

Curriculum Vitae

Sergei Sazhenkov

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Date and place of birth: 27 June 1972, Novosibirsk, Russia

Marital status: spouse Elena (1977), daughter Polina (2000)

Research interests: Nonlinear partial differential equations, continuum mechanics, homogenization procedures for physical models describing dynamics of nonhomogeneous fluids

Education

Ph. D. in Mathematics, Novosibirsk State University, Siberian Scientific Center of Russian Academy of Sciences, 8 December 1998. **Subject:** Partial differential equations. **Thesis:** “Weak limits of sequences of solutions to problems on motion of non-homogeneous fluids”.
Scientific advisor: Professor Pavel I. Plotnikov.

M. Sc. in Mathematics (cum laude), Novosibirsk State University, 1995.

B. Sc. in Applied Mathematics and Mechanics (cum laude), Novosibirsk State University, 1993.

Phillips Academy, Andover, Massachusetts, USA, 1989.

Lavrentiev Specialized Boarding School for Physics and Mathematics, Novosibirsk, 1988–1989.

Academic experience:

Foreign Professor (from August 2005):

Centre for Applied Mathematics and Physics,
College of Electrical and Mechanical Engineering,
National University of Sciences and Technology, Rawalpindi, Pakistan.

Senior Research Scientist (from March 2004),

Research Scientist (June 1999 – February 2004),

Junior Research Scientist (October 1995 – May 1999):

Laboratory for Mathematical Modeling of Phase Changes,
Lavrentiev Institute of Hydrodynamics, Novosibirsk, Russia.

Postdoctoral Researcher (December 2001 – November 2002):

Department of Mathematics, University of Beira Interior, Covilhã, Portugal.

The main results of studies:

Proof of the well posedness of initial-boundary value problems for incompressible dilatant non-Newtonian fluids with inclusions (other fluids or solid bodies). Development of a method of the Tartar equation in homogenization procedures for mixtures of incompressible liquids possessing highly oscillatory regimes. Construction of a concept of generalized Lagrangian coordinates in

the case of non-smooth solenoidal velocity fields. Proof of the well posedness of Cauchy problems for the Tartar equation in classes of nonnegative measure-valued functions and of Cauchy problems for a linear transport equation in the Lebesgue functional spaces.

Mathematical analysis of problems on dynamics of non-homogeneous fluids filtering through porous structure:

proof of the well posedness of entropy and kinetic formulations of Cauchy problems for quasilinear non-isotropic diffusion-convection equations with non-smooth convection coefficients (jointly with Prof. P.I. Plotnikov). Proof of solvability and stability properties for genuinely nonlinear non-isotropic diffusion-convection equations with sophisticated diffusion matrices. Proof of solvability of the Darcy–Stefan problem on the freezing and melting phenomena in a fluid filtering through a porous ground.

Teaching experience:

Foreign Professor (from August 2005):

Centre for Applied Mathematics and Physics,
National University of Sciences and Technology, Rawalpindi, Pakistan.

The taught classes:

Special Functions (course of lectures for MS and PhD students), Fall 2005.

Taught a class on classical topics of the special functions including the gamma and beta functions, the hypergeometric function, Bessel's functions, etc.

Differential Equations (course of lectures for PhD students), Spring 2006.

Taught a class on classical topics of higher-order ordinary differential equations, systems of ordinary differential equations, and boundary value problems for classical equations of mathematical physics.

Associate Professor (January 2003 – July 2005),

Lecturer (September 1998 – June 2001):

Chair of Theoretical Mechanics, Department of Mathematics, Novosibirsk State University

The taught classes:

Theoretical Mechanics (course of seminars for the second year students), Fall–Spring 1998–2001, Spring 2003.

Taught a class on classical topics of theoretical mechanics.

Mathematical Methods in Continuum Mechanics II (a half-year course of lectures and seminars for the fourth year students), Spring 2001, 2004, 2005

Taught a class on mathematical methods for the Navier–Stokes and Stokes equations, for the Euler equations of ideal fluid, and for the Stefan problem.

Mathematical Modeling (a half-year course of seminars for the second year students), Spring 2003.

Taught a class on fundamentals of mathematical modeling in continuum mechanics.

Generalized Solutions of Equations of Mathematical Physics (a half-year course of lectures for the fifth year students), Fall 2003, 2004.

Taught a class on the theory of generalized solutions of elliptic, parabolic and hyperbolic linear equations of the second order and on the theory of entropy and kinetic solutions of scalar conservation laws.

Supervision of Student's Thesis:

Supervised the B.S. in Mathematics thesis of Ilia Paranichev in 2005. Title of the thesis: Kinetic formulations for scalar conservation laws in bounded domains.

