynamic fracture	Michael Strobl
15:05 15:25	Finite element interface model for simulating delamination using a thick level set approach	Mohammad Latifi

MS2 Chair: S. Roux. J. Réthoré **112**
Advances in the Experiment-Modeling Dialog

	Title	Authors
13:45 14:05	X-DIC for ductile tearing monitoring using ultra high resolution cameras	Michel Coret
14:05 14:25	Mode I-III Decomposition of the J-integral from Digital Image Correlation Displacement Data	Matthew Molteno
14:25 14:45	Crack propagation in inelastic pre-strained specimen	Sven von Ende
14:45 15:05	Mixed mode fracture of mortar joints in masonry buildings	Marie Sauve
15:05 15:25	Experimental database for mixed-mode crack propagation in concrete: comparison between experimental and numerical results using full-field measurements	Andreea Carpiuc-Prisacari
15:25 15:45	Extraction of SIFs and crack tip detection for curved cracks using digital images	Julien Réthoré

MS9 Chair: P. Massin. Ph. Pasquet **103**
Industrial applications

	Title	Authors
13:45 14:05	Computational and Experimental Fracture Assessment of a Cracked Hand Wheel	Goran Vukelic
14:05 14:25	Modelling and Simulation of TB32 Crash Test of N2-W4-A Category Safety Barrier on Road Bend	Marian Klasztorny
14:25 14:45	Modeling Failure Progression in Structures Informed by Demolition and Forensic Experience	Francesca Brando
14:45 15:05	Current status in fuel performance codes of cracks and damage modelling	Thomas Helfer
15:05 15:25	Finite Element Analysis of Ductile Fracture during Shearing Process of Shield Slot Plate for Molten Carbonate Fuel Cell	Ho Won Lee

MS10 Chair: U. Perego **Fonteneau**
Innovative trends and applications in fracture mechanics

	Title	Authors
13:45 14:15	Fail-safe Design of Structures Based on the Material Force Approach and Uncertainty Analysis (Keynote)	Michael Kaliske
14:15 14:35	Explicit simulation of blade cutting and through-the-thickness fracture in multi-layer, thin-walled structures	Federica Confalonieri
14:35 14:55	Comparison of fracture prediction models on sheet metal blanking simulations	Cristian Canales
14:55 15:15	Analyzing 3D cracks using arbitrary tetrahedral meshes	Morteza Nejati
15:15 15:35	Investigation into the rupture of the grains in an granular material in an oedometric loading and the fracture energy	Aymen Seyf Eddine Salhi

Wednesday — Parallel sessions 16:00-18:00

MS14 Chair: C. Miehe. M. Jirasek. N. Moes **Marie-Curie**
Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
16:00 16:20	Smeared damage model and crack localization for RC multi-fiber beam descriptions	Jacky Mazars
16:20 16:40	Experimental and theoretical investigations of concrete fatigue using damage approach with non-local softening	Ireneusz Marzec
16:40 17:00	Combined XFEM-continuous damage mechanics approach for three dimensional concrete crack propagation	Simon-Nicolas Roth
17:00 17:20	Formulation of a constitutive law with a gradual transition from continuous to discontinuous descriptions of cracks in concrete	Jerzy Bobinski
17:20 17:40	Intermittency and localization in quasi-brittle failure of heterogeneous materials: A numerical and analytical study	Estelle Berthier

MS16 Chair: V. Lazarus. N. Moës **Condorcet**
Theory of fracture, crack propagation criteria, and crack tracking algorithms

	Title	Authors
16:00 16:20	Three-dimensional crack nucleation, growth and coalescence using the Thick Level Set approach to fracture	Nicolas Moës
16:20 16:40	3D crack propagation with X-FEM cohesive elements	Patrick Massin
16:40 17:00	Fast marching method for threedimensional crack propagation	Matthieu Le Cren
17:00 17:20	Finite-element modeling and analyses for quasicrystals with cracks	Zhibin Wang
17:20 17:40	Crack path predictions and experiments in structures with interfaces	Paul Judt
17:40 18:00	Modelling of Quasi-Brittle Fracture in Large Scale Coarse Mesh Finite Element Models using the FEMME Finite Element Microstructure MEshfre Multiscale Model	Luis Saucedo-Mora

Chair: **Tocqueville**

	Title	Authors

MS15 Chair: G. Piiaudier-Cabot **112**
Quasi-brittle failure with applications to concrete and fiber-reinforced concrete

