

KONSTANTIN LIPNIKOV

CURRICULUM VITAE

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Education:

- Ph.D. Mathematics, University of Houston, May 2002
Thesis: *Numerical Methods for the Biot Model in Poroelasticity*
Adviser: *Yuri A. Kuznetsov*
- M.S. Mathematics, University of Houston, Fall 2000, GPA 3.94/4.00
- M.S. Applied Mathematics, Moscow Institute of Physics and Technology, 1990,
Moscow Region, RUSSIA

Employment History:

- 06/2013 – *present* *Senior Research Staff Member*
Applied Mathematics and Plasma Physics, Theoretical Division
Los Alamos National Laboratory, Los Alamos, NM
- 01/2005 – 05/2013 *Research Staff Member*
Applied Mathematics and Plasma Physics, Theoretical Division
Los Alamos National Laboratory, Los Alamos, NM
- 06/2002 – 12/2004 *Postdoctoral Research Associate*
Mathematical Modeling and Analysis Group, Theoretical Division
Los Alamos National Laboratory, Los Alamos, NM
- 06/2001 – 08/2001 *Graduate Research Assistant*
Mathematical Modeling and Analysis Group, Theoretical Division
Los Alamos National Laboratory, Los Alamos, NM
- 09/2000 – 05/2002 *Research Assistant*
Department of Mathematics, University of Houston, Houston, TX
- 06/2000 – 07/2000 *Graduate Research Assistant*
Computational Fluid Dynamics Laboratory,
University of Texas, Austin, TX

Revised: Apr 2017

- 01/1999 – 05/2000 *Research Assistant/Teaching Assistant*
Department of Mathematics, University of Houston, Houston, TX
- 09/1993 – 01/1999 *Research Staff Member*
Institute of Numerical Mathematics, Moscow, RUSSIA
- 09/1990 – 07/1993 *Research Assistant*
Moscow Institute of Physics and Technology, Moscow, RUSSIA

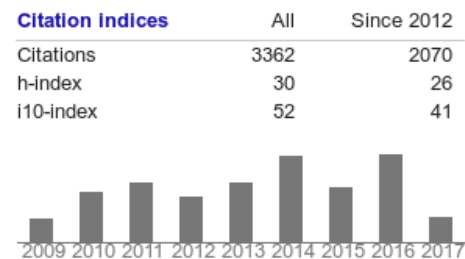
Publications:

Books and Book Chapters:

1. *Discretization of Mixed Formulations of Elliptic Problems on Polyhedral Meshes*, In "Building Bridges: Connections and Challenges in Modern Approaches to Numerical Partial Differential Equations, Springer, 2016, 309–340. (with G.Manzini).
2. *The Mimetic Finite Difference Method for Elliptic PDEs*. Springer, 2014, 408p (with L.Beirao da Veiga and G.Manzini).
3. *Automated Technologies for Generation Unstructured Meshes*. Fizmatlit, Moscow, Vol.4 of "Nonlinear computational solid mechanics", Editor V.Levin (with Yu.Vassilevski, A.Danilov and B.Chugunov), 2016, 216p, in Russian.

Invited:

4. M-Adaptation in the mimetic finite difference method. *Math. Models Methods Appl. Sci.* **24** (2014), 1621-1663. (with V.Gyrya, G.Manzini, D.Svyatskiy).
5. On discrete boundaries and solution accuracy in anisotropic adaptive meshing. *Engrg. Computers*, **26** (2010), 281–288 (with Yu.Vassilevski).
6. Solution of the diffusion equation in multi-material domains by subdivision of elements along reconstructed interfaces. *Int. J. Numer. Meth. Fl.*, **65**:11-12, (2011), 1423–1437 (with R.Garimella).
7. A new discretization methodology for diffusion problems on generalized polyhedral meshes, *Comput. Methods Appl. Mech. Engrg.*, **196** (2007), 3682–3692 (with F.Brezzi, M.Shashkov and V.Simoncini).
8. The error-minimization-based strategy for moving mesh methods. *Communications in Computational Physics*, **1**:1 (2006), 53–81 (with M.Shashkov).
9. Hessian recovery method for adaptive mesh generation, *Voprosy Atomnoj Nauki i Tehniki*. Ser. "Mathematical modeling of physical processes", **3** (2006), 37–53 (with Yu.Vassilevski).



10. A node reconnection algorithm for mimetic finite difference discretizations of elliptic equations on triangular meshes, *Communications in Mathematical Sciences*, **3**:4 (2005), 665–680 (with M.Berndt, M.Shashkov and P.Vachal).
11. Hessian based anisotropic mesh adaptation in domains with discrete boundaries, *Russian J. Numer. Analysis Math. Modelling*, **20**, No.4 (2005), 391–402 (with V.Dyadechko and Yu.Vassilevski).
12. On control of adaptation in parallel mesh generation, *Engineering with Computers*, **20** (2004), 193–201 (with Yu.Vassilevski).

