

CURRICULUM VITAE

Alexey Geynts

(German spelling **Alexei Heintz** is used in my papers published in West)

Associate professor (docent), Department of Mathematics, Chalmers.

Address: Department of Mathematics, Chalmers University of Technology,
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PERSONAL DETAILS

Born July 10, 1955 in St. Petersburg, Russia.

Swedish citizen

married, having two daughters, born in 1984 and in 1997.

Fluent in English, Swedish, Russian.

DEGREES

M.Sc. in Fluid Mechanics from St.Petersburg State University, Russia, - 1979.

Ph.D. in Mathematics from St. Petersburg State University, Russia, - 1986.

Docent from Department of Mathematics, Chalmers, - 1999.

POSITIONS

1999- present - Associate professor (docent) Department of Mathematics, Chalmers.

1979-1998 - junior and later senior researcher at the Laboratory of Gas Dynamics, Institute of Mathematics and Mechanics, at St. Petersburg State University.

RESEARCH INTERESTS

Mathematical problems for the Boltzmann type kinetic equations.

Numerical methods for kinetic equations and fluid mechanics.

Geometric flows of surfaces. Theory, computations and applications.

Mathematical modeling of biological lipid membranes in liquids.

Mathematical modeling of transport in biomaterials by the Lattice Boltzmann technique.

RECEIVED FUNDING FOR RESEARCH

TFR, Swedish Research Council in Technical Sciences, 1998-2002: funding for research project "Geometric surface dynamics. A kinetic approach.

NFR, Swedish Research Council in Natural Sciences, 2002-2004: funding for research project "Kinetic models for spatial dynamics of intracellular signalling pathways."

Research School in Genomics and Bioinformatics, 2002-2006:

Funding for a Ph.D. position for the project "Spatial dynamics modelling of an intracellular signalling pathway" in collaboration with the department of Molecular Cell Biology at GU. The collaboration partner was professor Per Sunnerhagen, per.sunnerhagen@cmb.gu.se, +46 (0)31-786 3830

2009-2013: Funding for a Ph.D. position for the project " Modeling the dynamics of lipid membranes in liquids" in collaboration with **Orwar Group**, Chalmers,(<http://www.orwarlab.org/index.html>)

2010-2012: Funding from **SuMo Biomaterials** Excellence Center at Chalmers (<http://www.chalmers.se/chem/sumo-en/>) for the project "Flow and diffusion simulation with the Lattice-Boltzmann technique". This project supplies funding for 50% of my position, and funding for 50% of a Post. Doc. position, and purchasing necessary computer resources. The collaborating partner for this project is director of SuMo Biomaterials, professor Anette Larsson, anette.larsson@chalmers.se

2012-2016 The scientific project related to transport processes in heterogeneous materials is extended for period 2012-2016 and includes funding from **SuMo Biomaterials** for 75% of an assistant professor position (Tobias Gebäck) at the Mathematical department at Chalmers and a part of my salary.

SUPERVISION OF Ph.D. STUDENTS

Main supervisor of three Ph.D. students:

Vladislav Panferov defended Ph.D. thesis "Two problems on existence and approximation related to the Boltzmann equation" in 1999 ,

Riçard Grzibovskis defended Ph.D. thesis "Some non-linear geometric and kinetic evolutions and their approximations" in 2004, and

Tobias Gebäck defended Ph.D. thesis "On boundary value problems for intracellular subdiffusion and signaling pathways, and for geometric flows" in 2007.

Main supervisor of a Ph.D. student Svitlana Ruzhytska that started in 2009.

Second supervisor of a Ph.D. student (in biochemistry) Natalia Sepanyants that started in 2009 and defended a licenciat thesis in 2011.

SCIENTIFIC ASSIGNMENTS

Opponent for a licentiate thesis at KTH - Royal Institute of Technology, Stockholm.

Member of the evaluation committees for three Ph.D. theses at KTH - Royal Institute of Technology in Stockholm, at the University of Linköping and at Chalmers.

Invited speaker at the Workshop on Mathematical Problems in Image Processing at the Mathematical Research Institute of Oberwolfach 2007.

Invited speaker at the 12-th International Conference on Free Boundary Problems, Theory and Applications. GERMANY 11-15. June 2012.

PEDAGOGICAL ACTIVITY

Studied an intensive pedagogic course for Chalmers and GU members in 1999.

Have got a docent degree at the Department of Mathematics, Chalmers 1999.

