

Alex Bespalov

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Qualifications

- Postgraduate Certificate in Academic Practice (with distinction), 2016
University of Birmingham, United Kingdom
- Ph.D. in Computational Mathematics, 1999
Institute for Computational Mathematics and Mathematical Geophysics,
Russian Academy of Sciences, Siberian Branch (Novosibirsk, Russia)
Ph.D. Thesis: The design and analysis of the h - p version of the finite element method for the Dirichlet problem with singularity of solution
Advisor: Professor V. A. Rukavishnikov
- B.Sc. (with distinction) in Mathematics, 1994
Additional qualification: Teacher of Mathematics and Computer Science
Khabarovsk State Pedagogical University (Khabarovsk, Russia)

Current Employment

- *School of Mathematics, University of Birmingham* (Birmingham, United Kingdom)
Lecturer in Applied Mathematics (May 2013 – present, tenured since March 2016)

Previous Employment

- *School of Mathematics, University of Manchester* (Manchester, United Kingdom)
Research Associate (August 2010 – May 2013)
- *Department of Mathematical Sciences, Brunel University* (Uxbridge, United Kingdom)
Research Fellow (September 2007 – August 2010)
- *Computational Center, Russian Academy of Sciences, Far-Eastern Branch*
(Khabarovsk, Russia)
Senior Researcher (2000 till September 2007), Researcher (1999 – 2000),
Junior Researcher (1995 – 1999), Research Assistant (1991 – 1995)
- *Department of Mathematical Analysis and Computer Science, Khabarovsk State Pedagogical University* (Khabarovsk, Russia)
Docent (Senior Lecturer) (2002 – 2003), part-time employment

International Research Visits

- *Institute for Analysis and Scientific Computing, TU Wien* (Vienna, Austria)
Visiting Researcher (March – April 2017)
- *Facultad de Matemáticas, Universidad Católica* (Santiago, Chile)
Visiting Researcher (April 2014)
- *Laboratory of Mathematics and its Applications (LAMAV), Université de Valenciennes*
(Valenciennes, France)
Visiting Professor (May – June 2013)
- *Facultad de Matemáticas, Pontificia Universidad Católica de Chile* (Santiago, Chile)
Visiting Researcher (March 2009)
- *School of Mathematical Sciences, Brunel University* (Uxbridge, United Kingdom)
Visiting Researcher (June 2005; June 2006)
- *Departamento de Ingeniería Matemática, Universidad de Concepción* (Concepción, Chile)
Visiting Postdoctoral Researcher (June – November 2003)

Brief Summary of Research

- Main research area: Numerical Analysis
- Research interests: numerical solution of deterministic and stochastic partial differential and boundary integral equations; uncertainty quantification; high order finite element and boundary element methods; adaptive methods; convergence analysis and error estimation; singularities and their approximation; applications to electromagnetics, fluid dynamics, and linear elasticity; software development

List of Publications

Publications in Refereed Journals

- [1] A. Bespalov and L. Rocchi, Efficient adaptive algorithms for elliptic PDEs with random data. *SIAM/ASA Journal on Uncertainty Quantification* (to appear).
- [2] A. Bespalov, A. Haberl and D. Praetorius, Adaptive FEM with coarse initial mesh guarantees optimal convergence rates for compactly perturbed elliptic problems. *Computer Methods in Applied Mechanics and Engineering*, Vol. 317 (2017), pp. 318–340.
- [3] A. Bespalov and D. Silvester, Efficient adaptive stochastic Galerkin methods for parametric operator equations. *SIAM Journal on Scientific Computing*, Vol. 38 (2016), Issue 4, pp. A2118–A2140.
- [4] A. Bespalov and S. Nicaise, A priori error analysis of the BEM with graded meshes for the electric field integral equation on polyhedral surfaces. *Computers & Mathematics with Applications*, Vol. 71 (2016), no. 8, pp. 1636–1644.
- [5] A. Bespalov and S. Nicaise, The BEM with graded meshes for the electric field integral equation on polyhedral surfaces. *Numerische Mathematik*, Vol. 132 (2016), no. 4, pp. 631–655.
- [6] A. Bespalov, C. Powell and D. Silvester, Energy norm a posteriori error estimation for parametric operator equations. *SIAM Journal on Scientific Computing*, Vol. 36 (2014), Issue 2, pp. A339–A363.
- [7] A. Bespalov, C. Powell and D. Silvester, A priori error analysis of stochastic Galerkin mixed approximations of elliptic PDEs with random data. *SIAM Journal on Numerical Analysis*, Vol. 50 (2012), Issue 4, pp. 2039–2063.

