

Table of Contents

I Invited Papers

Discrete Energy Laws for the First-Order System Least-Squares Finite-Element Approach	3
<i>J. H. Adler, I. Lashuk, S. P. MacLachlan, and L. T. Zikatanov</i>	
Multipatch Space-Time Isogeometric Analysis of Parabolic Diffusion Problems	22
<i>U. Langer, M. Neumüller, and I. Touloupoulos</i>	
Numerical Methods for Controlled Switching Diffusions	34
<i>G. Yin, C. Zhang, and L.Y. Wang</i>	

II Space-Time Methods for Solving Time-Dependent PDEs

Preconditioners for Time-Harmonic Optimal Control Eddy-Current Problems	49
<i>Owe Axelsson and Dalibor Lukáš</i>	
Functional Type Error Control for Stabilised Space-Time IgA Approximations to Parabolic Problems	57
<i>Ulrich Langer, Svetlana Matculevich, and Sergey Repin</i>	
An Algebraic Multigrid Method for an Adaptive Space-Time Finite Element Discretization	67
<i>Olaf Steinbach and Huidong Yang</i>	

III Advanced Discretizations and Solvers for Coupled Systems of Partial Differential Equations

Splitting Schemes for Mixtures of Nematic-Isotropic Flows with Anchoring Effects	77
<i>Giordano Tierra, Francisco Guillén-González, and María Ángeles Rodríguez-Bellido</i>	
Two Classes of Vector Domain Decomposition Schemes for Time-dependent Problems with Overlapping Subdomains	85
<i>Petr N. Vabishchevich</i>	

IV Least-Squares Finite Element Methods

An Alternative Proof of a Strip Estimate for First-Order System Least-Squares for Interface Problems	95
<i>Fleurianne Bertrand</i>	
Spectral Mimetic Least-Squares Method for Div-curl Systems	103
<i>Marc Gerritsma and Artur Palha</i>	
Spectral Mimetic Least-Squares Methods on Curvilinear Grids	111
<i>R. O. Hjort and B. Gervang</i>	
Spectral Mimetic Least-Squares Method for Curl-curl Systems	119
<i>Artur Palha and Marc Gerritsma</i>	
Numerical Solution of Cahn-Hilliard System by Adaptive Least-Squares Spectral Element Method	128
<i>Keunsoo Park, Marc Gerritsma, and Maria Fernandino</i>	
Stress-Velocity Mixed Least-Squares FEMs for the Time-Dependent Incompressible Navier-Stokes Equations	137
<i>Alexander Schwarz, Carina Nisters, Solveigh Averweg, and Jörg Schröder</i>	

V Advances in Heterogeneous Numerical Methods for Multi Physics Problems

A Virtual Control Coupling Approach for Problems with Non-coincident Discrete Interfaces	147
<i>Pavel Bochev, Paul Kuberry, and Kara Peterson</i>	
Towards a Scalable Multifidelity Simulation Approach for Electrokinetic Problems at the Mesoscale	156
<i>Brian D. Hong, Mauro Perego, Pavel Bochev, Amalie L. Frischknecht, and Edward G. Phillips</i>	

VI Advanced Numerical Methods for Nonlinear Elliptic Partial Differential Equations

On a Problem of Optimal Control of Convection-Diffusion Processes	167
<i>Aigul Manapova and Fedor Lubyshev</i>	
Verifications of Primal Energy Identities for Variational Problems with Obstacles	175
<i>Sergey Repin and Jan Valdman</i>	

VII Control and Optimization of Dynamical Systems

An Optimal Control Problem with a Risk Zone 185
Sergey M. Aseev

Spreading Rumors and External Actions 193
S  verine Bernard, T  nissia C  sar, and Alain Pi  trus

Superposition Principle for Differential Inclusions 201
Giulia Cavagnari, Antonio Marigonda, and Benedetto Piccoli

Estimation of Star-Shaped Reachable Sets of Nonlinear Control Systems . 209
Tatiana F. Filippova

On Reachability Analysis of Nonlinear Systems with Joint Integral
 Constraints 217
Mikhail Gusev

