

ALEX A. KURZHANSKIY

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EDUCATION

University of California, Berkeley

Ph.D. in Electrical Engineering & Computer Science

2007

Dissertation: "Modeling and Software Tools for Freeway Operational Planning"

Lomonosov Moscow State University, Russia

M.S. in Applied Mathematics and Computer Science

1998

AUTHOR OF

Ellipsoidal Toolbox (ET), <http://code.google.com/p/ellipsoids>

CTMSIM – interactive macroscopic traffic simulator for MATLAB, <http://path.berkeley.edu/topl/software.html>

Aurora Road Network Modeler, <http://code.google.com/p/aurorarnm>

RESEARCH INTERESTS AND EXPERTISE

Dynamical Systems: Automatic Control Theory and Applications

Partial Differential Equations: Numerical Methods, Inverse Problems

Complex Infrastructure Systems: Dynamic Modeling, Estimation, Simulation and Control

Information Technology: Cloud Computing, Complex Data Processing and Visualization, Convex Optimization

PUBLICATIONS

Journal Papers

Guaranteed Prediction and Estimation of the State of a Road Network

A.A. Kurzhanskiy and P. Varaiya. Transportation Research, Part C (accepted with revisions).

2011

Reach Set Computation and Control Synthesis for Discrete-Time Dynamical Systems with Disturbances

A.A. Kurzhanskiy and P. Varaiya. Automatica, 47(7), pp. 1414-1426.

2011

Theory and Computational Techniques for Analysis of Discrete-Time Control Systems with Disturbances

A.A. Kurzhanskiy and P. Varaiya. Optimization Methods & Software (In Print).

2011

Active Traffic Management on Road Networks: A Macroscopic Approach

A.A. Kurzhanskiy and P. Varaiya. Philosophical Transactions of Royal Society A, 368, pp. 4607-4626.

2010

Behavior of the Cell Transmission Model and Effectiveness of Ramp Metering

G. Gomes, R. Horowitz, A.A. Kurzhanskiy, P. Varaiya, and J. Kwon. Transportation Research C, 16(4), pp. 485-513.

2008

Ellipsoidal Techniques for Reachability Analysis of Discrete-Time Linear Systems

A.A. Kurzhanskiy and P. Varaiya. IEEE Transactions on Automatic Control, 52(1), pp. 26-38.

2007

Conference Papers

Using Aurora Road Network Modeler for Active Traffic Management

A.A. Kurzhanskiy and P. Varaiya. American Control Conference, Baltimore. Invited paper.

2010

Aurora RNM – A Macroscopic Simulation Tool for Arterial Traffic Modeling and Control

A.H.F. Chow, G. Gomes, A.A. Kurzhanskiy, and P. Varaiya. 89th Annual TRB Meeting.

2010

Set-Valued Estimation of Freeway Traffic Density

A.A. Kurzhanskiy. 12th IFAC Symposium on Control in Transportation Systems, Redondo Beach.

2009

Aurora Road Network Modeler

A.A. Kurzhanskiy, J. Kwon, and P. Varaiya. 12th IFAC Symposium on Control in Transportation Systems.

2009

Aurora Arterial Modeler- A Macroscopic Tool for Urban Traffic Control

A.H.F. Chow, G. Gomes, A.A. Kurzhanskiy, and P. Varaiya. 12th IFAC Symposium on Control in Transportation Systems.

2009

Congestion in ACTM Model

G. Gomes, R. Horowitz, A.A. Kurzhanskiy, P. Varaiya, and J. Kwon. European Control Conference, Koss, Greece. 2007

Ellipsoidal Toolbox (ET)

A.A. Kurzhanskiy and P. Varaiya. 45th IEEE Conference on Decision and Control, San Diego. 2006

Book Chapters*Active Traffic Management*

P. Varaiya and A.A. Kurzhanskiy. Chapter 20 of "Homi Bhabha and the Computer Revolution", R.K. Shyamasundar and M.A. Pai, Editors. Oxford University Press.
<http://www.amazon.com/Bhabha-Computer-Revolution-Edited-Shyamasundar/dp/0198072465> 2011

Computation of Reach Sets for Dynamical Systems

A.A. Kurzhanskiy and P. Varaiya. Chapter 29 of Control Handbook, 2nd Edition.
 W.S. Levine, Editor. Taylor & Francis Group, LLC.
<http://www.amazon.com/Control-Handbook-Second-Electrical-Engineering/dp/1420073664/> 2010

Working Papers and Technical Reports*Strategic Placement of Loop Detectors for Improving the Efficiency of Ramp Metering*