- [8] D. Silvester, A. Bespalov and C. Powell, A framework for the development of implicit solvers for incompressible flow problems. *Discrete and Continuous Dynamical Systems - Series S*, Vol. 5 (2012), Issue 6, pp. 1195-1221.
- [9] A. Bespalov and N. Heuer, Natural hp -BEM for the electric field integral equation with singular solutions. *Numerical Methods for Partial Differential Equations*, Vol. 28 (2012), Issue 5, pp. 1466-1480.
- [10] A. Bespalov and N. Heuer, A new $\mathbf{H}(\text{div})$ -conforming p -interpolation operator in two dimensions. *ESAIM: Mathematical Modelling and Numerical Analysis*, Vol. 45 (2011), no. 2, pp. 255-275.
- [11] A. Bespalov, N. Heuer and R. Hiptmair, Convergence of the natural hp -BEM for the electric field integral equation on polyhedral surfaces. *SIAM Journal on Numerical Analysis*, Vol. 48 (2010), Issue 4, pp. 1518-1529.
- [12] A. Bespalov and N. Heuer, Natural p -BEM for the electric field integral equation on screens. *IMA Journal of Numerical Analysis*, Vol. 30 (2010), No. 3, pp. 595-628.
- [13] A. Bespalov and N. Heuer, The hp -BEM with quasi-uniform meshes for the electric field integral equation on polyhedral surfaces: a priori error analysis. *Applied Numerical Mathematics*, Vol. 60 (2010), Issue 7, pp. 705-718.
- [14] A. Bespalov and N. Heuer, The hp -version of the boundary element method with quasi-uniform meshes for weakly singular operators on surfaces. *IMA Journal of Numerical Analysis*, Vol. 30 (2010), No. 2, pp. 377-400.
- [15] A. Bespalov and N. Heuer, Optimal error estimation for $\mathbf{H}(\text{curl})$ -conforming p -interpolation in two dimensions. *SIAM Journal on Numerical Analysis*, Vol. 47 (2009), Issue 5, pp. 3977-3989.
- [16] A. Bespalov, A note on the polynomial approximation of vertex singularities in boundary element methods in three dimensions. *Journal of Integral Equations and Applications*, Vol. 21 (2009), No. 3, pp. 359-380.
- [17] A. Bespalov and N. Heuer, The hp -version of the boundary element method with quasi-uniform meshes in three dimensions. *ESAIM: Mathematical Modelling and Numerical Analysis*, Vol. 42 (2008), Issue 5, pp. 821-849.
- [18] A. Bespalov, The hp -version of the BEM with quasi-uniform meshes for a three-dimensional crack problem: the case of a smooth crack having smooth boundary curve. *Numerical Methods for Partial Differential Equations*, Vol. 24 (2008), Issue 4, pp. 1159-1180.
- [19] A. Bespalov and N. Heuer, The p -version of the boundary element method for weakly singular operators on piecewise plane open surfaces. *Numerische Mathematik*, Vol. 106 (2007), No. 1, pp. 69-97.
- [20] D. Arroyo, A. Bespalov and N. Heuer, On the finite element method for elliptic problems with degenerated and singular coefficients. *Mathematics of Computation*, Vol. 76 (2007), no. 258, pp. 509-537.
- [21] A. Bespalov and N. Heuer, The p -version of the boundary element method for a three-dimensional crack problem. *Journal of Integral Equations and Applications*, Vol. 17 (2005), No. 3, pp. 243-258.
- [22] A. Bespalov and N. Heuer, The p -version of the boundary element method for hypersingular operators on piecewise plane open surfaces. *Numerische Mathematik*, Vol. 100 (2005), No. 2, pp. 185-209.

