VADIM SOKOLOV

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APPOINTMENTS

University of Chicago

Fellow, Computation Institute

(Nov 2014-present)

Argonne National Laboratory

Principal Computational Scientist, Center for Transportation Research

(Nov 2008-present)

EDUCATION

Northern Illinois University

Ph.D. in Computational Mathematics

(Jan 2004 - Oct 2008; advisor: Biswa N. Datta)

Rostov State University, Russia (now Southern Federal University)

Diploma in Applied Mathematics

(Sep 1999 - Jun 2004; graduated with high honors - red diploma)

University of Chicago

Graduate Studies in Statistics

(September 2013 - 2014)

MIT

Professional Education in Modeling and Simulation of Transportation Networks

(June 2010; lead instructor: Moshe Ben-Akiva)

TEACHING EXPERIENCE

Northern Illinois University

Grader/Recitation Instructor, Department of Mathematical Sciences

(Sprint 2004: Math 232 Calculus III; Fall 2004/Spring 2005: Math 211 Business Calculus)

Northern Illinois University

Course Assistant/Recitation Instructor, Department of Mathematical Sciences

(Fall 2005: Math 434 Numerical Linear Algebra; Sprint 2006: Math 435 Numerical Analysis)

Argonne National Laboratory

Student supervision

(3 master's students from Northern Illinois University Engineering working on Illinois Department of Transportation project; 1 master's and 1 doctorate student from Illinois Institute of Technology Engineering working on Regional Catastrophic Preparedness Grant Program project)

TRANSIMS Training Course

Three day course. Designed and taught sections on transportation networks modeling

(Apr 2008, Nov 2008, Dec 2009 and Jan 2011: Argonne National Laboratory; Jun 2008: Georgia Institute of Technology; Jan 2009: City of Moreno Valley; Jun 2009: University of Houston; Sep 2010: Turner Fairbank Highway Research Center; Apr 2011: South Carolina State University)

GREET Workshop

One day training-workshop. Designed and taught sections on mathematical models for life-cycle analyses

(Dec 2011 and Sep 2012: Argonne National Laboratory)

RELEVANT COURSEWORK

Probability and Statistics (STAT 324/BUSF 41901)

University of Chicago (Ph.D level)

(probability theory, transformation theory, multivariate distributions, hierarchical models, bivariate normal, martingales and stochastic processes, particle filters, Markov Chain Monte Carlo)

Applied Multivariate Analysis (STAT 329/BUSF 41912)
University of Chicago (Ph.D level)
(multivariate data analysis, multivariate linear regression, principal component analysis & independent component analysis, dimension reduction, factor analysis and discriminant analysis, canonical correlation analysis, prediction, classification, clustering, LASSO)

Probabilistic Graphical Models
Coursera (Stanford/Ph.D. level)
(Bayesian network, Markov network, belief propagation, variable elimination, MAP estimation, Markov Chain Monte Carlo)

Introduction to Artificial Intelligence
Udacity (Stanford/undergrad level)
(Markov decision process, clustering, naive Bayes, expectation maximization, Q-learning, introduction to game theory, computer vision)

Numerical Linear Algebra
Northern Illinois University (Ph.D. level)
(IEEE floating point calculations, LU factorization, QR factorization, least-squares problems, SVD, iterative solution to eigenvalue problem and for linear systems, large scale problems)

Database Design
Rostov State University (undergraduate level)
(relational algebra, schema normalization, integrity constraints, transactions, query optimization, constraints and triggers)

RELEVANT PROJECTS

Bayesian Analysis of Traffic Flow Data. Tools: SQLite, MongoDB, R, Python, QuantumGIS, XML Data. Methodologies: exploratory data analysis, quantile regression, smooting, time series analysis, particle filtering, clustering, principal component analysis, liner regression

Estimation of people flows though the city of Chicago boundaries. Tools: Spatialite, QuantumGIS, Python. Methodologies: exploratory data analysis

Eevacuation behavior. Tools: HTML, JavaScript, SQLite, Python, C++, Python, JSON Data. Methodologies: stated response survey, multi-level nested-logit descrite choice model

