

**Slovak University of Technology, Bratislava  
Comenius University, Bratislava**

---

**ALGORITMY 2012**  
**19<sup>th</sup> Conference on Scientific Computing**  
**Vysoké Tatry – Podbanské, Slovakia**  
**September 9 – 14, 2012**

**Proceedings of contributed papers and posters**

**Editors:**  
**Angela Handlovičová**  
**Zuzana Minarechová**  
**Daniel Ševčovič**

**S T U • •**  
**• • • • •**  
**• S v F •**  
**• • • • •**

**Slovak University of Technology in Bratislava**  
**Faculty of Civil Engineering**  
**Department of Mathematics and Descriptive Geometry**

*Editors:*

A. Handlovičová, Slovak University of Technology, Bratislava  
Z. Minarechová, Slovak University of Technology, Bratislava  
D. Ševčovič, Comenius University, Bratislava

*Scientific Programme Committee:*

E. Bänsch, Erlangen, Germany  
P. Bastian, Heidelberg, Germany  
M. Beneš, Prague, Czech Republic  
M. Feistauer, Prague, Czech Republic  
M. Gander, Geneve, Switzerland  
J. Kačur, Bratislava, Slovakia  
K. Mikula, Bratislava, Slovakia  
M. Ohlberger, Münster, Germany  
M. Rumpf, Bonn, Germany  
O. Scherzer, Vienna, Austria  
J.A. Sethian, Berkeley, USA  
D. Ševčovič, Bratislava, Slovakia  
M. Tůma, Prague, Czech Republic  
M. Vajteršic, Salzburg, Austria

*Published by:*

Slovak University of Technology in Bratislava  
Faculty of Civil Engineering  
Department of Mathematics and Descriptive Geometry  
Radlinského 11  
813 68 Bratislava, Slovak Republic

*Printed by:*

Nakladateľstvo STU, Vazovova 5, Bratislava  
*Typesetting: Latex2e*  
*Number of printed copies: 150*

ISBN 978-80-227-3742-5

## CONTENTS

- 1 **Error control based model reduction for multiscale problems**  
*M. Ohlberger*
- 11 **Efficient matrix-free implementation of discontinuous Galerkin methods for compressible flow problems**  
*R. Klöforn*
- 22 **On numerical simulation of airfoil vibrations induced by compressible flow**  
*M. Feistauer, J. Česenek*
- 32 **Immersed interface method for a level set formulation of problems with moving boundaries**  
*P. Frolkovič*
- 42 **Lagrangian method with topological changes for numerical modelling of forest fire propagation**  
*M. Balážovjeh, K. Mikula, M. Petrášová, J. Urbán*
- 53 **Interface problems for quasi-linear elliptic equations by material and shape derivative methods**  
*I. Cimrák*
- 65 **A Newton-scheme framework for multiscale methods for nonlinear elliptic homogenization problems**  
*P. Henning, M. Ohlberger*
- 75 **Solving the oblique derivative boundary-value problem by the finite volume method**  
*M. Macák, K. Mikula, Z. Minarechová*
- 85 **Two dimensional simulation of fluid-structure interaction using DGFEM**  
*J. Hasnedlová-Prokopová, M. Feistauer, J. Horáček, A. Kosík, V. Kučera*
- 95 **A three-factor convergence model of interest rates**  
*B. Stehlíková, Z. Zíková*
- 105 **Modelling root system phosphate uptake from a soil column as affected by root exudation**  
*A. Schnepf, P. Scholl, G. Bodner, D. Leitner*
- 113 **Image analysis of 2-dimensional root system architecture**  
*D. Leitner, A. Schnepf*
- 120 **A new form-finding method based on mean curvature flow of surfaces**  
*M. Húska, M. Medlá, K. Mikula, P. Novýsedlák, M. Remešíková*
- 132 **Parallel one-sided Block-Jacobi SVD algorithm**  
*M. Bečka, G. Okša, M. Vajteršic*
- 141 **Aggregation schemes for k-cycle AMG**  
*M. Emans*
- 151 **Performance of the block Jacobi method for the symmetric eigenvalue problem on a modern massively parallel computer**  
*Y. Takahashi, Y. Hirota, Y. Yamamoto*
- 161 **On some model reduction approaches for simulations of processes in Li-ion battery**  
*O. Iliev, A. Latz, J. Zausch, S. Q. Zhang*

- 172 **Numerical study of flow in a 2D boiler**  
*P. Bauer, V. Klement, P. Strachota, V. Žabka*
- 179 **Comparison of three different obstacle models for modeling of stratified flows over the body**  
*L. Beneš, P. Fraunié*
- 190 **On the use of non-linear TVD filters in finite-volume simulations**  
*T. Bodnár*
- 200 **Mortar-like mixed-hybrid methods for elliptic problems on complex geometries**  
*J. Březina*
- 209 **Numerical simulation of interaction between incompressible flow and an elastic wall**  
*M. Hadrava, M. Feistauer, P. Sváček*
- 219 **Vector penalty-projection method for incompressible fluid flows with open boundary conditions**  
*P. Angot, R. Cheaytoui*
- 230 **Structure-preserving finite difference scheme for vortex filament motion**  
*T. Ishiwata, K. Kumazaki*
- 239 **Time-convenient deformation of musculoskeletal system**  
*P. Kellnhofer, J. Kohout*
- 250 **Exploiting limited access distance of ODE systems for parallelism and locality in explicit methods**  
*M. Korch*
- 261 **Interaction patterns for concurrently executed parallel tasks**  
*J. Dümmler*
- 272 **A reduced basis method for parameter optimization of multiscale problems**  
*M. Ohlberger, M. Schaefer*
- 282 **Improved row-grouped CSR format for storing of sparse matrices on GPU**  
*T. Oberhuber, M. Heller*
- 291 **Finite element approximation of Stokes-like systems with implicit constitutive relation**  
*J. Stebel*
- 301 **Numerical modelling of compressible inviscid and viscous flow in turbine cascades**  
*P. Louda, K. Kozel, J. Příhoda*
- 311 **Necessary and sufficient condition for the validity of the discrete maximum principle**  
*T. Vejchodský*
- 321 **Numerical approximation of nonlinear fluid-structure interaction problems**  
*P. Sváček*
- 331 **A comparison of several time discretization methods for free surface flows**  
*E. Bänsch, S. Weller*

- 342 **Some second order time accurate finite volume method for the wave equation using a spatial multidimensional generic mesh**  
*A. Bradji*
- 353 **Bridging law shape for long fibre composites and its finite element construction**  
*V. Kozák, Z. Chlup*
- 362 **Geometric properties of particle ensembles in terms of their set covariance**  
*W. Gille*
- 371 **Generalized fronts propagation on weighted graphs**  
*X. Desquesnes, A. Elmoataz, O. Lézoray*
- 382 **Finite element error estimates for nonlinear convective problems**  
*V. Kučera*
- 393 **The localized reduced basis multiscale method**  
*F. Albrecht, B. Haasdonk, S. Kaulmann, M. Ohlberger*
- 404 **Numerical studies of variational-type time-discretization techniques for transient Oseen problem**  
*N. Ahmed, G. Matthies*
- 416 **Parallel algorithms for segmentation of cellular structures in 2D+Time and 3D morphogenesis data**  
*K. Mikula, M. Smíšek, R. Špir*
- 427 **Application of a degenerate diffusion method in 3D medical image processing**  
*R. Máca, M. Beneš*
- 438 **Stabilized semi-implicit finite volume scheme for parabolic tensor diffusion equations**  
*A. Handlovičová, P. Kútik, K. Mikula*