
IRINA F. SIVERGINA

Office Address

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Research Interest

- Inverse and Ill-Posed Problems for Partial Differential Equations
- Control and Observation Theory
- Numerical Analysis
- Viscosity Solutions for Hamilton-Jacobi-Bellman Equations

Education

- 1993 **Doctor of Sciences** (habilitation), Mathematics and Physics, Institute of Mathematics and Mechanics, Ural Branch of Russian Academy of Sciences, Ekaterinburg, Russia
Dissertation: *Inverse problems in observation theory*
Opponents: Academician Nikolai N. Krasovskiy (Ekaterinburg, Russia)
 Academician Feliks L. Chernousko (Moscow, Russia)
 Professor Fedor P. Vasilyev (Moscow, Russia)
- 1986–1987 **Specialization**, Image Processing and Pattern Recognition, Moscow Physical-Technical University, Moscow, Russia
Thesis: *The Conway problem and image generation*
Advisor: Professor Leonid P. Yaroslavsky
- 1984 **Ph.D., Mathematics and Physics**, Institute of Mathematics and Mechanics, The Ural Branch of Russian Academy of Sciences, Ekaterinburg, Russia
Dissertation: *The evolution equations in the estimation for the systems with non-modeled dynamics*
Advisor: Academician Alexander B. Kurzhanskii
Opponents: Professor Feliks L. Chernousko (Moscow, Russia)
 Associate Professor V.I. Isakov, (Sverdlovsk, Russia)
- 1976–1981 **MS, Applied Mathematics**, The Ural State University, Ekaterinburg, Russia
Concentration: Observation and Estimation Theory
Masters Thesis: *Estimation problems for the systems with non- modeled dynamics*
Advisor: Academician Alexander B. Kurzhanskii

Employment

07/2004– present: **Associate Professor**, Kettering University, Flint, MI (<http://www.kettering.edu>)

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- *Teaching Undergraduate Mathematics Courses*
 - *Research in Observability of Thermoelastic Systems*
 - *Studies on Viscosity Solutions of Thermoelastic Systems*
- 08/2003– 07/2004: **Senior Scientist**, Oakland University, Rochester, MI (<http://www.oakland.edu>)
- *Adaptive Parameter Identification in Thermoelastic Contact Brake Heating*
 - *Control in a Multi-Agent Model of Fuel Flow in DISI Engines*
 - *Control and Stabilization of Electrostatically Formed Antennas*
- 08/2002 – 8/2003: **Visiting Assistant Professor**, Oakland University, Rochester, MI (<http://www.oakland.edu>)
- *Teaching Undergraduate Mathematics Courses*
- 09/2000 – 8/2002: **Senior Scientist**, Oakland University, Rochester, MI (<http://www.oakland.edu>)
- *Control of Fuel Flow in the Common Rail Fuel Injection Systems*
 - *Source Identification for Atmospheric Diffusion*
 - *Adaptive Parameter Identification in DISI Engines*
 - *Controllability and Observability of Thermoelastic Contact Systems*
- 02/2000 – 07/2000: **Invited Researcher**, Scientific Research Laboratory, Ford Motor Co., Dearborn, MI
- *Stochastic DP Approach in Optimization of Powertrain Operating Policy for Feasibility Assessment and Calibration*
- 1995 – present: **Leading Scientific Researcher**, Institute of Mathematics and Mechanics, Ural Branch, Russian Academy of Sciences, Ekaterinburg, Russia (<http://www.msu.ru/english>)
- *Research in Inverse Problems for Systems Governed by PDEs*
 - *Conducting Research on Viscosity Solutions of the Hamilton-Jacobi-Bellman Equations*
- 1995 – 2003: **Professor**, Urals State Technical University, Ekaterinburg (http://www.ustu.ru/main/ustu_eng.html)
- *Teaching Undergraduate and Graduate Mathematics Courses*
- 1996 – 2000: **Invited Lecturer**, Moscow State University, Moscow, Russia (<http://www.ustu.ru/>) (<http://www.imm.uran.ru>)
- *Lecturing on Mathematical Models of Environmental Problems*
- 1985 – 1995: **Senior Scientific Researcher**, Institute of Mathematics and Mechanics, Russian Academy of Sciences, Ekaterinburg (<http://www.mgu.ru>)
- *Conducting Research on Parameter and State Estimation in the Systems Governed by PDEs*
 - *Exploration in Data Mining and Image Processing*
- 1984 – 1985: **Scientific Researcher**, Institute of Mathematics and Mechanics, Ural Branch, Russian Academy of Sciences, Ekaterinburg (<http://www.mgu.ru>)
- *Conducting Research on Adaptive Parameter Identification in PDEs*
 - *Recursive Parameter Identification in the Systems with Non-Modeled Dynamics*
- 1981 – 1984: **Ph.D. Scholar**, Institute of Mathematics and Mechanics, Ural Branch, Russian Academy of Sciences, Ekaterinburg (<http://www.mgu.ru>)

