Alexander Alekseenko

alexander.alekseenko@csun.edu
http://www.csun.edu/~ama5348

Research Interests

Development of efficient numerical methods for differential and integral equations based on Galerkin techniques, analysis of error and uncertainty in solutions, numerical analysis of PDEs, discontinuous Galerkin methods, a posteriori estimates, numerical solution of kinetic equations, IBVPs for systems with differential constraints, optimization, inverse problems and numerical relativity.

Employment

2009 – present Associate Professor, Department of Mathematics, California State University Northridge

2011 – 2013 Visiting Senior Research Associate, Air Force Research Laboratory, Wright-Patterson AFB

2010 New Directions Research Professor, Institute for Mathematics and its Applications, UMN

2009 – 2010 Visiting Associate Professor, Department of Mathematics, Purdue University

2003 – 2009 Assistant Professor, Department of Mathematics, California State University Northridge

Awards

2010 New Directions Research Professor, IMA, University of Minnesota
2007 College of Science and Mathematics Early Career Research Award

Education

2001 Postdoctoral Position at the University of Minnesota
2000 Postdoctoral Position at Penn State University
Adviser: Dr. D.N. Arnold
1999 Ph.D. in Applied Mathematics, Novosibirsk State University
Adviser: Dr. S.I. Kabanikhin
1995 M.S. in Applied Mathematics, Novosibirsk State University
1993 B.S. in Mathematics, Novosibirsk State University

Research Grants

2014 Co-PI Methodology and Phenomenological Simulation Considerations for Multi-Application, with T. Lilly (PI), UCCS, S. Gimelshein, USC, and B. Windom, UCCS **Extreme Science and Engineering Discovery Environment (XSEDE)**, 380,000 hours of CPU time.

2012 PI High Order Algorithms for the Deterministic Simulation of Gas Flows in Transitional Regime and Error Estimation (extension), **National Research Council Research Associateship award** $101000

2011 PI High Order Algorithms for the Deterministic Simulation of Gas Flows in Transitional Regime and Error Estimation, **National Research Council Research Associateship award** $98000

2010 New Directions Research Professor, Inst. for Mathematics and its Applications, UMN $18000

Research Grants

2010 PI High Order Numerical Methods for Transient Gas Flows, continuation award, Air Force Summer Faculty Fellowship $24000

2009 PI High Order Numerical Methods for Transient Gas Flows, continuation award, Air Force Summer Faculty Fellowship $18000

2008 PI High Order Numerical Methods for Transient Gas Flows, Air Force Summer Faculty Fellowship $13000

2008 PI The Development of Techniques for Constraint-Damping in Numerical Solutions of Partial Differential Equations, 2008-09 CSUN Competition for Research, Scholarship and Creative Activity Award, reassigned time

2006 PI Constrained Evolution and Boundary Conditions in General Relativity, Probationary Faculty Support Program, reassigned time

2005 PI Fiber Reconstruction Based on Diffusion-Weighted MRI, College of Science and Mathematics 2005-06 research support program, reassigned time

2004 PI Fiber Tracking Techniques in Magnetic Resonance Diffusion Tensor Imaging, College of Science and Mathematics 2004-05 research support program, reassigned time

Educational Grants

2010 Co-PI CSUN Online Calculus Tutoring Center, Office of the Provost, CSUN $60000

2006-07 Co-PI Hybrid Re-Design of Mathematics 131: Mathematical Explorations, California State University Northridge $96000

2004-05 Co-PI The development of an Accessibility Media Library for Calculus Class, Grace Petri Endowment fund for students with disabilities, $56000.

Publication

2014 A. Alekseenko and E. Josyula, Deterministic solution of the Boltzmann equation using discontinuous Galerkin discretizations in velocity space. *to appear in the Journal of Computational Physics* `http://arxiv.org/abs/1301.1099`

2013 A. Alekseenko and C. Euler, A Bhatnagar-Gross-Krook kinetic model with velocity-dependent collision frequency and corrected relaxation of moments. *In preparation for re-submission to Continuum Mechanics and Thermodynamics*

2012 A. Alekseenko and E. Josyula, Deterministic solution of the Boltzmann equation using a discontinuous Galerkin velocity discretization. *Proceedings of the* 28^{th} *International Symposium on Rarefied Gas Dynamics, Spain 2012*, AIP Conference Proceedings, 2012, 8 pp.

2011 A. Alekseenko, S. Gimelshein and N. Gimelshein, An application of discontinuous Galerkin space and velocity discretization to model kinetic equations. *International Journal of Computational Fluid Dynamics*, Vol. 26, No. 3, 145–161, 2012.

