

Table of Contents

I Invited Papers

Preconditioners for Mixed FEM Solution of Stationary and Nonstationary Porous Media Flow Problems	3
<i>Owe Axelsson, Radim Blaheta, and Tomáš Luber</i>	
Fast Constrained Image Segmentation Using Optimal Spanning Trees	15
<i>Stanislav Harizanov, Svetozar Margenov, and Ludmil Zikatanov</i>	
On Computer Simulation of Fluid-Porous Structure Interaction Problems for a Class of Filtration Problems	29
<i>Oleg Iliev, Dimitar Iliev, and Ralf Kirsch</i>	
Spin-Based CMOS-Compatible Devices	41
<i>Viktor Sverdlov and Siegfried Selberherr</i>	

II Multilevel Methods on Graphs

Shortest-Path Queries in Planar Graphs on GPU-Accelerated Architectures	51
<i>Guillaume Chapuis and Hristo Djidjev</i>	

III Mathematical Modeling and Analysis of PDEs Describing Physical Problems

A Numerical Approach to Price Path Dependent Asian Options	61
<i>Tatiana Chernogorova and Lubin Vulkov</i>	
Operator-difference Schemes with a Factorized Operator	69
<i>Petr N. Vabishchevich</i>	
Computational Identification of the Right Hand Side of the Parabolic Equations in Problems of Filtration	77
<i>V.I. Vasil'ev, M.V. Vasil'eva, A.M. Kardashevsky, and D.Ya. Nikiforov</i>	

IV Numerical Methods for Multiphysics Problems

Algebraic Multigrid Based Preconditioners for Fluid-structure Interaction and Its Related Sub-problems	87
<i>Ulrich Langer and Huidong Yang</i>	

V Control and Uncertain Systems

Functional Differential Model of an Anaerobic Biodegradation Process . . .	97
<i>Milen K. Borisov, Neli S. Dimitrova, and Mikhail I. Krastanov</i>	
Time-optimal Control Problem in the Space of Probability Measures	105
<i>Giulia Cavagnari and Antonio Marigonda</i>	
Sufficient Conditions for Small Time Local Attainability for a Class of Control Systems	113
<i>Antonio Marigonda and Thuy Thi Le</i>	
Financing the Reduction of Emissions from Deforestation: A Differential Game Approach	121
<i>Bernadette Riesner and Gernot Tragler</i>	
Relaxation of Euler-Type Discrete-Time Control System	129
<i>Vladimir M. Veliov</i>	

VI Enabling Exascale Computation

Uncertainty Quantification for Porous Media Flow Using Multilevel Monte Carlo	139
<i>Jan Mohring, René Milk, Adrian Ngo, Ole Klein, Oleg Iliev, Mario Ohlberger, and Peter Bastian</i>	
Task-based Parallel Sparse Matrix-Vector Multiplication (SpMVM) with GPI-2	147
<i>Dimitar Stoyanov, Rui Machado, and Franz-Josef Pfreundt</i>	

VII Efficient Algorithms for Hybrid HPC Systems

On the Preconditioned Quasi-Monte Carlo Algorithm for Matrix Computations	157
<i>V. Alexandrov, O. Esquivel-Flores, S. Ivanovska, and A. Karaivanova</i>	
Energy Performance Evaluation of Quasi-Monte Carlo Algorithms on Hybrid HPC	166
<i>E. Atanassov, T. Gurov, and A. Karaivanova</i>	
Towards RBF Interpolation on Heterogeneous HPC Systems	175
<i>Gundolf Haase, Dirk Martin, and Günter Offner</i>	

On the Relation between Matrices and the Greatest Common Divisor
of Polynomials 183
Nikolai L. Manev

VIII Applications of Metaheuristics to Large-Scale Problems

Distributed Evolutionary Computing Migration Strategy by Incident
Node Participation 193
Todor Balabanov, Iliyan Zankinski, and Maria Barova

Slot Machine RTP Optimization and Symbols Wins Equalization with
Discrete Differential Evolution 200
Todor Balabanov, Iliyan Zankinski, and Bozhidar Shumanov

Application of Ants Ideas on Image Edge Detection 208
Stefka Fidanova and Zlatolilya Ilcheva

ACD with ESN for Tuning of MEMS Kalman Filter 216
Petia Koprinkova-Hristova and Kiril Alexiev

Optimal Discretization Orders for Distance Geometry: a Theoretical
Standpoint 224
Antonio Mucherino

