Ivan Oseledets

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Research interests

Numerical analysis, linear algebra, tensor methods, high-dimensional problems, quantum chemistry, stochastic partial differential equations, wavelets, data mining

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Education/Scientific degrees

2012	**Doctor of Sciences in Numerical Mathematics**, *Institute of Numerical Mathematics of Russian Academy of Sciences*, Russia.
2007	**Ph.D. in Numerical Mathematics**, *Institute of Numerical Mathematics of Russian Academy of Sciences*, Russia, *Supervisor Prof. Eugene Tyrtyshnikov*.
2000-2006	**B.Sc, M.Sc. in Applied Mathematics and Physics**, *Moscow Institute of Physics and Technology*, Russia, *Supervisor Prof. Eugene Tyrtyshnikov*. With honors.
1996-2000	**Lyceum "Second School"**, *Moscow*, Russia.

Doctor of sciences thesis

title
: *Numerical tensor methods and their applications*

description
: I developed a new efficient and stable representation for the high-dimensional tensors — Tensor Train (TT) format, which has no inheritent curse of dimensionality. I proposed fast and efficient algorithms to perform basic linear algebra operations with tensors in the TT-format (including approximation of a full tensor, addition of tensors, matrix-by-vector product) in a stable way using QR and SVD factorization and in linear complexity in the dimension of the tensor. I also proposed an interpolation formula for low-rank tensors that allows to recover the full tensor only from a small amount of its entries. I demonstrate how the TT-format can be applied to the solution of the high-dimensional problems in quantum chemistry, to the solution of stochastic partial differential equations and to multidimensional data compression.

PhD thesis

title
: *Nonlinear approximation of matrices*

supervisor
: Prof. Eugene Tyrtyshnikov

description
: I constructed efficient algorithms for several problems of non-linear approximation of matrices, based on the low-rank approximation techniques. The problems include approximation by a sum of a circulant plus low rank matrix (with application to preconditioning of Toeplitz systems), approximation by a sparse plus low rank matrix (with application to missing data estimation) and approximation of the inverse matrix by a sum of Kronecker product using a Newton-type algorithm with truncations.

Master thesis

title	*A unifying approach to the construction of circulant preconditioners*
supervisor	Prof. Eugene Tyrtyshnikov
description	I proposed a finite algorithm ("black dots method") for the circulant plus low-rank approximation. The circulant counterpart is then guaranteed to yield a good preconditioner for the given matrix

Bachelor thesis

title	*On a method for the construction of discrete wavelet transforms using divided differences*
supervisor	Prof. Eugene Tyrtyshnikov
description	I derived an explicit parametization of discrete wavelet-like transforms on nonuniform grids with a given number of zero moments using lifting scheme and divided differences. The numerical experiments show that the transforms yield better compression that Daubechies transforms of similar complexity

Academic positions

2013-present	**Associate Professor**, *Skolkovo Institute of Science and Technology*, Moscow Region, Head of Scientific Computing Group.
2003–present	**part-time researcher (2003-2006),junior researcher (2006-2007),researcher (2007-2008),senior researcher(2008-2014), leading researcher(2014-present)**, *Institute of Numerical Mathematics of Russian Academy of Sciences*, Moscow, the group "Matrix methods in mathematics and applications" (group leader Prof. Eugene Tyrtyshnikov).

Visiting positions

2012	**Invited professor in the Trimester program for Numerical methods in higher dimensons**, *Bonn*, Hausdorf Institute for Mathematics.
2009-2012	**Invited researcher in Max-Planck Institute for Mathematics in den Naturwissenschaften**, *Leipzig*, group of W. Hackbusch.

Selected honors and awards

2012	**Winner of Dynasty Foundation contest among young mathematicians**.
2009	**Medal for the best scientific work among young scientists in Mathematics in 2009 (joint with D.V. Savostyanov)**, *Russian Academy of Sciences*, Moscow, Russia. Every year, RAS awards prizes to young scientists for best research, usually no more than two in each of 19 areas of sciences.
2005	**Medal for the best student scientific work in Mathematics in 2005**, *Russian Academy of Sciences*, Moscow, Russia. Every year RAS awards prizes to students of Russian institutes and universities, usually no more than two in each of 19 areas of sciences.

