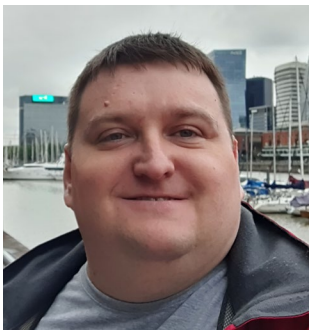
Curriculum Vitae



Igor Kulikov

Positions: Leading Researcher
Department of Supercomputer Modeling
Institute of Computational Mathematics and Mathematical Geophysics
Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

Associate Professor
Department of Computing Systems
Novosibirsk State University, Novosibirsk, Russia

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Citizenship: Russia

H-index (Scopus) 15

Citations in Scopus 686

1. Research interests

Numerical modeling in astrophysics
Parallel numerical methods
Computational mathematics
Numerical solvers for hyperbolic equation

2. Educational degrees & rewards

The Winner of the Personal Prize of the Government of the Novosibirsk Region
for outstanding scientific achievement in 2022

Institute of Computational Mathematics and Mathematical Geophysics
Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia
Doctor of Science in applied mathematics, 2017

Novosibirsk administration
Position on the Honor Board of Novosibirsk for the Author of best scientific project, 2014

Sobolev Institute of Mathematics
Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia
PhD in applied mathematics, 2010

Ministry of Education and Science of Russian Federation
Medal for the Best scientific student work, 2007

Novosibirsk State Technical University, Novosibirsk, Russia
Master Diploma in Applied Mathematics and Informatics with Honours, 2007

Novosibirsk State Technical University, Novosibirsk, Russia
Bachelor Diploma in Applied Mathematics and Informatics with Honours, 2005

3. Work background

Institute of Computational Mathematics and Mathematical Geophysics SB RAS

from 06/2021	Leading researcher
03/2018 – 05/2021	Senior researcher
09/2017 – 05/2018	Scientific secretary
06/2015 – 09/2017	Researcher
05/2010 – 06/2015	Junior researcher
05/2005 – 12/2005	Assistant
08/2004 – 12/2004	Assistant

Novosibirsk State Technical University

12/2017 – 03/2024	Professor
09/2011 – 12/2017	Associate Professor
09/2006 – 09/2011	Assistant

Novosibirsk State University

from 11/2017	Associate Professor

4. Grants supervised

The RSF grant 23-11-00014, 2023-2025, Title «The development, design, and research of Computational Methods of High Order Accuracy for Solving Special Relativistic Hydrodynamics Equations using Adaptive Mesh Refinement on Supercomputers».

The RSF grant 18-11-00044, 2018-2022. Title «The development, design and research of efficient parallel computational methods for solving the equations of hydrodynamics by means a nested mesh on massively parallel supercomputers».

The RFBR grant 19-51-14002, 2019-2024. Title «Modeling of star formation on massively parallel computers».

The RFBR grant 18-01-00166, 2018-2020. Title «The development of vectorized parallel numerical high accuracy methods for the simulation of dynamical evolution of galaxies on supercomputers with Intel Xeon Phi accelerators».

The RFBR grant 18-41-543012, 2018-2020. Title «The development of digital platform "Virtual Planetarium" for the Big Novosibirsk Planetarium».

The RFBR grant 15-01-00508, 2015-2017. Title «The development efficiency parallel numerical high order accuracy methods for numerical modeling of astrophysical objects on supercomputers».

The RFBR grant for young leader groups 15-31-20150, 2015-2016. Title «The development efficiency parallel numerical high order accuracy methods for multiscale numerical modeling of astrophysical flows on hybrid supercomputers».

The RFBR grant for young scientist 12-01-31352, 2012-2013. Title «The development efficiency parallel numerical methods for numerical modeling of multiphase astrophysical objects on hybrid supercomputers».

The Grant of the President of Russian Federation for the support of young PhD MK-1445.2017.9, 2017-2018. Title «The development of efficiency vectorized parallel algorithms for MHD modeling of astrophysical flows on Intel Xeon Phi supercomputers».

The Grant of the President of Russian Federation for the support of young PhD MK-6648.2015.9, 2015-2016. Title «The development of efficiency high order accuracy parallel algorithms for MHD modeling of dynamics of galaxies on GPU-based and Intel Xeon Phi supercomputers».

The Grant of the President of Russian Federation for the support of young PhD MK-4183.2013.9, 2013-2014. Title «The development of efficiency parallel algorithms for numerical modeling of dynamics of galaxies on GPU-based and Intel Xeon Phi supercomputers».

The grant of Novosibirsk, 2013. Title «The development of numerical models and parallel methods for numerical simulation of dynamics of protoplanetary disks on GPU».

The Federal target program «Scientific and scientific-pedagogical cadres innovation Russia for 2009-2013» (16.740.11.0573 from May 30 2011), 2011-2013. Title «The development high order accuracy numerical methods and codes for numerical modeling of astrophysical processes on supercomputers».

