Curriculum Vitae

name	*Jakub Šístek*
birth	*June 21, 1981 in Tábor, Czech Republic*
family	*married, two children*
languages	English (CAE), German (basic), Czech (native)
date	*August 3, 2011*
e-mail	*sistek@math.cas.cz*
web	*http://www.math.cas.cz/∼sistek*

Education

Ph.D. (2008) Czech Technical University in Prague (Czech Republic), Faculty of Mechanical Engineering, Department of Mathematics

> Dissertation title: *The finite element method in fluids: stabilization and domain decomposition*
>
> Advisor: Pavel Burda
>
> Doctoral exam: *Continuum Mechanics, Partial Differential Equations, Numerical Methods for Partial Differential Equations (Finite Element Method)*

Ing. (M.S. equivalent, 2005) Czech Technical University in Prague (Czech Republic), Faculty of Mechanical Engineering, Department of Mathematics, with honours

> Thesis title: *Stabilization of finite element method for solving incompressible viscous flows*
>
> Advisor: Pavel Burda

Interests

Numerical Mathematics: numerical solution of partial differential equations, domain decomposition methods, finite element method, applications in engineering.
Computational Fluid Dynamics: incompressible viscous flow simulations, finite element methods for CFD, parellel solvers for CFD, vortex identification methods, stabilization of the finite element method.
Programming: high-performance computing, distributed programming with MPI, GPU computing with CUDA and OpenCL.

Scientific stays

2011 five months at the Department of Engineering of the University of Cambridge, at Computational Structural Mechanics group

2010 two months stay at CINECA Supercomputing Centre, Bologna, Italy

2009 four months stay at Department of Mathematics, University of Colorado Denver, USA

2007 four months stay at Department of Mathematics, University of Colorado Denver, USA

2005 three months stay at Edinburgh Parallel Computing Centre, Edinburgh, UK within HPC Europa project

Honours

- *Prof. Babuška Prize for an important contribution to computer science* (2009)
  (awarded jointly by *the Union of Czech Mathematicians and Physicists* and *the Czech Society for Mechanics* for the best doctoral dissertation of the year)

- *Prof. Zvoníček foundation award* (2009)
  (awarded at the Faculty of Mechanical Engineering, Czech Technical University in Prague for the best doctoral dissertation in theoretical disciplines of the year)

- *Prof. Babuška Honour for master thesis* (2005)
  (awarded jointly by *the Union of Czech Mathematicians and Physicists* and *the Czech Society for Mechanics* for selected master theses of the year)

- *Karel Spála Prize* (2005)
  (awarded at the Faculty of Mechanical Engineering, Czech Technical University in Prague for the best master thesis in theoretical disciplines of the year)

Collaboration

2009 – Institute of Mathematics, Czech Academy of Sciences, Prague
numerical analysis group, research projects

2011 University of Cambridge, Department of Engineering (United Kingdom)
domain decomposition methods, parallel CFD solvers

2010 – Institute of New Technologies and Applied Informatics, Technical University of Liberec
domain decomposition methods, parallel solvers

2009, 2007   Department of Mathematics, University of Colorado Denver (USA)
research assistant

2006 – 2009   Department of Low Speed Aerodynamics, Aeronautical Research and Test Institute, Prague
code development, research assistant, group for optimisation

2005 – 2009   Institute of Thermomechanics, Czech Academy of Sciences, Prague
research projects, parallel programming, code development

2003 –   Department of Mathematics, Faculty of Mechanical Engineering, Czech Technical University in Prague
teaching, research projects

Teaching experience

Department of Mathematics, Faculty of Mechanical Engineering, Czech Technical University in Prague:

- Mathematics I (1x 4 hours of lectures in 2009, 1x 4 hours of tutorial in 2009, 2008)

- Mathematics II (3x 2 hours of tutorial in 2008)

- Numerical Mathematics (2x 2 hours of tutorial in 2006, 1x 2 hours of tutorial in 2005, 2007)