PUBLICATIONS IN PREPARATION

N. Polson and V. Sokolov, "Bayesian Analysis of Traffic Flow on Interstate I-55: The LWR Model," *The Annals of Applied Statistics* (2014), submitted

N. Polson and V. Sokolov, "On-line Particle Learning of Highway Link Capacities," *Applied Stochastic Models in Business and Industry* (2014), submitted

J. Auld, M. Hope, H. Ley, V. Sokolov, B. Xu and K. Zhang, "POLARIS: Agent-Based Modeling Framework Development and Implementation for Integrated Travel Demand and Network and Operations Simulations," (2014), under review

V. Sokolov and K. Zhang, "Transit vehicle routing during evacuation", (2014), under preparation

E. Jacquier, N. Polson and V. Sokolov, "Bayesian Filtering and Learning in Finance: Application to the Jump Stochastic Volatility Model", (2014), under preparation.

JOURNAL ARTICLES

J. Auld, V. Sokolov, A. Fontes, R. Bautista, "Internet-based stated response survey for no-notice emergency evacuations," *Transportation Letters: The International Journal of Transportation Research*, **4** (2012), no. 1 pp. 41-53

B. Datta and V. Sokolov, "A solution of the affine quadratic inverse eigenvalue problem," *Linear Algebra and Its Applications*, **434** (2011) pp. 1745-1760

B. Datta, S. Deng, D. R. Sarkissian and V. Sokolov, "An optimization technique for damped model updating with measured data satisfying quadratic orthogonality constraint," *Mechanical Systems and Signal Processing*, **23** (2009), no. 6, pp. 1759-1772

B. N. Datta and V Sokolov, "Quadratic inverse eigenvalue problems, active vibration control and model updating," *Appl. Comput. Math*, **8** (2009), no. 2, pp. 170-191

L. Krukier, O. Pichugina and V. Sokolov, "Numerical investigation of Krylov subspace methods for solving non-symmetric systems of linear equations with dominant skew-symmetric part," *International Journal of Numerical Analysis And Modeling*, **3** (2005), no. 1, pp. 115-124

PEER-REVIEWED PROCEEDINGS

M. Hope, J. Auld, H. Ley, V. Sokolov, B. Xu, and K. Zhang, "POLARIS: A general purpose agent-based modeling framework specialized for transportation simulations," *4th Transportation Research Board Conference on Innovations in Travel Modeling* (2014)

J. Auld, M. Hope, H. Ley, V. Sokolov, B. Xu, and K. Zhang, "POLARIS: A fully integrated agent-based simulation model of activity travel behavior and network operations," *4th Transportation Research Board Conference on Innovations in Travel Modeling* (2014)

V. Sokolov, D. Karbowski and N. Kim, "Assessing Energy Impact of Traffic Management and ITS Technologies," *The 21st World Congress on Intelligent Transport Systems* (2014)

V. Sokolov, J, Auld, M. Hope, H. Ley, B. Xu and K. Zhang, "Modelling framework for regional integrated simulation of transportation network and activity-based demand (Polaris)," *Proc. of International Symposium for Next Generation Infrastructure* (2013)

V. Sokolov, J. Auld and M. Hope, "A flexible framework for developing integrated models of transportation systems using an agent-based approach," *Procedia Computer Science*, **10** (2012), pp. 854-859

Y. Park, M. E, H. Ley and V. Sokolov, "Fuzzy Rule-base approach for evacuation trip demand modeling," *TRB (Transportation Research Board) Annual Meeting* (2010)

S. Are, P. Dostert, B. Ettinger, J. Liu, V. Sokolov, A. Wei and K. Wiegand, "Reservoir model optimization under uncertainty," *IMA Preprint Series* (2006)

V. Sokolov "Investigation of eigenvalue distribution of a matrix arising from a central difference approximation of the two dimensional convection diffusion problem," *Proc. of the Conference on Numerical Methods for Solving Linear and Non-linear Boundary Problems,* Kazan', Russia (2003), pp. 216-221 (Russian)

V. Sokolov and L. Krukier, "Investigation of eigenvalue distribution of transition operators of iterative methods for solution strongly non-symmetric systems," *Proc. of the Workshop on Contemporary Problems in Mathematical Modeling*, Durso, Russia (2003), pp. 206 - 212 (Russian)

SOFTWARE DEVELOPED

GREET

Designer. Lead Developer. An implementation of The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model.

