

# MIKHAIL KURNOSOV

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## EDUCATION

- 2016      **Doctor of Science**, Siberian State University of Telecommunications and Information Sciences, Novosibirsk, Russia
- 2005 – 2008    **Candidate of Science (PhD)**, Siberian State University of Telecommunications and Information Sciences, Novosibirsk, Russia
- 2000 – 2005    **Diploma in Mathematics**, Gorno-Altaysk State University, Gorno-Altaysk, Russia

## POSITIONS AND EXPERIENCE

### Siberian State University of Telecommunications and Information Sciences,

Computer Systems Department, Novosibirsk

2016 – present	Professor
2008 – 2016	Associate Professor
2007 – 2008	Senior Lecturer
2005 – 2007	Assistant (PhD student)

- Models and algorithms for optimizing parallel programs (MPI, OpenMP)
  - Benchmarking MPI collectives: MPIPerf (<https://github.com/mkurnosov/mpiperf>)
  - Optimizing MPI process placement: TopoMPI (<http://topompi.cpct.sibsutis.ru>)
  - Optimized MPI Collectives (<https://github.com/mkurnosov/reduce-kchain>)
  - Implementing MPI collectives in Open MPI (<https://www.open-mpi.org>)
- Designing and administration of HPC clusters (NIS/NFS, SLURM, TORQUE, InfiniBand)
- Teaching courses (<http://www.mkurnosov.net/teaching>, <https://www.slideshare.net/mkurnosov>)
  - Parallel Programming (undergrad. and M.Sc. students)
  - Theory of Distributed Computer Systems Functioning Organization (undergrad. stud.)
  - High-Performance Computing Systems (undergrad. and M.Sc. students)
  - Data Structures and Algorithms (undergrad. students)
- Advising: Bachelors, Masters and PhD students (3 Candidate of Science – 2013, 2018, 2019)

### Rzhanov Institute of Semiconductor Physics Siberian Branch of Russian Academy of Sciences,

Computer Systems Laboratory, Novosibirsk, Russia

2017 – present	Senior Research Scientist
2012 – 2016	Research Scientist
2007 – 2012	Research Assistant
2006 – 2007	Software Engineer

- Design and optimization of parallel programs: MPI, OpenMP, CUDA, SIMD-vectorization
- Teaching course “Introduction to Parallel Programming” (2015-2016) <http://www.mkurnosov.net/parprog>

### Yandex, School of Data Analysis, Novosibirsk, Russia

2014 – 2016	Lecturer
	Course “Parallel and Distributed Computing” (C++11 multithreading, OpenMP, MPI, MapReduce, Apache Hadoop, distributed algorithms)

### Intel, Threading Tools (SSG), Nizhny Novgorod, Russia

Summer 2006	Software Engineer (Intern)
	Porting GNU/Linux version of Intel Thread Profiler runtime library to the Pin – dynamic binary instrumentation tool (C/C++, Pin probes, POSIX threads)

## **Republican Center of Children's Creativity, Gorno-Altaysk, Russia**

1998 – 2005      Software Engineer

- Software Development
  - Development of educational programming language Rapira++: modifiable syntax – Russian and Altay keywords, basic OOP constructions, visual programming, IDE (<https://github.com/mkurnosov/rapiraxx>, <http://www.school-sector.relearn.ru/dckt/projects/rapira/>)
  - Client-server software for monitoring and remote control of launched application on Windows-based workstations (C, DLL injection, Win32 API, network sockets, MySQL)
- Teaching courses (high school students): Rapira++, Visual Basic, Delphi, JavaScript; network technologies (TCP/IP, Ethernet switches: VLANs, Spanning Tree, QoS; WiFi protocols)

## **RESEARCH INTERESTS**

### **I. Parallel programming models and runtime systems (MPI, multithreading, synchronization)**

- MPI: algorithms for collective communications, task mapping, performance analysis
- Performance optimization: MPI, OpenMP, CUDA, SIMD-vectorization, MapReduce

### **II. Distributed computing: decentralized algorithms for job scheduling**

## **AWARDS**

- 2019    Certificate of Honor of the Governor of the Novosibirsk Region
- 2017    Diploma of city administration of Novosibirsk
- 2012    Award of the Government of the Russian Federation in the field of education
- 2009    Award of Administration of Novosibirsk Region
- 2008    Intel Scholarship in Recognition of Academic Progress and Active Scientific Work
- 2007    Alcatel-Lucent Scholarship
- 2007    Scholarship of the Government of the Russian Federation
- 2004    Scholarship of the Russian Federation President