Existence Theorem for Infinite Horizon Optimal Control Problems with
 Mixed Control-State Isoperimetrical Constraint 226
Valeriya Lykina

On the Regularity of Linear-Quadratic Optimal Control Problems with
 Bang-Bang Solutions 235
J. Preininger, T. Scarinci, and V.M. Veliov

VIII HPC and Big Data: Algorithms and Applications

On Monte Carlo and Quasi-Monte Carlo for Matrix Computations 245
*Vassil Alexandrov, Diego Davila, Oscar Esquivel-Flores, Aneta
 Karaivanova, Todor Gurov, and Emanouil Atanassov*

On the Parallel Implementation of Quasi-Monte Carlo Algorithms 254
*E. Atanassov, T. Gurov, S. Ivanovska, A. Karaivanova, and T.
 Simchev*

TVRegCM Numerical Simulations - Preliminary Results 262
*Georgi Gadzhev, Vladimir Ivanov, Kostadin Ganev, and Hristo
 Chervenkov*

Territorial Design Optimization for Business Sales Plan 270
Laura Hervert-Escobar and Vassil Alexandrov

Monte Carlo Algorithms for Problems with Partially Reflecting Boundaries 278
Nikolai A. Simonov

IX Toward Exascale Computation

- Renormalization Based MLMC Method for Scalar Elliptic SPDE 289
Oleg Iliev, Jan Mohring, and Nikolay Shegunov
- Performance Analysis of MG Preconditioning on Intel Xeon Phi:
 Towards Scalability for Extreme Scale Problems with Fractional Laplacians 297
Nikola Kosturski, Svetozar Margenov, and Yavor Vutov

X Application of Metaheuristics to Large-Scale Problems

- Training Feed-Forward Neural Networks Employing Improved Bat
 Algorithm For Digital Image Compression 307
Adis Alihodzic
- Modeling and Optimization of Pickup and Delivery Problem Using
 Constraint Logic Programming 315
Amelia Bădică, Costin Bădică, Florin Leon, and Ion Buligiu
- Intercriteria Analysis over Intuitionistic Fuzzy Data 324
*Veselina Bureva, Evdokia Sotirova, Vassia Atanassova, Nora
 Angelova, and Krassimir Atanassov*
- Genetic Algorithm with Optimal Recombination for the Asymmetric
 Travelling Salesman Problem 332
Anton V. Eremeev and Yulia V. Kovalenko
- Heuristic Algorithm for 2D Cutting Stock Problem 340
Georgi Evtimov and Stefka Fidanova
- Influence of Ant Colony Optimization Parameters on the Algorithm
 Performance 348
Stefka Fidanova and Olympia Roeva
- 2D Optimal Packing with Population Based Algorithms 356
Desislava Koleva, Maria Barova, and Petar Tomov
- A Non-dominated Sorting Approach to Bi-objective Optimisation of
 Mixed-model Two-sided Assembly Lines 364
Ibrahim Kucukkoc
- Development of Threshold Algorithms for a Location Problem with
 Elastic Demand 372
Tatyana Levanova and Alexander Gnusarev

Investigation of Genetic Algorithm Performance Based on Different Algorithms for InterCriteria Relations Calculation	380
<i>Tania Pencheva, Olympia Roeva, and Maria Angelova</i>	
Free Search in Multidimensional Space M	388
<i>Kalin Penev</i>	
Generalized Net Model of Adhesive Capsulitis Diagnosing	396
<i>Simeon Ribagin, Evdokia Sotirova, and Tania Pencheva</i>	
Adaptive Multi-Agent System Based on Wasp-Like Behaviour for the Virtual Learning Game Sotirios	404
<i>Dana Simian and Florentin Bota</i>	
Hybrid Approach Based on Combination of Backpropagation and Evolutionary Algorithms for Artificial Neural Networks Training by Using Mobile Devices in Distributed Computing Environment	412
<i>Iliyan Zankinski, Maria Barova, and Petar Tomov</i>	