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- *Recursive Parameter Identification for the Systems with Non-Modeled Dynamics*

Courses Taught at Kettering University

- Calculus II
- Multivariate Calculus
- Differential Equations and Laplace Transform
- Complex Variables

Research Funding

2005	<i>Mathematics and Science Partnership (MSP)</i> Genesee Intermediate School District (and its participating constituent school districts) and Kettering University in support of the federally funded MSP program
2003	<i>Optimization and Inverse Problem for Acoustic Radiation Problems</i> (the project is submitted to NSF-SBIR)
2001	Gift from Ford Research Laboratory, Ford Motor Co.
1999 – 2001	Grant 99-01-00176 on <i>Observation and Estimation Problems for Distributed Parameter Systems</i> (Principal Investigator) supported by the Russian Fund of Fundamental Research
1996	Grant from the International Institute of Applied Systems Analysis, Vienna, Austria
1994 – 2001	Russia State Grant for the Distinguished Scientists
1996 – 1998	Grant 96-01-00050 on <i>Inverse Problems of Observation Theory</i> (Principal Investigator) supported by the Russian Fund of Fundamental Research
1997, 1999	Travel Grants 99-01-10785, 97-01-10689 by the Russian Fund of Fundamental Research

Awards and Recognition

1994	Prize of the Ural Branch of the Russian Academy of Sciences for the best scientific paper
1986	Junior Scientist Prize of the Ural Branch of the Russian Academy of Sciences

Skills

- **Foreign Languages:** Russian, English, German (reading), French (reading)
- **Computing:** C++, Pascal, Fortran, HTML, modeling in the MATLAB environment

Membership

- AMS
- SIAM
- MAA

Services at Kettering University

- A member of the Employee Handbook Committee (February 2005 – present)
- Services at *Discover Kettering* (November 2004, August 2005, November 2005)
- Tutoring at the Mathematics Placement Test study session during orientation (September 2005)

Other Activities

- **Reviewer for:**
 - Automatica
 - IEEE Transactions on Automatic Control
 - Mathematical Reviews
 - Optimization. Methods and Software
 - Journal on Numerical Analysis and Mathematical Physics (in Russian)
 - International Conference on Physics and Control 2003
- **Co-Organizer:** the three session Minisymposium at the 21st IFIP TC7 Conference on System Modeling and Optimization, Sophia Antipolis, France, 2003
- **Co-Organizer:** the three session Minisymposium at the 22st IFIP TC7 Conference on System Modeling and Optimization, Turin, Italy, 2005
- **Program Committee Member:** Southern Symposium on Computation, University of Southern Mississippi, Hattiesburg, Mississippi, December 4-5, 1998
- **Ph.D. and M.S. Student Advisor (January 2000-present):** Moscow State University, Moscow, Russia
- **M.S. Student Advisor (1985--1999):** Ural State Technical University, Ekaterinburg, Russia
- **M.S. Student Advisor (1991):** Ural State University, Ekaterinburg, Russia
- **Program Committee Member: (1985, 1988, 1993, 1995):** Regional High School Student Competition on Mathematics and Informatics
- **Volunteer (1981--2000):** Summer Mathematics Courses for the Gifted High School Students, Ekaterinburg, Russia