## **ATTENDED SCHOOLS AND WORKSHOPS**

- 2009    Architecture of High-Performance Computer Clusters, Institute for System Programming of RAS, Moscow, Russia
- 2007    Intel Multicore Programming for Academia, Intel, Nizhny Novgorod, Russia
- 2007    Java Programming, Sun Java Academy, Sun Microsystems, Novosibirsk, Russia
- 2006    Russian-German Schools on Parallel Programming and High-Performance Computing Systems, -2008    Institute of Computational Technologies SB RAS, Novosibirsk, Russia

## **SELECTED PUBLICATIONS (MOSTLY IN RUSSIAN)**

### **Book Chapters**

1. V.G. Khoroshevsky, M.G. Kurnosov et al. Computational Methods, Algorithms and Hardware and Software Tools for Parallel Modelling of Natural Processes. Chapter 2 on Architecture and Software of Distributed Computer Systems, SB RAS, 2012. – 355 p. (in Russian, ISBN 978-5-7692-1237-6).
2. Kurnosov M. Introduction to Data Structures and Algorithms. – Novosibirsk, 2015. – 179 p. (in Russian, ISBN 978-5-9906983-4-5, <http://dsabook.mkurnosov.net/>)
3. Kurnosov M., Paznikov A. Theory of Distributed Computer Systems Functioning Organization. – Novosibirsk, 2015. – 52 p. (in Russian, ISBN 978-5-9906983-5-2).

### **Dissertation (thesis)**

1. Kurnosov M. Algorithms for Functioning Organization of Hierarchical Distributed Computer Systems (Doctor of Science), Siberian State University of Telecommunications and Information Sciences, Novosibirsk, Russia, October 2016.
2. Kurnosov M. Models and Algorithms of Mapping Parallel Programs into Distributed Computer Systems, Ph.D. Dissertation (Candidate of Science), Siberian State University of Telecommunications and Information Sciences, Novosibirsk, Russia, December 2008 (Advisor: Corresponding Member of RAS Prof. V.G. Khoroshevsky).