Peer-Reviewed:

13. Second-order accurate finite volume schemes with the discrete maximum principle for solving Richards' equation on unstructured meshes *Adv. Water Res.* (2017), published online March 18 (with D.Svyatskiy).
14. The mimetic finite difference method for the Landau-Lifshitz equation. *JCP* **328** (2017), 109-130 (with E.Kim).
15. New preconditioning strategy for Jacobian-free solvers for variably saturated flows with Richards' equation. *Adv. Water Res.* **94** (2016), 11-22 with (D.Svyatskiy and J.D.Moulton).
16. The nonconforming virtual element method. *M2AN: Math. Model. Numer. Anal.* **50**:3 (2016), 879–904 (with B.Ayuso de Dios and G.Manzini).
17. The arbitrary order mixed mimetic finite difference method for the diffusion equation. *M2AN: Math. Model. Numer. Anal.* **50**:3 (2016), 851–877 (with V.Gyrya, G.Manzini).
18. The mimetic finite difference method for elliptic and parabolic problems with a staggered discretization of diffusion coefficient, *J. Comp. Phys.* **305** (2016), 113–126 (with G.Manzini, J.D.Moulton and M.Shashkov).
19. Mesh Infrastructure for Coupled Multiprocess Geophysical Simulations. *Procedia Eng.* **82** (2014) 34–45 (with R.Garimella, W.Perkins, M.Buksas, M.Berndt, E.Coon, J.Moulton and S.Painter).
20. A high-order mimetic method on unstructured polyhedral meshes for the diffusion equation *J. Comp. Phys.* **272**:1 (2014), 360–385 (with G.Manzini).
21. A Lagrangian staggered grid Godunov-like approach for hydrodynamics, *J. Comp. Phys.* **259** (2014), 568–597. (with N.Morgan, D.Burton and M.Kenamond).
22. Mimetic finite difference method, *J. Comp. Phys.*, **257** (2014), 1163–1227, a review paper (with G.Manzini and M.Shashkov).
23. Discontinuous Galerkin and Mimetic Finite Difference Methods for Coupled Stokes-Darcy Flows on Polygonal and Polyhedral Grids *Numer. Mathematik*, **126**:2, (2014), 321–360 (with I.Yotov and D.Vassilev).

24. Second-order accurate monotone finite volume scheme for Richards' equation. *J. Comp. Phys.* **239** (2013), 123–137 (with O.Misitas).
25. Anderson acceleration for nonlinear finite volume scheme for advection-diffusion problems. *SIAM J. Sci. Comput.*, **35**: 2, (2013), A1120–A1136. (with D.Svyatskiy, Yu.Vassilevski).
26. On the reconstruction of Darcy velocity in finite volume methods. *Transport in Porous Media*, **96** (2013), 337–351. (with G.Srinivasan).
27. Mimetic discretization of two-dimensional magnetic diffusion equations, *J. Comp. Phys.* **247** (2013), 1–16 (with J.Reynolds, E.Nelson).
28. M-adaptation method for acoustic wave equation on square meshes. *J. Comp. Acoustics* **20**:4 (2012), 1250022-1:23 (with V.Gyrya).
29. Minimal stencil finite volume scheme with the discrete maximum principle. *Russ. J. Numer. Anal. Math. Modelling*, **27**:4 (2012), 369–385. (with D.Svyatskiy and Yu.Vassilevski).
30. Arbitrary order nodal mimetic discretizations of elliptic problems on polygonal meshes, *SIAM J. Numer. Anal.*, **49**:5 (2011), 1737–1760 (with L. Beirao da Veiga, G.Manzini).
31. Families of meshes minimizing P_1 interpolation for functions with indefinite Hessian. *Russ. J. Numer. Anal. Math. Modelling*, **26**:4 (2011), 337–352. (with Agouzal, and Yu. Vassilevski).
32. Adaptive strategies in the multilevel multiscale mimetic M^3 method for two-phase flows in porous media. *Multiscale Modeling and Simulation*, **9**:3 (2011), 991–1016. (with D.Moulton and D.Svyatskiy).
33. Analysis of the monotonicity conditions in the mimetic finite difference method for elliptic problems. *J. Comp. Phys.*, **230** (2011), 2620–2642 (with M.Manzini and D.Svyatskiy).
34. On optimal convergence rate of finite element solutions of boundary value problems on adaptive anisotropic meshes. *Math. Comput. Simul.*, **81**:10 (2011), 1949–1961 (with A.Agouzal and Yu.Vassilevski).
35. The mimetic finite difference method for the 3D magnetostatic field problems on polyhedral meshes, *J. Comp. Phys.*, **230**:2 (2011), 305–328. (with M.Manzini, F.Brezzi and A.Buffa).
36. Effective shear viscosity and dynamics of suspensions of micro-swimmers at moderate concentrations. *J. Math. Biol.*, **62**:5 (2011), 2010, 707–740. (with V. Gyrya, I. Aronson and L. Berlyand).
37. Edge-based a posteriori error estimators for generating quasi-optimal simplicial meshes. *Math. Mod. Nat. Phenom.*, **5**:7 (2010), 91–96. (with A.Agouzal and Yu.Vassielvski).

