Dmitry Mikushin

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Academic experience

2015–present Research Associate, University of Zurich, Institut für Banking und Finance, Switzerland.

Group of Dr. Simon Scheidegger. Computing global solutions to annually calibrated dynamic stochastic general equilibrium models for policy analysis (overlapping generation models or OLG). Given prototypes from economists within the group, developing production code for large hybrid computing systems equipped with NVIDIA or Intel accelerators (CSCS/Piz Daint, NERSC/Cori). Fine-tuning of value function interpolation kernels on a sparse grid with linear or polynomial basis (AVX, CUDA, Intel Thread Building Blocks). Co-authored a journal paper.

2012–2015 Doctoral Assistant, University of Lugano, Switzerland.

Group of Prof. Olaf Schenk. Assisting education and research activities. Worked on manual optimization and designed tools for automatic optimization of stencil codes in seismic and weather prediiction models (CUDA, OpenACC). Main author for a conference paper.

2013 Visiting Scholar, Rutgers University, New Jersey, US.

Group of Prof. Eddy Zheng Zhang. Analyzed the efficiency of atomics on different families of NVIDIA GPUs. Tuned GPU kernels optimizations in KernelGen compiler.

2008–2011 Junior scientist, Supercomputer simulation laboratory for climate modeling, Research Computing Center, Lomonosov Moscow State University, Russia.

Numerical and performance evaluation of various mesoscale and regional models. Experimented with porting key model dynamics blocks on Cell Broadband Engine and GPU architectures.

2006–2007 Contractor, Global Energy Problems Lab, Moscow Energy Institute.

Implemented toolbox for Voronoi tesselation and regression analysis in C#.

Industrial experience

2018–present System Analyst (part time), REG.RU, Moscow.

Overseeing the development of Cloud GPU services for scientific and industrial machine learning. Helping with internal GPU-based spin-off products.

2017–2018 Lead Technical Expert, Luxoft Inc., Moscow.

GPGPU for high-performance Monte-Carlo backpricing valuation (financial customer). Complete rewrite of Scala code into C++ & CUDA, skip-ahead optimizations for Sobol RNG. Design and implementation of efficient GPU kernels for lidar simulation (automotive customer).

2014–present Owner, Applied Parallel Computing LLC (CUDA Education & Research in EMEA), http://parallel-computing.pro/.

2011–present Project lead, KernelGen open-source compiler toolchain, http://kernelgen.org/.

Design and development of LLVM-based compiler for identifying parallel loops in C/Fortran code and converting them into GPU kernels. Strategic planning, interacting with community, creating new partnerships.

2011–2012 CTO, Applied Parallel Computing LLC (CUDA Education & Research in EMEA), Dubna, Moscow Region, Russia, http://parallel-computing.pro/.

Managing technological aspects in company's GPGPU training and software development business. Created course list on comprehensive CUDA training program, implemented original presentations and hands-ons, later used in CUDA 4.x Handbook in Russian. Served as trainer on events in Germany, Ireland and Russia. Organizing and reviewing work of 7 company's contracted trainers/developers. Responsible for interaction with customers and partners worldwide.

2009–2011 DevTech Engineer, NVIDIA, Moscow, Russia.

Ported parts of numerical weather prediction models onto GPUs: spectral solver benchmark (Russian Met Office), GPU kernels generator for COSMO model (Deutscher Wetterdienst et al). Supported customers and developers on CUDA programming in HPC applications, provided training sessions. PhysX game physics engine: implemented SPU-interacting radix sort for rigid bodies broad phase algorithm on Cell Broadband Engine processor (Sony PlayStation 3), made first experimental Tegra/ARM ports of PhysX engine, helped with Linux port.

Awards

2013 PhD fellowship, Rutgers University, Department of Computer Science.

2011 CUDA Certificate 016-2011/29.10.2011, NVIDIA, Moscow, Massively parallel processors, CUDA architecture and programming environment.

2008 PhD fellowship, Institute of Numerical Mathematics, Russian Academy of Science.

2008 T-Platforms PowerXCell 8i Programmers Contest, second award, Optimization of mathematical modeling package for hydrodynamics "GeoPhyCell".