### Selected Refereed Journal Articles

1. Kurnosov M., Tokmasheva E. *Shared Memory based MPI Broadcast Algorithms* // Journal “Vestnik SibGUTI”, 2020, No. 1, pp. 42-59 (in Russian).
2. Kurnosov M. *Analysis and Optimization of Pipelined Broadcast Algorithms* // Journal “Vestnik SibGUTI”, 2019, No. 2, pp. 43-56 (in Russian).
3. Peryshkova E., Kurnosov M. *Modeling Network Contention Effects on Process Allocation in Computer Systems* // Journal “Vestnik Tomskogo gosudarstvennogo universiteta. Upravlenie vychislitel'naja tehnika i informatika” (Tomsk State University Journal of Control and Computer Science), 2019, No. 47, pp. 93-101 (in Russian).
4. Kurnosov M. *Analysis and Optimization of a k-chain Reduction Algorithm for Distributed Computer Systems* // Journal “Numerical Methods and Programming”, 2017. – Vol. 17. – pp. 318-328 (in Russian).
5. Kulagin I., Kurnosov M. *Instrumentation and Optimization of Transactional Sections Execution in multithreaded Programs* // Proceedings of the Institute for System Programming. – 2015. – Vol. 27 (6). – pp. 135-150 (in Russian).
6. Kulagin I., Paznikov A. Kurnosov M. *Heuristic Algorithms for Optimizing Communications in Parallel PGAS-programs* // Journal “Vestnik SibGUTI”, 2014, No. 3, pp. 52-66 (in Russian).
7. Pavsky K., Kurnosov M., Polyakov A. *Software Tools for Optimizing Parallel Modeling of Nanostructures with Quantum Dots*. Journal “Avtometriya”, 2014, Vol. 50(3), pp. 56-61 (in Russian).
8. Kurnosov M., Paznikov A. *Heuristic Algorithms for Mapping Parallel MPI Programs into Multicenter Computer and Grid Systems*. Journal “Vichislitel'nie metodi i programmirovaniye”, 2013, Vol. 14(2), pp. 1-10 (in Russian).
9. Kurnosov M. *MPIPerf: a Toolkit for Benchmarking MPI-libraries*. Journal “Vestnik NNGU”, 2012, No. 5(2), pp. 385-391 (in Russian).
10. Kurnosov M., Paznikov A. *Modelling of Decentralized Algorithms for Scheduling Jobs in Grid Systems*, Journal “Problemi informatiki”, 2012, No. 2, pp. 45-54 (in Russian).
11. Kurnosov M., Paznikov A. *Decentralized Algorithms for Scheduling Parallel Tasks in Geographically-distributed Computer Systems*. Journal “Vestnik TGU. Upravlenie, vychislitel'naya tehnika i informatika”, 2012, No. 1(18), pp. 133-142 (in Russian).
12. Kurnosov M. *Allgather Algorithms for Hierarchical Distributed Computer Systems*. Journal “Vestnik Komputernih i Informacionnih Tehnologiy”, 2011, No. 5, pp. 27-34 (in Russian).
13. Khoroshevsky V.G., Kurnosov M.G., Mamoienko S.N., *Geographically-distributed Multicenter Computer System: Architecture and Software*. Journal “Vestnik TGU. Upravlenie, vychislitel'naya tehnika i informatika”, 2011, No. 1(14), pp. 79-84 (in Russian).
14. Kurnosov M. *Optimization of Collective Communications Routines in Computer Systems with Hierarchical Networks*. Journal “Vestnik TGU. Upravlenie, vychislitel'naya tehnika i informatika”, 2011, No. 2(15), pp. 61-71 (in Russian).
15. Kurnosov M., Paznikov A. *Algorithms and Software Tools for Decentralized Scheduling of MPI Programs in Multicenter Computer Systems*. Journal “Vestnik TGU. Upravlenie, vychislitel'naya tehnika i informatika”, 2011, No. 3(16), pp. 78-85 (in Russian).
16. Khoroshevsky V.G., Kurnosov M.G., Mamoienko S.N., Pavsky K.V., Efimov A.V., Paznikov A.A., Perishkova E.N. *Scalable Software Tools for Parallel Multiprogramming in Distributed Computer Systems*. Journal “Vestnik SibGUTI”, 2011, No. 4, pp. 3-18 (in Russian).
17. Kurnosov M. *Structure-oriented Method for Optimizing MPI Collective Communications in Distributed Computer Systems*. Journal “Vestnik SibGUTI”, 2010, No. 2(10), pp. 54-65 (in Russian).
18. Khoroshevsky V.G., Kurnosov M.G., Mamoienko S.N., Polyakov A.Yu. *Architecture and Software tools of multicenter computer systems*. Journal “Vestnik SibGUTI”, 2010, No.2(10), pp. 112-122 (in Russian).
19. Kurnosov M., Paznikov A. *Decentralized Scheduling of Parallel Tasks in Geographically-distributed Computer Systems*. Journal “Vestnik SibGUTI”, 2010, No. 2(10), pp. 79-86 (in Russian).
20. Khoroshevsky V.G., Kurnosov M.G. *Algorithms for Assigning Parallel Program Branches to Computer System Processor Cores* // Optoelectronics, Instrumentation and Data Processing. – 2008. – Vol. 44, No. 2. – P. 135-143.

### Conference/Workshop Proceedings

1. Kurnosov M., Tokmasheva E. *Shared Memory based MPI Broadcast Algorithms for NUMA Systems* // Russian Supercomputing Days: Proceedings of the International Conference, 2020. – P. 1-12.
2. Kurnosov M., Berlizov D., Tkacheva T., Tokmasheva E. *Analysis and Optimization of Pipelined Broadcast Algorithms on Gigabit Ethernet and InfiniBand Networks* // Proc. of the 15th International