5. Teaching Experience

Master's course « The parallel technologies of numerical modeling» (NSU from 2017)
Master's course « The modern Fortran for numerical modeling» (NSU from 2023)

6. Students supervised

Oleg Zavyalov, ICM&MG SB RAS, PhD Student, 2023-2024
Oleg Zavyalov, NSTU, Master Student, 2021-2023
Oleg Zavyalov, NSTU, Bachelor Student, 2019-2021
Vladimir Prigarin, NSTU, PhD Student, 2018-2022
Vladimir Prigarin, NSTU, Master Student, 2016-2018
Vladimir Prigarin, NSTU, Bachelor Student, 2014-2016
Ivan Ulyanichev, NSTU, PhD Student, 2017-2022
Viktor Protasov, NSTU, PhD Student, 2015-2019
Viktor Protasov, NSTU, Master Student, 2013-2015
Viktor Protasov, NSTU, Bachelor Student, 2011-2013
Vladislav Nenashev, NSTU, PhD Student, 2015-2019
Vladislav Nenashev, NSTU, Master Student, 2013-2015
Vladislav Nenashev, NSTU, Bachelor Student, 2011-2013
Alexander Serenko, ICMMG SB RAS, PhD Student, 2015-2019
Alexander Serenko, NSTU, Master Student, 2013-2015
Alexander Serenko, NSTU, Bachelor Student, 2011-2013

7. Refereeing and expert

The deputy chief editor of The Siberian journal of Computational Mathematics
The member of editorial board of Numerical methods and programming
The member of expert board in Russian Science Foundation
The member of expert board in Russian Foundation for Basic Research
The member of expert board in Swiss National Scientific Foundation

8. Main publications (last 5 years)

1. Kulikov I., Chernykh I., Karavaev D., Prigarin V., Sapetina A., Ulyanichev I., Zavyalov O. A New Parallel Code Based on a Simple Piecewise Parabolic Method for Numerical Modeling of Colliding Flows in Relativistic Hydrodynamics // Mathematics. – 2022. – V. 10, I. 11. – Article Number 1865 (WoS/Scopus, квартиль Q1, DOI 10.3390/math10111865).
2. Akimova E.N., Misilov V.E., Kulikov I.M., Chernykh I.G. OMPEGAS: Optimized Relativistic Code for Multicore Architecture // Mathematics. – 2022. – V. 10, I. 11. – Article Number 2546 (WoS/Scopus, квартиль Q1, DOI 10.3390/math10142546).
3. Kulikov I.M. An Operator-Splitting Approach to the Godunov Method for Numerically Solving the Special Relativistic Hydrodynamics Equations in Symmetric Hyperbolic Form // Lobachevskii Journal of Mathematics. – 2025. – V. 46. – P. 112-120 (WoS/Scopus, квартиль Q2, DOI 10.1134/S1995080224608294).
4. Kulikov I.M., Vorobyov E.I. On One Numerical Scheme for Solving Radiative Transfer Equations in the Diffusion Approximation // Lobachevskii Journal of Mathematics. – 2024. – V. 45. – P. 67-74 (WoS/Scopus, квартиль Q2, DOI 10.1134/S199508022401030X).
5. Kulikov I.M. Using Adaptive Mesh Refinement Technique for Numerical Modeling of Relativistic Jets // Lobachevskii Journal of Mathematics. – 2024. – V. 45. - P. 60-66 (WoS/Scopus, квартиль Q2, DOI 10.1134/S1995080224010293).
6. Kulikov I.M. Using Piecewise Parabolic Reconstruction of Physical Variables in the Rusanov Solver. I. The Special Relativistic Hydrodynamics Equations // Journal of Applied and Industrial Mathematics. – 2023. – V. 17. – P. 737-749 (Scopus, квартиль Q2, DOI 10.1134/S1990478923040051).
7. Kulikov I.M. Using Piecewise Parabolic Reconstruction of Physical Variables in Rusanov's Solver. II. Special Relativistic Magnetohydrodynamics Equations // Journal of Applied and Industrial Mathematics. – 2024. – V. 18. – P. 81-92 (Scopus, квартиль Q2, DOI 10.1134/S1990478924010083).
8. McKevitt J., Vorobyov E.I., Kulikov I. Accelerating Fortran codes: A method for integrating Coarray Fortran with CUDA Fortran and OpenMP // Journal of Parallel and Distributed Computing. – 2025. – V. 195. – Article Number 104977 (WoS/Scopus, квартиль Q1, DOI 10.1016/j.jpdc.2024.104977).
9. Vorobyov E., McKevitt J., Kulikov I., Elbakyan V. Computing the gravitational potential on nested meshes using the convolution method // Astronomy and Astrophysics. – 2023. – V. 671. – Article Number A81 (WoS/Scopus, квартиль Q1, DOI 10.1051/0004-6361/202244701).
10. Vorobyov E., Kulikov I., Elbakyan V.G., McKevitt J., Guedel M. Dust growth and pebble formation in the initial stages of protoplanetary disk evolution // Astronomy and Astrophysics. – 2024. – V. 683. – Article number A202 (WoS/Scopus, квартиль Q1, DOI 10.1051/0004-6361/202348023).
11. Vorobyov E.I., Elbakyan V., Skliarevskii A., Akimkin V., Kulikov I. Dust enrichment and growth in the earliest stages of protoplanetary disk formation // Astronomy and Astrophysics. – 2025. – V. 699. – Article Number A27 (WoS/Scopus, квартиль Q1, DOI 10.1051/0004-6361/202553718).