2008 Best Student Diploma, second award, Numerical modeling of mesoscale aerosol transfer due to hydrological inhomogeneity of the boundary layer.

Education

2012–2015 PhD studies, University of Lugano, Institute of Computational Science, Switzerland.

2008–2011 PhD (ABD – passed qualification and comprehensive examinations), Institute of Numerical Mathematics, Russian Academy of Science, Moscow.

2003–2008 Specialist (5-year B.S. + M.S program), Faculty of Computational Mathematics and Cybernetics, Lomonosov Moscow State University, Computational Technologies and Modeling.

Master thesis

title Numerical modeling of mesoscale aerosol transfer due to hydrological inhomogeneity of the boundary layer

supervisors Dr. Vasily N. Lykossov, Dr. Victor M. Stepanenko

Implemented and analyzed Smolarkiewicz transport scheme, the positive-definite method of LaxWendroff class. Resulting source code was incorporated into regional non-hydrostatic model of atmosphere and boundary layer (NH3D) and used to trace passive aerosol. Experiments with real terrains showed significant numerical accuracy improvement both in mass conservation and approximation order over leapfrog and first order transport schemes.

Publications

Simon Scheidegger, Dmitry Mikushin, Felix Kubler, and Olaf Schenk. Rethinking large-scale economic modeling for efficiency: optimizations for GPU and Xeon Phi clusters. IEEE IPDPS, pp. 610-619, 2018.

Johannes Brumm, Dmitry Mikushin, Simon Scheidegger, and Olaf Schenk. Scalable high-dimensional dynamic stochastic economic modeling. Journal of Computational Science, 11:12–25, 2015.

Dmitry Mikushin, Nikolay Likhogrud, Eddy Z. Zhang, and Christopher Bergström. Kernelgen – the design and implementation of a next generation compiler platform for accelerating numerical models on gpus. In Proceedings of the 2014 IEEE International Parallel & Distributed Processing Symposium Workshops, IPDPSW '14, pages 1011–1020, Washington, DC, USA, 2014. IEEE Computer Society.

Dmitry Mikushin and Victor Stepanenko. The implementation of regional atmospheric model

numerical algorithms for Cell Broadband Engine Architecture -based clusters. In Roman Wyrzykowski, Jack Dongarra, Konrad Karczewski, and Jerzy Wasniewski, editors, PPAM (1), volume 6067 of Lecture Notes in Computer Science, pages 525–534. Springer, 2009.

Selected talks

Dmitry Mikushin, Nikolay Likhogrud, Sergey Kovylov. KernelGen: A Prototype of Auto-parallelizing Fortran/C compiler for NVIDIA GPUs, GPU Technology Conference 2013, available online.

Active skills

CS/Research	Explore new environments/software and teach others to use them, design & perform experiments to analyse hardware/software properties and generalize findings into practically useful methods/tools.
HPC/Engineer	Fluency in full development & support cycle of HPC applications for Linux clusters: programming, parallelization for different architectures, debugging, profiling.
Bitcoin mining	Basic understanding of SHA256 and Zero-knowledge proof. Optimization of Equihash miner for NVIDIA GPUs. Available on GitHub.
Compilers Dev	Basic knowledge of compilers internal structure, contributions to LLVM. Designed and developed KernelGen – a prototype of auto-parallelizing Fortran/C compiler for NVIDIA GPUs, targeting numerical modelling code.
GPU low-level	Experience with NVIDIA GPU binary format and Fermi/Kepler assembler, profiling & optimization.
Numericals	Practical experience with linear solvers, PDEs and related cache-aware optimizations.
NWP	Engineer-level experience with numerical weather prediction models: WRF-ARW, COSMO.

Teaching

2014 Parallel & Distributed Computing Lab, University of Lugano.
5 practical assignments on code porting, profiling & optimization for TBB, MPI, CUDA, CellBE and Xeon Phi.

2014 Parallel & Distributed Computing, University of Lugano.
The fundamentals of concurrent execution. Threading in Java. The basics of OpenMP and MPI.

2013 Parallel & Distributed Computing Lab, University of Lugano.
Configuration & deployment of scientific codes on modern GPU-enabled HPC facilities, by example of SWE tsunami simulation model and CSCS “Tödi” cluster

Languages

English	fluent technical
Russian	native