- Asian School-Seminar Optimization Problems of Complex Systems (OPCS), 2019. – pp. 86-91. ISBN 978-1-7281-2986-0.
3. Peryshkova E., Kurnosov M. *Experimental Study of Network Contention Effects on All-to-All Operation* // Proc. of the 14th International Scientific-Technical Conference Actual Problems of Electronic Instrument Engineering (APEIE-2018), 2018. – Vol. 6 – P. 506-510.
  4. Moldovanova O., Kurnosov M. *Automatic SIMD Vectorization of Loops: Issues, Energy Efficiency and Performance on Intel Processors* // Russian Supercomputing Days: Proceedings of the International Conference, 2017. – P. 55-66.
  5. Paznikov A., Kurnosov M., Kupriyanov M. *Algorithms of Collective Operations for Distributed Arrays in Partitioned Global Address Space* // 2017 IEEE II International Conference on Control in Technical Systems, Saint Petersburg, Russia, 2017, pp. 5-8.
  6. Moldovanova O., Kurnosov M. *Auto-Vectorization of Loops on Intel 64 and Intel Xeon Phi: Analysis and Evaluation* // Proc. of the 14th International Conference on Parallel Computing Technologies (PaCT-2017), 2017. – Springer LNCS 10421. – P. 143-150.
  7. Kurnosov M. *Dynamic Mapping of All-to-All Collective Operations into Hierarchical Computer Clusters* // Proc. of Int. scientific-technical conference on Actual Problems of Electronic Instrument Engineering (APEIE-2016), 2016. – Vol. 1, Part 2. – 475-478.
  8. Kulagin I., Kurnosov M. *Optimization of conflict detection in parallel programs with transactional memory* // Proc. of 10th Annual International Scientific Conference on Parallel Computing Technologies (PCT-2016). – pp. 582-594.
  9. Kulagin I., Paznikov A., Kurnosov M. *Heuristic Algorithms for Optimizing Communications in Parallel PGAS-programs* // Proc. of the 13th International Conference on Parallel Computing Technologies, 2015. – Springer Lecture Notes in Computer Science. Vol. 9251. – pp. 405-409.
  10. Kurnosov M., Paznikov A. *Efficiency Analysis of Decentralized Grid Scheduling with Job Migration and Replication* // 7th International ACM Conference on Ubiquitous Information Management and Communication (ICUIMC-2013), Malaysia, 2013. – 7 p.
  11. Khoroshevsky V., Kurnosov M. *Mapping Parallel Programs into Hierarchical Distributed Computer Systems* // Proceedings of 4th International Conference “Software and Data Technologies (ICSOFT 2009)”, – Sofia: INSTICC, 2009. – Vol. 2. – P. 123-128.
  12. Kurnosov M.G. *MPIPerf: a Toolkit for Benchmarking MPI-libraries* // Proc. of International conf. “Parallel Computational Technologies”, Novosibirsk, Russia, 2012, pp. 212-223 (in Russian).
  13. Khoroshevsky V., Kurnosov M., Mamoilenko S. *Scalable Multicluster Computer System* // Proc. of International conference “Mathematical and Informational Technologies” (MIT-2011), Serbia, Montenegro, 2011, 6 p. (in Russian).
  14. Kurnosov M.G. *Topology-aware Collective Communication Algorithms for Distributed Computer Systems* // Proc. of Conference “Supercomputer technologies: development, programming, application” (SCT-2010), Divnomorskoe, Russia, 2010, Vol. 2, pp. 62-66 (in Russian).
  15. Kurnosov M.G. *Structure-oriented Subsystems Allocation in Computer Systems* // Proc. of conference “High-performance parallel computing on clusters”, Kazan, Russia, 2008 (in Russian).
  16. Khoroshevsky V., Kurnosov M. *Modelling of Algorithms for Mapping Parallel Applications into Structures of Computer Systems* // Proc. of international conf. “Simulation-2008”, Kiev, Ukraine, 2008, Vol. 2, pp. 435-440 (in Russian).
  17. Kurnosov M. *Parallel Algorithm for Mapping Communication Graph of MPI Task into Computer System* // Proc. of international conf. “Parallel Computational Technologies”, Chelyabinsk, Russia, 2008 (in Russian).
  18. Kurnosov M. *Experience in Building Computer Clusters with a Remote Diskless Boot* // Proc. of conference “High-performance parallel computing on clusters”, Nizhny Novgorod, 2005, pp. 149-154 (in Russian).

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#### RESEARCH GRANTS (PRINCIPLE INVESTIGATOR)

1. Models and methods of analyzing and organizing of multiprogram execution of parallel programs on large-scale computer systems, Russian Foundation for Basic Research, 2018-2020
2. Models, algorithms and software for optimizing PGAS-programs, Russian Foundation for Basic Research, 2015-2017

3. Algorithms and system software for optimizing functioning of hierarchical computer systems, Russian Foundation for Basic Research, 2015-2016
4. Models, Methods and Software for Efficient Execution of Parallel Programs on Multiarchitectural Computer Systems, Russian Foundation for Basic Research, 2011-2013
5. Topology-aware Algorithms and Software for Functioning Organization of Distributed Computer Systems, Russian Foundation for Basic Research, 2008-2010
6. Development of Tools for Mapping Parallel MPI Programs into Multicore Computer Clusters, Foundation for Assistance to Small Innovative Enterprises, 2008-2009
7. Grant of Novosibirsk's Administration, 2009