- Algorithmization and Programming (3x 2 hours of tutorial in 2006, 3x 2 hours of tutorial in 2008)

Participation in research projects

international

- EP/G008531/1 (EPSRC) Computational Toolbox for Fluid-Membrane Interaction with Applications to Micro Air Vehicles and Insect Flight (2009 – 2012)

- DMS-0713876 (NSF) Adaptive Multilevel Iterative Substructuring Methods (2007 – 2010)

national

- LH11004 (AMVIS – MSMT) Domain Decomposition Methods (2011 – 2014)

- GA106/08/0403 (GACR) Development and parallelization of domain decomposition methods and application to nonlinear elasticity and material engineering (2008 – 2012)

- IAA200600801 (GAAV) Decomposition techniques for flow-field analysis (2008 – 2012)

Presentations at international conferences

- ICCFD 6 2010 – The Sixth International Conference on Computational Fluid Dynamics,
  St Petersburg, Russia, July 12–16, 2010

- ICFD International Conference on Numerical Methods for Fluid Dynamics 2010,
  Reading, UK, April 12 –15, 2010 (poster)

- MAFELAP 2009 – The Mathematics of Finite Elements and Applications,
  London, UK, June 9–12, 2009

- ParCFD 2009 – 21st International Conference on Parallel Computational Fluid Dynamics,
  Moffet Field, California, USA, May 18–22, 2009

- SUPERCONVERGENCE 2008 – 4-th Conference on Superconvergence Phenomena in The Finite Element Method,
  Praha, June 25–28, 2008

- ICFD International Conference on Numerical Methods for Fluid Dynamics 2007,
  Reading, UK, March 26–29, 2007 (poster)

- MAFELAP 2006 – The Mathematics of Finite Elements and Applications,
  London, UK, June 13–16, 2006

- PANM 13 – Progams and algorithms of numerical mathematics,
  Praha, May 28–31, 2006 (poster)

- FEF05 – Thirteenth Conference on Finite Elements for Flow Problems,
  Swansea, UK, April 4–6, 2005

- ICFD International Conference on Numerical Methods for Fluid Dynamics 2004,
  Oxford, UK, March 29 – April 1, 2004 (poster)

List of publications of Jakub Šístek

Journal papers

[1] MANDEL, J., SOUSEDÍK, B., AND ŠÍSTEK, J. Adaptive BDDC in three dimensions. *Math. Comput. Simulation*. To appear, preprint available at arXiv:0910.5863.

[2] ŠÍSTEK, J., SOUSEDÍK, B., BURDA, P., MANDEL, J., AND NOVOTNÝ, J. Application of the parallel BDDC preconditioner to the Stokes flow. *Comput. & Fluids 46* (2011), 429–435.

[3] HÁJEK, J., SZÖLLÖS, A., AND ŠÍSTEK, J. A new mechanism for maintaining diversity of Pareto archive in multiobjective optimization. Accepted to *Advances in Engineering Software.*

[4] ŠÍSTEK, J., NOVOTNÝ, J., MANDEL, J., ČERTÍKOVÁ, M., AND BURDA, P. BDDC by a frontal solver and stress computation in a hip joint replacement. *Math. Comput. Simulation 80*, 6 (2010), 1310–1323.

[5] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Accuracy of semiGLS stabilization of FEM for solving Navier–Stokes equations and a posteriori error estimates. *Internat. J. Numer. Methods Fluids 56*, 8 (2008), 1167–1173.

[6] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Numerical solution of flow problems by stabilized finite element method and verification of its accuracy using a posteriori error estimates. *Math. Comp. Simul. 76*, 1–3 (2007), 28–33.

[7] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Finite element solution of Navier-Stokes equations adapted to a priori error estimates. *WSEAS Trans. Math. 5*, 1 (2006), 188–195.

[8] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: On a modification of GLS stabilized FEM for solving incompressible viscous flows. *Internat. J. Numer. Methods Fluids 51*, 9–10 (2006), 1001–1016. MR 2007d:76172. (1 citation according to ISI Web of Knowledge).