	Title	Authors
16:00 16:20	Numerical Simulation of Fracturing in Steel Fiber Reinforced Concrete Structures using Interface Solid Elements	Yijian Zhan
16:20 16:40	Embedded Finite Element Method based on plate-kinematics for reinforced concrete elements	Ejona Kishta
16:40 17:00	Numerical simulations to determine the constitutive parameters of the oxide layer in corrosion of reinforced concrete	Beatriz Sanz
17:00 17:20	A Smooth unloading-reloading approach for modelling quasi-brittle failure	Waled Alnaas
17:20 17:40	General sequentially linear method for saw-teeth constitutive relations	Jan Elias
17:40 18:00	Eigenerosion: extension and applications to heterogeneous media	Lionel Bichet

MS7 Chair: J. Remmers **103**
Fracture and damage of composites and laminates

	Title	Authors
16:00 16:20	Dynamic effects in unidirectional fiber-reinforced composites: a peridynamic analysis	Florin Bobaru
16:20 16:40	A New Mixed DEM/FEM Approach to Model Advanced Damage of Reinforced Concrete	Serguei Potapov
16:40 17:00	A mesh independent simplified cohesive segment method to model matrix cracking in composites.	Supratik Mukhopadhyay
17:00 17:20	Modelling multiple delamination and intralaminar cracks using a single-layer shell approach	Martin Fagerström
17:20 17:40	Translaminar fracture of WRM composite using Random Spring Network	Anuradha Banerjee
17:40 18:00	A computational approach to the ultimate failure of unidirectional ceramic-matrix composites	Guillaume Couégnat

MS10 Chair: M. Kaliske **Fonteneau**
Innovative trends and applications in fracture mechanics

	Title	Authors
16:00 16:20	Design of Sheet Metal Forming Process for Reducing the Stress Concentration of Corrugated Plate for Molten Carbonate Fuel Cell	Young-Seok Oh
16:20 16:40	Influence of Autocorrelation Length in Random Lattice-Particle Model	Jana Kaderova
16:40 17:00	Strain Rate Influence on the Elastoplastic Damage Behaviour of Nodular Cast Iron	Ivica Skozrit

MS14 Chair: C. Miehe. M. Jirasek. N. Moes **Marie-Curie**

Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
10:45 11:15	Mixing first- and second-gradient models in finite element simulations of ductile rupture (Keynote)	Jean-Baptiste Leblond
11:15 11:35	A non-local damage model for ductile fracture	Jose Cesar de Sa
11:35 11:55	Ductile damage modeling with locking-free regularized GTN model	Yi Zhang
11:55 12:15	Numerical treatment of the damage/crack transition in a Gurson ductile material	Johannes Wolf
12:15 12:35	3D ductile crack propagation with the XFEM	Steffen Beese

MS16 Chair: A. Pandolfi. R. Toader **Condorcet**

Theory of fracture, crack propagation criteria, and crack tracking algorithms

	Title	Authors
10:45 11:15	Intrinsic Brittleness of Magnesium (Keynote)	William Curtin
11:15 11:35	Plasticity-induced crack closure during cyclic propagation: numerical prediction of crack shape evolution	Catherine Gardin
11:35 11:55	Assessment of Size-Dependent Fatigue Failure Modes Using a Cyclic Cohesive Zone Model	Stephan Roth
11:55 12:15	Effect of brittle fracture in a metaconcrete slab under shock loading	Anna Pandolfi

MS13 Chair: Geers. Huespe. Loehnert. Oliver. Wriggers **Tocqueville**

Multi-scale analysis

	Title	Authors
10:45 11:15	A Multiscale Approach to Fracture in Brick-Mortar Masonry Composites (Keynote)	Kaspar Willam
11:15 11:35	3D dislocation dynamics simulation of crack shielding and blunting in FCC metals	Laurent Korzeczek
11:35 11:55	Fracture initiation in multi-phase materials: a micromechanical approach	Ron Peerlings
11:55 12:15	Multiscale homogenization for ductile materials with initial voids: an arc length based procedure for the rve constitutive modeling	Ayrton Ferreira

MS15 Chair: I. Carol **112**

Quasi-brittle failure with applications to concrete and fiber-reinforced concrete