12. Chernykh I., Kulikov I., Tutukov A. Hydrogen–helium chemical and nuclear galaxy collision: Hydrodynamic simulations on AVX-512 supercomputers // Journal of Computational and Applied Mathematics. – 2021. – V. 3911. – Article Number 113395 (WoS/Scopus, квартиль Q2, DOI 10.1016/j.cam.2021.113395).

9. Other publications

1. Kulikov I. A new code for the numerical simulation of relativistic flows on supercomputers by means of a low-dissipation scheme // Computer Physics Communications. – 2020. – V. 257. – Article Number 107532 (WoS/Scopus, квартиль Q1, DOI 10.1016/j.cpc.2020.107532).
2. Godunov S.K., Kulikov I.M. Computation of discontinuous solutions of fluid dynamics equations with entropy nondecrease guarantee // Computational Mathematics and Mathematical Physics. – 2014. – V. 54, № 6. – P. 1012-1024 (WoS/Scopus, квартиль Q3, DOI 10.1134/S0965542514060086).
3. Kulikov I.M., Vorobyov E.I., Chernykh I.G., Elbakyan V.G. Application of Geodesic Grids for Modeling the Hydrodynamic Processes in Spherical Objects // Journal of Applied and Industrial Mathematics. – 2020. – V. 14. – P. 672-680 (Scopus, квартиль Q2, DOI 10.1134/S1990478920040067).
4. Kulikov I., Chernykh I., Tutukov A. A new hydrodynamic code with explicit vectorization instructions optimizations, dedicated to the numerical simulation of astrophysical gas flow. I. Numerical method, tests and model problems // The Astrophysical Journal Supplement Series. – 2019. – V. 243. – Article Number 4 (WoS/Scopus, квартиль Q1, DOI 10.3847/1538-4365/ab2237).
5. Kulikov I., Vorobyov E. Using the PPML approach for constructing a low-dissipation, operator-splitting scheme for numerical simulations of hydrodynamic flows // Journal of Computational Physics. – 2016. – V. 317. – P. 318-346 (WoS/Scopus, квартиль Q1, DOI 10.1016/j.jcp.2016.04.057).
6. Kulikov I.M., Chernykh I.G., Snytnikov A.V., Glinskiy B.M., Tutukov A.V. AstroPhi: A code for complex simulation of dynamics of astrophysical objects using hybrid supercomputers // Computer Physics Communications. – 2015. – V. 186. – P. 71-80 (WoS/Scopus, квартиль Q1, DOI 10.1016/j.cpc.2014.09.004).
7. Kulikov I. GPUPEGAS: A New GPU-accelerated Hydrodynamic Code for Numerical Simulations of Interacting Galaxies // The Astrophysical Journal Supplements Series. – 2014. – V. 214. – Article Number 12 (WoS/Scopus, квартиль Q1, DOI 10.1088/0067-0049/214/1/12).
8. Vshivkov V., Lazareva G., Snytnikov A., Kulikov I., Tutukov A. Hydrodynamical code for numerical simulation of the gas components of colliding galaxies // The Astrophysical Journal Supplement Series. – 2011. – V. 194. – Article Number 47 (WoS/Scopus, квартиль Q1, DOI 10.1088/0067-0049/194/2/47).

10. Book

1. Kulikov I.M. Supercomputer modeling of hydrodynamic objects in problems of astrophysics. – Monograph. – ICM&MG SB RAS, Novosibirsk: SB RAS Publishing, 2020. – 170 p.
2. Godunov S.K., Kiselev S.P., Kulikov I.M., Mali V.I. Modeling of shock-wave processes in elastic-plastic materials at various (atomic, meso and thermodynamic) structural levels. – Publishing of Institute of Computer Science, Izhevsk, Russia. – 2014. – 296 p.

11. Main scientific results

The numerical methods of high order of accuracy to solving hydrodynamic equations, MHD equations, for equations for the first moments of the collisionless Boltzmann equations, special relativistic hydrodynamics equations, and special relativistic MHD equations was developed. The

developed computational methods were effectively implemented in numerical codes for classic supercomputers and hybrid supercomputers, equipped with graphics accelerators and Intel Xeon Phi accelerators, including those using low-level vectorization and by means Coarray Fortran. The code developed for supercomputers based on Intel Xeon Phi KNL accelerators using low-level vectorization tools and Coarray Fortran code are a unique in the World for complex solving astrophysical problems on architectures of this type. The developed computational methods and efficient codes were used to study the problems of evolution and collisions of galaxies, non-central explosion of SNeIa, and modeling of relativistic jets.

12. Developing Experience

https://github.com/igorkulikov GitHub profile

https://gitflic.ru/user/igorkulikov GitFlic profile