K. Chung, G. Gomes, S.H. Park, A.A. Kurzhanskiy, and S.-Y. Kho. Working paper. 2010

Macroscopic Modeling of Multiple Vehicle Types and Freeways with HOV Lanes

A.A. Kurzhanskiy and A. Muralidharan. Working paper. Online:
http://path.berkeley.edu/topl/papers/2009_KurzhanskiyMuralidharan_ModelingHOV.pdf 2009

Aurora – Object-Oriented Framework for Simulation and Analysis of Flow Networks

A.A. Kurzhanskiy, J. Kwon, and P. Varaiya. Working paper. Online:
http://path.berkeley.edu/topl/papers/2008_AuroraFramework.pdf 2008

CTMSIM – An Interactive Macroscopic Traffic Simulator for MATLAB

A.A. Kurzhanskiy and P. Varaiya. Working paper. Online:
http://path.berkeley.edu/topl/papers/2008_KurzhanskiyVaraiya_CTMSIM.pdf 2008

Ellipsoidal Toolbox

A.A. Kurzhanskiy and P. Varaiya. Technical Report 2006-46, EECS, UC Berkeley. 2006

RESEARCH EXPERIENCE

Tools for Operational Planning (TOPL) Project, <http://path.berkeley.edu/topl>
 PATH, University of California at Berkeley

Assistant Research Engineer

January 2011 – Present

Postdoctoral Researcher

January 2008 – December 2010

Leading the development of the Aurora RNM © system: <http://code.google.com/p/aurorarnm>.
 Aurora Road Network Modeler is a set of tools for operational planning and management of travel corridors (road networks comprised of freeways and surrounding urban arterials) and analysis of their performance. It is based on the Aurora object-oriented framework for simulation, analysis and control of SCADA flow networks. California Department of Transportation (Caltrans) is currently evaluating Aurora RNM for using in operations planning. Berkeley Transportation Systems (<http://www.bt-systems.com>) is using Aurora RNM for dynamic traffic prediction and scenario evaluation. Center for Innovation in Transport (CENIT) in Barcelona, Spain (<http://www.cenit.es>) is using Aurora RNM for assessment of management strategies for Barcelona freeways. In 2010, Aurora RNM became part of the graduate course "Traffic Operations" in the Department of Civil and Environmental Engineering at UC Berkeley (CEE 255).

TOPL Project

Department of Electrical Engineering & Computer Science, University of California at Berkeley

Ph.D. Student / Graduate Student Researcher (Advisor: professor Pravin Varaiya)

May 2006 – December 2007

- Initiator and author of Aurora Object-Oriented Framework © for simulation, analysis and control of SCADA flow networks, such as road networks, oil/gas pipelines and irrigation canals: <http://www.eecs.berkeley.edu/Pubs/TechRpts/2007/EECS-2007-148.html>.
- Author of CTMSIM © – interactive freeway traffic macro-simulator for MATLAB: <http://path.berkeley.edu/topl/software.html>. CTMSIM has proved to be a handy tool for

control and transportation researchers who can use it for evaluating ramp metering algorithms and for estimating the impact of different response times in the incident management. CTMSIM is actively used at the ITS lab of Portland State University for modeling freeways around Portland, OR area.

Center for Hybrid and Embedded Software Systems (CHESS), <http://chess.eecs.berkeley.edu>
Department of Electrical Engineering & Computer Science

Ph.D. Student / Graduate Student Researcher (Advisor: professor Pravin Varaiya)

August 2003 – April 2006

Initiator and author of the Ellipsoidal Toolbox© (ET) for MATLAB – implementation of Ellipsoidal Calculus and reach set computation for piecewise linear continuous- and discrete-time systems with disturbances: <http://code.google.com/p/ellipsoids>. This toolbox is used by control and estimation research community throughout the world including UC Berkeley, Stanford University, MIT, CMU, Moscow University (Russia), ETHZ (Switzerland), VERIMAG (France), Lund University (Sweden), NASA Ames. ET is also distributed as part of the Multi-Parametric Toolbox (MPT): <http://control.ee.ethz.ch/~mpt>.

TEACHING AND MENTORSHIP EXPERIENCE

Author-Instructor

Spring – Summer 2008

Organized and conducted a series of online (webinar) tutorial sessions on dynamic traffic modeling, simulation and control, and application of Aurora Road Network Modeler, for the staff of Caltrans and Metropolitan Transportation Commission, and for graduate students and research engineers.

Graduate Research Mentor (TOPL)

2008 – 2010

Supervised research of graduate students working in the TOPL project.