Grants and projects

I have served as PI for the following grants and projects:

2014- **Russian Science Foundation grant, "Theory and algorithms for the approximation of multidimensional arrays.**

2013-2014 **Yandex company, grant "Matrix and tensor methods for optimization and data mining".**

2012-2013 **Ministry of Science and Education, grant 8235 "Web-based educational computing system".**

2012-2014 **Russian Foundation for Basic Research, grant 12-01-00546-a "Tensor methods for complex configurations of particles".**

2011-2013 **Russian Government contract Π1065 "Development of efficient software for photonic electronic spectrometer".**

2010-2012 **Russian Government contract Π1112 "Methods for the solution of differential equations with highly varying coefficients".**

2011-2012 **Russian President Grant for the young PhD scientists MK-140.2011.1 "Numerical tensor methods and their applications".**

2009-2011 **Russian Government contract Π1178 "Tensor methods for compression of signals, images and videos".**

2009-2011 **Russian Fund for Basic Research, grant 09-01-00565-a "Matrix methods for many-body problems".**

2009-2010 **Russian President Grant for the young PhD scientists MK-127.2009.1 "Approximation of multidimensional arrays and numerical solution of problems in high dimensions".**

Courses taught

2014-present **Numerical Linear Algebra**, *Skoltech*.

2014-present **Fast methods for partial differential and integral equations**, *Skoltech*.

2010-2013 **Matrix methods for data compression and analysis**, *Moscow Institute of Physics and Technology*.

2009-2013 **Modern computational technologies**, *Moscow State University*.

Research advising

Doctoral advising

Alexander Mikhalev, Moscow State University. Graduated: 2014.

Dariya Sushnikova, Institute of Numerical Mathematics of Russian Academy of Sciences. Expected graduation: 2016.

Denis Kolesnikov, Skoltech. Expected graduation: 2018

, Maxim Rakhuba, MIPT/Skoltech. Expected graduation: 2018

, Vitaly Baranov. Skoltech. Expected graduation: 2018

, Andrey Chertkov. Skoltech. Expected graduation: 2018

, Evgeny Frolov. Skoltech. Expected graduation: 2018

, Maxim Kuznetsov. Skoltech. Expected graduation: 2018

,   Pavel Kharyuk. Skoltech. Expected graduation: 2018
,   Alexander Fonarev. Skoltech. Expected graduation: 2018
,   Stanislav Ashmanov. Skoltech. Expected graduation: 2018
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Professional service

Reviewer for the following journals

Applied Numerical Mathematics

Digital Signal Processing

IEEE Transactions on Very Large Scale Integration Systems

IET Information Security

Journal of Computational and Applied Mathematics

Journal of Computational Mathematics and Mathematical Physics

Linear Algebra and its Applications

Linear and Multilinear Algebra

Mathematics of Computation

Mathematical Notes

Numerische Mathematik

Numerical Linear Algebra and its Applications

Russian Journal of Numerical Analysis and Mathematical Modelling

Sbornik: Mathematics

SIAM Journal on Scientific Computing

SIAM Journal on Matrix Analysis

SIAM Journal on Numerical Analysis

SIAM Journal on Optimization

SIAM Journal on Uncertainty Quantification

Theoretical Computer Science

Journal of Computational Physics

Service

2009-2012	Member of the Council of young scientists of Russian Academy of Sciences
2012-2015	Member of the expert commitee on the projects by young scientists, Russian Foundation for Basic research

Software development

2009-present	**TT-Toolbox**, *http://github.com/oseledets/TT-Toolbox*. Efficient algorithms for tensors in the TT-format, including basic linear algebra and advanced solvers, MATLAB, see http://www.ohloh.net/p/TT-Toolbox
2008-2009	**Fast multiplication of polynomials over GF(2)**. Generator of optimal algorithms of multiplication of polynomials over GF(2)

2009-present	**h2tools**, *http://bitbucket.org/muxas/h2tools*. Efficient open-source code for the solution of integral equations/N-body problems using hierarchical matrices and nested cross approximation

