

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)
Senior Lecturer in Applied Mathematics (August 2018 – present)
Lecturer in Applied Mathematics (May 2013 – July 2018)

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 (2000–2007), Researcher (1999–2000)
- *Department of Mathematical Analysis and Computer Science, Khabarovsk State Pedagogical University* (Khabarovsk, Russia)
Docent (Senior Lecturer) (2002–2003), part-time employment

Visiting Appointments and Awards

- *The Alan Turing Institute* (London, United Kingdom)
Turing Fellow (October 2018–September 2020)
- *Isaac Newton Institute for Mathematical Sciences* (Cambridge, United Kingdom)
Programme participant for the scientific programme “Uncertainty quantification for complex systems: theory and methodologies” (April–May 2018)
- *Institute for Analysis and Scientific Computing, TU Wien* (Vienna, Austria)
Visiting Researcher (March–April 2017); Guest Professor (2018)
- *Facultad de Matemáticas, Universidad Católica* (Santiago, Chile)
Visiting Researcher (March 2009, April 2014)
- *Laboratory of Mathematics and its Applications, Université de Valenciennes* (France)
Visiting Professor (May–June 2013)
- *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 areas: numerical analysis, scientific computing, uncertainty quantification
- Research interests: numerical solution of partial differential and boundary integral equations; numerical methods for PDEs with parametric or uncertain inputs; high order finite element and boundary element methods; adaptive methods; convergence analysis and error estimation; singularities and their approximation; software development; applications to electromagnetics, fluid dynamics, and linear elasticity

List of Publications

Preprints submitted for publication

- [1] A. Khan, A. Bepalov, C. E. Powell and D. J. Silvester, Robust a posteriori error estimation for stochastic Galerkin formulations of parameter-dependent linear elasticity equations. *Preprint*, arXiv:1810.07440 [math.NA], 2018.
- [2] A. Bepalov, T. Betcke, A. Haberl and D. Praetorius, Adaptive BEM with optimal convergence rates for the Helmholtz equation. *Preprint*, arXiv:1807.11802 [math.NA], 2018.
- [3] A. J. Crowder, C. E. Powell and A. Bepalov, Efficient adaptive multilevel stochastic Galerkin approximation using implicit a posteriori error estimation. *Preprint*, arXiv:1806.05987 [math.NA], 2018.
- [4] A. Bepalov, D. Praetorius, L. Rocchi and M. Ruggeri, Goal-oriented error estimation and adaptivity for elliptic PDEs with parametric or uncertain inputs. *Preprint*, arXiv:1806.03928 [math.NA], 2018.

Publications in Refereed Journals

- [5] A. Bespalov and L. Rocchi, Efficient adaptive algorithms for parametric PDEs with spatial singularities. *SIAM/ASA Journal on Uncertainty Quantification*, Vol. 6 (2018), no. 1, pp. 243–272.
- [6] 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.
- [7] 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.
- [8] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] 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.
- [15] 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.
- [16] 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.

- [17] A. Besselov 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.
- [18] A. Besselov and N. Heuer, The hp -version of the boundary element method with quasiuniform meshes for weakly singular operators on surfaces. *IMA Journal of Numerical Analysis*, Vol. 30 (2010), No. 2, pp. 377–400.
- [19] A. Besselov 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.
- [20] A. Besselov, 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.
- [21] A. Besselov and N. Heuer, The hp -version of the boundary element method with quasiuniform meshes in three dimensions. *ESAIM: Mathematical Modelling and Numerical Analysis*, Vol. 42 (2008), Issue 5, pp. 821–849.
- [22] A. Besselov, 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.
- [23] A. Besselov 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.
- [24] D. Arroyo, A. Besselov 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.
- [25] A. Besselov 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.
- [26] A. Besselov 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.
- [27] A. Besselov, Orthogonal systems of singular functions and numerical treatment of problems with degeneration of data. *Advances in Computational Mathematics*, Vol. 19 (2003), pp. 159–182.
- [28] A. Yu. Besselov 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.

- [29] 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.
- [30] 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 solution. *Siberian Journal of Numerical Mathematics*, Vol. 1 (1998), no. 2, pp. 153–170.

Publications in refereed conference proceedings

- [31] 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.
- [32] 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.
- [33] 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.
- [34] 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, Jyvaskyla, Finland, July 26–30, 1999*”, ed. by P. Neittaanmaki, T. Tiihonen and P. Tarvainen, World Scientific, Singapore, 2000, pp. 681–689.
- [35] 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.