Articles in Encyclopedias

1. Kurzhanski A.B. and Sivergina I.F., Controllability and Observability, Sensitivity and Stability of Mathematical Models, in Mathematical Models, in *Encyclopedia of Life Support Systems (EOLSS)*, Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford, UK, (<http://www.eolss.net>) (to appear).
2. Kurzhanski A.B. and Sivergina I.F., (2003), The Stability Concepts. In Physical Sciences, Engineering and Technology Resources, edited by H. Unbehauen, in *Encyclopedia of Life Support Systems (EOLSS)*, Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford, UK, 2003, (<http://www.eolss.net>)

Journal Publications

1. Kolmanovsky, I.V., Polis M.P., Sivergina I.F., Identification of the Heat Flux in a Quasi-Static Thermoelastic System, Transactions of ASME J. of Dynamic Systems, Measurement, and Control (to appear).

2. Sivergina I.F., Polis M.P., Global Null Controllability of a Quasi-Static Thermoelastic Contact System, Proc. of the Fifth International Conference on Dynamical Systems and Differential Equations, June 16-19, 2004, Pomona, CA, USA. In: Discrete and Continuous Dynamical Systems, 2005, (to appear).
3. Sivergina I.F., Polis M.P., Local null controllability in a state constrained thermoelastic contact problem, *Lecture Notes in Pure and Applied Mathematics*. 240 (2005), 131 – 144.
4. Sivergina, I., and Polis, M., Null Controllability in a Nonlinear Thermoelastic Contact Problem, *Applied Mathematics and Optimization*, 51(2005), 107 – 122.
5. Zachary D.S., Haurie A., Sivergina I., A Reduced-Order Photochemical Air Quality Model, *Cybernetics and Systems*, 35 (2004), pp. 579-593.
6. Sivergina I., Polis, M., and Kolmanovsky I., Source identification for parabolic Equations, *Mathematics of Control, Signals, and Systems*, **16** (2003), 2/3, 141 – 157.
7. Sivergina I., and Polis M., Comments on "Model-Based Solution Techniques for the Source Localization Problem", *IEEE Trans. Control Systems Technology*, **10** (2002), p. 633.
8. Kurzhanski A.B., and Sivergina I. F., Dynamic programming in an identification problem for distributed parameter systems. (in Russian) *Prikl. Mat. Mekh.* 62 (1998), no. 6, 899 – 912; translation in *J. Appl. Math. Mech.* 62 (1998), no. 6, pp. 831 – 842 (1999).
9. Sivergina I.F., Parallel algorithm in the source identification problem for atmospheric diffusion equations, in Algorithms and Programs for parallel computations, Ekaterinburg, UO RAN, 1998, pp. 286-300.
10. Kurzhanski A.B., and Sivergina I.F. The dynamic programming in an inverse estimation problem for distributed parameters systems. (in Russian) *Dokl. Akad. Nauk* 360 (1998), no. 2, pp. 161 – 166.
11. Sivergina I.F., On the data re-processing-free algorithm in the initial state estimation problem for parabolic systems, *Lecture Notes in Computer Science*, 1196, pp. 450 – 457.
12. Sivergina I.F., Invertibility and observability of evolutionary systems. (in Russian) *Dokl. Akad. Nauk*, 351 (1996), no. 3, pp. 304 – 308.
13. Sivergina I., The diffusion processes: an invertibility problem and the guaranteed estimation theory. *Modelling and optimization of distributed parameter systems* (Warsaw, 1995), pp. 159 – 166, Chapman & Hall, New York, 1996.
14. Kurzhanski A.B., and Sivergina I.F., *Quasiinversion, regularization and the observability problem*, Luxenburg, International Institute of Applied System Analysis, 1992. WP-92-14. 25 p.
15. Kurzhanski A.B., and Sivergina I.F., The method of guaranteed estimates and the regularization problems for evolutionary systems. (in Russian) *Zh. Vychisl. Mat. i Mat. Fiz.* 32 (1992), no. 11, pp. 1720-1733; translation in *Comput. Math. Math. Phys.* 32 (1992), no. 11, pp. 1545 – 1558 (1993).
16. Kurzhanski A.B., and Sivergina I.F., Epsilon-observability of the distributed systems. (in Russian) *Proceedings of the Institute of Mathematics and Mechanics*, Vol. 1, 122 – 137, 222, Ross. Akad. Nauk, Ural. Otdel., Inst. Mat. Mekh., Ekaterinburg, 1992.
17. Yaroslavski L.P., and Sivergina I.F., On the properties of texture images in nonlinear dynamical systems. (in Russian) *Avtometriya*, 1991, no. 1.
18. Kurzhanski A.B., and Sivergina I.F., On inverse problems for the evolutionary systems: the guaranteed estimates and the regularized solutions. *Modeling and inverse problems of control for distributed parameter systems* (Luxenburg, 1989), pp. 93 – 101, Lecture Notes in Control and Inform. Sci., 154, Springer, Berlin, 1991.