38. A mimetic tensor artificial viscosity method for arbitrary polyhedral meshes. *Procedia Computer Science*, **1:1** (2010), 1915–1923. (with M.Shashkov).
39. A multiscale multilevel mimetic (M3) method for well-driven flows in porous media. *Procedia Computer Science*, **1:1** (2010), 771–779. (with J.D.Moulton and D.Svyatskiy).
40. Error analysis for a mimetic discretization of the steady Stokes problem on polyhedral meshes. *SIAM J. Numer. Anal.*, **48:4** (2010), 1419–1443. (with L.Beirao da Veiga and G.Manzini).
41. A framework for developing a mimetic tensor artificial viscosity for Lagrangian hydrocodes on arbitrary polygonal meshes. *J. Comp. Phys.*, **32** (2010), 7911–7941. (with M.Shashkov).
42. A mimetic discretization of the Stokes problem with selected edge bubbles, *SIAM J Sci. Comp.*, **32:2** (2010), 875–893. (with L.Beirao da Veiga).
43. A monotone finite volume scheme for advection-diffusion equations on unstructured polygonal meshes. *J. Comp. Phys.*, **229:11** (2010), 4017–4032. (with D.Svyatskiy and Yu.Vassilevski).
44. Hessian-free metric-based mesh adaptation via geometry of interpolation error, *Comput. Math. Math. Phys.* (2010) **50:1**, 131–145. (with A.Agouzal and Yu.Vassilevski).
45. Mimetic finite difference method for the Stokes problem on polygonal meshes, *J Comp. Phys.*, **228:19** (2009), 7215–7232 (with L.Beirao da Veiga, V.Gyrya and G.Manzini).
46. A Multilevel Multiscale Mimetic (M³) Method for an Anisotropic Infiltration Problem, *Lecture Notes in Computer Science*, Vol. 5544, Springer-Verlag, 2009, pp.685–694 (with J.Moulton and D.Svyatskiy).
47. Error estimates for a finite element solution of the diffusion equation based on composite norms, *J. Numer. Math.* (2009) **17:2**, 77–95 (with A.Agouzal and Yu.Vassilevski).
48. Convergence analysis of the high-order mimetic finite difference method, *Numer. Math.*, (2009) **113:3**, 325–356. (with L.Beirao da Veiga and G.Manzini).
49. Local flux mimetic finite difference methods, *Numerische Mathematik*, (2009) **112:1**, 115–152 (with M.Shashkov and I.Yotov).
50. Interpolation-free monotone finite volume method for diffusion equations on polygonal meshes, *J. Comp. Phys.* (2009), **228:3** 703–716 (with D.Svyatskiy and Yu.Vassilevski).
51. Mimetic finite differences for elliptic problems, *M2AN: Math. Model. Numer. Anal.* (2009), **43** 277–295 (with F.Brezzi and A.Buffa).
52. High-order mimetic finite difference method for diffusion problems on polygonal meshes, *J. Comp. Physics* **227** (2008), 8841–8854. (with V.Gyrya).
53. A multilevel multiscale mimetic (M³) method for two-phase flows in porous media, *J. Comp. Physics* **144** (2008), 6727–6753. (with D.Moulton and D.Svyatskiy).

54. Monotone finite volume schemes for diffusion equations on unstructured triangular and shape-regular polygonal meshes, *J. Comp. Physics* **227** (2007), 492–512 (with M.Shashkov, D.Svyatskiy and Yu.Vassilevski).
55. Convergence of mimetic finite difference method for diffusion problems on polyhedral meshes with curved faces, *M3AS: Mathematical Models and Methods in Applied Sciences*, **16**:2 (2006), 275–297 (with F.Brezzi and M.Shashkov).
56. The error-minimization-based rezone strategy for arbitrary Lagrangian-Eulerian methods, *Numerical Methods for PDEs* **22**:3 (2006), 617–637 (with M.Shashkov).
57. The mimetic finite difference discretization of diffusion problem on unstructured polyhedral meshes, *J. Comp. Phys.* **211** (2006), 473–491 (with M.Shashkov and D.Svyatskiy).
58. Convergence of mimetic finite difference method for diffusion problems on polyhedral meshes, *SIAM J. Numer. Anal.* **43**:5 (2005), 1872–1896 (with F.Brezzi and M.Shashkov).
59. Error bounds for controllable adaptive algorithms based on a Hessian recovery, *Computational Mathematics and Mathematical Physics*, **45**:8 (2005), 1424–1434 (with Yu.Vassilevski).
60. A family of mimetic finite difference methods on polygonal and polyhedral meshes, *M3AS: Mathematical Models and Methods in Applied Sciences* **15**:10 (2005), 1533–1552 (with F.Brezzi and V.Simoncini).
61. A mortar mimetic finite difference method on non-matching grids, *Numer. Math.*, **102**:2 (2005), 203–230 (with M.Berndt, M.Shashkov, M.Wheeler and I.Yotov).
62. Superconvergence of the velocity in mimetic finite difference methods on quadrilaterals, *SIAM J. Numer. Anal.* **43**:4 (2005), 1728–1749 (with M.Berndt, M.Shashkov, M.Wheeler and I.Yotov).
63. Mimetic finite difference method on polygonal meshes for diffusion-type problems, *Comp. Geosciences*, **8** (2004), 301–324 (with Yu.Kuznetsov and M.Shashkov).
64. Mimetic finite difference methods for diffusion equations on non-orthogonal non-conformal meshes. *J. Comp. Phys.*, **199** (2004), 589–597 (with J.Morel and M.Shashkov).
65. Mathematics modeling and numerical algorithms for poroelastic problems, *Contemporary Mathematics*, **329** (2003), 191–202 (with Yu.Kuznetsov, S.Lyons and S.Maliassov).
66. Optimal triangulations: existence, approximation and double differentiation of P_1 finite element functions, *Computational Mathematics and Mathematical Physics*, **43**:6 (2003), 827–835 (with Yu.Vassilevski).
67. Nested grid iteration for incompressible viscous flow and transport, *Inter. J. Comp. Fluid Dynamics*, **17**:4 (2003), 253–262 (with G.Carey and B.Kirk).