[9] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Precise FEM solution of a corner singularity using an adjusted mesh. *Internat. J. Numer. Methods Fluids 47*, 10–11 (2005), 1285–1292. (1 citation according to ISI Web of Knowledge).

Proceedings of international conferences

[1] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J. Singularities in lid driven cavity solved by adjusted finite element method. In *Computational Fluid Dy-*

namics 2010, Proceedings of 6th ICCFD Conference, St. Petersburg, Russia, July 12–16, 2010, A. Kuzmin, Ed. Springer, 2011, pp. 799–805.

[2] KOLÁŘ, V., MOSES, P., AND ŠÍSTEK, J. Triple Decomposition Method for Vortex Identification in Two-Dimensional and Three-Dimensional Flows. In *Computational Fluid Dynamics 2010, Proceedings of 6th ICCFD Conference, St. Petersburg, Russia, July 12–16, 2010*, A. Kuzmin, Ed. Springer, 2011, pp. 225–231.

[3] ŠÍSTEK, J., BURDA, P., MANDEL, J., NOVOTNÝ, J., AND SOUSEDÍK, B. A parallel implementation of the BDDC for the Stokes flow. In *Computational Fluid Dynamics 2010, Proceedings of 6th ICCFD Conference, St. Petersburg, Russia, July 12–16, 2010*, A. Kuzmin, Ed. Springer, 2011, pp. 806–812.

[4] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J. Accuracy Analysis Based on A Posteriori Error Estimates of SemiGLS Stabilization of FEM for Solving Navier-Stokes Equations. In *Computational Fluid Dynamics 2008, Proceedings of 5th ICCFD Conference, Seoul, South Korea, July 7–11, 2008*, H. Choi, H. Choi, and J. Yoo, Eds. Springer, 2009, pp. 315–320.

[5] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J. Semi-GLS stabilization of FEM applied to incompressible flows with higher Reynolds numbers. In *Computational Fluid Dynamics 2006, Proceedings of 4th ICCFD Conference, Ghent, Belgium, July 10–14, 2006*, H. Deconinck and E. Dick, Eds. Springer, 2009, pp. 203–208.

[6] ŠÍSTEK, J., BURDA, P., DAMAŠEK, A., MANDEL, J., NOVOTNÝ, J., AND SOUSEDÍK, B. On a parallel implementation of the BDDC method and its application to the Stokes problem. In *Abstracts of 21st International Conference on Parallel Computational Fluid Dynamics*, Biswas, Rupak, Ed. NASA Ames Research Center, Moffett Field, California, USA, 2009, pp. 183–187.

[7] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Application of a priori error estimates for Navier-Stokes equations to accurate finite element solution. In *Proceedings of WSEAS Conference*. WSEAS, Puerto de la Cruz, Tenerife, Spain, 2005.

[8] BURDA, P., NOVOTNÝ, J., SOUSEDÍK, B., AND ŠÍSTEK, J.: Finite element mesh adjusted to singularities applied to axisymmetric and plane flow. In *Proceedings of Numerical Mathematics and Advanced Applications, ENUMATH 2003, Praha, Czech Republic, August 18–22*, Feistauer, M. and et al., Ed., Springer, Berlin, 2004, pp. 186–195.

[9] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Accurate solution of corner singularities in axisymmetric and plane flows using adjusted mesh of finite elements. In *Proceedings of 3rd ICCFD Conference, Toronto, Canada, July 12–16*. Springer, 2004.

[10] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Precise FEM solution of corner singularity using adjusted mesh applied to axisymmetric and plane flow. In *Proceedings of ICFD Conference on Numerical Methods for Fluid Dynamics, Oxford, UK, March 29 – April 1*. Oxford University Computing Laboratory, 2004. Proceedings on CD.

