

INSTITUTE OF GEONICS AS CR, OSTRAVA

VŠB - TECHNICAL UNIVERSITY OF OSTRAVA

IMACS: INTERNATIONAL ASSOCIATION FOR
MATHEMATICS AND COMPUTERS
IN SIMULATION

Modelling 2014

Scientific program

JUNE 2 – 6, 2014

ROŽNOV POD RADHOŠTĚM, CZECH REPUBLIC

Co-chairs

R. Blaheta	Institute of Geonics AS CR, Ostrava, Czech Republic
Z. Dostál	VŠB - Technical University of Ostrava, Czech Republic
T. Kozubek	VŠB - Technical University of Ostrava, Czech Republic

Scientific Committee

P. Arbenz	ETH Zurich, Switzerland
R. Beauwens	Université Libre de Bruxelles, Belgium & President of IMACS
P. Drábek	University of West Bohemia in Pilsen, Czech Republic
J. Haslinger	Charles University in Prague, Czech Republic
M. Kružík	ÚTIA AS CR Prague, Czech Republic
U. Langer	RICAM Linz, Austria
I. Marek	Czech Technical University in Prague, Czech Republic
S. Margenov	IICT BAS, Sofia, Bulgaria
M. Neytcheva	Uppsala University, Sweden
J. Plešek	Institute of Thermomechanics AS CR Prague, Czech Republic
M. Tůma	Institute of Computer Science AS CR Prague, Czech Republic
P. S. Vassilevski	Lawrence Livermore National Laboratory, Livermore, USA

Organizing Committee

L. Bestová	VŠB-Technical University of Ostrava, Czech Republic
J. Starý	Institute of Geonics AS CR, Ostrava, Czech Republic
D. Sysalová	Institute of Geonics AS CR, Ostrava, Czech Republic

Plenary invited speakers

J. Karátson	ELTE University, Budapest, Hungary
B. Khoromskij	Max-Planck Institute MIS, Leipzig, Germany
J. Kraus	University of Duisburg-Essen, Germany & RICAM, Austria
U. Langer	RICAM and JKU Linz, Austria
F. Magoulès	Ecole Centrale, Paris, France
J. Mandel	University of Colorado, Denver, USA
J. Nordbotten	University of Bergen, Norway
H. Petryk	IPPT PAN, Warsaw, Poland
P. Råback	CSC - IT Center for Science, Espoo, Finland
K. Rajagopal	Texas A&M University, College Station, USA
S. Repin	Steklov Institute of Mathematics at St. Petersburg, Russia
T. Roubíček	Charles University & AS CR, Prague, Czech Republic
Y. Saad	University of Minnesota, Minneapolis, USA
D. Szyld	Temple University, Philadelphia, USA

June 2 – Monday

Hotel Relax

10:00 - 13:30 Registration 1 (Hotel Relax)

12:00 - 13:30 Lunch

June 2 – Monday

Hotel Eroplán, "The cone"

13:00 - 14:00 Registration 2 (Hotel Eroplán)

14:00 - 14:45 Opening the conference

Modelling and IT4Innovations

SPOMECH project

IMACS society

Laudatio to Owe Axelsson

Plenary talks

Chairman: Z. Dostál

14:45 - 15:30 O. Axelsson: Easy Way to Analyze Some Preconditioners for Saddle Point Problems

15:30 - 16:15 Y. Saad: Multilevel Low-rank Approximation Preconditioners

16:15 - 16:45 Coffee break

Plenary talks

Chairman: T. Kozubek

16:45 - 17:30 U. Langer: Discontinuous Galerkin Multipatch Isogeometric Analysis of Diffusion Problems on Surfaces and in Volumetric Domains

17:30 - 18:15 J. Karátson: Equivalent Operator Preconditioning

18:30 Welcome dinner

June 3 – Tuesday

Hotel Relax

Plenary talks

Chairman: Y. Saad

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- 09:00 - 09:45 B. Khoromskij: Recent Advances in Grid-based Tensor Numerical Methods with Applications to Multidimensional PDEs
- 09:45 - 10:30 J. Kraus: Robust Preconditioning of Weighted $H(\text{div})$ -norm and Applications
- 10:30 - 11:00 Coffee break

