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, Warszaw, 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

10:00 - 13:30  Registration 1 (Hotel Relax)
12:00 - 13:30  Lunch

Hotel Erolán, "The cone"

13:00 - 14:00  Registration 2 (Hotel Erolán)
14:00 - 14:45  Opening the conference
               Modelling and IT4Innovations
               SPOMECH project
               IMACS society
               Laudatio to Owe Axelsson

Plenary talks

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

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

Chairman: Z. Dostál

Chairman: T. Kozubek
### June 3 – Tuesday

**Hotel Relax**

<table>
<thead>
<tr>
<th>Time</th>
<th>Plenary talks</th>
<th>Chairman:</th>
</tr>
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<tbody>
<tr>
<td>09:00 - 09:45</td>
<td>B. Khoromskij: Recent Advances in Grid-based Tensor Numerical Methods with Applications to Multidimensional PDEs</td>
<td>Y. Saad</td>
</tr>
<tr>
<td>09:45 - 10:30</td>
<td>J. Kraus: Robust Preconditioning of Weighted $H(div)$-norm and Applications</td>
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<tr>
<td>10:30 - 11:00</td>
<td>Coffee break</td>
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>11:00 - 11:45</td>
<td>S. Repin: Guaranteed and Fully Computable Bounds of Approximation and Modeling Errors for Problems with Divergence Free Condition</td>
<td>J. Valdman</td>
</tr>
<tr>
<td>11:45 - 12:30</td>
<td>F. Magoulès: Chaotic Iterations of Domain Decomposition Methods</td>
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<tr>
<td>12:30 - 14:00</td>
<td>Lunch</td>
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**Parallel session A: Nonlinear mechanics 1**

<table>
<thead>
<tr>
<th>Time</th>
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<th>Chairman:</th>
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</thead>
<tbody>
<tr>
<td>14:00 - 14:20</td>
<td>J. Málek: Thermodynamics of Rate-type Fluid Models and Their Applications to Deformations of Asphalt Binders</td>
<td>T. Roubíček</td>
</tr>
<tr>
<td>14:20 - 14:40</td>
<td>M. Kružík, J. Valdman: Modeling of Ferro/paramagnetic Transition</td>
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<tr>
<td>14:40 - 15:00</td>
<td>S. Sysala: On Control of the Loading Process in Hencky's Perfect Plasticity</td>
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<tr>
<td>15:00 - 15:20</td>
<td>K. Goyal, M. Mehra: Diffusion Wavelet Based Space-time Adaptive Numerical Method</td>
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<tr>
<td>15:20 - 15:40</td>
<td>P. Salač: The Two Steps Optimization of Plunger Cooling in the Glass Forming Process</td>
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</tbody>
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**Parallel session B: High-performance computing**

<table>
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<tr>
<th>Time</th>
<th>Parallel session B: High-performance computing</th>
<th>Chairman:</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00 - 14:20</td>
<td>T. Kozubek: Acceleration of Direct and Iterative Solvers Used in Domain Decomposition Based Algorithms by Novel Techniques and Novel Many-cores Accelerators</td>
<td>F. Magoulès</td>
</tr>
<tr>
<td>14:20 - 14:40</td>
<td>P. Pafík, J. Plešek: Efficient In-core Sparse Direct Solution of Large Finite Element Problems</td>
<td></td>
</tr>
<tr>
<td>14:40 - 15:00</td>
<td>A. Markopoulos, F.-X. Roux: Domain Decomposition Method, Plasticity, Krylov Subspace Method with Multiple Search Directions</td>
<td></td>
</tr>
<tr>
<td>15:20 - 15:40</td>
<td>V. Hapla: FLFOP: A Massively Parallel QP Solver Compatible with the TFETI Substructuring Scheme</td>
<td></td>
</tr>
</tbody>
</table>
June 3 – Tuesday

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


Parallel session B: **Homogenization and multiscale**  
Chairman: J. Kruij

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**

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>09:00 - 09:45</td>
<td>H. Petryk: The Energy Approach to Material Instability and Microstructure Evolution in Rate-independent Dissipative Solids</td>
</tr>
<tr>
<td>09:45 - 10:30</td>
<td>T. Roubíček: Various Solution Concepts in Rate-independent Evolution Systems</td>
</tr>
<tr>
<td>10:30 - 11:00</td>
<td>Coffee break</td>
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</tbody>
</table>

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<th>Time</th>
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<tbody>
<tr>
<td>11:00 - 11:45</td>
<td>K. Rajagopal: On Implicit Constitutive Relations</td>
</tr>
<tr>
<td>11:45 - 12:30</td>
<td>D. Szyld: Old and New Iterative Methods for the Solution of Generalized Lyapunov Equations</td>
</tr>
<tr>
<td>12:30 - 14:00</td>
<td>Lunch</td>
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</table>