19. Kurzhanski A.B., and Sivergina I.F., Irreversible evolution systems: the guaranteed estimation and the regularization problems. (in Russian) *Dokl. Akad. Nauk SSSR*, 314 (1990), no. 2, 292 – 296; translation in *Soviet Math. Dokl.* 42 (1991), no. 2, pp. 451 – 455.
20. Yaroslavsky L.P., and Sivergina I.F., The textures, the game 'life', and the non-linear dynamical systems. *Probl. Control and Infirm. Theory.* 19 (1990), no. 4, 24 p.
21. Kurzhanski A.B., and Sivergina I.F., *On the noninvertible evolutionary systems: the guaranteed estimates and a regularization problem*, Laxenburg, Intern Institute Applied System Analysis, 1989. WP-89-058. 10p.
22. Sivergina I.F. On the evolution equations in a trajectory estimations problem for the systems with an a priori quadratic restriction on the unknown parameters. (in Russian) *Avtomatica I Telemech.*, 1985, no. 1, pp. 84 – 94.

Books and Book Chapters

1. Sivergina I.F., On the input estimation problem for PDEs: the regularized solutions and the evolutionary numerical algorithms, in *Recent Advances in Numerical Methods and Applications*, Singapore: World Scientific, pp. 401 – 410, 1999.
2. Kislyak V.M., Maksimov V.I., Piskunov L.I. and Sivergina I.F., *Mathematical methods for investigation of Ecological models*. Urals Branch, Russian Academy of Sciences, Ekaterinburg, Russia, 1999.
3. Sivergina I.F., On the guaranteed estimation problem of an initial state in a first order evolution system with uncertainties. (in Russian) in *Dynamic estimation problems under conditions of uncertainty*, 104-109, Akad. Nauk SSSR, Ural. Otdel., Sverdlovsk, 1989.
4. Sivergina I.F., The trajectory estimation problem for the systems with a general quadratic constraint on the uncertain parameters. (in Russian) *Guaranteed estimation and control problems*, pp. 101-109, 135, Akad. Nauk SSSR, Ural. Nauchn. Tsentr, Sverdlovsk, 1986.
5. Sivergina I.F., On some extreme properties of signals in the state estimation problem for systems with the quadratic constraints on uncertain parameters. (in Russian) *Guaranteed estimation and control problems*, pp. 92-100, 135, Acad. Nauk SSSR, Ural. Nauchn. Tsentr, Sverdlovsk, 1986.
6. Sivergina I.F., The evolution equations in an identification problem for the systems with quadratic constrains. (in Russian) *Evolution systems in an estimation problem*, pp. 77-84, 140, Acad. Nauk SSSR, Ural Nauchn. Tsentr, Sverdlovsk, 1985.

Referred Publications

1. Sivergina I.F., Polis M.P., On Approximate Controllability of a Quasi-Static Thermoelastic Plate, Proc. of the International Seminar “Control and Generalized Solutions” dedicated to the 65th anniversary of A.I. Subbotin, June 23-27, 2005, Ekaterinburg, Russia (to appear).
2. Sivergina I.F., Polis M.P., Kolmanovskiy I.V., Boundary Heat Flux Estimation in Quasi-Static Thermoelastic Systems, Proc. of 2005 American Control Conference, June 8-10, 2005, Portland, Oregon, USA.
3. Kolmanovsky I.V., Sivergina I.F., Sun J., Combined Input and Parameter Estimation with Input observers and Set-Membership Parameter Bounding, Proc. of the 43rd IEEE Conference on Decision and Control, December 14-17, 2004, Atlantis, Paradise Island, Bahamas.