	Title	Authors
10:45 11:05	Experimental and numerical investigations of the correlations involved during failure in quasi-brittle materials	David Grégoire
11:05 11:25	Mesoscale modelling of concrete quasi-brittle behaviour	Alexandre Gangnant
11:25 11:45	Analysis of Crack Propagation Instabilities in Rock Specimens via Numerical Analysis of Wedge Splitting Tests	Ignacio Carol
11:45 12:05	Benefits of numerical experimentation to formulate and calibrate constitutive laws for concrete	Maxime Vassaux
12:05 12:25	A thermodynamically consistent framework to couple microplane damage and plasticity models	Aamir Dean
12:25 12:45	FE analyses of a coupled energetic-statistical size effect in concrete beams under bending	Ewelina Syroka-Korol

MS7 Chair: S. Hallett **103**

Fracture and damage of composites and laminates

	Title	Authors
10:45 11:15	Transverse cracking scenarios under oxidation and mechanical loading in polymer matrix composites (Keynote)	Federica Daghia
11:15 11:35	A general Finite Fracture Mechanics model for crack initiation in adhesive lap joints	Nicolas Stein
11:35 11:55	Pattern based description of a CMC yarn failure combining GFEM multi-scale & Finite Fracture Mechanics	Orestis Friderikos
11:55 12:15	Simulation of ply damage and delamination in multilayer composites to predict the residual compressive strength after impact loading	Martin Springer

Chair: **Fonteneau**

	Title	Authors

MS14 Chair: C. Miehe. M. Jirasek. N. Moes **Marie-Curie**
Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
13:45 14:05	Gradient-enriched models: the role of boundary conditions on failure initiation and propagation	Antonio Rodriguez-Ferran
14:05 14:25	Nonlocal Averaging Near Boundaries and Its Influence on Size Effect	Milan Jirasek
14:25 14:45	Isotropic and anisotropic damage-dependent interactions motivated by internal time	Rodrigue Desmorat
14:45 15:05	The Thick Level Set approach, towards simulations coupling local and non-local evolutions	Kévin Moreau
15:05 15:25	Strain localisation from eikonal nonlocal damage formulation with evolving internal length	Cédric Giry
15:25 15:45	A transition approach from a local second gradient model to a cohesive zone model	Panagiotis Kotronis

MS4 Chair: Bouchard. Cesar de Sa. Peerlings **Condorcet**
Ductile fracture, modeling of shear bands and necking

	Title	Authors
13:45 14:05	Localization and damage interactions in Al-alloy sheets: in situ 3D measurements	Thilo Morgeneyer
14:05 14:25	Ductile damage analysis by particles tracking in large tomographic dataset	Christophe Le Bourlot
14:25 14:45	In situ 3D observation of ductile failure mechanisms in cast iron under shear loading	Lutz Zybel
14:45 15:05	Micromechanical modelling of ductile fracture mechanisms using a new body-fitted immersed volume method	Pierre-Olivier Bouchard
15:05 15:25	Plasticity-damage couplings in Titanium alloys	Oana Cazacu

MS13 Chair: Geers. Huespe. Loehnert. Oliver. Wriggers **Tocqueville**
Multi-scale analysis

	Title	Authors
13:45 14:05	Multiscale Schemes for Modelling Fracture in Soft and Brittle Materials under Impact	Amin Karamnejad
14:05 14:25	Computational homogenization of fracturing continua using weakly periodic boundary conditions	Erik Svenning
14:25 14:45	X-FEM based computational homogenization-localization for propagating discontinuities	Emanuela Bosco
14:45 15:05	Numerical simulation of damage patterns in brittle materials under thermo-mechanical loading	Dimitri Henneberg
15:05 15:25	Determination of the Effective Fracture Behavior of Heterogeneous Materials by a Phase Field Approach	Charlotte Kuhn
15:25 15:45	Compressive failure of composites: A computational homogenization approach	Saeid Nezamabadi

MS5 Chair: A. Combescure. J. Ozbolt **112**
Dynamic fracture, fragmentation and impact

	Title	Authors
13:45 14:15	Dynamic Fracture of Materials and Structures (Keynote)	Josko Ozbolt
14:15 14:35	Numerical Analyses of Fracture and Failure of Concretes under Dynamic Loading Conditions	Gengsheng Wang
14:35 14:55	Fracture of Recycled Aggregate Concrete under High Loading Rates	Yunping Xi
14:55 15:15	Impact Comminution of Solids Due to Progressive Crack Growth Driven by Kinetic Energy of High-Rate Shear	Zdenek Bazant
15:15 15:35	Simulation of dynamic tensile failure of quasi-brittle materials with a rate dependent, stress-enhanced nonlocal damage model	Luis Pereira