**Excursions**

- **14:00** Visiting the **Wallachian open air museum**
- Hiking to **Radhošt**
- Trip to **Hukvaldy**

**18:00 - 20:00** Dinner at the hotel

**Poster session**

- **20:00**
  1. R. Blaheta, O. Jakl, J. Starý: Parallel Processing of High Resolution FEM Systems in Micromechanics
  3. R. Kohut: Parallel Solution of Elasticity Problems using Aggregations
  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

Plenary talks

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

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


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

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


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

Hotel Relax
## June 5 – Thursday

### Hotel Relax

**Parallel session A: Environmental problems**

Chairman: V. Vondrák

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>14:00 - 14:20</td>
<td>K. Georgiev, Z. Zlatev</td>
<td>Comparison Results of Running of an Eulerian Computer Model for Long Range Air Pollution on Different High-performance Computers</td>
</tr>
<tr>
<td>14:40 - 15:00</td>
<td>J. Mandel, I. Kasanický, M. Vejmelka</td>
<td>Spectral Diagonal Covariance in EnKF</td>
</tr>
<tr>
<td>15:00 - 15:20</td>
<td>J. Resler, P. Juruš, K. Eben et al</td>
<td>Fine Resolution Modelling of Meteorological Conditions and Air Quality in Urbanized Areas</td>
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</tbody>
</table>

**Parallel session B: Numerical linear algebra**

Chairman: D. Szyld

<table>
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<tr>
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<tbody>
<tr>
<td>14:00 - 14:20</td>
<td>M. Tůma</td>
<td>On Incomplete Symmetric Decompositions</td>
</tr>
<tr>
<td>14:20 - 14:40</td>
<td>V. Khoromskaiia</td>
<td>Black-box Eigenvalue Solver for the 3D Integro-differential Hartree-Fock Equation by Tensor Numerical Methods</td>
</tr>
<tr>
<td>14:40 - 15:00</td>
<td>J. Kraus, M. Lymberry</td>
<td>Incomplete Factorization by Local Exact Factorization (ILUE)</td>
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<tr>
<td>15:00 - 15:20</td>
<td>J. Alvarez, A. Duran</td>
<td>Numerical Treatment of Algebraic Equations with Symmetries</td>
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<tr>
<td>15:40 - 16:10</td>
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<td>Coffee break</td>
</tr>
</tbody>
</table>
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 Navaculite Fracture

17:30 - 17:50 J. Šembera, V. Žabka: Geochemical Model of Calcite Dissolution in Column Experiments

17:50 - 18:10 L. Zedeč, 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


16:30 - 16:50 M. Neumüller: A Parallel Space-time Multigrid Solver for the Stokes Equations


17:10 - 17:30 M. Čermák, V. Hapla, D. Horák: Solving Elastoplastic Problems with the FILOP Solver


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

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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>09:00</td>
<td>D. Lukáš, P. Kovář, T. Kovářová et al</td>
<td>Parallel Fast BEM</td>
</tr>
<tr>
<td>09:20</td>
<td>J. Bouchala, D. Lukáš, L. Malý et al</td>
<td>BEM-based Domain Decomposition for Polygonal Subdomains</td>
</tr>
<tr>
<td>09:40</td>
<td>M. Merta, J. Zapletal</td>
<td>BEM4I - parallel BEM Library with Applications</td>
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</table>

#### Parallel session B: Meshes and images
Chairman: O. Jakl

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<thead>
<tr>
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<tbody>
<tr>
<td>09:00</td>
<td>M. Jaroš</td>
<td>Rendering and Post-processing of OpenFOAM CFD Simulations</td>
</tr>
<tr>
<td>09:20</td>
<td>A. Kolicun</td>
<td>Goldberg-like Decompositions and Voxel Representation of 3D Space</td>
</tr>
<tr>
<td>09:40</td>
<td>A. Ronovský, A. Vašatová</td>
<td>Elastic Image Registration with Mesh Adaptation</td>
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<tr>
<td>10:00</td>
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<td>Coffee break</td>
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#### Plenary talk
Chairman: R. Blaheta

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<thead>
<tr>
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<tbody>
<tr>
<td>10:20</td>
<td>P. Ráback</td>
<td>Building Blocks for Multiphysical Simulation Software</td>
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<tr>
<td>11:05</td>
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<td>Closing the conference</td>
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<tr>
<td>11:20</td>
<td></td>
<td>Lunch</td>
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