68. Parallel adaptive solution of 3D boundary value problems by Hessian recovery, *Comput. Methods Appl. Mech. Engrg.*, **192** (2003), 1495–1513 (with Yu.Vassilevski).
69. A subspace cascadic multigrid method for mortar elements, *Computing*, **69:3** (2002), 205–225 (with D.Braess and P.Deuffhard).
70. Fast separable solver for mixed finite element methods and applications, *J. Numer. Math.*, **10:2** (2002), 137–155 (with Yu.Kuznetsov).
71. Convergence of mimetic finite difference discretizations of the diffusion equation, *East-West J. Numer. Math.*, **9:4** (2001), 265–284 (with M.Berndt, D.Moulton and M.Shashkov).
72. An efficient iterative solver for a simplified poroelasticity problem, *East-West Journal*, **8:3** (2000), 207–222 (with Yu.Kuznetsov).
73. Adaptive generation of quasi-optimal tetrahedral meshes, *East-West Journal*, **7** (1999), 223–244 (with A.Agouzal and Yu.Vassilevski).
74. An adaptive algorithm for quasi-optimal mesh generation, *Computational Mathematics and Mathematical Physics*, **39** (1999), 1468–1486 (with Yu.Vassilevski).
75. Fictitious domain methods for the numerical solution of three-dimensional acoustic scattering problems, *J. Comp. Acoustics*, **7:3** (1998), 161–183 (with E.Heikkola and Yu.Kuznetsov).
76. 3D Helmholtz wave equation by fictitious domain method, *Russian J. Numer. Anal. and Math. Modelling*, **13** (1998), 371–389 (with Yu.Kuznetsov).
77. Domain decomposition with subdomain CCG for material jump elliptic problems, *East-West Journal*, **6** (1998), 81–100 (with P.Deuffhard).

In Proceedings:

78. Effective Long-term Monitoring Strategies by Integrating Reactive Transport Models with In situ Geochemical Measurements, Proceeding of WM2016 Conf. March 6-10, 2016 Phoenix, AZ (with H.Wainwright, B.Faybishenko, S.Molins, J.Davis, B.Arora, G. Shu Heng Pau, J.Johnson, G.Flash, M.Denham, C.Eddy-Dilek, D.Moulton, C.Gable, T.Miller, E.Baker, V.Freedman, and M.Freshley).
79. Using ASCEM Modeling and Visualization to Inform Stakeholders of Contaminant Plume Evolution and Remediation Efficacy at F-Basin Savannah River, Proceeding of WM2015 Conf. March 15-19, 2015 Phoenix, AZ (with H.Wainwright, S.Molins, J.Davis, B.Arora, B.Faybishenko, H.Krishnan, S.Hubbard, G.Flach, M.Denham, C.Eddy-Dilek, D.Moulton, C.Gable, T.Miller and M.Freshley).
80. Amanzi; an open-source multi-process simulator for environmental applications American Geophysical Union 2014 fall meeting, 2014 (with J.Moulton, S.Molins, J.Johnson, E.Coon, M.Day, E.Barker).

81. Mimetic finite difference schemes with conditional maximum principle for diffusion problems, In Springer Proceedings in Mathematics & Statistics " *Finite Volumes for Complex Applications VII - Methods and Theoretical Aspects*", Volume 1, 2014, J.Fuhrmann, M.Ohlberger, C.Rohde (Editors), Springer, pp.373–381.
82. On shape-regularity of polyhedral meshes for solving PDEs, Online Proceedings on Int. Meshing RoundTable, 2013.
83. Benchmark 3D: Mimetic Finite difference Method for Generalized Polyhedral Meshes, In Springer Proceedings in Mathematics " *Finite Volumes for Complex Applications VI Problems & Perspectives*", Volume 2, 2011, J.Fort, J.Fürst, J.Halama, R.Herbin, F.Hubert (Editors), Springer, pp.235–242.
84. Monotonicity Conditions in the Mimetic Finite Difference Method, In Springer Proceedings in Mathematics " *Finite Volumes for Complex Applications VI Problems & Perspectives*", Volume 1, 2011, J.Fort, J.Fürst, J.Halama, R.Herbin, F.Hubert (Editors), Springer, pp.653–662.
85. Arbitrary order nodal mimetic discretizations of elliptic problems on polygonal meshes, In Springer Proceedings in Mathematics " *Finite Volumes for Complex Applications VI Problems & Perspectives*", Volume 1, 2011, J.Fort, J.Fürst, J.Halama, R.Herbin, F.Hubert (Editors), Springer, pp.69–78.
86. Adaptation of mimetic finite difference discretization to reducing numerical dispersion in wave equation. Proceedings of *10th Int. Conference on the Mathematical and Numerical Aspects of Waves*, July 25-29, 2011, Vancouver, Canada, pp.343–346 (with V.Gyrya).
87. Advanced numerical methods in mesh generation and mesh adaptation Proceedings of the 7th International Conference on Engineering Computational Technology, 2010, (with A.Agouzal, A.Danilov, Yu. Vassilevski).
88. Anisotropic mesh adaptation for solution of finite element problems using hierarchical edge-based error estimates, Proceedings of *18th International Meshing Roundtable*, October 25-28, 2009, Salt Lake City, UT. B.Clark (Editor), Springer, pp.595–610 (with A.Agouzal and Yu.Vassilevski).
89. Mimetic finite difference method, Proceedings of *5th International Symposium on Finite Volumes for Complex Applications*, June 8-13, 2008, Aussois, France; R.Eymard, J.-M.Hérard (Editors), Wiley, pp.843–850.
90. Metric tensors for generation of optimal meshes, Proceedings of *Int. Conf. NUM-GRID*, June 10-13, 2008, Computing Center RAS, Moscow, pp.264–271.
91. Generation of quasi-optimal meshes based on a posteriori error estimates, Proceedings of *16th International Meshing Roundtable*, October 15-17, 2007, Seattle, WA. M.Brewer, D.Marcum (Editors), Springer, pp.139–148. (with A.Agouzal and Yu.Vassilevski).