MS3 Chair: I. Carol. K. Willam **103**
Cracking due to coupled processes, including durability mechanics and hydraulic fracture

	Title	Authors
13:45 14:05	3D simulation of interface debonding driven by fluid injection	Vasily Lapin
14:05 14:25	A microstructural model of porosity based on brittle damage	Anna Pandolfi
14:25 14:45	Hydrogen-assisted crack propagation modelling with a cohesive zone model approach	Mandana Arzaghi
14:45 15:05	3D analysis of hydraulic fracture with zero-thickness interface elements, comparison with GDK and PKN analytical methods	Daniel Garolera
15:05 15:25	Numerical modeling of hydraulic fracturing under the influence of natural faults.	Ernst Remij
15:25 15:45	Lattice modelling of hydraulic fracture	Gilles Pijaudier-Cabot

Chair: **Fonteneau**

	Title	Authors

MS14 Chair: C. Miehe. M. Jirasek. N. Moes **Marie-Curie**
Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
16:00 16:20	Microdamage modeling of crack initiation and propagation in metal single crystals	Samuel Forest
16:20 16:40	Phase-field modeling of ductile fracture	Laura De Lorenzis
16:40 17:00	Fracture as material instability in strain-softening processes: a non-convex variational approach	Giovanni Lancioni

MS4 Chair: Bouchard. Cesar de Sa. Peerlings **Condorcet**
Ductile fracture, modeling of shear bands and necking

	Title	Authors
16:00 16:20	A bipotential-based approach of ductile porous materials having a non-associated matrix: theory and numerical assessment	Djimédo Kondo
16:20 16:40	New three-dimensional strain-rate potentials for isotropic porous metals: role of the plastic flow of the matrix	Benoit Revil-Baudard
16:40 17:00	Porous materials with Mohr-Coulomb matrix: theoretical investigation and numerical validation	Kokou Anoukou
17:00 17:20	Mesh objective models for ductile fracture based on a damage phase field concept	Ragnar Larsson

MS13 Chair: Geers. Huespe. Loehnert. Oliver. Wriggers **Tocqueville**
Multi-scale analysis

	Title	Authors
16:00 16:20	Crystal plasticity model for describing fatigue of a lead-free solder under passive temperature cycling	Van Nhat Le
16:20 16:40	High toughness fibrillating interfaces in stretchable electronics - a multi-scale numerical and experimental analysis	Olaf van der Sluis
16:40 17:00	3D Fracture Simulation in Porous Graphite	Yelena Vertyagina

MS5 Chair: A. Combescure. J. Ozbolt **112**
Dynamic fracture, fragmentation and impact

	Title	Authors
16:00 16:20	Peridynamic modeling of crack branching and impact on polycrystalline ceramics	Florin Bobaru
16:20 16:40	Mass and velocity of fragments in impact fragmentation	Gergo Pal
16:40 17:00	Inverse analysis in fracture mechanics: Comparison of two numerical methods for spalling test simulations	Tim Dally
17:00 17:20	Digital image analysis of ASB assisted dynamic fracture under impact loading	Emile Roux
17:20 17:40	Multiscale simulation of damage and fracture of ceramic nanocomposites under intensive pulse loading	Vlafdimir A. Skripnyak

MS7 Chair: M. Fagerstrom **103**
Fracture and damage of composites and laminates

	Title	Authors
16:00 16:20	A Phenomenological Damage Model for Elastoplastic Behavior of Particle Reinforced TRIP-Steel Matrix Composites based on Micromechanical Simulations	Meinhard Kuna
16:20 16:40	Micro-mechanical analysis of the in situ effect in polymer composite laminates	Albertino Arteiro
16:40 17:00	Void shape effects and porosity ratcheting of elasto-plastic materials subjected to cyclic loading	Kostas Danas
17:00 17:20	Numerical Simulation and Analysis of a Progressive Failure of Notched Composite Laminates Based on Elastoplastic Damage Model	Evgeny Morozov

Chair: **Fonteneau**

	Title	Authors

MS14 Chair: C. Miehe. M. Jirasek. N. Moes **Marie-Curie**
Nonlocal damage models and other regularized approaches & Transition from damage to fracture