Sensitivity Analysis of Checkpointing Strategies for Multimemetic
Algorithms on Unstable Complex Networks 233
Rafael Nogueras and Carlos Cotta

Free Search in Multidimensional Space III 241
Kalin Penev

Speeding up Parallel Combinatorial Optimization Algorithms with Las
Vegas Method 248
Bogdan Zavalnij

IX Computational Microelectronics — from Monte Carlo to Deterministic Approaches

Optimization of the Deterministic Solution of the Discrete Wigner
Equation 259
Johann Cervenka, Paul Ellinghaus, Mihail Nedjalkov, and Erasmus Langer

The Influence of Electrostatic Lenses on Wave Packet Dynamics 265
Paul Ellinghaus, Mihail Nedjalkov, and Siegfried Selberherr

Evaluation of Spin Lifetime in Thin-Body FETs: A High Performance Computing Approach	275
<i>Joydeep Ghosh, Dmitry Osintsev, Viktor Sverdlov, Josef Weinbub, and Siegfried Selberherr</i>	
Free Open Source Mesh Healing for TCAD Device Simulations	283
<i>Florian Rudolf, Josef Weinbub, Karl Rupp, Peter Resutik, Andreas Morhammer, and Siegfried Selberherr</i>	
A Non-Equilibrium Greens Functions Study of Energy-Filtering Thermoelectrics Including Scattering	292
<i>Mischa Thesberg, Mahdi Pourfath, Neophytos Neophytou, and Hans Kosina</i>	
Parallelization of the Two-Dimensional Wigner Monte Carlo Method	300
<i>Josef Weinbub, Paul Ellinghaus, and Siegfried Selberherr</i>	

X Large-Scale Models: Numerical Methods, Paralel Computations and Applications

A Splitting Numerical Method for Primary and Secondary Pollutant Models	311
<i>Tatiana Chernogorova, Ivan Dimov, and Lubin Vulkov</i>	
Snow Cover Assessment with Regional Climate Model - Problems and Results	319
<i>Hristo Chervenkov, Todor Todorov, and Kiril Slavov</i>	
Input Data Preparation for Fire Behavior Fuel Modeling of Bulgarian Test Cases (Main Focus on Zlatograd Test Case)	327
<i>Nina Dobrinkova and Georgi Dobrinkov</i>	
Supervised 2-phase Segmentation of Porous Media with Known Porosity .	335
<i>Ivan Georgiev, Stanislav Harizanov, and Yavor Vutov</i>	
Image Processing Methods in Analysis of Component Composition and Distribution of Dust Emissions for Environmental Quality Management . .	344
<i>Andrew Kokoulin, Irina May, and Anastasija Kokoulina</i>	
Fully Implicit Time-Stepping Schemes for a Parabolic-ODE System of European Options with Liquidity Shocks	352
<i>Miglena N. Koleva and Lubin G. Vulkov</i>	
Thermoelectrical Tick Removal Process Modeling	360
<i>Nikola Kosturski, Ivan Lirkov, Svetozar Margenov, and Yavor Vutov</i>	

Performance Analysis of Block AMG Preconditioning of Poroelasticity Equations	368
<i>Nikola Kosturski, Svetozar Margenov, Peter Popov, Nikola Simeonov, and Yavor Vutov</i>	
Surface Constructions on Irregular Grids	374
<i>Arne Lakså and Børre Bang</i>	
Spline Representation of Connected Surfaces with Custom-shaped Holes .	383
<i>Aleksander Pedersen, Jostein Bratlie, and Rune Dalmo</i>	
Scalability of Shooting Method for Nonlinear Dynamical Systems	390
<i>Stanislav Stoykov and Svetozar Margenov</i>	
Selecting Explicit Runge-Kutta Methods with Improved Stability Properties.	399
<i>Zahari Zlatev, Krassimir Georgiev, and Ivan Dimov</i>	

XI Contributed Papers

Schur Complement Matrix and Its (Elementwise) Approximation: A Spectral Analysis Based on GLT Sequences	409
<i>Ali Dorostkar, Maya Neytcheva, and Stefano Serra Capizzano</i>	
An Iterative Process for the Solution of Semi-Linear Elliptic Equations with Discontinuous Coefficients and Solution	417
<i>Aigul Manapova</i>	
Extremal Interpolation of Convex Scattered Data in \mathbb{R}^3 Using Tensor Product Bézier Surfaces	425
<i>Krassimira Vlachkova</i>	
Author Index	433