Graduate Research Mentor (CHESS)

Summer 2006

NSF Undergraduate Program in Engineering Research. Supervised Dominique Duncan, University of Chicago, <http://chess.eecs.berkeley.edu/superb/students.html>.

INDUSTRY AND ENTREPRENEURSHIP EXPERIENCE

Relteq Systems, Inc.

Founder-CEO

February 2010 – Present

Relteq Systems develops the online service for active traffic management for freeways and urban arterials. Its technology is based upon dynamic modeling, estimation, reachability and control techniques for transportation systems developed within UC Berkeley TOPL project. Relteq distributed simulation platform is built upon Amazon EC2 cloud service. Currently a team of 6, Relteq is funded by the NSF Small Business Innovative Research grant, <http://nsf.gov/awardsearch/showAward.do?AwardNumber=1045906>

Ditech Communications (now Ditech Networks, NASDAQ:DITC), Mountain View, CA, <http://ditechnetworks.com>

Senior Network Engineer (Voice Products)

December 2000 – July 2003

- Developed the Element Management Systems for various families of Echo Cancellation products (Netconsul™) <http://www.ditechnetworks.com/platforms/management.html>
- Designed and worked on the Voice Quality Monitoring (VQM) in TDM networks until leaving the company.

Customers of Ditech Voice Products include Qwest, AT&T, Nextel, Verizon as well as various telecommunications companies in Brazil, Russia, India and China.

Ditech Communications, Mountain View, CA

Software Engineer (Optical Products)

July 1998 – November 2000

- Responsible for the software portion of the Optical Telemetry System (OTS): software support for EDFAs, optical transmitters, receivers, transponders; TL1 interface; configuration management. Major customers for the OTS included Lucent, Nortel and Cisco.
- Developed test automation suite for EDFAs and transponders that was used by Manufacturing and Optical Engineering Departments. Customers of Ditech Optical Products include Ericsson and Lucent.

In 2001 Optical Products became Altamar Networks, wholly owned subsidiary of Ditech, that was sold to JDS Uniphase (Nasdaq: JDSU) in 2003.

INVITED TALKS

December 8, 2009

Active Traffic Management using Aurora Road Network Modeler

Talk at the Robotics and Embedded Systems Seminar at UC Berkeley.

March 6, 2009

Freeway Traffic Dynamics, Estimation and Control

Talk at the Center for Control, Dynamical Systems and Computation at UC Santa Barbara.

The same talk was given at UC San Diego on April 3, 2009.

February 18, 2009

Tools for Travel Corridor Management

Talk at the METRANS Transportation Center at University of Southern California.

March 27, 2006

Ellipsoidal Toolbox

Talk at the "Topics in Computation and Control (TCC)" Workshop at Santa Barbara, CA.

INDEPENDENT CONSULTING

The Mergex Group, Carlsbad, CA, <http://mergexgroup.com>

Development and MATLAB implementation of robust control algorithms for the Mergex traffic management system.

2010

Berkeley Transportation Systems, Inc., Berkeley, CA, <http://bt-systems.com>

Integration of Aurora RNM simulator into the traffic prediction subsystem of PeMS (<http://pems.dot.ca.gov>).

2009

Celeridyn, Roseville, CA, <http://celeridyn.com>

Development of scalable algorithms for conversion of large size GIS data into directed graphs. Supporting software functionality description and design.

2009

LasMed, LLC., Mountain View, CA

Development of the LabVIEW based management software for Diode Laser Neuro-Simulator used for functional MRI.

2002 – 2006

Calmar Optcom, Inc., Sunnyvale, CA

Development of the LabVIEW suite of simulation and data acquisition tools for laser testing.

July 2001 – November 2001

Sparcolor, Inc., Santa Clara, CA

Development of LabVIEW laser test automation application.

May 2001 – June 2001

SOFTWARE DEVELOPMENT

OS: Unix/Linux, pSOS, VxWorks, Windows

Cloud Computing: Amazon AWS, Heroku, MapReduce (Hadoop)

Programming: C/C++, Java, Ruby (some exposure to Rails), JRuby, Shell, SQL, MATLAB, LabVIEW

Networking: IP, TCP, UDP, BGP, OSPF, SNMP, HTTP, SNMP, TL1

Source Control: Git, Subversion, CVS, ClearCase, etc.

Miscellaneous: GIS, PostGIS, Google Maps, Directions API

PERSONAL INFORMATION

Languages: English (fluent), German (fluent), Russian (native)

US Citizen