Teach 2 - 3 undergraduate mathematical courses per year during last 12 years, in most of cases as a responsible for the course. According to internal rules at the Mathematical Department the responsibility for a course implies writing detailed plans of the context of lectures, collecting problems for exercises and for computer classes. All this information is represented at the home page of the course that I maintain together with recommendations for studies, information about requirements at exams and solutions of typical problems. I teach students of all levels.

Undergraduate courses I teach last two years:

The course in **Analysis and Linear Algebra Part A** is the first course in mathematics and programming for students in chemistry, physical chemistry and biotechnology, with totally 180 students. I gave it 4 times. The plan of the course was changed by me to fulfill requirements from the program board of the Departments of Chemistry and Physical Chemistry. At this course I run 3 lectures, and 2 exercises and 2 programming laboratories per week. I also make plans for teaching for other 5 junior teachers teaching the course and meet with student representatives to see a feedback.

The approach to teaching and examination in programming on Matlab within this course was changed toward higher requirements and better control that had a positive effect on their later studies.

After the first year teaching this course I became a member of the program board at the Department of Chemistry and Physical Chemistry.

The course in **Mathematical Modeling** is attended by approximately 30 second and third year students from GU and Chalmers. I gave it 5 times. This course in its present form was developed by me. It includes several different modeling approaches: by ODE, by stochastic processes and by Lattice Boltzmann technique. The main examination consists of a large project done in groups of 2-3 students including studying some particular class of models from physics, biology, environmental and medical sciences, the choice of mathematical model, and numerical modeling.

I am going to teach an advanced course in **Ordinary Differential Equations and Dynamical Systems** starting from the next academic year.

Courses I gave earlier:

Applied Biomathematics for Master students - 15 students, 4 times. This course was not given before and was developed by me.

Mathematical analysis in one variable. Chalmers, - 220 students in mechanical engineering and technical design. 1 time.

Analysis of several variables for physicists at GU - 30 students, 5 times.

Ordinary Differential Equations - 20 third year students, 1 time.

Linear Algebra for physicists at GU - 30 students, 2 times.

Analysis of several variables for the Department of Electrical Engineering - 120 students, 2 times.

Numerical methods for the Department of Technical Mechanics - 80 students, 2 times.

Functions of Complex variables - 20 third year students, 1 time.

Supervised of 6 Master projects - two of them defended in 2012 investigate problems with transport processes in multiphase fluids actual for SuMo Biomaterials.

Graduate courses.

"Stationary problems for kinetic equations" - in 1997.

"Geometric measure theory", with applications to minimal surfaces and geometric flows - in 2003.

Two following Ph.D. courses I developed within a collaboration with the Department of Technical Mechanics, Group of Vehicle Aero Dynamics, collaborating partner was professor Lennart Löfdahl.

"Lattice Boltzmann equation and its applications" - given in 2007.

"Applications of modern mathematics in fluid mechanics" - given in 2008.

"Lattice Boltzmann modeling and its applications" - given in 2012 for Ph.D. students from BIOSUM research school and SuMo Biomaterials.

PEDAGOGICAL EXPERIENCE OUTSIDE MATHEMATICS

During several years gave popular lectures in History of Art for students at the University of St. Petersburg.

INDUSTRIAL AND INTERNATIONAL COLLABORATIONS

1992-1993- senior researcher on contract, at the State Institute for Projecting Hypersonic Devices, St. Petersburg. Project "Non-linear and thermal effects from kinetic boundary layers in hypersonic flows".

1991-1992- senior researcher, on contract, spacecraft enterprise "Polet" Omsk, Russia.

Nov.1993, Mar.1994, and Nov.-Dec. 1994. Invited researcher at the Laboratory of Scientific computing at Jyväskylä University, Finland. Project "Finite element modeling of viscous drops with phase transitions and chemical reactions". Contact person: professor Pekka Neittaanmäki, Dept. of Mathematical Information Technology, University of Jyväskylä, P.O. Box 35 (Agora), FI-40014 University of Jyväskylä, Finland, e-mail pn@mit.jyu.fi.

June - July 2000. Invited researcher, Department of Mathematics, University of South Carolina, and SUMMUS, USA. Project "Curvature flows of surfaces for image processing".

May 2002. Invited researcher, Department of Mathematics. Warsaw University. Poland. Contact person: professor Andrzej Palczewski, Faculty of Mathematics, Informatics and Mechanics, University of Warsaw, 2 Banach St., 02-097 Warsaw, Poland, e-mail apalczew.@mimuw.edu.pl.