Plenary talks

Chairman: J. Valdman

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- 11:00 - 11:45 S. Repin: Guaranteed and Fully Computable Bounds of Approximation and Modeling Errors for Problems with Divergence Free Condition
- 11:45 - 12:30 F. Magoulès: Chaotic Iterations of Domain Decomposition Methods
- 12:30 - 14:00 Lunch

Parallel session A: **Nonlinear mechanics 1**

Chairman: T. Roubíček

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- 14:00 - 14:20 J. Málek: Thermodynamics of Rate-type Fluid Models and Their Applications to Deformations of Asphalt Binders
- 14:20 - 14:40 M. Kružík, J. Valdman: Modeling of Ferro/paramagnetic Transition
- 14:40 - 15:00 S. Sysala: On Control of the Loading Process in Hencky's Perfect Plasticity
- 15:00 - 15:20 K. Goyal, M. Mehra: Diffusion Wavelet Based Space-time Adaptive Numerical Method
- 15:20 - 15:40 P. Salač: The Two Steps Optimization of Plunger Cooling in the Glass Forming Process

Parallel session B: **High-performance computing**

Chairman: F. Magoulès

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- 14:00 - 14:20 T. Kozubek: Acceleration of Direct and Iterative Solvers Used in Domain Decomposition Based Algorithms by Novel Techniques and Novel Many-cores Accelerators
- 14:20 - 14:40 P. Pařík, J. Plešek: Efficient In-core Sparse Direct Solution of Large Finite Element Problems
- 14:40 - 15:00 A. Markopoulos, F.-X. Roux: Domain Decomposition Method, Plasticity, Krylov Subspace Method with Multiple Search Directions
- 15:00 - 15:20 A. Polovinkin, K. Barkalov, I. Meyerov et al: SVM Regression Parameters Optimization Using Parallel Global Search Algorithm on Intel Xeon Phi
- 15:20 - 15:40 V. Hapla: FLLOP: A Massively Parallel QP Solver Compatible with the TFETI Substructuring Scheme

June 3 – Tuesday

Hotel Relax

15:40 - 16:10 Coffee break

Parallel session A: **Nonlinear mechanics 2**

Chairman: D. Lukáš

16:10 - 16:30 J. Haslinger, V. Janovský, R. Kučera: On Parameter Dependent Static Contact Problems

16:30 - 16:50 P. Beremlijski, A. Markopoulos: Shape Optimization in 3D Contact Problems with Coulomb Friction

16:50 - 17:10 I. Bock: Mindlin-Timoshenko Beam in a Dynamic Contact with a Rigid Obstacle

17:10 - 17:30 D. Gabriel, J. Kopačka, J. Plešek: Searching for Local Contact Constraints in the Finite Element Procedures for Contact Problems

17:30 - 17:50 J. Kopačka, D. Gabriel, R. Kolman, J. Plešek: Influence of Mass Lumping Techniques on Contact Pressure Oscillations in Explicit Finite Element Contact-impact Algorithm Based on Isogeometric Analysis with NURBS

17:50 - 18:10 J.- J. Shu: Heat Transfer of an Impinging Jet on a Plane Surface

Parallel session B: **Homogenization and multiscale**

Chairman: J. Kruis

16:10 - 16:30 E. Rohan: Waves in Large Contrast Fluid-saturated Porous Deformable Media

16:30 - 16:50 F. Kolařík, J. Zeman, B. Patzák: On Homogenization-based Models for Fresh Concrete Flow through Reinforcing Bars

16:50 - 17:10 J. Vondřejc, J. Zeman, I. Marek: Accurate Guaranteed Bounds on Homogenized Matrix by FFT-based Methods

17:10 - 17:30 N. Mishra, J. Vondřejc, J. Zeman: A Comparative Study on Iterative Solvers for FFT-based Homogenization of Periodic Media

17:30 - 17:50 R. Cimrman, M. Novák, R. Kolman, M. Tůma, J. Vackář: Isogeometric Analysis in Electronic Structure Calculations

17:50 - 18:10 M. Theuer, D. Lukáš, J. Bouchala: BEM for Homogenization in 2D

18:30 Dinner at the hotel

June 4 – Wednesday

Hotel Relax

Plenary talks

Chairman: M. Kružík

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- 09:00 - 09:45 H. Petryk: The Energy Approach to Material Instability and Microstructure Evolution in Rate-independent Dissipative Solids
- 09:45 - 10:30 T. Roubíček: Various Solution Concepts in Rate-independent Evolution Systems
- 10:30 - 11:00 Coffee break