- [23] A. Bepalov, Orthogonal systems of singular functions and numerical treatment of problems with degeneration of data. *Advances in Computational Mathematics*, Vol. 19 (2003), pp. 159-182.
- [24] A. Yu. Bepalov and V. A. Rukavishnikov, The use of singular functions in the h - p version of the finite element method for the Dirichlet problem with degeneration of input data. *Siberian Journal of Numerical Mathematics*, Vol. 4 (2001), no. 3, pp. 201-228.
- [25] A. Yu. Bepalov and V. A. Rukavishnikov, The exponential rate of convergence of the finite element method for the Dirichlet problem with singularity of the solution. *Dokl. Russ. Acad. Nauk*, Vol. 374 (2000), no. 6, pp. 727-731. English translation in: *Russian Acad. Sci. Doklady Mathematics*, Vol. 62 (2000), no. 2, pp. 266-270.
- [26] V. A. Rukavishnikov and A. Yu. Bepalov, On the h - p version of the finite element method for one-dimensional boundary value problem with singularity of a solution. *Siberian Journal of Numerical Mathematics*, Vol. 1 (1998), no. 2, pp. 153-170.

Publications in Refereed Conference Proceedings

- [27] A. Bepalov and N. Heuer, High-order boundary element method for electromagnetic scattering at non-smooth surfaces. In: “*Proceedings of the 10-th International Conference on the Mathematical and Numerical Aspects of Waves; Vancouver, Canada, July 25-29, 2011*”, ed. by N. Nigam, Pacific Institute for the Mathematical Sciences, Canada, 2011, pp. 121-124.
- [28] A. Bepalov and N. Heuer, The p -version of the boundary element method for mixed boundary value problems on polyhedra. In: “*Advances in Boundary Integral Methods, Proceedings of the 5th UK Conference on Boundary Integral Methods*”, ed. by K. Chen, University of Liverpool, UK, 2005, pp. 145-152.
- [29] A. Bepalov and N. Heuer, Optimal a priori error estimate for the p -version of the BEM on open surfaces. In: “*Proceedings of the International Conference on Computational Mathematics, ICCM-2004. Part II*”, ed. by G. A. Mikhailov, V. P. Il'in, and Y. M. Laevsky, ICM&MG Publishers, Novosibirsk, Russia, 2004, pp. 794-799.
- [30] A. Yu. Bepalov and V. A. Rukavishnikov, An exponential rate of convergence of the finite element method for the Dirichlet problem with singularity of a solution. In: “*ENUMATH-99. Proceedings of the Third European Conference on Numerical Mathematics and Advanced Applications, Jyväskylä, Finland, July 26-30, 1999*”, ed. by P. Neittaanmaki, T. Tiihonen and P. Tarvainen, World Scientific, Singapore, 2000, pp. 681-689.
- [31] A. Yu. Bepalov and V. A. Rukavishnikov, On the h - p version of the finite element method using singular functions”. In: “*The Far-Eastern School-Seminar on Mathematical Modeling and Numerical Analysis. The Proceedings & Abstracts*”, ed. by V. A. Rukavishnikov, Khabarovsk, 1999, pp. 6-13.

Software developed

- A. Bepalov, C. Powell and D. Silvester, *Stochastic IFISS (S-IFISS)*, version 1.04, October 2017. Available online at <http://www.maths.manchester.ac.uk/~djs/ifiss/sifiss.html>
- D. Silvester, A. Bepalov, Q. Liao and L. Rocchi, *Triangular IFISS (T-IFISS)*, version 1.1, January 2018. Available online at <http://www.maths.manchester.ac.uk/~djs/ifiss/tifiss.html>
- A. Bepalov and L. Rocchi, *Stochastic T-IFISS*, January 2018. Available online at http://web.mat.bham.ac.uk/A.Bepalov/software/index.html#stoch_tifiss