92. Analysis of Hessian recovery methods for generating adaptive meshes, *Proceedings of 15th International Meshing Roundtable*, September 17-20, 2006, Birmingham, LA. P.Pebay (Editor), Springer, pp.163–171. (with Yu.Vassilevski).
93. On discrete boundaries and solution accuracy in anisotropic adaptive meshing, *Proceedings of 14th International Meshing Roundtable*, September 11-14, 2005, San Diego, CA. Byron W.Hanks (Editor), Springer, pp.313–324 (with Yu.Vassilevski).
94. Parallel adaptive solution of the Stokes and Oseen problems on unstructured 3D meshes, In *Parallel Computational Fluid Dynamics 2003: Advanced Numerical Methods, Software and Applications*, B.Chetverushkin, J.Periaux, N.Satofuka, A.Ecer (Editors), Elsevier B.V, 2004, pp.153–161 (with Yu.Vassilevski).
95. Error estimates for Hessian-based mesh adaptation algorithms with control of adaptivity, *Proceedings of 13th International Meshing Roundtable*, September 19-22, 2004, Williamsburg, Virginia, pp.345-351 (with Yu.Vassilevski).
96. On a parallel algorithm for controlled Hessian-based mesh adaptation, *Proceedings of 3rd Conf. Appl. Geometry, Mesh Generation and High Performance Computing*, Moscow, June 28 – July 1, 2004, Comp. Center RAS, Vol.1, pp.154-166 (with Yu.Vassilevski).
97. Moving grids for hyperbolic problems, *Proceedings of the Workshop on Mesh Quality and Dynamic Meshing*, January 16-17, 2003, Sandia National Laboratory, Livermore, CA (with M.Shashkov).
98. Fictitious domain based solvers for particulate flows, *Proceedings of the 13th International Conference on DD Methods*, October 2000, Lyon, France, pp.351–357 (with D.Dashevski, R.Glowinski and Yu.Kuznetsov).
99. Finite element methods with nonmatching grids and applications, *Proceedings of the Conference on Applied Mathematics and Computer Science*, October 28-29, 1996, Moscow, French-Russian A.M.Liapunov Institute, Moscow State University, pp.65–81 (with G.Abdoulaev, Y.Achdou, Yu.Kuznetsov, J.Periaux and O.Pironneau).

Selected Technical Reports:

100. Consistent nonlinear solver for solute transport in variably saturated porous media, Submitted to *FVCA8* (2017) (with D.Svyatskiy).
101. Coupled surface and subsurface hydrologic flow using mimetic finite differences, Submitted to *Adv. Water Resources* (2014) (with E.Coon, J.Moulton, M.Berndt, G. Manzini, R.Garimella and S.Painter).
102. ASCEM Pumping Test Capabilities: Benchmarking and Demonstration for UGTA at U-20 WW. Los Alamos Report LAUR-12-26614 (2012) (with D.Harp, E.Kwicklis, A. Wolfsberg, J.Moulton, C.Gable, C.Walter, N.Becker, M. Berndt and V.Vesselinov).
103. Metric-based control of mesh adaptation in arbitrary Lagrangian Eulerian simulations, Los Alamos Report LAUR-06-4765 (2006) (with Yu.Vassilevski).

104. Moving meshes for the Burgers equation, Los Alamos Report LAUR-03-7605 (2003) (with M.Shashkov).
105. On the application of fictitious domain and domain decomposition methods for scattering problems on Cray Y-MP C98, *Report No.9557*, University of Nijmegen, The Netherlands, 1998 (with Yu.Kuznetsov).
106. On using parallel MIMD computer systems in the inverse problem of acoustic scattering, *RIM-GARC Preprint Series 96-27*, Seoul National University, Seoul, South Korea, June 1996.

Scientific Presentations:

Plenary:

1. *Mimetic finite difference method for nonlinear parabolic equations: theory and applications*, IHP quarter on Numerical Methods for PDEs, ME2 Conference: Advanced numerical methods: Recent developments, analysis and applications, Paris, FRANCE, October 3-7, 2016.
2. *Design Principles of the Mimetic Finite Difference Schemes*, Workshop "Polytopal Element Methods in Mathematics and Engineering" Georgia Institute of Technology, GA, October 26-28, 2015.
3. *Mimetic finite difference method for elliptic problems*, London Mathematical Society – EPSRC Durham Symposium "Building bridges: connections and challenges in modern approaches to numerical partial differential equations", University of Durham, UK, July 15-16, 2014 (2 lectures).
4. *Mimetic finite difference method for diffusion problems*, International Workshop "Advanced methods for the diffusion equation on general meshes", Laboratory Jacques-Louis Lions, University of Paris 6, FRANCE, July 5, 2010.
5. *Mimetic finite difference method for solving PDEs on polygonal and polyhedral meshes*, international Workshop "Non-Standard Numerical Methods for PDEs", University of Pavia, ITALY, July 1, 2010.

Invited:

6. *Physics-preserving discretizations for subsurface flows*, Workshop I: Multiphysics, Multiscale, and Coupled Problems in Subsurface Physics, Institute for Pure & Applied Mathematics, UCLA, Los Angeles, April 2017.
7. *The mimetic finite difference method for the Landau-Lifshitz equation*, The Mathematics of Finite Elements and Applications (MAFELAP), Brunel University, London, UK, June 2016.