XI Large-Scale Models: Numerical Methods, Parallel Computations and Applications

Solution of the 3D Neutron Diffusion Benchmark by FEM	423
<i>A.V. Avvakumov, P.N. Vabishchevich, A.O. Vasilev, and V.F. Strizhov</i>	
Precipitation Pattern Estimation with the Standardized Precipitation Index in Projected Future Climate over Bulgaria	431
<i>Hristo Chervenkov and Valery Spiridonov</i>	
Time Discretization/Linearization Approach Based on HOC Difference Schemes for Semilinear Parabolic Systems of Atmosphere Modelling	439
<i>I. Dimov, J. Kandilarov, V. Todorov, and L. Vulkov</i>	
Landslide Hazard, Environmental Dependencies and Computer Simulations	447
<i>Nina Dobrinkova and Pierluigi Maponi</i>	
On the Winter Wave Climate of the Western Black Sea: the Changes During the Last 115 Years	455
<i>Vasko Galabov and Hristo Chervenkov</i>	
Computer Simulations of Atmospheric Composition in Urban Areas. Some Results for the City of Sofia	463
<i>Ivelina Georgieva, Georgi Gadzhev, Kostadin Ganev, and Nikolay Miloshev</i>	
Numerical Simulation of Deformations of Softwood Sawn Timber	471
<i>Vladimir N. Glukhikh, Anna Y. Okhlopkova, and Petr V. Sivtsev</i>	

Large Scale Computations in Fluid Dynamics	479
<i>Valentin A. Gushchin</i>	
A Domain Decomposition Multilevel Preconditioner for Interpolation with Radial Basis Functions	487
<i>Gundolf Haase, Dirk Martin, Patrick Schiffmann, and Günter Offner</i>	
Sampling in <i>In Silico</i> Biomolecular Studies: Single-Stage Experiments vs Multiscale Approaches	495
<i>Nevena Ilieva, Jiaojiao Liu, Xubiao Peng, Jianfeng He, Antti Niemi, Peicho Petkov, and Leandar Litov</i>	
Cultural Heritage RC Structures Environmentally Degradated: Optimal Seismic Upgrading by Tention-Ties under Shear Effects	503
<i>A. Liolios, K. Liolios, A. Moropoulou, K. Georgiev, and I. Georgiev</i>	
New Approach to Identifying Solitary Wave Solutions of Modified Kawahara Equation	514
<i>Tchavdar T. Marinov and Rossitza S. Marinova</i>	
Sequential Variational Data Assimilation Algorithms at the Splitting Stages of a Numerical Atmospheric Chemistry Model	523
<i>Alexey Penenko (0000-0002-1729-3343), Vladimir Penenko (0000-0002-1646-7743), Elena Tsvetova (0000-0003-1947-9560), Anastasia Grishina (0000-0003-3139-0200), and Pavel Antokhin (0000-0003-4064-5594)</i>	
Computational Modelling of the Full Length hIFN- γ Homodimer	531
<i>Peicho Petkov, Elena Lilkova, Nevena Ilieva, Genoveva Nacheva, Ivan Ivanov, and Leandar Litov</i>	
Using Advanced Mathematical Tools in Complex Studies Related to Climate Changes and High Pollution Levels	539
<i>Zahari Zlatev, Ivan Dimov, Krassimir Georgiev, and Radim Blaheta</i>	

XII Large-Scale Numerical Computations for Sustainable Energy Production and Storage

Parallel Aggregation Based on Compatible Weighted Matching for AMG	549
<i>Ambra Abdullahi, Pasqua D'Ambra, Daniela di Serafino, and Salvatore Filippone</i>	
Efficient Solution Techniques for Multi-Phase Flow in Porous Media	558
<i>Henrik Büsing</i>	

XIII Contributed Papers

A Unified Numerical Approach for a Large Class of Nonlinear Black-Scholes Models	569
<i>Miglena N. Koleva and Lubin G. Vulkov</i>	
Beta-Function B-splines and Subdivision Schemes, a Preliminary Study . .	578
<i>Arne Lakså</i>	
Conjugate Gradient Method for Identification of a Spacewise Heat Source	586
<i>Vasil'ev V.I., Popov V.V., and Kardashevsky A.M.</i>	
Author Index	595