Research Funding

- *Engineering and Physical Sciences Research Council (EPSRC)*
Standard research grant, 2017-2020.
Project title: Numerical analysis of adaptive UQ algorithms for PDEs with random inputs (Ref. EP/P013791/1).
Role: principal investigator. **Value:** £329,468.
- *The Institute of Mathematics and its Applications (IMA)*
Travel grant (IMA Small grant scheme) to attend the SIAM Conference on Uncertainty Quantification at EPFL in Lausanne, Switzerland, 2016.
Role: grant holder. **Value:** £600.
- *London Mathematical Society*
Conference Grant (Scheme 1) to organise the workshop “Adaptive algorithms for computational PDEs”, 2015.
Role: grant holder. **Value:** £4,720.
- *European Union – INTAS*
Grant for Young Scientists in the category Post Doctoral Fellowship; 2007-2008.
Project title: Efficient boundary element approximations of time-harmonic electromagnetic waves with singularities (Ref. 06-1000014-5945).
Role: fellowship holder and principal investigator. **Value:** €21,400.
- *Russian Science Support Foundation*
Research Fellowship; 2006-2007.
Role: fellowship holder. **Value:** \$6,000.
- *Russian Foundation for Basic Research*
Grant for young scientists and post-graduate students (Ref. 02-01-06291) within the project “Numerical analysis methods for boundary value problems with strong singularities and applications”; 2002.
Role: principal investigator. **Value:** \$1,000.
- *Russian Foundation for Basic Research*
Individual travel grants to attend international conferences: Pohang, Korea (2001); Toronto, Canada (2002); Uxbridge, UK (2006); Beijing, China (2007).
Role: grant holder.

Research Communications

Conferences and Workshops: invited talks / participation supported by the organisers

- 27th Biennial Numerical Analysis Conference (June 2017; Glasgow, UK).
Invited mini-symposium talk: “*On the design and performance of adaptive stochastic Galerkin methods*”.
- SIAM Conference on Uncertainty Quantification (April 2016; EPFL, Lausanne, Switzerland).
Invited mini-symposium talk: “*Adaptive algorithms driven by a posteriori estimates of error reduction for PDEs with random data*”.
- British Computational PDEs Colloquium: New Trends (January, 2014; International Centre for Mathematical Sciences, Edinburgh, UK).
Invited talk: “*A posteriori error estimation for stochastic Galerkin approximations*”.
All expenses paid by the organisers.
- Workshop “Numerical Analysis of Stochastic PDEs” (June, 2012; Mathematics Institute, University of Warwick, UK).

- Invited talk: “*Stochastic Galerkin finite element methods for saddle point problems with random data*”. All local expenses paid by the organisers.
- Workshop “High-Order Numerical Approximation for Partial Differential Equations” (February 2012; Hausdorff Center for Mathematics, Bonn, Germany).
Invited talk: “*A priori error analysis of stochastic Galerkin mixed finite element methods*”. Local expenses paid by the organisers.
 - Workshop on Linear Algebra Aspects of Solving PDEs with Random Data (January 2012; Manchester, UK).
Invited talk: “*Numerical analysis of saddle point problems with random data*”.
 - WAVES 2011, 10-th International Conference on Mathematical and Numerical Aspects of Waves (July 2011; Vancouver, Canada).
Contributed talk: “*High-order boundary element method for electro-magnetic scattering at non-smooth surfaces*”. Registration fee waived by the organisers.
 - ICOSAHOM-07, International Conference on Spectral and High Order Methods (June 2007; Beijing, China).
Invited mini-symposium talk: “*On the error analysis of the high order boundary element methods in three dimensions*”. All local expenses paid by the organisers.
 - MAFELAP 2006, Mathematics of Finite Elements and Applications (June 2006; Uxbridge, UK).
Invited mini-symposium talk “*On the hp-version of the boundary element method with quasi-uniform meshes in three dimensions*” and contributed talk “*On the finite element approximation of elliptic problems with non-regular coefficients*”. Registration fee waived by the organisers.
 - BICOM Workshop on Boundary Elements (June 2005; Uxbridge, UK).
Contributed talk “*The p-version of the boundary element method for hypersingular operators*”. All local expenses paid by the organisers.