8. *Mimetic Finite Difference Method for the Richards Equation*, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Palo Alto, CA, June-July 2015.
9. *Mimetic finite difference and virtual element methods*, International Workshop "Advanced Numerical Methods in the Mathematical Sciences", Texas A&M University, College Station, TX, May 2015.
10. *Mimetic finite difference method for elliptic equations, Part I*, Institute of Applied Physics and Computational Mathematics, Beijing, CHINA, October 2012.
11. *Mimetic finite difference method for elliptic equations, Part II*, Institute of Applied Physics and Computational Mathematics, Beijing, CHINA, November 2012.
12. *M-adaptation for numerical solution of PDEs*, International Workshop on Discretization method for Polygonal and Polyhedral Meshes, Milan, ITALY, September 2012.
13. *Advanced Discretizations for Modeling Flow and REactive Transport on Distorted Unstructured Grids*, SIAM annual meeting, Minneapolis, MN, July 2012.
14. *M-adaptation for numerical solution of PDEs*, The European Numerical Mathematics and Advanced Applications (ENUMATH), University of Leicester, UK, September 2011.
15. *A Mimetic Tensor Artificial Viscosity Method for Arbitrary Polygonal and Polyhedral Meshes*, SIAM Conference on Computational Science and Engineering, Reno, NV, March 4, 2011.
16. *Adaptive Solution of PDEs on Anisotropic Simplicial Meshes*, The 8th International Conference of Numerical Analysis and Applied Mathematics, Rhodes, GREECE, September 23, 2010.
17. *Advanced Numerical Methods in Mesh Generation and Mesh Adaptation*, The 7th International Conference on Engineering Computational Technology, Valencia, SPAIN, September 15, 2010.
18. *Monotone Family of Mimetic Finite Difference Methods*, International Workshop on Discretization Methods for Viscous Flows, Carry-le-Rouet, FRANCE, September 9, 2010.
19. *A multilevel multiscale mimetic (M^3) method for well-driven flows in porous media*, International Conference on Computational Science, University of Amsterdam, NETHERLANDS, June 1, 2010.
20. *A mimetic tensor artificial viscosity method for arbitrary polygonal and polyhedral meshes*, International Conference on Computational Science, University of Amsterdam, NETHERLANDS, May 31, 2010.
21. *A mimetic discretization of the Stokes problem with selected edge bubbles*, Scientific Computing Seminar, Department of Mathematics, University of Houston, September 10, 2009.

22. *Mimetic finite difference method for meshes with curved faces*, International Workshop on Discretization methods for Viscous Flows, Porquerolles, FRANCE, June 2009.
23. *A multilevel multiscale mimetic (M^3) method for two-phase flows in porous media*, The SIAM Conference on Mathematical and Computational Issues in the Geosciences, Leipzig, GERMANY, June 2009.
24. *A multilevel multiscale mimetic (M^3) method for two-phase flows in porous media*, The Mathematics of Finite Elements and Applications (MAFELAP), Brunel University, London, UK, June 2009.
25. *Optimal and quasi-optimal meshes for minimizing the interpolation error and its gradient* SIAM Conference on Computational Science and Engineering, Miami, FL, March 2009.
26. *Mimetic finite difference method for solving PDEs on polygonal and polyhedral meshes*, Dipartimento di Matematica "F.Enriques", Università degli Studi di Milano, Milan, ITALY, December 2008.
27. *Local flux mimetic finite difference method for diffusion problems*, Istituto di Matematica Applicata e Tecnologie Informatiche, Pavia, ITALY, December 2008.
28. *Mimetic finite difference method for solving PDEs on polygonal and polyhedral meshes*, Department of Mathematics, University of Pittsburgh, PA, October 2008.
29. *Mimetic finite difference method for diffusion problems*, Multiphysics Methods Group Seminar, Idaho National Laboratory, September 2008.
30. *Mimetic finite difference method for PDEs*, CCMA PDEs and Numerical Methods Seminar Series, Department of Mathematics, PennState University, May 2008.
31. *Mimetic discretization methods*, Colloquium, Department of Mathematics, Oregon State University, March, 2008.
32. *Mimetic finite difference method for diffusion problems*, Applied Mathematics and Computation Seminar, Oregon State University, March, 2008.
33. *High order mimetic discretizations on finite volume meshes*, Lawrence Livermore National Laboratory, Livermore, December, 2007.
34. *Optimal and Quasi-Optimal Meshes for Numerical Solution of PDEs*, International Conference on Adaptive Modeling and Simulation, Goteborg, SWEDEN, October 2007.
35. *Second-order accurate discretization method for diffusion problems with tensor coefficients on polyhedral meshes*, Sandia National Laboratory, Albuquerque, NM, August 2007.
36. *Optimal and quasi-optimal meshes for numerical solution of PDEs*, Innovative Computing Laboratory, University of Tennessee, Knoxville TN, December 2006.

37. *The new error-minimization-based moving mesh method: theoretical and numerical analysis*, SIAM annual meeting, Boston, MA, July 2006.
38. *The error-minimization-based rezone strategy for arbitrary Lagrangian-Eulerian methods*, Seminar "Applied and Computational Mathematics", Tulane University, LA, January 2005.
39. *Mimetic finite difference methods on unstructured polyhedral meshes*, 8th US National Congress for Computational Mechanics, Austin, TX, July 2005.
40. *Convergence of mimetic finite difference discretizations for diffusion equations*, Workshop on Mimetic Discretizations of Continuum Mechanics, San Diego, CA, July 2003.
41. *Mimetic finite difference methods for diffusion equations on non-orthogonal AMR meshes*, Workshop on Mimetic Discretizations of Continuum Mechanics, San Diego, CA, July 2003.