`http://greet.es.anl.gov/greet`

(C#, .NET, SQLite; more then 2000 unique users within first year of release, 2013)

POLARIS

Designer. Developer. Transportation systems simulations framework

`https://github.com/anl-tracc/polaris`

(C++)

MATCOM

Contributor. Distributed on CD with Numerical Linear Algebra and Applications, Second Edition book By Biswa Nath Datta, SIAM.

`http://www.siam.org/books/ot116/`

(MATLAB)

TRANSIMS

Contributor. An agent-based forecast software for modeling regional transport systems.

`http://sourceforge.net/projects/transims`

(C++; 22,295 total downloads since 2006)

Advanced Numerical Methods II

Sole Developer. Package for solving large scale control problems.

`http://library.wolfram.com/infocenter/Conferences/5787/`

(Mathematica; an experimental library that was not published)

TALKS

Invited seminar & colloquium talks

2014 George Washington University: Decision Sciences

2014 University of Chicago: Computational Institute

2014 Argonne National Laboratory: Material Science Division

2012 University of California, Berkeley: Life-Cycle Assessment

2012 University of California, Davis: Institute for Transportation Studies

2011 California Air Resources Board: Life-Cycle Assessment

2010 Turner-Fairbank Highway Research Center

2009 University of Illinois at Urbana-Champaign: Short course on *Transportaion Networks Simulation (4 lectures)*

Conferences

2014 ITS World Congress

2014 TRB Automated Vehicles Symposium

2014 TRB Innovations in Travel Modeling Conference

2013 International Symposium for Next Generation Infrastructure

2012 Council of Energy Research & Education Leaders Annual Meeting (*Invited*)

2010 American Mathematical Society Spring Southern Section Meeting

2010 TRANSIMS Applications and Development Workshop

2009 Linear Algebra and Numerical Linear Algebra: Theory, Methods, and Application Conference

2008 XIXth International Workshop on Operator Theory

2008 Gene Golub Symposium at University of Illinois at Urbana-Champaign (*Invited*)

2008 Conference on the Occasion of Richard Varga's 80th Birthday

2007 2nd International Conference on Matrix Methods and Operator Equations

2007 Numerical Linear Algebra in Signal, Systems, and Control Workshop (*Invited*)

2006 X Mathematical Modeling in Industry - A Workshop for Graduate Students at University of Minnesota

2005 Wolfram Technology Conference

2003 Workshop on contemporary problems in mathematical modeling

2003 Conference on Numerical methods for solving linear and non-linear boundary problems

2002 Turkish-German Summer Academy in Izmir

2002 International Summer School on *Iterative Methods and Matrix computations*

AWARDS

Northern Illinois University

Outstanding Graduate Student Award

(2007; nominated by faculty; awarded to an individual "who is distinguished in the area of scholarship")

Northern Illinois University

Outstanding Graduate Student Award

(2007; awarded to 8 graduate students every year, out of more then a hundred)

Travel Awards

NIU Graduate School (2007), *NIU Department of Mathematical Sciences* (2007), *NIU Department of Mathematical Sciences* (2006), *NIU School of Arts and Sciences* (2006), *Institute for Mathematics and its Applications* (2006), *DAAD and SIEMENS* (2002)

OTHER APPOINTMENTS

Argonne National Laboratory
Research Assistant
(Sep 2007 - Oct 2008; adviser: H. Ley)

Norhtern Illinois University
Research Assistant
(Sep 2006 - Sep 2007; adviser: B. N. Datta)

Wolfram Research
Summer Intern, Software Technologies Department
(May 2005 - Aug 2005; developed a Mathematic package for solution of large scale control problems; selectivity 6 offers out of 160 applicants)

Northern Illinois University
Teaching Assistant, Department of Mathematical Sciences
(Jan 2004 - Sep 2006)

Rostov State University
Lab Assistant, High Performance Computing Center
(Dec 2002 - Dec 2003; responsible for installing and testing software, helped writing tutorials on linear algebra packages such as LAPACK, ScaLAPACK, ARPACK)