Conferences and Workshops: mini-symposium talks and contributed talks

- 30th Chemnitz FEM Symposium (September 2017; Strobl / St. Wolfgang, Austria).
Contributed talk: “*Adaptive stochastic Galerkin methods for parametric PDEs with spatial singularities*”.
- 15th European Finite Element Fair (May 2017; Milan, Italy). Contributed talk: “*An adaptive algorithm for parametric PDEs with singular solutions*”.
- 26th Biennial Numerical Analysis Conference (June 2015; Glasgow, UK). Contributed talk: “*An adaptive algorithm for PDE problems with random data*”.
- MAFELAP 2013, Mathematics of Finite Elements and Applications (June 2013; Uxbridge, UK). Mini-symposium talk: “*A posteriori error estimation for stochastic Galerkin FEMs*”.
- 7th International Congress on Industrial and Applied Mathematics, ICIAM 2011 (July 2011; Vancouver, Canada). Contributed talk “*Numerical analysis of the electric field integral equation on non-smooth surfaces*”.
- 24th Biennial Conference on Numerical Analysis, NACONF 2011 (June 2011; Glasgow, UK). Contributed talk “*Differential complexes and interpolation operators in the context of high-order numerical methods for electromagnetic problems*”.
- IMSE 2010, Integral Methods in Science and Engineering 2010 (July 2010; Brighton, UK). Contributed talk “*Numerical solution of the electric field integral equation on polyhedral surfaces*”.

- European Finite Element Fair 2010 (May 2010; University of Warwick, Coventry, UK). Contributed talk “ *$\mathbf{H}(\text{div})$ -conforming p -interpolation in two dimensions: error estimates and applications*”.
- 23rd Biennial Conference on Numerical Analysis, NACONF 2009 (June 2009; Glasgow, UK). Contributed talk “*High-order boundary element methods for electromagnetic scattering*”.
- MAFELAP 2009, Mathematics of Finite Elements and Applications (June 2009; Uxbridge, UK). Mini-symposium talks: “*On the convergence analysis of high-order BEM for electro-magnetic scattering in three dimensions*” and “*Approximations of singularities by boundary element methods*”.
- Workshop on Higher Order Methods in Computational Science and Engineering (May 2008; Swansea, UK). Contributed talk “*On the convergence and error analysis of the p -version of the BEM for electromagnetic scattering on screens*”.
- 6th UK Conference on Boundary Integral Methods (September 2007; Durham, UK). Contributed talk “*High order boundary element method for a three-dimensional crack problem*”.
- COMCA 2003, XIII Congreso de Matemáticas Capricornio (August 2003; Antofagasta, Chile). Mini-symposium talk “*On the p -version of the finite element method for boundary value problems with strongly singular solutions*”.
- IMACS Workshop on Adaptive Methods for Partial Differential Equations (August 2002; Toronto, Canada). Contributed talk “*An a-posteriori error estimate for problems with strong singularities*”.
- Com²MaC Conference on Computational Mathematics (July 2001; Pohang, Korea). Contributed talk “*Efficient finite element approximations of boundary value problems with strong singularity of solution*”.

Research Seminars: invited talks

- School of Mathematics, Cardiff University, UK (October 2016). The title of the talk: “*Adaptive algorithms for high-dimensional parametric PDEs*”.
- School of Mathematics, University of Birmingham, UK (March 2016). The title of the talk: “*Adaptive algorithms for high-dimensional parametric PDEs*”.
- Department of Mathematics, University of Sussex, Brighton, UK (February 2015). The title of the talk: “*Error estimation and adaptivity for stochastic Galerkin FEM*”.
- Facultad de Matemáticas, Universidad Católica, Santiago, Chile (April 2014). The title of the talk: “*A posteriori error estimation in stochastic Galerkin FEM*”.
- School of Mathematics, University of Birmingham, UK (March 2014). The title of the talk: “*A posteriori error estimation for stochastic Galerkin approximations*”.
- LAMAV, Université de Valenciennes, France (May 2013). The title of the talk: “*Numerical solution of PDEs with random data: available methods and recent results*”.
- Department of Mathematics and Statistics, University of Strathclyde, UK (November 2012). The title of the talk: “*Numerical analysis of PDEs with random data: from a priori error bounds to adaptivity*”.
- Department of Mathematical Sciences, Brunel University, UK (October 2012). The title of the talk: “*Numerical analysis of PDEs with random data: from a priori error bounds to adaptivity*”.