Invited and plenary talks

March 2015	**Low-rank approximation of matrices and tensor with application to dynamical and optimization problems**, *SIAM CSE*, Salt Lake City, USA.
January 2015	**Tensor methods for numerical solution of PDEs**, *New Discretization Methods for the Numerical Approximation of PDEs*, Oberwolfach, Germany.
June 2014	**Numerical tensor methods: algorithms and tools**, *ECMTB*, Groningen, Sweden.
March 2014	**Numerical tensor methods: tools and applications**, *SIAM Conf. Imag. Sciences*, Hong Kong.
January 2014	**Multidimensional numerical algorithms and their applications**, *Conference on numerical analysis and scientific computing*, Leipzig, Germany.
July 2013	**Numerical tensor methods in higher dimensions**, *Workshop on Novel Numerical methods*, Munich, Germany.
June 2013	**Numerical tensor methods: multiparametric and non-stationary problems**, *MODRED 2013*, Luminy, France.
June 2013	**Numerical tensor methods and their applications**, *ILAS 2013*, Providence, USA.
September 2012	**Computational tensor methods and their applications**, *SLMA 2012*, KU Leuven.
January 2012	**Problems that tensor methods can not solve yet (invited talk)**, *28 GAMM Seminar*, MPI MIS, Leipzig.
August 2011	**Multiparametric model reduction using TT-format. (invited talk)**, *ILAS 2012*, TU Braunschweig.
August 2011	**TT-approach to the solution of high-dimensional problems (invited talk)**, *HDA 2011*, Uni. Bonn.
April 2011	**Computational tensor methods in physics, chemistry and mathematics (plenary talk)**, *24*, Saratov, Russia.
March 2011	**Advanced operations in TT-format and QTT-formats. (invited talk**, *Comput. meth. in multidimensional applications*, MPI MIS, Leipzig.
January 2011	**QTT-approach to the solution of high-dimensional problems (invited talk)**, *27 GAMM Seminar*, MPI MIS, Leipzig.
June 2010	**Algorithms and applications of TT-decompositions (plenary talk)**, Novosibirsk, Russia.
May 2010	**Applications and development of TT and QTT format (invited talk)**, *Tensor meth. in multidim. boundary value and spectral problems*, MPI MIS, Leipzig.
September 2010	**Computational tensor methods and their applications**, *Theory and numerical methods for the inverse problems*, Novosibirsk, Russia.
September 2010	**Tensor trains, TT and QTT formats (plenary talk)**, *Separation of variables and applications*, Nice.
June 2010	**Algorithms and applications of TT and QTT decompositions**, *ILAS-2010*, Pisa.
February 2010	**TT-decomposition of tensors with application to high-dimensional problems and data compression (invited talk)**, *26 GAMM Seminar*, MPI MIS, Leipzig.

October 2009	**Compact matrix form of the d-dimensional tensor decomposition (invited talk)**, *NOLTA*, Sapporo.
February 2009	**Breaking the curse of dimensionality, or how to use SVD in many dimensions (invited talk)**, *GAMM*, Gdansk.
December 2008	**Some new results and algorithms for tensor-structured matrices in 3D problems (invited talk)** , *SCPDE*, Hong Kong.
September 2008	**Parallel solution of linear systems over finite fields and optimal multiplication of matrix polynomials (invited talk)** , *Cortona-2008*.
September 2008	**Some new results and algorithms for tensor-structured matrices in 3D problems (invited talk)**, *Conference on numerical matrix analysis and operator theory (invited talk)*, Helsinki.
July 2007	**Fast multiplication of matrix polynomials and some tricks for the computation of trilinear decomposition in GF(2) (invited talk)**, *ICCMOE*, INM RAS, Moscow.

Peer-reviewed publications

1. Christian Lubich, Ivan Oseledets, and Bart Vandereycken. Time integration of tensor trains. *SIAM J. Numer. Anal.*, 53(2):917–941, 2015.

2. M. V. Rakhuba and I. V. Oseledets. Fast multidimensional convolution in low-rank tensor formats via cross approximation. *SIAM J. Sci. Comput.*, 37(2):A565–A582, 2015.

3. Zhang Zheng, Xiu Yang, Ivan V. Oseledets, George Em Karniadakis, and Luca Daniel. Enabling high-dimensional hierarchical uncertainty quantification by ANOVA and Tensor-Train decomposition. *IEEE Trans. Comput-aided Des. Integr. Circuits Syst.*, 34(1):63–76, 2015.

4. P. A. Absil and I. V. Oseledets. Low-rank retractions: a survey and new results. *Comput. Optim. Appl.*, 2014.

5. M. A. Botchev, I. V. Oseledets, and E. E. Tyrtyshnikov. Iterative across-time solution of linear differential equations: Krylov subspace versus waveform relaxation. *Comput. Math. Appl.*, 67(2):2088–2098, 2014.

6. Anwesha Chaudhury, Ivan Oseledets, and Rohit Ramachandran. A computationally efficient technique for the solution of multi-dimensional PBMs of granulation. *Comput. Chem. Eng.*, 61(11):234–244, 2014.