4. Sivergina I. and Polis M., Local null controllability in a state constrained thermoelastic contact problem, Proceedings of the 21st IFIP TC 7 Conference on System Modeling and Optimization, Sophia Antipolis, France, July 21-25, 2003.
5. Sivergina I., Polis M., and Kolmanovsky I., Adaptive reconstruction of multiple source intensities for distributed parabolic systems, Proceedings of 2002 American Control Conference, Anchorage, Al, May 8-10, 2002.
6. Kolmanovsky I., Sivergina I., and Lygoe B., Optimization of Powertrain Operating Policy for Feasibility Assessment and Calibration: Stochastic Dynamic Programming Approach, Proceedings of 2002 American Control Conference, Anchorage, Al, May 8-10, 2002.
7. Sivergina I., and Polis M., Boundary Observability of a Nonlinear Thermoelastic System, Proceedings of the 5th International Symposium on Mathematical Theory of Networks and Systems, University of Notre Dame, August 12-16, 2002.
8. Kolmanovsky I., Polis M., and Sivergina I., Control of partial differential equations arising in the study of fuel injection systems, Proceedings of IFAC Symposium on Nonlinear Control Systems (NOLCOS 2001), St. Petersburg, Russia, 4-6 July 2001, pp.1533-1536.
9. Kolmanovsky I., and Sivergina I., Adaptive identification schemes in presence of bounded disturbances: An automotive case study, Proceedings of the 40th IEEE Conference on Decision and Control, Orlando, Florida, December 4-7, 2002.
10. Kolmanovsky I., and Sivergina I., Feasibility assessment and operating policy optimization of automotive powertrains with uncertainties using game theory, Proceedings of ASME International Mechanical Congress and Exposition, New York, November, 2001.
11. Kolmanovsky I., and Sivergina I., Set-membership approach to experiment planning for parameter identification in static regression models, Proceedings of 2001 American Control Conference, Arlington, Virginia, June 25-27, 2001, pp. 5034-5039.
12. Sivergina I., Regularization of the informational states in an inverse infinite-dimensional control problem, in Proceedings of the 14th International Symposium of Mathematical Theory of Networks and Systems, Perpignan, France, June 19-23, 2000. 5 p.
13. Sivergina I.F. On the input identification for parabolic systems: the guaranteed estimates and the dynamic programming, in Proceedings of the 15th IMACS World Congress on Scientific Computations, Modeling and Applied Mathematics, pp. 633-638. Berlin, Germany. 1997.

Presentations on Workshops and Seminars

1. Sivergina I.F., Polis M.P., On Controllability of a Quasi-Static Thermoelastic Plate, AMS Fall Section Meeting, October 15-16, 2005, East Tennessee State University, Johnson City, TN.
2. Sivergina I.F., Kolmanovsky I., Polis M.P., Contact Identification in a Quasi-static Thermoelastic System, The 22nd IFIP TC-7 Conference on System Modeling and Optimization, July 18-22 2005, Turin, Italy.
3. Sivergina I.F., Polis M.P., The Identification problem for a Quasi-Static Thermoelastic System, The Sixth Annual Midwest Optimization Seminar, September 11, 2004, Wayne State University, Detroit, MI.
4. Sivergina I.F., *Research Review*, School of Engineering and Computer Sciences, Oakland University, Rochester, MI, October 10, 2003.
(<http://www.oakland.edu/~jsearigh/Brochure%20October%202003.pdf>)