Plenary talks

Chairman: J. Málek

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- 11:00 - 11:45 K. Rajagopal: On Implicit Constitutive Relations
- 11:45 - 12:30 D. Szyld: Old and New Iterative Methods for the Solution of Generalized Lyapunov Equations
- 12:30 - 14:00 Lunch

Excursions

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- 14:00 A. Visiting *the Wallachian open air museum*
 B. Hiking to *Radhošť*
 C. Trip to *Hukvaldy*
- 18:00 - 20:00 Dinner at the hotel

Poster session

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- 20:00 1. R. Blaheta, O. Jakl, J. Starý: Parallel Processing of High Resolution FEM Systems in Micromechanics
2. D. Horák, V. Hapla, L. Říha, A. Markopoulos: Solution of Contact Problems Using FLLOP Library
3. R. Kohut: Parallel Solution of Elasticity Problems using Aggregations
4. P. Maršálek: Passenger Safety in Railway Traffic
5. P. Rálek, M. Hokr: Application of the 3D Numerical Model in the Control and Predictions during the Underground Rock Heating Experiment
6. J. Říha, J. Šembera: Model of the Water Balance of a Lake Created by Hydrological Recultivation of an Open Pit Coal Mine
7. O. Vlach: Thermomechanical Contact Problems in MatSol
8. J. Zapletal, M. Merta: BEM4I - Parallel BEM Library and its Applications

June 5 – Thursday

Hotel Relax

Plenary talks

Chairman: M. Tůma

09:00 - 09:45 J. Mandel, J. Beezley, M. Jenkins et al: A Coupled Weather and Wildland Fire Forecasting System with Assimilation of Satellite Remote Sensing Data

09:45 - 10:30 J. Nordbotten: Finite Volume Methods for Elasticity and Poro-elasticity

10:30 - 11:00 Coffee break

Parallel session A: **Porous media flow**

Chairman: J. Zeman

11:00 - 11:20 J. Kruis, T. Koudelka: Moisture Transport in Partially Damaged Materials

11:20 - 11:40 J. Vala: Identification of Moisture Distribution in Porous Building Materials from Microwave Measurements

11:40 - 12:00 J. Březina, J. Stebel: Flow123d - Modeling Tool for Processes in Fractured Media

12:00 - 12:20 J. Březina, J. Stebel: Robust Discontinuous Galerkin Method for Transport Processes in Fractured Porous Media

Parallel session B: **Flow problems**

Chairman: M. Brandner

11:00 - 11:20 J. Šístek: Parallel Performance of Iterative Solvers for Pressure-correction Methods for Incompressible Flows

11:20 - 11:40 P. Burda, M. Hanek, J. Šístek: Analytical Solution for Singularities of Rotationally Symmetric Stokes Flow and Applications to Finite Element Solution

11:40 - 12:00 B. Bastl, M. Brandner, E. Turnerová et al: Isogeometric Analysis for Navier-Stokes Equations

12:00 - 12:20 O. Bublík, J. Vimmr, A. Jonášová: On Modelling of Non-Newtonian Free Surface Flows Using the Lattice Boltzmann Method

12:30 - 14:00 Lunch

Parallel session A: **Environmental problems**

Chairman: V. Vondrák

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- 14:00 - 14:20 K. Georgiev, Z. Zlatev: Comparison Results of Running of an Eulerian Computer Model for Long Range Air Pollution on Different High-performance Computers
- 14:20 - 14:40 D. Fedorčák, M. Theuer, R. Vavřík et al: Calibration Methods for Rainfall-runoff Simulations inside FLOREON+ System
- 14:40 - 15:00 J. Mandel, I. Kasanický, M. Vejmelka: Spectral Diagonal Covariance in EnKF
- 15:00 - 15:20 J. Resler, P. Juruš, K. Eben et al: Fine Resolution Modelling of Meteorological Conditions and Air Quality in Urbanized Areas
- 15:20 - 15:40 U. Schaarschmidt, S. Subbey, T. Steihaug: A Stock-recruitment Relationship Derived from a Slow-fast Population Dynamic Model