	Title	Authors
10:45 11:05	Isogeometric Implementation of the High-Order Microplane Model for Softening and Localization	Cusatis Gianluca
11:05 11:25	Strain-gradient vs. damage-gradient regularizations of damage models	Duc Trung Le
11:25 11:45	Record breaking events in crackling time series	Zsuzsa Danku
11:45 12:05	Remarks on constitutive laws and influence functions used in the Peridynamic theory	Mirco Zaccariotto
12:05 12:25	Isogeometric collocation for phase-field modeling of brittle fracture	Marreddy Ambati

MS4 Chair: Bouchard. Cesar de Sa. Peerlings **Condorcet**
Ductile fracture, modeling of shear bands and necking

	Title	Authors
10:45 11:15	Unraveling the apparent ductility of martensite: a computational micro-scale analysis (Keynote)	Marc Geers
11:15 11:35	A Homogenization model for porous crystals comprising general ellipsoidal voids	Armel Brice Mbiakop Ngassa
11:35 11:55	Molecular dynamics investigation of dynamic effects in fracture of ductile materials	Varun Rajan
11:55 12:15	Void growth and coalescence in an irradiated single crystal	Chao Ling

MS13 Chair: Geers. Huespe. Loehnert. Oliver. Wriggers **Tocqueville**
Multi-scale analysis

	Title	Authors
10:45 11:15	A Concurrent Parallel Multiscale Algorithm for Large 3D Continuum/Atomistic Simulations with Applications to Dislocations (Keynote)	William Curtin
11:15 11:35	Compelling issues in modelling concrete with recycled aggregates	Gianluca Mazzucco
11:35 11:55	Double scale approaches for the behaviour of a clay rock: full field measurement and FE2 model for hydro-mechanical coupling	Pierre Bésuelle
11:55 12:15	Multiscale modelling of propagating fracture in quasi brittle materials: a continuum approach	Javier Oliver

MS5 Chair: A. Combescure. J. Ozbolt **112**
Dynamic fracture, fragmentation and impact

	Title	Authors
10:45 11:15	Gradient Damage Models and Their Use to Approximate Dynamic Brittle Fracture (Keynote)	Tianyi Li
11:15 11:35	Addressing grid sensitivity in Peridynamics: an adaptive refinement approach	Daniele Dipasquale
11:35 11:55	Dynamic fracture of thin shells: an X-FEM approach	Alain Combescure
11:55 12:15	Accurate Finite Element Modeling of Stresses for Stationary Cracks Under Impact Loading	Alexander Idesman
12:15 12:35	A local phantom node approach for crack propagation and fragmentation	Jessica Sanders

MS3 Chair: I. Carol. K. Willam **103**
Cracking due to coupled processes, including durability mechanics and hydraulic fracture

	Title	Authors
10:45 11:15	Stability of distributed hydraulic fractures against localization: A fundamental problem in fracking of gas shale (Keynote)	Zdenek Bazant
11:15 11:35	Peridynamic modeling of pitting corrosion damage	Ziguang Chen
11:35 11:55	Using the coupled criterion to predict surface cracking induced by oxidation in polymers	Dominique Leguillon
11:55 12:15	Utilization of Kinetic Model on the Expansion of Modified AMBT	Nader Ghafoori

Chair: **Fonteneau**

	Title	Authors

Chair: **Marie-Curie**

	Title	Authors

MS4 **Chair:** Bouchard. Cesar de Sa. Peerlings **Condorcet**

Ductile fracture, modeling of shear bands and necking

	Title	Authors
13:45 14:05	Damage evolution law based on the micromechanical of defects and coupled in an unconventional yield surface	Lucival Malcher
14:05 14:25	High and low stress triaxiality GTN-based ductile failure model	Jose Cesar de Sa
14:25 14:45	Numerical simulation of biaxial experiments on stress-state-dependent behavior of ductile metals	Michael Brunig
14:45 15:05	Use of a continuum damage model with the improved Lemaitre's damage evolution law to estimate fatigue life	Estarle Roberto Campos

MS13 **Chair:** Geers. Huespe. Loehnert. Oliver. Wriggers **Tocqueville**

Multi-scale analysis

	Title	Authors
13:45 14:05	Computational modeling of molecular discrete systems: the role of nonlocality on flaw-tolerance	Andrea Infuso
14:05 14:25	A Multiscale Formulation for Cohesive Fracture Analysis	Alfredo Huespe
14:25 14:45	Fracture of light alloys with unimodal and bimodal grain size distribution: Multiscale simulation	Vladimir V. Skripnyak

Chair: **112**

	Title	Authors

Chair: **103**

	Title	Authors

Chair: **Fonteneau**

	Title	Authors

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