7. S. V. Dolgov, B. N. Khoromskij, I. V. Oseledets, and D. V. Savostyanov. Computation of extreme eigenvalues in higher dimensions using block tensor train format. *Computer Phys. Comm.*, 185(4):1207–1216, 2014.

8. Mikhail S. Litsarev and Ivan V. Oseledets. The DEPOSIT computer code based on the low rank approximations. *Computer Phys. Comm.*, 185(10):2801–2082, 2014.

9. Christian Lubich and Ivan V. Oseledets. A projector-splitting integrator for dynamical low-rank approximation. *BIT*, 54(1):171–188, 2014.

10. I. V. Oseledets. Constructive representation of functions in low-rank tensor formats. *Constr. Approx.*, 37(1):1–18, 2013.

11. S. V. Dolgov, Boris N. Khoromskij, and Ivan V. Oseledets. Fast solution of multi-dimensional parabolic problems in the tensor train/quantized tensor train–format with initial application to the Fokker-Planck equation. *SIAM J. Sci. Comput.*, 34(6):A3016–A3038, 2012.

12. S. V. Dolgov, Boris N. Khoromskij, Ivan V. Oseledets, and Eugene E. Tyrtyshnikov. Low-rank tensor structure of solutions to elliptic problems with jumping coefficients. *J. Comput. Math.*, 30(1):14–23, 2012.

13. Sergey Dolgov, Boris N. Khoromskij, Ivan V. Oseledets, and Eugene E. Tyrtyshnikov. A reciprocal preconditioner for structured matrices arising from elliptic problems with jumping coefficients. *Linear Algebra Appl.*, 436(9):2980–3007, 2012.

14. S. A. Goreinov, I. V. Oseledets, and D. V. Savostyanov. Wedderburn rank reduction and Krylov subspace method for tensor approximation. Part 1: Tucker case. *SIAM J. Sci. Comput.*, 34(1):A1–A27, 2012.

15. I. V. Oseledets and S. V. Dolgov. Solution of linear systems and matrix inversion in the TT-format. *SIAM J. Sci. Comput.*, 34(5):A2718–A2739, 2012.

16. I. V. Oseledets and A. Yu Mikhalev. Representation of quasiseparable matrices using excluded sums and equivalent charges. *Linear Algebra Appl.*, 436(3):699–708, 2012.

17. B. N. Khoromskij and I. V. Oseledets. QTT-approximation of elliptic solution operators in higher dimensions. *Rus. J. Numer. Anal. Math. Model.*, 26(3):303–322, 2011.

18. I. V. Oseledets. DMRG approach to fast linear algebra in the TT–format. *Comput. Meth. Appl. Math.*, 11(3):382–393, 2011.

19. I. V. Oseledets. Improved n-term Karatsuba-like formulas in GF(2). *IEEE Trans. Computers*, 60(8):1212–1216, 2011.

20. I. V. Oseledets. Tensor-train decomposition. *SIAM J. Sci. Comput.*, 33(5):2295–2317, 2011.

21. I. V. Oseledets and E. E. Tyrtyshnikov. Algebraic wavelet transform via quantics tensor train decomposition. *SIAM J. Sci. Comput.*, 33(3):1315–1328, 2011.

22. I. V. Oseledets, E. E. Tyrtyshnikov, and N. L. Zamarashkin. Tensor-train ranks of matrices and their inverses. *Comput. Meth. Appl. Math*, 11(3):394–403, 2011.

23. B. N. Khoromskij and I. V. Oseledets. Quantics-TT collocation approximation of parameter-dependent and stochastic elliptic PDEs. *Comput. Methods Appl. Math.*, 10(4):376–394, 2010.

24. I. V. Oseledets. Approximation of $2^d \times 2^d$ matrices using tensor decomposition. *SIAM J. Matrix Anal. Appl.*, 31(4):2130–2145, 2010.

25. I. V. Oseledets and E. A. Muravleva. Fast orthogonalization to the kernel of discrete gradient operator with application to the Stokes problem. *Linear Algebra Appl.*, 432(6):1492–1500, 2010.

26. I. V. Oseledets, D. V. Savostyanov, and E. E. Tyrtyshnikov. Cross approximation in tensor electron density computations. *Numer. Linear Algebra Appl.*, 17(6):935–952, 2010.

27. I. V. Oseledets and E. E. Tyrtyshnikov. TT-cross approximation for multidimensional arrays. *Linear Algebra Appl.*, 432(1):70–88, 2010.