Conferences:

42. *Upwinding in the mimetic finite difference method for nonlinear parabolic equations*, SIAM Conference on Computational Science & Engineering, Salt Lake City, UT, March 2015.
43. *M-adaptation*, Workshop on Discretization methods for fluid flows, University of Provence, Marseille, FRANCE, September 2011.
44. *A framework for developing a mimetic tensor artificial viscosity for Lagrangian hydrocodes on arbitrary polygonal and polyhedral meshes*, NECDC–Nuclear Explosives Code Developers' Conference, Los Alamos, NM, October 2010.
45. *Mimetic Finite Difference (MFD) Methods: Theory and Applications*, 2010 DOE Applied Mathematics Program Meeting, Berkeley, CA, May 2010.
46. *Anisotropic mesh adaptation for solution of finite element problems using edge-based error estimates*, 18th international Meshing Roundtable, Salt Lake City, UT, October 2009.
47. *Local flux mimetic finite difference method for diffusion problems*, The Mathematics of Finite Elements and Applications (MAFELAP), Brunel University, London, UK, June 2009.
48. *Solving the diffusion and Stokes problems on polygonal and polyhedral meshes*, Finite Element Methods in Engineering and Science (FEMTEC 2009), Granlibakken Conference Center, Lake Tahoe, CA, January 2009.
49. *A mimetic finite-difference method for acoustic-wave modeling on arbitrary meshes*, Annual meeting of the Society of Exploration Geophysicists (SEG), Las Vegas, NV, November 2008.

50. *Hessian-free metric-based mesh adaptation via geometry of interpolation error*, 17th international Meshing Roundtable, Pittsburgh, PA, October 2008.
51. *Generation of quasi-optimal meshes based on a posteriori error estimates*, 16th international Meshing Roundtable, Seattle, WA, October 2007.
52. *Mimetic finite difference methods on polyhedral meshes*, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Santa Fe, NM, March 20, 2007.
53. *Mimetic finite difference methods on generalized polyhedral meshes*, NECDC–14th Joint Laboratory Biennial Conference, Los Alamos, NM, October 2006.
54. *Numerical analysis of Hessian recovery methods for generating adaptive meshes*, 15th International Meshing Roundtable, Birmingham, LA, September 2006.
55. *New discretization methodology for diffusion problems on generalized polyhedral meshes*, LACSI Symposium, Santa Fe, NM, October 2005.
56. *On discrete boundaries and solution accuracy in anisotropic adaptive meshing*, 14th International Meshing Roundtable, San Diego, CA, September 2005.
57. *A family of mimetic finite difference methods on polygonal and polyhedral meshes*, SIAM Annual Meeting, New Orleans, LA, July 2005.
58. *Convergence of mimetic finite difference method for diffusion problems on polyhedral meshes*, SIAM Conf. on Computational Science & Engineering, Orlando, FL, February 2005.
59. *Convergence of mimetic finite difference method for diffusion problems on polyhedral meshes*, LACSI Symposium, Santa Fe, NM, October 2004.
60. *Error estimates for Hessian-based mesh adaptation algorithms with control of adaptivity*, 13th International Meshing Roundtable, Williamsburg, VA, September 2004.
61. *The EMB rezone strategy for ALE methods*, SIAM annual meeting, Portland, OR, July 2004.
62. *Error-minimization-based rezone strategy for ALE methods*, 8th Copper Mountain Conference, Copper Mountain, CO, April 2004.
63. *Mimetic discretizations for diffusion equation on polygonal meshes in Cartesian and cylindrical geometries*, LACSI Symposium, Santa Fe, NM, October 2003.
64. *Moving grids for problems of gas dynamics*, 7th US National Congress on Computational Mechanics, Albuquerque, NM, July 2003.
65. *Robust parallel algorithm for anisotropic adaptive tetrahedral meshes*, 7th US National Congress on Computational Mechanics, Albuquerque, NM, July 2003.
66. *Algebraic multilevel preconditioner with projectors*, 11th Copper Mountain Conference, Copper Mountain, CO, April 2003.

67. *Mimetic finite difference methods for diffusion equations on AMR meshes*, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Austin, TX, March 2003.

Miscellaneous:

68. *Mimetic Finite Difference Schemes with Conditional Maximum Principle*, FVCA7 - The International Symposium of Finite Volumes for Complex Applications VII Berlin, June 15-20, 2014 (poster).
69. *Mimetic Finite Difference Method: Theory and Applications*, Computational Physics and Applied Math (CPAM) Review, Los Alamos National Laboratory, 2013.
70. *M-Adaptation*, 2011 DOE Applied Mathematics Program Meeting, Reston, VA, October 17-19, 2011 (poster).
71. *Mimetic Finite Difference Method for Generalized Polyhedral Meshes*, 6th International Symposium on Finite Volumes for Complex Applications, June 6-10, 2011, Prague, Czech Republic (poster).
72. *Mimetic Finite Difference Method for Modeling Subsurface Flows*, SIAM Conference of Mathematical & computational Issues in the Geosciences, Los Angeles, CA, March 2011 (poster).
73. *Amanzi: Transport Process Kernel*, Amanzi Developers ICE 2011 Workshop, Albuquerque, NM, February 2011.
74. *Amanzi: Flow & Transport Process Kernels*, Amanzi Developers ICE 2011 Workshop, Albuquerque, NM, February 2011.
75. *Mimetic finite difference methods: theory & applications*, Computational Physics and Applied Math (CPAM) Capability Review, Los Alamos National Laboratory, NM, June 2010 (poster).
76. *Anisotropic mesh adaptation for solution of finite element problems using edge-based error estimates*, Conference "Monge-Kantorovich Optimal Transport Theory and Applications", Santa Fe, NM, October 2009 (poster).
77. *A multilevel multiscale mimetic (M^3) method for two-phase flows in porous media*, ExxonMobil Upstream Research Company, Houston, TX, September 10, 2009.
78. *Mimetic Methods for Solving Diffusion Problems on Polyhedral Meshes*, ExxonMobil Upstream Research Company, Houston, TX, September 2007.
79. *Monotone Finite Volume Methods on Unstructured Triangular and Shape-Regular Polygonal Meshes*, ExxonMobil Upstream Research Company, Houston, TX, September 2007.
80. *A new discretization method for solving pressure equation on arbitrary meshes*, Los Alamos National Laboratory, September 2007.