[11] ŠÍSTEK, J., BURDA, P., AND NOVOTNÝ, J.: Application of a priori error estimates of finite element method for mesh refinement near singularity in incompressible viscous flow. In *Proceedings of Topical Problems of Fluid Mechanics 2004, Praha, Czech Republic, February 25*, Příhoda, J. and Kozel, K., Ed., Institute of Thermomechanics AS CR, Praha, 2004, pp. 153–158.

[12] BURDA, P., NOVOTNÝ, J., SOUSEDÍK, B., AND ŠÍSTEK, J.: Comparison of a posteriori and a priori error estimates of FEM for Navier-Stokes equations near singularity. In *Proceedings of IMMAM 2003, Rožnov pod Radhoštěm, Czech Republic, June 30 – July 4*. VŠB TU, Ostrava, 2003, pp. 15–28.

Other publications

[1] BURDA, P., ČERTÍKOVÁ, M., NOVOTNÝ, J., AND ŠÍSTEK, J. On coarse space for the BDDC method. In *Modelling 2009, book of abstracts*. Ústav geoniky AV ČR, v.v.i., Studentská 1768, Ostrava-Poruba, 2009, pp. 78–78.

[2] ŠÍSTEK, J., BURDA, P., ČERTÍKOVÁ, M., AND NOVOTNÝ, J. Implementation of the BDDC method based on the frontal and multifrontal algorithm. In *Proceedings of Seminar on Numerical Analysis, SNA'09, Ostrava, Czech Republic, February 2 – 6*, Blaheta, Radim and Starý, Jiří, Ed. Ústav geoniky AV ČR, v.v.i., Studentská 1768, Ostrava-Poruba, 2009, pp. 83–86.

[3] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J. On the Accuracy of semiGLS Stabilization of FEM for Solving Incompressible Flows. In *Proceedings of International Conference PRESENTATION of MATHEMATICS '08, Liberec, Czech Republic, September 16-19, 2008*, Příhonská, J. and Segeth, K. and Andrejsová, D., Ed. Technical University, Liberec, 2008, pp. 15–20.

[4] BURDA, P., ČERTÍKOVÁ, M., NOVOTNÝ, J., AND ŠÍSTEK, J.: Stress computations of the hip joint replacement using the BDDC method. In *Short communications of The 1-st IMACS International Conference on Computational Biomechanics and Biology, Plzeň, Czech Republic, September 10–13*. University of West Bohemia in Plzeň, 2007.

[5] ŠÍSTEK, J., GOLDA, M., AND PROKŠ, M.: Calculation of Aerodynamic Characteristics of L-610 Aircraft by AVL and Digital Datcom. *Czech Aerospace Proceedings*, 2 (2007), 24–28.

[6] BURDA, P., ČERTÍKOVÁ, M., NOVOTNÝ, J., AND ŠÍSTEK, J.: BDDC method with simplified coarse problem and its parallel implementation. In *Proceedings of MIS 2007, Josefův Důl, Czech Republic, January 13–20*, Obdržálek, D. and et al., Ed., Matfyzpress, Praha, 2007.

[7] ŠÍSTEK, J., ČERTÍKOVÁ, M., BURDA, P., NEUMANOVÁ, E., PTÁK, S., NOVOTNÝ, J., AND DAMAŠEK, A.: Development of an efficient parallel BDDC solver for linear elasticity problems. In *Proceedings of Seminar on Numerical Analysis, SNA'07, Ostrava, Czech Republic, January 22–26*, Blaheta, R. and Starý, J., Ed., Institute of Geonics AS CR, Ostrava, 2007, pp. 105–108.

[8] BURDA, P., ČERTÍKOVÁ, M., DAMAŠEK, A., NEUMANOVÁ, E., NOVOTNÝ, J., AND ŠÍSTEK, J.: Application of the BDDC method to linear elasticity problems. In *Proceedings of SAMO'06, Ostravice, Czech Republic, September 13–15*, Sameš, M., Ed., VŠB TU, Ostrava, 2006, pp. 9–10.