- Mathematics Institute, University of Warwick, UK (March 2012). The title of the talk: “*Numerical analysis of saddle point problems with random data*”.
- School of Mathematics, University of Manchester, UK (October 2010). The title of the talk: “*Polynomial approximations of regular and singular vector fields with applications to electromagnetic problems*”.
- Department of Mathematics, University of Leicester, UK (July 2010). The title of the talk: “*Numerical analysis of boundary integral equations on non-smooth surfaces: recent results and open problems*”.
- School of Mathematics, Statistics & Actuarial Science, University of Kent, UK (May 2010). The title of the talk: “*Differential complexes and interpolation operators in the context of high-order numerical methods for electromagnetic problems*”.
- Department of Mathematical Sciences, Brunel University, UK (February 2010). The title of the talk: “*Polynomial approximations of regular and singular vector fields*”.
- Department of Mathematics, Heriot-Watt University, UK (April 2009). The title of the talk: “*High-order boundary element methods for electromagnetic scattering*”.
- The School of Mathematics, University of Edinburgh, UK (April 2009). The title of the talk: “*High-order boundary element methods for electromagnetic scattering*”.
- Department of Mathematics, University of Strathclyde, UK (January 2007). The title of the talk: “*High order boundary element methods in three dimensions*”.
- Departamento de Ingeniería Matemática, Universidad de Concepción, Chile (July, November 2003). The titles of presentations: “*Efficient finite element approximations of boundary value problems with strong singularity of solution*” and “*The finite element method for elliptic problems with degenerated and singular coefficients*”.

PhD supervision

- Leonardo Rocchi (current PhD student; since October 2015). Project title: “*Adaptive algorithms for numerical solution of PDEs with random inputs*”.
- Rawin Youngnoi (current PhD student; since September 2016), jointly supervised with Daniel Loghin. Project title: “*Domain decomposition methods for PDE problems with random inputs*”.

Teaching

- *School of Mathematics, University of Birmingham* (2013 – present)
Courses taught:
Numerical Methods II (Year 3/4), Advanced Numerical Methods (Year 4 / PGT),
Computational Methods and Frontiers (Year 4),
Computational Methods and Programming (PGT)
- *School of Mathematics, University of Manchester* (2010 – 2012)
Course taught: service course “Engineering Mathematics” (Linear Algebra module) for Year 2 Electrical and Electronic Engineering students.
- *Department of Mathematical Analysis and Computer Science, Khabarovsk State Pedagogical University* (Khabarovsk, Russia; 2002 – 2003)
Course taught: Mathematical Analysis for 2nd year students
- *Khabarovsk High School with Advanced Mathematical Education* (Khabarovsk, Russia)
Teaching apprenticeship (1994)
Course taught: Calculus of Complex Variables

Supervised Master Student

Matthew Williams (MSci project, 2014 – 2015). Project title: “*Stochastic sampling methods for PDEs with random input data*”.

Other Professional and Administrative Activities

- Co-organiser (together with Daniel Loghin) of the workshop “Adaptive algorithms for computational PDEs” (5-6 January 2016; University of Birmingham, UK).
- Co-organiser (together with Serge Nicaise) of the mini-symposium “Finite Elements for Problems with Singularities” at the MAFELAP 2013 Conference (June 2013; Brunel University, Uxbridge, UK).
- Organizer of the mini-symposium “Finite Element Approximations of Singularities” at the MAFELAP 2009 Conference (June 2009; Brunel University, Uxbridge, UK).
- Referee for
SIAM Journal on Numerical Analysis,
IMA Journal of Numerical Analysis,
Numerical Methods for PDE,
Applied Numerical Mathematics,
BIT Numerical Mathematics,
Numerical Algorithms,
Computers and Mathematics with Applications,
Mathematical Methods in the Applied Sciences.
- Reviewer for Mathematical Reviews (since 2008).
- Deputy Year 1 Director, School of Mathematics, University of Birmingham (September 2015 – August 2017).
- Co-organiser (together with Rachel Nicks and Alexandra Tzella) of the Applied Mathematics Seminar series, School of Mathematics, University of Birmingham (September 2013 – June 2015).
- Organizer of the Numerical Analysis and Scientific Computing Seminar series in the School of Mathematics, University of Manchester (September 2010 – June 2012).