SPONSORED RESEARCH

Argonne National Laboratory
Modeling Energy Consumption and Electricity Demand of a Transportation System using Behavioral Travel Demand and Vehicle Models
(Co-PI with D. Karbowski; amount awarded $200,000; 2013-2015)

Federal Emergency Managment Agency and the U.S. Department of the Army
The Chemical Stockpile Emergency Preparedness Program - U.S. Army Pueblo Chemical Depot
(Sub-Award with W. Metz (PI); amount awarded $130,000, 2013-2014)

McCaffery Interests and University of Chicago
Computation-Enabled Design for the Chicago Lakeside Development
(Sub-Award with C. Catlett and Leah Guzowski (PI); 2013-2014)

Federal Emergency Managment Agency
Analysis of Evacuation Induced Demand for Transit Services
(PI; amount awarded $30,000; 2013)

U.S. Department of Transportation Federal Highway Administration
TRANSIMS Research and Deployment
(Lead Investigator with H. Ley (PI); amount awarded: $3,500,000; 2011-2014)

Federal Emergency Management Agency Regional Catastrophic Preparedness Grant Program
Regional Transportation Simulation Tool for Evacuation Planning
(PI; amount awarded: $2,000,000; 2010-2011)

U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
The New GREET Model Development
(Lead Developer with A. Elgowainy, M. Wang (PI); 2008-2014)

Illinois Department of Transportation
Chicago Metropolitan Evacuation Simulation Project
(Team Member; with D. Weber (PI); 2008-2010)

U.S. Department of Transportation Research and Innovative Technology Administration
National User Facility to Meet US DOT Advanced Computation Needs
(Team Member; with D. Weber (PI); 2007-2011)

National Science Foundation
Quadratic Inverse Eigenvalue Problems for Model Updating in Science and Engineering: Theory and Computations
(Ph.D. student with B. Datta (Co-PI), M. Chu (Co-PI); 2005-2008)

PROFESSIONAL SERVICE

Meetings Organized

2013 Special session on Transport Network Modeling at International Symposium for Next Generation Infrastructure

2012 Integrated Transportation Models Workshop at Conference on Innovations in Travel Modeling (with J. Auld)

2010 Workshop on TRANSIMS: Applications and Development, Argonne National Laboratory (with H. Ley and B. Gardner)

2009 Linear Algebra and Numerical Linear Algebra: Theory, Methods, and Application, Northern Illinois University (with B. Datta, G. Ammar, K. Datta, S. Deng, Y. Hong, L. Reichel, V. Olshevsky, B. Shader and Q. Ye)

Referee

Lecture Notes in Electrical Engineering

Applied Mathematics and Computation

Mechanical Systems and Signal Processing

TRB Annual Meeting

TRB Innovations in Travel Modeling Conference

Grant Proposals Reviewer for Argonne LDRD Grants 2012, 2014

ITRB Innovations in Travel Modeling Conference

SKILLS

Languages

English (fluent), Russian (fluent), German (basic)

Programming

C/C++ (VC and gcc), Python, C#, Java, Fortran, Ruby, HTML, PHP, JavaScript, SQL, MPI, OpenMP, .NET, QT, WinForms, CMake

Data Analysis

SQLite, PostgreSQL, MongoDB, Hadoop, Gephi

Spatial Analysis

PostGIS, Spatialite, ArcGIS, Quantum GIS

Mathematical

Maple, Mathematica, MATLAB, LaTeX, R, Coin-OR SYMPHONY

Complex Systems

Repast, NetLogo, NodeXL for .NET

Soft Skills

Student supervision, project management, collaboration, proposal writing

REFERENCES

Dr. Nicholas Polson

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(Professor of Econometrics and Statistics, The University of Chicago Booth School of Business)

Dr. Hubert Ley

hley@anl.gov; (630) 252-8224

(Director of Transportation Research and Analysis Computing Center, Argonne National Laboratory)

Dr. Biswa Datta

dattab@math.niu.edu; (630) 862-9877

(Distinguished Research Professor, Department of Mathematical Sciences, Northern Illinois University)