81. *Mimetic discretizations*, OASCR Applied Mathematics PI Meeting, Livermore, CA, May 2007 (poster).

Workshop Organization:

1. **Co-organizer:** Minisymposium "Numerical Methods in Micromagnetics", SIAM Conference on Computational Science & Engineering, Atlanta, GA, February 27 - March 3, 2017.
2. **Co-organizer:** Minisymposium "Advanced Discretizations for Complex Applications", SIAM Conference on Computational Science & Engineering, Salt Lake City, UT, March 14-18, 2015.
3. **Co-organizer:** Minisymposium "Advanced Discretization Methods", International Conference "The Mathematics of Finite Elements and Applications", Brunel University, London, June 2009.
4. **Co-organizer:** *Adaptive anisotropic mesh generation: Advances in analysis and practice*, Minisymposium in the SIAM Conference on Mathematical and Computational Issues in the Geosciences, Avignon, France, June 7-10, 2005.
5. **Organizer:** *Moving mesh methods*, Minisymposium in the SIAM Annual Meeting, Portland, OR, July 12-16, 2004.

Panels & Committees:

1. *Committee Member:* Los Alamos National Laboratory, Laboratory-Directed Research and Development, Exploratory Research (LDRD/ER), *Computational and Numerical Methods*, 2017.
2. *Scientific Committee Member:* The International Symposium of Finite Volumes for Complex Applications VIII Lille, June 12-16, 2017.
3. *Committee Member:* Los Alamos National Laboratory, Laboratory-Directed Research and Development, Exploratory Research (LDRD/ER), *Computational and Numerical Methods*, 2016.
4. *Scientific Committee Member:* The International Symposium of Finite Volumes for Complex Applications VII Berlin, June 16-20, 2014.
5. *Invited External Reviewer:* Italian Research and University Evaluation Agency, 2012.
6. *Committee Member:* Dissertation by Danail Vassilev for the degree of Doctor of Philosophy, University of Pittsburgh, July 16, 2010.
7. *Panel Member:* DOE SciDAC Mid-Term Review of Applied Partial Differential Equations Center (APDEC), Washington DC, April 21, 2009.

8. *Panel Member*: "Research at Fundamental Scales" at Computational Subsurface Sciences Workshop, Washington DC, January 10-12, 2007.
9. *Committee Member*: Los Alamos National Laboratory, Laboratory-Directed Research and Development, Exploratory Research (LDRD/ER), *Mathematics and Computational Science*, 2006.

Awards:

- Outstanding Paper Award "A multiscale multilevel mimetic (M^3) method for well-driven flows in porous media" presented by Elsevier and Journal of Computational Science at the International Conference on Computational Science in Amsterdam, May 31-June 2, 2010.

Journal Referee:

- Applied Mathematics and Computations
- Journal of Computational Physics
- Journal of Computational and Applied Mathematics
- SIAM Journal on Numerical Analysis
- SIAM Journal on Scientific Computing
- Multiscale Modeling and Simulation
- Numerical Methods for PDEs
- Communications in Computational Physics
- Transport in Porous Media
- Applied Numerical Mathematics
- Physics Letters A
- Discrete Applied Mathematics
- Computational Mathematics and Mathematical Physics
- Computers and Mathematics with Applications
- Computers and Geotechnics
- IMA Journal on Numerical Analysis
- International Journal on Finite Volumes
- Engineering with Computers
- Mathematics and Computers in Simulations
- Computer Methods in Applied Mechanics and Engineering
- Russian Journal of Numerical Analysis and Mathematical Modelling
- Applied Mathematics and Computations
- Calcolo
- Computational and Applied Mathematics

- Computers & Fluids
- International Journal for Numerical Methods in Fluids
- Mathematical Models and Methods in Applied Sciences (M3AS)
- SPE Journal
- Mathematical Modelling and Numerical Analysis (M2AN)

The total number of reviewed manuscripts is 148.

Book Referee:

- John Wiley & Sons

Academic Activities:

1. mentor of the DOE SCGSR Fellow Eugenia Kim, 2015-2016
2. mentor of the postdoctoral researcher, Vitaliy Gyrya, 2010-2013
3. mentor of the summer student, Maranda Bean, 2013, 2014
4. mentor of the summer student, Oleksandr Misiats, 2011
5. mentor of the postdoctoral researcher, Daniil Svyatskiy, 2006–2009
6. mentor of the summer student, Vitaliy Gyrya, 2007, 2008
7. mentor of the summer student, Danail Vassilev, 2006
8. mentor of the summer student, Daniil Svyatskiy, 2005
9. reviewer for "Mathematical Reviews". 22 reviewed articles.

Professional Memberships:

- Society of Industrial and Applied Mathematics (SIAM)
- American Mathematical Society (AMS), until 2008

Computing Experience:

- *Numerical Analysis:*

I have 18 years of experience in developing algorithms for the numerical solution of partial differential equations. Knowledge of discretization techniques includes finite differences, finite elements, spectral elements, and finite volume methods. Knowledge of iterative solution techniques includes preconditioned Krylov subspace, multigrid and domain decomposition methods.

- *Programming:*

Experience with many languages, including Fortran, C, C++, MPI, Matlab, L^AT_EX, PostScript, HTML, XML. Currently working on a few multi-developer projects that use various version control systems (CVS, SVN, Mecerual).

References:

Dr. Pieter Swart, Los Alamos National Laboratory, MS B284, Los Alamos NM, phone: (505) 665-9437, e-mail: swart@lanl.gov

Prof. Dr. Yuri Kuznetsov, University of Houston, Department of Mathematics, Houston TX, phone: (713) 743-3493, e-mail: kuz@math.uh.edu