Parallel session B: **Numerical linear algebra**

Chairman: D. Szyld

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- 14:00 - 14:20 M. Tůma: On Incomplete Symmetric Decompositions
- 14:20 - 14:40 V. Khoromskaia: Black-box Eigenvalue Solver for the 3D Integro-differential Hartree-Fock Equation by Tensor Numerical Methods
- 14:40 - 15:00 J. Kraus, M. Lymbery: Incomplete Factorization by Local Exact Factorization (ILUE)
- 15:00 - 15:20 J. Alvarez, A. Duran: Numerical Treatment of Algebraic Equations with Symmetries
- 15:20 - 15:40 A. Y. Wang, F.-X. Roux: A Coupling Method for the Parallel Solution of Vibro-acoustic Problems
- 15:40 - 16:10 Coffee break

June 5 – Thursday

Hotel Relax

Parallel session A: **Flow and environmental problems** Chairman: P. Burda

- 16:10 - 16:30 M. Lanzendörfer: Thin Film Flows of Piezoviscous Fluids in Lubrication Problems
- 16:30 - 16:50 V. Aggarwal, B. Srinivasan: An Adaptive Mesh Strategy for Convection Diffusion Problems
- 16:50 - 17:10 R. Blaheta, M. Hasal, Z. Michalec: Hydro-mechanical Modelling of SEALEX Experiments
- 17:10 - 17:30 I. Bruský, J. Šembera: Coupled Model of Flow-through Experiment in Novaculite Fracture
- 17:30 - 17:50 J. Šembera, V. Žabka: Geochemical Model of Calcite Dissolution in Column Experiments
- 17:50 - 18:10 L. Zedek, J. Šembera: ODE's for Description of Reactive Transport Including Equilibrium Reactions
- 18:10 - 18:30 I. Oguoma, T. Acho: Mathematical Modelling of the Spread and Control of Onchocerciasis in Nigeria

Parallel session B: **Numerical methods** Chairman: P. Råback

- 16:10 - 16:30 R. Kolman, S.-S. Cho, K. Park: On an Accurate Explicit Time Integration Algorithm for Wave Propagation Problems in Solids
- 16:30 - 16:50 M. Neumüller: A Parallel Space-time Multigrid Solver for the Stokes Equations
- 16:50 - 17:10 U. Langer, H. Yang: Partitioned and Monolithic Approaches for Fluid-structure Interaction Simulation
- 17:10 - 17:30 M. Čermák, V. Hapla, D. Horák: Solving Elastoplastic Problems with the FLLOP Solver
- 17:30 - 17:50 Z. Dostál, L. Pospíšil: The Projected Barzilai-Borwein Method for Solving Quadratic Programming Problems with Separable Elliptic Constraints
- 17:50 - 18:10 M. Jarošová, Z. Dostál: The Monotonic Algorithm for the Solution of the Variational Equations with Bound Constrains Exploiting Weakly Feasible Steps
- 18:10 - 18:30 S. Basterrech, V. Snášel: A Study of the Impact of the Pseudospectra on the Stability of the Recurrent Neural Networks
- 19:00 Conference dinner at the hotel

June 6 – Friday

Hotel Relax

Parallel session A: **Boundary elements**

Chairman: J. Malík

09:00 - 09:20 D. Lukáš, P. Kovář, T. Kovářová et al: Parallel Fast BEM

09:20 - 09:40 J. Bouchala, D. Lukáš, L. Malý et al: BEM-based Domain Decomposition for Polygonal Subdomains

09:40 - 10:00 M. Merta, J. Zapletal: BEM4I - parallel BEM Library with Applications

Parallel session B: **Meshes and images**

Chairman: O. Jakl

09:00 - 09:20 M. Jaroš: Rendering and Post-processing of OpenFOAM CFD Simulations

09:20 - 09:40 A. Kolcun: Goldberg-like Decompositions and Voxel Representation of 3D Space

09:40 - 10:00 A. Ronovský, A. Vašatová: Elastic Image Registration with Mesh Adaptation

10:00 - 10:20 Coffee break

Plenary talk

Chairman: R. Blaheta

10:20 - 11:05 P. Råback: Building Blocks for Multiphysical Simulation Software

11:05 Closing the conference

11:20 - 12:20 Lunch