Grants and awards:

Grants of the Russian Foundation for Basic Research:

Code: 03-01-00829. Years: 2003-2005. Title: Mathematical problems of the theory of nonlinear waves in fluids. Principle researcher: Prof. P.I. Plotnikov.

Code: 00-01-00911. Years: 2000-2002. Title: Dynamics of multi-phase continuum media. Principle researcher: Prof. P.I. Plotnikov.

Code: 97-01-00501. Years: 1997-1999. Title: Evolution of singularities of solutions of dynamical equations of continuum media. Principle researcher: Prof. P.I. Plotnikov.

Code: 01-01-06016. Year: 2001. Title: Individual grant for a young scientist.

Contract between Lavrentiev Institute of Hydrodynamics and Hyundai Heavy Industries Co.:

Code: LH-04-06. Years: 2004-2005. Title: Development of the software for coupled dynamic analysis of vessel/mooring/risers system including vortex induced vibrations. Principle researcher: Prof. A.A. Korobkin.

Grant of the Federal Agency for Education of the Russian Federation:

Code: 8247. Year: 2005. The program title: Development of Scientific Potential of Higher School. The grant title: Contemporary functional analysis for nonlinear models of continuous media. Principal researcher: Dr. S.A. Sazhenkov.

Grant of Higher Education Commission of Pakistan:

Years: 2005-2007. The project title: Modern Mathematical Analysis for Phenomenon of Anisotropic Diffusion and Acoustic Wave Propagation in Porous Media. Principal researcher: Dr. S.A. Sazhenkov.

Scholarship of the Russian Academy of Sciences for young talented scientists:

Years: 1999-2001.

Prize for Young Scientists of Siberian Division of Russian Academy of Sciences in Honour of Academician I.N. Vekua:

Year: 2005. Awarded for the work entitled "Method of kinetic equation for studying of nonlinear problems on dynamics of multi-phase media".

Computer Experience

Software development tools: Pascal, Fortran, Matlab, Matematica.

Knowledge of languages: English, Portuguese.

List of Publications

SERGEI SAZHENKOV

Ph.D. Thesis

1. S. A. Sazhenkov. *Weak limits of sequences of solutions to problems on motion of nonhomogeneous fluids* (Ph. D. Thesis, Novosibirsk State University, Novosibirsk, 1998, 116 pages). (In Russian.)

Articles in Journals

2. S. A. Sazhenkov. A problem on motion of rigid bodies in a non-Newtonian incompressible fluid. *Sibirskii Matematicheskii Zhurnal*, 1998, **39**(1). P. 146–160. (In Russian.) (English translation: *Siberian Math. Journal*, Plenum Publishers, 1998, **39**(1). P. 126–140.)
3. S. A. Sazhenkov. Solutions of a problem on motion of a viscous incompressible fluid provided with frequently oscillating initial data. *Dinamika Sploshnoi Sredy (Dynamics of Continuum Media)*, Novosibirsk, 1998, **113**. P. 123–134. (In Russian.)
4. S. A. Sazhenkov. Generalized Lagrange coordinates in a case of non-smooth solenoidal velocity field. *Dinamika Sploshnoi Sredy (Dynamics of Continuum Media)*, Novosibirsk, 1999, **114**, P. 74–77. (In Russian.)
5. S. A. Sazhenkov. On homogenization of multi-dimensional parabolic differential operators in hydrodynamics. *News of Altai State University*, Barnaul, Russia, 2001, **17**(1). P. 43–47. (In Russian. English summary.)
6. S. A. Sazhenkov. The Tartar equation for homogenization of a dynamical model for fine-dispersion mixture. *Sibirskii Matematicheskii Zhurnal*, 2001, **42**(6), P. 1375–1390. (In Russian.) (English translation: *Siberian Math. Journal*, Plenum Publishers, 2001, **42**(6). P. 1142–1155.)
7. S. A. Sazhenkov. Generalized Lagrange coordinates and the uniqueness of the solution of a linear transport equation. *Differentsialnye Uravneniya*, 2002, **38**(1). P. 117–125. (In Russian.) (English translation: *Differential Equations*, MAIK Nauka/Interperiodica, 2002, **38**(1). P. 127–136.)
8. S. A. Sazhenkov. A Cauchy problem for the Tartar equation. *Proceedings of the Royal Society of Edinburgh*, 2002, **132A**. P. 395–418. (In English.)
9. S. A. Sazhenkov. A method of kinetic equation and the Darcy–Stefan problem on phase transitions in a porous ground. *News of Altai State University*, Barnaul, Russia, 2004, **31**(1). P. 17–22. (In Russian.) (English translation: Server of Preprints on Conservation Laws www.math.ntnu.no/conservation/. Preprint no. 2004-006, February 2004, 9 pages.)
10. P. I. Plotnikov and S. A. Sazhenkov. Kinetic formulation for the Graetz–Nusselt ultraparabolic equation. *Journal of Mathematical Analysis and Applications*, 2005, **304**. P. 703–724. (In English.)
11. P. I. Plotnikov and S. A. Sazhenkov. A Cauchy problem for the Graetz–Nusselt ultraparabolic equation. *Doklady Akademii Nauk*, 2005, **401**(4). P. 455–458. (In Russian.) (English translation: *Doklady Mathematics*, 2005, **71**(2). P. 234–237.)