2011 A.M. Alekseenko, Numerical properties of high order discrete velocity solutions to the BGK kinetic equation. *Applied Numerical Mathematics*, Vol. 61 (2011), pp. 410–427. http://dx.doi.org/10.1016/j.apnum.2010.11.005

Publication

2008 A.M. Alekseenko, Constraint-preserving boundary conditions for the linearized BSSN formulation. *Abstract and Applied Analysis*, vol. 2008, 742040. http://www.hindawi.com/getarticle.aspx?doi=10.1155/2008/742040

2007 A.M. Alekseenko, Well-posed initial-boundary value problem for a constrained evolution system and radiation-controlling constraint-preserving boundary conditions. Journal of Hyperbolic Differential Equations, Vol. 4, No. 4, pp. 587–612. http://arXiv.org/abs/gr-qc/0611011

2003 A.M. Alekseenko and D.N. Arnold, New first-order formulation for the Einstein equations. *Physical Review D*, vol. 68, 064013. http://arXiv.org/abs/gr-qc/0210071

1999 A.M. Alekseenko and S.I. Kabanikhin, Numerical algorithms for identification problem in magnetoencephalography, *Journal of Inverse and Ill-Posed Problems*, vol. 7, No. 5, pp. 387–408.

1998 A.M. Alekseenko and S.I. Kabanikhin, Uniqueness of the stationary point for the one-dimensional inverse problem in two-dimensional space, *Journal of Inverse and Ill-Posed Problems*, vol. 6, No. 2, pp. 95–114.

Conference Proceedings

2011 A. Alekseenko, An Application of Discontinuous Galerkin Methods for Simulation of Model Kinetic Equations of Gas Dynamics, in *Abstracts of 7th International Congress on Industrial and Applied Mathematics, July 2011 Vancouver, BC, Canada*

2008 A. Alexeenko, C. Galitzine and A.M. Alekseenko, High order discontinuous Galerkin method for Boltzmann model equations, in *Proceedings of 40th AIAA Thermophysics Conference, Seattle, WA, June 23–26, 2008*

2008 A.M. Alekseenko, Numerical study of a set of differential boundary conditions for a problem of constrained evolution, in *Proceeding of the 2008 Joint AMS Meetings, San Diego, CA, January 6–9, 2008*

2007 A.M. Alekseenko, A.A. Alexeenko and A. Mirzoyan, Conservative higher order Runge-Kutta discontinuous Galerkin Method for the one-dimensional gas kinetic equations, in *Abstracts for Seventh Mississippi State-UAB Conference on Differential Equations and Computational Simulations, November, 2007, Birmingham, AL*

2007 A.M. Alekseenko, Runge-Kutta discontinuous Galerkin schemes for a model constrained evolution problem in numerical relativity, in: *Abstracts of 7th Mississippi State-UAB Conference on Differential Equations and Computational Simulations, November, 2007, Birmingham, AL*

2007 A.M. Alekseenko, Radiation-controlling boundary conditions for a problem of constrained evolution, in *Proceedings of the International Conference on Inverse and Ill-Posed Problems of Mathematical Physics, August 20-25, 2007, Novosibirsk, Russia*

2002 D.N. Arnold and A.M. Alekseenko, Hyperbolic formulations in linearized gravity, in: *Proceedings of the International Conference on Inverse and Ill-Posed Problems, Novosibirsk, August 5–9, 2002*

Conference Proceedings

1999 A.M. Alekseenko, *Inverse source problem for the Laplace equation in Sobolev spaces*, Preprint No. 5,Novosibirsk State University, Novosibirsk

1999 A.M. Alekseenko and S.I. Kabanikhin, Numerical methods for determining an electromagnetic source in magnetoencephalography, in *Proceedings of international conference on Inverse and Ill-Posed Problems, Moscow State University, Moscow, 1999*, p. 7

1996 A.M. Alekseenko and S.I. Kabanikhin, Investigation of properties of cost functional in inverse problem for hyperbolic equation, in *Proceedings of international seminar Inverse Problems in Geophysics*, The Computing Center of Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Sept. 30–Oct. 4, 1996, pp. 74–75

Research Codes

2012 The author of the high order Discontinuous Galerkin discretization of the Boltzmann collision operator. The software utilizes an MPI parallelization with an optional OpenMP parallelization. Implemented in Fortran. Tested on 4000 processors.

2009 The author of the high order Runge-Kutta Discontinuous Galerkin solver for the one-dimensional BGK kinetic equation. Implemented in Fortran

2009, The author of the high order Runge-Kutta Discontinuous Galerkin solver for the two-dimensional vector wave equation in second order form. Implemented in MATLAB.

Teaching Experience

California State University Northridge

Taught courses in Calculus I and III, Numerical Analysis, Numerical Analysis for Linear Systems (graduate), Foundations of Mathematics. Student evaluations vary from 4.1 to 4.76 out of 5 in Calculus I, from 3.87 to 4.6 out of 5 in Calculus III, from 4.1 to 4.7 out of 5 for Numerical Analysis. The class sizes very from 20 to 40 students. For Numerical Analysis for Linear Systems the evaluations were 3.87 out of 5. For Foundations of mathematics the evaluations were 2.87 out of 5. The usual course load is two or three courses per semester

Purdue University (sabbatical Appointment)

In Spring of 2010 taught courses in Multivariable Analysis I. Honors and Foundations of Analysis. The evaluations were 3.7 and 3.6 out of 5 respectively.