5. Sivergina I.F., Adaptive Identification Schemes in Presence of Bounded Disturbances, The *Fifth Annual Midwest Optimization Seminar*, Oakland University, Rochester, MI, October 4, 2003.
6. Zachary D.S., Haurie A., and Sivergina I., A Reduced Order Photo-Chemical Air Quality Model, *First International ICSC Symposium on Information Technologies in Environmental Engineering ITEE 2003*, Gdansk University of Technology, Poland, June 24-27, 2003.
7. Sivergina I.F., Controllability and observability problems for the quasi-static thermoelastic contact problem, The *Fourth Annual Midwest Optimization Seminar*, University of Michigan, Ann Arbor, MI, September 28, 2002.
8. Polis M., and Siverguina I., On the source identification problem for parabolic equations, Abstracts of the *5th Conference on Control and its Applications*, San Diego, California, July 11-14, 2001, p. 275.
9. Kolmanovsky I., and Siverguina I. A set-membership approach: the process modeling and the optimization of observation, Abstracts of *Algorithmic Analysis of Ill-Posed Problems, Russian Scientific Conference*, Ekaterinburg, Russia, 26 February – 2 March, 2001, URGU.
10. Kurzzhanski A.B., Sivergina I.F., and Sorokina M.M. The informational state in a boundary control inverse problem for parabolic type, in *Distributed systems: optimization and economic-environmental applications*, Abstracts of the International Conference DSO'2000, Ekaterinburg, Russia. May 22-25, 2000.
11. Sivergina I.F., The optimality principle and viscosity solutions of the Hamilton-Jacobi equations in an input identification problem for the infinite-dimensional systems, in *Differential and Integral Equations*, Abstracts of the International Conference, Cheljabinsk, Russia. June 22-29, 1999.
12. Sivergina I.F., Dynamic programming and an inverse boundary control problem for the systems of parabolic type, in Abstracts of the *VII Workshop on well-posedness in optimization and related topics*, Gargnano, Italy. September 13-18, 1999. 5 p.
13. Sivergina I.F., On the regularization of the informational functions in an input estimation for distributed parameter systems. (in Russian) in *Algorithmic analysis of ill-posed problems*, Abstracts of the Conference dedicated to V.K. Ivanov, Ekaterinburg, Russia, 1998.
14. Sivergina I.F., On the input identification problem for evolutionary systems, in *Abstracts of the International conference dedicated to the 90th anniversary of L.S. Pontryagin. Optimal control and Applications*, p.179. Moscow, MGU. 1998.
15. Sivergina I.F., On the adaptive modeling of the uncertain dynamical systems, in *Math. Methods in operation research & VI Workshop on well-posedness and stability of optimization problems*, Abstracts of the International conference, Sozopol, Bulgaria. 1997.
16. Sivergina I.F., On the computational algorithms in an input identification problem for parabolic systems, in *Finite differential methods: theory and Applications*, Abstracts of the International Conference, Sofia, Bulgaria. 1997.
17. Kurzzhanski A.B., Sivergina I. Adaptive estimation of an input for the distributed parameter systems, in *Abstracts of the Sixth Viennese Workshop on Optimal Control, Dynamical Games, Nonlinear Dynamics and Adaptive Systems*, Vienna, Austria. 1997.
18. Sivergina I.F., On evolution equations for the initial state estimation problem for the parabolic systems. (in Russian) Abstracts of the *International Conference on Inverse and Ill-posed problems*, Moscow, Russia. Sept. 10-13, 1996.

19. Kurzhanski A.B., and Sivergina I.F., On the reversibility and observability of the heat equation. (in Russian) Abstr. of the *Conference on Algorithmic and numerical analysis of ill-posed problems*, Ekaterinburg, Russia. February 27-March 3, 1995.
20. Sivergina I.F., *Optimization of observations for the systems with unmodelled dynamics*. (in Russian) Acad. Nauk SSSR, Ural. Otdel., Inst. Mat. Mekh., Sverdlovsk, Dep. in VINITI. N 756-B93. 21p.
21. Kurzhanski A.B., and Sivergina I.F., The inverse problems in observation theory. (in Russian) *Abstracts of the International Conference on Ill—posed problems in Science, Moscow, 19-23 Aug., 1991*.
22. Kurzhanski A.B., Sivergina I.F., and Khapalov A.Yu., On modeling the distributed processes for a noninvertible evolutionary system. (in Russian) *Abstracts of the VII Conference on Control in Mech. Systems, Sverdlovsk*, 1990.
23. Lyubarski L.V., Sivergina I.F., and Yaroslavski L.P., Convey's game and an evolutionary algorithmic model of the textures. (in Russian) in *Abstracts of the Conference on Methods and tools for processing complete graphical information*, Gorkii, Russia, part 1. 1988.