28. I. V. Oseledets. Approximation of matrices with logarithmic number of parameters. *Doklady Math.*, 428(1):23–24, 2009.

29. I. V. Oseledets. A new tensor decomposition. *Doklady Math.*, 80(1):495–496, 2009.

30. I. V. Oseledets, D. V. Savostyanov, and E. E. Tyrtyshnikov. Fast simultaneous orthogonal reduction to triangular matrices. *SIAM J. Matrix Anal. Appl.*, 31(2):316–330, 2009.

31. I. V. Oseledets, D. V. Savostyanov, and E. E. Tyrtyshnikov. Linear algebra for tensor problems. *Computing*, 85(3):169–188, 2009.

32. I. V. Oseledets, S. L. Stavtsev, and E. E. Tyrtyshnikov. Integration of oscillating functions in a quasi-threedimensional electrodynamic problem. *Comput. Math. Math. Phys*, 49(2):301–312, 2009.

33. I. V. Oseledets and E. E. Tyrtyshnikov. Breaking the curse of dimensionality, or how to use SVD in many dimensions. *SIAM J. Sci. Comput.*, 31(5):3744–3759, 2009.

34. I. V. Oseledets and E. E. Tyrtyshnikov. Recursive decomposition of multidimensional tensors. *Doklady Math.*, 427(1):14–16, 2009.

35. I. V. Oseledets, E. E. Tyrtyshnikov, and N. L. Zamarashkin. Matrix inversion cases with size-independent rank estimates. *Linear Algebra Appl.*, 431(5-7):558–570, 2009.

36. I. V. Oseledets, E. E. Tyrtyshnikov, and N. L. Zamarashkin. Tensor structure of the inverse of a banded Toeplitz matrix. *Doklady Math.*, 80(2):669–670, 2009.

37. V. Olshevsky, I. V. Oseledets, and E. E. Tyrtyshnikov. Superfast inversion of two-level Toeplitz matrices using Newton iteration and tensor-displacement structure. *Operator Theory: Advances and Applications*, 179:229–240, 2008.

38. I. V. Oseledets. The integral operator with logarithmic kernel has only one positive eigenvalue. *Linear Algebra Appl.*, 428(7):1560–1564, 2008.

39. I. V. Oseledets. Optimal Karatsuba-like formulae for certain bilinear forms in GF(2). *Linear Algebra Appl.*, 429(8):2052–2066, 2008.

40. I. V. Oseledets, D. V. Savostianov, and E. E. Tyrtyshnikov. Tucker dimensionality reduction of three-dimensional arrays in linear time. *SIAM J. Matrix Anal. Appl.*, 30(3):939–956, 2008.

41. I. V. Oseledets. Lower bounds for separable approximations of the Hilbert kernel. *Mat. Sb.*, 198(3):137–144, 2007.

42. V. Olshevsky, I. V. Oseledets, and E. E. Tyrtyshnikov. Tensor properties of multilevel Toeplitz and related matrices. *Linear Algebra Appl.*, 412(1):1–21, 2006.

43. I. V. Oseledets and D. V. Savostyanov. Minimization methods for approximating tensors and their comparison. *Comput. Math. Math. Phys.*, 46(10):1641–1650, 2006.

44. I. V. Oseledets and E. E. Tyrtyshnikov. A unifying approach to the construction of circulant preconditioners. *Linear Algebra Appl.*, 418(2-3):435–449, 2006.

45. I. V. Oseledets, E. E Tyrtyshnikov, and N. L. Zamarashkin. On the approximation of Toeplitz matrices by a sum of the circulant and low-rank matrix. *Doklady Math.*, 406(5):602–603, 2006.

46. I. V. Oseledets. Use of divided differences and B-splines for constructing fast discrete transforms of wavelet type on nonuniform grids. *Math. Notes*, 77(5-6):686–694, 2005.

47. I. V. Oseledets and E. E. Tyrtyshnikov. Approximate inversion of matrices in the process of solving a hypersingular integral equation. *Comput. Math. Math. Phys.*, 45(2):302–313, 2005.

48. J. M. Ford, I. V. Oseledets, and E. E. Tyrtyshnikov. Matrix approximations and solvers using tensor products and non-standard wavelet transforms related to irregular grids. *Russ. J. Numer. Anal. Math. Modelling*, 19(2):185–204, 2004.

Technical reports

49. M. S. Litsarev and I. V. Oseledets. Low-rank approach to the computation of path integrals. arXiv preprint 1504.06149, 2015.