University of Minnesota

Each semester from Fall 2001 through Spring 2003 lectured in Precalculus. In Spring 2003 also in Calculus. Each of sections taught had approximately 150 students and 4 or 5 assistants. Since Spring 2002 semesters served as the course supervisor for Precalculus. Average student evaluations are 4.6/7 (Fall 2001) and 5.5/7 (Spring 2002). Department average for the course is 4.5/7.

Teaching Experience

Penn State University

In Spring 2001 taught a class in Ordinary Differential Equations (about 40 students) as an independent instructor. Average student evaluation is 5.6/7.

Novosibirsk State University

Courses taught: Calculus I and II, Numerical methods, Equations of Mathematical Physics.

Graduate Students

2013 Craig Euler. Master Thesis in the Development of Efficient Techniques for Simulating Non-Continuum Gas Flows.

2012 Patrick Medina. Master Thesis in Development of Efficient Techniques for Simulations of Kinetic Equations of Gas Dynamics. Third place in Annual Sigma Xi Student Research Symposium in Spring 2012.

2008 John Sikora. Master Thesis in Fiber Reconstruction Techniques in Diffusion Weighted MRI.

Currently advising Truong Nguyen (2014 ORIS Internship) and Andrew Milne.

Undergraduate Students

2006 John Sikora, second prize on Tenth CSUN Annual Student Research Symposium in Fall 2005.

2005 Sarah Neyer, second prize on annual Sigma Xi student research competition in Spring 2005, transferred to Carnegie Mellon.

2004 Guergana Milanova, the recipient of a CSUN Student Research Project Award in Fall 2004.

Service

2014-present College of Science and Mathematics Representative in the Extended Learning Committee.

2014-present College of Science and Mathematics Representative in the International Education Council

2014 Co-organizer of the 16^{th} 16th Annual Sigma Xi Student Research Symposium at CSUN

2013 Co-Organizer of a Kinetic Interaction Team meeting at California State University, Northridge. Meeting is supported by KI-Net (`http://www.ki-net.umd.edu`).

2013 Lead organizer of an International Topical Workshop at ICERM at Brown University on Issues in Solving the Boltzmann Equation for Aerospace Applications.

2008-present Graduate Adviser in the Mathematics Department of California State University, Northridge

2007 Co-organizer of a special session on Numerical Relativity at the AMS Joint Meetings in New Orleans

Service

2004-2005 Served as NASA JPL PAIR undergraduate adviser. Taught a NASA PAIR Summer Institute in 2005

2007-2009 Served as NSF PUMP adviser. Taught a PUMP Winter institute in 2008.

2003-present Reviewer for the Department of Energy Office of Science, Journal of Computational Physics, Journal of Scientific Computing, Quebec Fond of Natural Research and Technology, Journal of Inverse and Ill-Posed Problems, Electronic Journal of Differential Equations, and Mathematical Reviews.

Recent Talks

Air Force Institute of Technology, Dayton, OH, February 13, 2014 **(invited)**
Air Force Research Laboratory, Edwards AFB, November 4, 2013
Air Force Research Laboratory, Wright-Patterson AFB, August 5, 2013
ICERM, Brown University, June 5, 2013
Purdue Universtiy, September 7, 2012
28th Int. Symp. on Rarefied Gas Dynamics, Zaragoza, Spain, July 9-13, 2012
Air Force Research Lab, Wright-Patterson AFB, June 2, 2012
University of Southern California, April 10, 2012
Georgia Southern University, April 2, 2012 **(invited)**
7th Int. Congress on Industrial and Applied Mathematics, July 21 2011
Wrigth-Patterson AFB, April 7 2011
University of Minnesota, November 15, 2010
AMS Sectional Meeting in St. Paul, MN, April 10-11, 2010
Northern Illinois University, November 20, 2009 **(invited)**
Purdue University Calumet, October 22, 2009 **(invited)**
Purdue University, September 25, 2009
Edwards AFRL/UCS, July 31, 2009
Institute for Pure and Applied Mathematics, UCLA, May 13, 2009
8th Mississippi State-UAB Conference, MSU, May 7, 2009
California State University, Nortrhidge, November 26, 2008
Rochester Institute of Technology, June 9, 2008
Edwards AFRL, June 4, 2008
Purdue University, March 21, 2008
Joint Mathematics Meetings, San Diego, CA, January 9, 2008

Reccomendations

E. Josyula, AFRL, Wright-Patterson AFB, `Eswar.Josyula@wpafb.af.mil`
S. Gimelshein, University of Southern California, `gimelshe@usc.edu`