November 2003. Invited researcher, Department of Aeronautics and Astronautics Graduate School of Engineering, Kyoto University, Japan. Contact person: professor Kazuo Aoki, Department of Mechanical Engineering and Science, Graduate School of Engineering, Kyoto University, Kyoto 606-8501, Japan, e-mail aoki@aero.mbox.media.kyoto-u.ac.jp.

2011-2012. Collaborate with **AstraZeneca** on problems including Lattice Boltzmann simulation of transport processes through polymer films used for drug release and in image processing of 3-dimensional CLSM images of such structures. Contact persons: Catherine Boissier, Catherine.Boissier@astrazeneca.com, Mariagrazia Marucci, Mariagrazia.Marucci@astrazeneca.com, **AstraZeneca**.

PUBLICATION LIST

The German spelling Heintz is used for my surname in the papers published in West. Varying spellings are used in references to my early papers because of varying translations from Russian which are taken here from the Mathematical Review.

Papers in referee reviewed journals.

1. A.G. Geĩnc, *Solvability of a boundary value problem for the nonlinear Boltzmann equation in a bounded domain.* in Aerodynamics of rarefied gases, issue 10. Leningrad University, Leningrad 1980, 16-24. (in Russian)
2. A.G. Geĩnc, V.A. Maljarenko, N.B. Maslova, *Free-molecular flow inside a spherical volume.* in Aerodynamics of rarefied gases, issue 10. Leningrad University, Leningrad 1980, 203-209. (in Russian)
3. A.G. Geĩnts, *Solvability of the initial - boundary value problem for the nonlinear Boltzmann equation in a bounded domain.* in Aerodynamics of rarefied gases, issue 11. Leningrad University, Leningrad 1983, 166 - 174. (in Russian)
4. A.G. Geĩnts, *On the solution of boundary value problems for the Boltzmann equation in domains with irregular boundaries.* in Numerical and Analytical Methods in Rarefied Gas Dynamics, Moscow, 1986, 7-11. (in Russian)
5. A.G. Geĩnts, *On the asymptotic behavior of solutions of the one integral equation of transport theory in a neighborhood of corner points of a contour.* Vestnik of Leningrad State University, ser. 1, (1988), iss. 4, 42-45. (in Russian)
6. L. Arkeryd, A. Heintz, *On the solvability and asymptotics of the Boltzmann equation in irregular domains.* Comm. Part. Diff. Eq., 22, (1997), 2129-2152.
7. A. Heintz, *Initial boundary value problems for the Enskog equation in irregular domains.* J. of Statistical Physics, 90 (1998), no. 3-4, 663-695.
8. A. Heintz, *Initial boundary value problems in irregular domains for nonlinear kinetic equations of Boltzmann type.* Transport theory and Statistical Physics, 28, (1999), no 2, 30 pp.
9. A. V. Bobylev, R. Grzsibovskis, A. Heintz, *Entropy inequalities for evaporation/condensation problem in rarefied gas dynamics,* J. Statist. Phys. 102, (2001), no. 5-6, 1151-1176.
10. Vladislav A. Panferov, Alexei G. Heintz, *A new consistent discrete-velocity model for the Boltzmann equation,* Mathematical Methods in the Applied Sciences, 25, (2002), no. 7, 571-593.
11. R. Grzibovskis, A. Heintz, *On a convolution-thresholding method for generalised curvature flows.* SIAM J. of Numerical Analysis 42, (2005), no. 6, 2652-2670.

12. R. Grzibovskis, A.Heintz, *A convolution-thresholding scheme for the Willmore flow*, Interfaces and Free Boundaries, 10, (2008),139-153.

13. P. Kowaltzyk, R. Grzibovskis, and A. Heintz, *Fast numerical method for the Boltzmann equation on non-uniform grids*, Journal of Computational Physics. 227, (2008),6681-6695.

Publicly available scientific software:

T.Gebäck, A.Heintz. *GESUALDO - a program package for modeling flow and diffusion through hetetogeneous biomaterials*. (2012) Available for members of SuMo Biomaterials - VINN Excelence Center, involving scientific groups at Chalmers, and several industrial partners such as **Astra-Zeneca**, **SIK**, **SCA**, **Akzo Nobel**, **Tetrapak** and other.

Papers in referee reviewed conference proceedings:

14. A.G. Geĩnts, I.N. Dubrovskaja, B.B. Starikov, A.A. Schmitt, *On the influence of the character of molecules reflection on the conducting properties of channels*. in Interaction of rarefied gases with surfaces. Moscow, 1986. (in Russian)

15. A.G. Geĩnts, *On some new methods in relaxation equations theory*, in Kinetic Theory of Gases, Moscow Power Institute, 1991, 120-126. (in Russian)