50. A. Yu. Mikhalev and I. V. Oseledets. Rectangular maximum-volume submatrices and their applications. arXiv preprint 1502.07838, 2015.

51. I. V. Oseledets, G. V. Ovchinnikov, and A. M. Katrutsa. Linear complexity SimRank using iterative diagonal estimation. arXiv preprint 1502.07167, 2015.

52. Igor Ostanin, Denis Zorin, and Ivan Oseledets. Toward fast topological-shape optimization. arXiv preprint 1503.02383, 2015.

53. Ben Usman and Ivan Oseledets. Tensor SimRank for heterogeneous information networks. arXiv preprint 1502.06818, 2015.

54. Jutho Haegeman, Christian Lubich, Ivan Oseledets, Bart Vandereycken, and Frank Verstraete. Unifying time evolution and optimization with matrix product states. arXiv preprint 1408.5056, 2014.

55. D. A. Kolesnikov and I. V. Oseledets. From low-rank approximation to an efficient rational Krylov subspace method for the Lyapunov equation. arXiv preprint 1410.3335, 2014.

56. Vadim Lebedev, Yaroslav Ganin, Maxim Rakhuba, Ivan Oseledets, and Victor Lempitsky. Speeding up convolutional neural networks using fine-tuned CP-decomposition. arXiv preprint 1412.6553, 2014.

57. M. S. Litsarev and I. V. Oseledets. Low rank approximations for the DEPOSIT computer code. arXiv preprint 1403.4068, 2014.

58. I. V. Oseledets and G. V. Ovchinnikov. Fast, memory efficient low-rank approximation of SimRank. arXiv preprint 1410.0717, 2014.

59. Ivan Oseledets. Solving high-dimensional problems via stable and efficient tensor factorization techniques. In *Abstracts of Papers of the American Chemical Society*, volume 246, pages 244–Phys, 2014.

60. G. V. Ovchinnikov, D. A. Kolesnikov, and I. V. Oseledets. Algebraic reputation model RepRank and its application to spambot detection. arXiv preprint 1411.5995, 2014.

61. Daria Sushnikova and Ivan V. Oseledets. Preconditioners for hierarchical matrices based on their extended sparse form. arXiv preprint 1412.1253, 2014.

62. Vladimir A. Kazeev and Ivan V. Oseledets. The tensor structure of a class of adaptive algebraic wavelet transforms. Preprint 2013-28, ETH SAM, Zürich, 2013.

63. Vladimir Lyashev, Ivan Oseledets, and Delai Zheng. Tensor-based multiuser detection and intra-cell interference mitigation in LTE PUCCH. In *Proc. TELFOR 2013*, pages 385–388, 2013.

64. A. Yu. Mikhalev and I. V. Oseledets. Adaptive nested cross approximation of non-local operators. arXiv preprint 1309.1773, 2013.

65. E.A. Muravleva and I.V. Oseledets. Fast low-rank solution of the Poisson equation with application to the Stokes problem. arXiv preprint 1306.2150, 2013.

66. I. V. Oseledets, B. N. Khoromskij, and R. Schneider. Efficient time-stepping scheme for dynamics on TT-manifolds. Preprint 24, MPI MIS, 2012.

67. I. V. Oseledets. Tensor train decomposition for low-parametric representation of high-dimensional arrays and functions: Review of recent results. In *Proceedings of 7th International Workshop on Multidimensional Systems (nDS)*. IEEE, 2011.

68. D. V. Savostyanov and I. V. Oseledets. Fast adaptive interpolation of multi-dimensional arrays in tensor train format. In *Proceedings of 7th International Workshop on Multidimensional Systems (nDS)*. IEEE, 2011.

69. S. Dolgov, B. Khoromskij, I. V. Oseledets, and E. E. Tyrtyshnikov. Tensor structured iterative solution of elliptic problems with jumping coefficients. Preprint 55, MPI MIS, Leipzig, 2010.

70. B. N. Khoromskij and I. V. Oseledets. DMRG+QTT approach to computation of the ground state for the molecular Schrödinger operator. Preprint 69, MPI MIS, Leipzig, 2010.

71. I. V. Oseledets and E. E. Tyrtyshnikov. Tensor tree decomposition does not need a tree. Preprint (Submitted to Linear Algebra Appl) 2009-04, INM RAS, Moscow, 2009.

Personal information

Citizenship **Russia**.

Date of birth **6 July 1983**.

Languages **English: fluent**.