12. S. A. Sazhenkov. The genuinely nonlinear ultra-parabolic Graetz–Nusselt equation. *Sibirskii Matematicheskii Zhurnal*, 2006, **47**(2). P. 432–455. (English translation: *Siberian Mathematical Journal*, Plenum Publishers, 2006, **47**(2).)

Textbooks for Students

13. S. A. Sazhenkov. *The collection of tests on theoretical mechanics for university undergraduate students* (Textbook for students. Novosibirsk State University, Russia, 2002. 40 pages). (In Russian.)
14. I. V. Basov, O. B. Bocharov, and S. A. Sazhenkov. *Mathematical Models of Continuum Mechanics*. (Lecture Notes for Students. Novosibirsk State University, Russia, 2005. 84 pages.) (In Russian.)

Abstracts of Talks on Conferences

15. S. A. Sazhenkov. On a motion in the Hele-Shaw cell driven by capillary forces. *35th All-Russian Conference The Students and the Technical Progress. Book of abstracts*. Novosibirsk, Russia, April, 1997. 1 page. (In Russian.)
16. S. A. Sazhenkov. On a motion of viscous incompressible fluid provided with frequently oscillating initial data. *The First Siberian Seminar on Mathematical Methods in Continuum mechanics. Book of abstracts*. Novosibirsk, Russia, December, 1997. P. 122. (In Russian.)
17. S. A. Sazhenkov. Lagrangian representation in a case of non-smooth solenoidal velocity field and a uniqueness theorem for solution of linear transport equations. *Proceedings of The First Regional Conference on Mathematics MAK-98*, Barnaul, Russia, March, 1998. P. 27–28. (In Russian.)
18. S. A. Sazhenkov. Representation in Lagrange coordinates for non-smooth solenoidal velocity fields and the well posedness of Cauchy problems for two kinetic equations. *Third All-Russian Congress on Industrial and Applied Mathematics. Book of abstracts*. Novosibirsk, Russia, June, 1998. P. 118-119. (In Russian.)
19. S. A. Sazhenkov. On a problem on motion of rigid bodies in a viscous incompressible fluid. *Proceedings of The Second Regional conference on mathematics MAK-99*, Barnaul, Russia, March, 1999, P. 35–36. (In Russian.)
20. S. A. Sazhenkov. Homogenization of vector-valued differential parabolic operators in hydrodynamics. *Proceedings of The Third Regional conference on mathematics MAK-2000*, Barnaul, Russia, March, 2000, P. 24–26. (In Russian.)
21. S. A. Sazhenkov. On homogenization of small asymptotic mixture of incompressible fluids. *The Fourth All-Russian Congress on Industrial and Applied Mathematics. Book of abstracts (Part I)*. Novosibirsk, Russia, June, 2000. P. 27. (In English.)
22. S. A. Sazhenkov. Tartar H-measure in a problem of derivation of correction terms in homogenized equations describing dynamics of fine-dispersion mixtures. *Proceedings of The Fourth Regional Conference on Mathematics MAK-2001*, Barnaul, Russia, April, 2001. P. 23–24. (In Russian.)