[9] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Accuracy investigation of a stabilized FEM for solving flows of incompressible fluid. In *Proceedings of Programs and Algorithms of Numerical Mathematics 13, Praha, Czech Republic, May 28–31*. Mathematical Institute AS CR, Praha, 2006.

[10] ŠÍSTEK, J., NOVOTNÝ, J., BURDA, P., AND ČERTÍKOVÁ, M.: Použití metody BDDC pro paralelizaci řešení velkých soustav lineárních rovnic. In *Proceedings of MIS 2006, Josefův Důl, Czech Republic, January 14–21*, Obdržálek, D. and et al., Ed., Matfyzpress, Praha, 2006, pp. 79–84. (in Czech).

[11] ŠÍSTEK, J.: Development of parallel solver for systems of linear equations based on BDDC method. In *Science and Supercomputing in Europe 2005 - HPC Europa report*. Cineca, Bologna, Italy, 2006, pp. 603–611.

[12] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Stabilization of FEM for incompressible flows by modified GLS algorithm. In *Proceedings of Výpočtová mechanika 2005, Nečtiny, Czech Republic, November 7–9*, Vimmr, J., Ed., ZČU, Plzeň, 2005, pp. 95–102.

[13] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: On the application of a priori error estimates for Navier-Stokes equations. In *Proceedings of International Conference Presentation of Mathematics, Liberec, Czech Republic, September*. Technical University, Liberec, 2005.

[14] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: Galerkin Least Squares stabilization of FEM for solving flows for higher Reynolds numbers. In *Proceedings of Seminar on Numerical Analysis, SNA'05, Ostrava, Czech Republic, February 7–11*. Institute of Geonics AS CR, Ostrava, 2005, pp. 14–16.

[15] BURDA, P., NOVOTNÝ, J., AND ŠÍSTEK, J.: An application of a priori and a posteriori error estimates to accurate FEM solution of incompressible flows. In *Proceedings of Software a algoritmy numerické matematiky, Srní, Czech Republic, September.* Charles University, Praha, 2005.

[16] ŠÍSTEK, J.: Stabilization of finite element method for solving incompressible viscous flows, 2004. Master thesis.

[17] BURDA, P., NOVOTNÝ, J., SOUSEDÍK, B., AND ŠÍSTEK, J.: Aplikace apriorních a aposteriorních odhadů. In *Proceedings of Výpočtová mechanika 2004, Nečtiny, Czech Republic, November 8–10*, Vimmr, J., Ed., ZČU, Plzeň, 2004. (in Czech).

[18] BURDA, P., NOVOTNÝ, J., SOUSEDÍK, B., AND ŠÍSTEK, J.: A priori and a posteriori error estimates for Navier-Stokes equations applied to incompressible flows. In *Proceedings of Programs and Algorithms of Numerical Mathematics 12, Dolní Maxov, Czech Republic, June 6–11.* Mathematical Institute AS CR, Praha, 2004.

[19] ŠÍSTEK, J., BURDA, P., AND NOVOTNÝ, J.: Řešení úlohy nestlačitelného proudění pomocí MKP na síti přizpůsobené singularitě. In *Proceedings of Výpočtová mechanika 2003, Nečtiny, Czech Republic, November 3–5*, Vimmr, J., Ed., ZČU, Plzeň, 2003, pp. 437–444. (in Czech).

[20] BURDA, P., BENEŠ, V., NOVOTNÝ, J., AND ŠÍSTEK, J.: O zdolávání singularity v proudu nestlačitelné tekutiny v oblasti s nekonvexními rohy. In *Proceedings of Matematika na vysokých školách, Herbertov, Czech Republic, September 1–3*, Herrmann, L., Ed., ČVUT, Praha, 2003, pp. 27–30. (in Czech).

[21] ŠÍSTEK, J.: Řešení úlohy proudění v trubici se singularitou pomocí MKP s vhodným zjemněním sítě. In *Proceedings of STČ 2003, Praha, Czech Republic, May*, Herman, A., Ed., ČVUT, Praha, 2003. (in Czech).