23. S. A. Sazhenkov. The Tartar equation in homogenization of a problem on motion of a small asymptotic mixture. *International Conference Differential Equations and Related Topics Dedicated to Centenary Anniversary of I. G. Petrovsky. Book of abstracts*. Moscow State University, Russia, May, 2001. P. 363–364. (In English.)
24. S. A. Sazhenkov. Generalized Lagrange coordinates in a case of non-smooth solenoidal velocity fields. *8th All-Russian Congress on Theoretical and Applied Mechanics. Book of abstracts*. Perm, Russia, August, 2001. P. 514. (In Russian.)
25. S. A. Sazhenkov. Entropy and kinetic formulations for nonlinear ultraparabolic equations. *Proceedings of the Sixth Regional Conference on Mathematics MAK-2003*, Barnaul, Russia, April, 2003. P. 24–26. (In Russian.)
26. S. A. Sazhenkov. Entropy and kinetic formulations for the ultra-parabolic diffusion-convection equations. *International Conference on Nonlinear Partial Differential Equations NPDE-2003, Book of Abstracts*, Alushta, Ukraine. P. 182–183. (In English.)
27. S. A. Sazhenkov. On the Darcy–Stefan problem on phase transitions in a porous ground. *Proceedings of the Seventh Regional Conference on Mathematics MAK-2004*, Barnaul, Russia, April, 2004. 2 pages. (In Russian.)
28. S. A. Sazhenkov. The genuinely nonlinear non-isotropic degenerate parabolic-hyperbolic equation. *International Conference Differential Equations and Related Topics Dedicated to the memory of I. G. Petrovsky. Book of abstracts*. Moscow State University, Russia, May, 2004. P. 194. (In English.)
29. S. A. Sazhenkov. Ultraparabolic Muskat–Leverett-like model. *Proceedings of the Eighth Regional Conference on Mathematics MAK-2005*, Barnaul, Russia, April, 2005. 2 pages. (In Russian.)
30. S. A. Sazhenkov. Kinetic formulations of degenerate filtration problems. *Winter School on Mechanics of Continuous Media. Book of abstracts*. Institute of Mechanics of Continuous Media, Ural Branch of Russian Academy of Sciences, Perm, Russia, February, 2005. 1 page. (In Russian.)
31. S. A. Sazhenkov. Kinetic formulation and entropy solutions of the ultraparabolic Graetz–Nusselt equation. *International Conference on Mathematics, Mechanics and Physics Dedicated to the memory of M. A. Lavrentiev. Book of Abstracts*. Lavrentiev Institute of Hydrodynamics, Novosibirsk, Russia, May, 2005. P. 75. (In Russian.)

**Participation in Conferences and International Seminars
(list of most important events)**

SERGEI SAZHENKOV

- The 3rd All-Russian Congress on Industrial and Applied Mathematics. Novosibirsk, Russia, June, 1998. Title of the talk: Representation in Lagrange coordinates for non-smooth solenoidal velocity fields and the well posedness of Cauchy problems for two kinetic equations.
- The 4th All-Russian Congress on Industrial and Applied Mathematics. Novosibirsk, Russia, June, 2000. Title of the talk: On homogenization of small asymptotic mixture of incompressible fluids.

- International Conference *Differential Equations and Related Topics* Dedicated to Centenary Anniversary of I. G. Petrovsky. Moscow State University, Russia, May, 2001. Title of the talk: The Tartar equation in homogenization of a problem on motion of a small asymptotic mixture.
- The 8th All-Russian Congress on Theoretical and Applied Mechanics. Perm, Russia, August, 2001. Title of the talk: Generalized Lagrange coordinates in a case of non-smooth solenoidal velocity fields.
- International seminar *Nonlinear partial differential equations and free boundary problems*. CMAF, Óbidos, Portugal, May 2002. Title of the talk: H -measures and homogenization of a fine-dispersed mixture.
- International seminar *Nonlinear partial differential equations and free boundary problems*. University of Algarve, Faro, Portugal, September 2002. Participation without a talk.
- Instructional conference on mathematical analysis of hydrodynamics. Edinburgh, UK, ICMS, June 2003. Participation without a talk.
- International conference *Nonlinear partial differential equations NPDE-2003*. Alushta, Ukraine, Ukrainian National Acad. Sc. September 2003. Title of the talk: Entropy and kinetic formulations for the convection-diffusion ultra-parabolic equations.
- International conference *Differential Equations and Related Topics* Dedicated to I. G. Petrovsky. Moscow State University, Russia, May, 2004. Title of the talk: The genuinely nonlinear non-isotropic degenerate parabolic-hyperbolic equation.
- International seminar on computational mechanics at the Institute of technical mechanics of the University of Karlsruhe, Germany, July, 2004. Title of the talk: Entropy and kinetic formulations for the reaction-diffusion-convection ultra-parabolic equations and related topics.
- International Conference on Mathematics, Mechanics and Physics Dedicated to the memory of M. A. Lavrentiev. Lavrentiev Institute of Hydrodynamics, Novosibirsk, Russia, May, 2005. Title of the talk: Kinetic formulation and entropy solutions of the ultra-parabolic Graetz–Nusselt equation.
- Weekly seminar series at the National University for Sciences and Technology, College of Electrical and Mechanical Engineering, Centre for Advanced Mathematics and Physics, Rawalpindi, Pakistan. September, 2005. Title of the talk: Kinetic formulation of conservation laws and one filtration problem.
- Weekly seminar series at the National University for Sciences and Technology, College of Electrical and Mechanical Engineering, Centre for Advanced Mathematics and Physics, Rawalpindi, Pakistan. March, 2006. Title of the talk: H -measures and homogenization of fine-dispersion mixtures.