Research Software

- D. Silvester, A. Bepalov and C. Powell, *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.
- *Birmingham–Nottingham Strategic Collaboration Fund*
Grant to initiate collaborative research, 2018–2019.
Project title: New solution paradigms for high-dimensional mathematical models using machine-learning algorithms (Ref. FRM279848).
Role: principal investigator (joint). **Value:** £4,840.
- *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

Invited talks / participation supported by organisers

- 27th Biennial Numerical Analysis Conference (Glasgow, UK; June 2017). Invited mini-symposium talk: *“On the design and performance of adaptive stochastic Galerkin methods”*.
- SIAM Conference on Uncertainty Quantification (EPFL, Lausanne, Switzerland; April 2016). 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 (International Centre for Mathematical Sciences, Edinburgh, UK; January, 2014). Invited talk: *“A posteriori error estimation for stochastic Galerkin approximations”*. All expenses paid by the organisers.
- MAFELAP 2013, Mathematics of Finite Elements and Applications (Uxbridge, UK; June 2013). Invited mini-symposium talk: *“A posteriori error estimation for stochastic Galerkin FEMs”*.
- Workshop “Numerical Analysis of Stochastic PDEs” (Mathematics Institute, University of Warwick, UK; June, 2012). 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” (Hausdorff Center for Mathematics, Bonn, Germany; February 2012). Invited talk: *“A priori error analysis of stochastic Galerkin mixed finite element methods”*. All local expenses paid by the organisers.
- Workshop on Linear Algebra Aspects of Solving PDEs with Random Data (Manchester, UK; January 2012). Invited talk: *“Numerical analysis of saddle point problems with random data”*.
- MAFELAP 2009, Mathematics of Finite Elements and Applications (Uxbridge, UK; June 2009). Invited 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”*.
- ICOSAHOM-07, International Conference on Spectral and High Order Methods (Beijing, China; June 2007). 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 (Uxbridge, UK; June 2006). Invited mini-symposium talk: *“On the hp-version of the boundary element method with quasi-uniform meshes in three dimensions”*. Registration fee waived by the organisers.
- BICOM Workshop on Boundary Elements (Uxbridge, UK; June 2005). Contributed talk: *“The p-version of the boundary element method for hypersingular operators”*. All local expenses paid by the organisers.
- COMCA 2003, XIII Congreso de Matemáticas Capricornio (Antofagasta, Chile; August 2003). Invited mini-symposium talk: *“On the p-version of the finite element method for boundary value problems with strongly singular solutions”*.

Research seminars

19 invited seminar talks, including those at

- Institute for Analysis and Scientific Computing, TU Wien, Vienna, Austria (April, 2017)
- School of Mathematics, Cardiff University, UK (October 2016)
- Department of Mathematics, University of Sussex, Brighton, UK (February 2015).
- Facultad de Matemáticas, Universidad Católica, Santiago, Chile (April 2014)
- Laboratory of Mathematics and its Applications, Université de Valenciennes, Valenciennes, France (May 2013)
- Department of Mathematics and Statistics, University of Strathclyde, UK (November 2012)
- Department of Mathematical Sciences, Brunel University, UK (October 2012).
- Mathematics Institute, University of Warwick, UK (March 2012)
- School of Mathematics, University of Manchester, UK (October 2010).
- Departamento de Ingeniería Matemática, Universidad de Concepción, Chile (July, November 2003).

Contributed talks

15 contributed talks at conferences and workshops, including

- Chemnitz FEM Symposia (Strobl / St. Wolfgang, 2017 and Chemnitz, 2018).
- European Finite Element Fairs (Coventry, 2010 and Milan, 2017).
- Biennial Numerical Analysis Conferences (Glasgow, 2009, 2011, 2015).
- International Congress on Industrial and Applied Mathematics, ICIAM (Vancouver, 2011).
- WAVES 2011, 10-th International Conference on Mathematical and Numerical Aspects of Waves (Vancouver, 2011).
- UK Conference on Boundary Integral Methods (Durham, September 2007).
- IMACS Workshop on Adaptive Methods for Partial Differential Equations (Toronto, 2002).
- Com2MaC Conference on Computational Mathematics (Pohang, 2001).

Research Supervision

- Dr Feng Xu (Research Fellow; since June 2017).
- Mr Leonardo Rocchi (current PhD student; since October 2015).
Project title: *“Adaptive algorithms for numerical solution of PDEs with random inputs”*.
- Mr Rawin Youngnoi (current PhD student; since September 2016), jointly supervised with Dr Daniel Loghin.
Project title: *“Domain decomposition methods for PDE problems with random inputs”*.
- Mr Matthew Williams (MSci project in Mathematics; 2014–15).
Project title: *“Stochastic sampling methods for PDEs with random input data”*.

Teaching Experience

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/PGT)
Computational Methods and Programming (PGT)

School of Mathematics, University of Manchester, 2010–12

Course taught: service course Engineering Mathematics (Linear Algebra sub-module) for Year 2 Electrical and Electronic Engineering students.

Department of Mathematical Analysis and Computer Science, Khabarovsk State Pedagogical University (Khabarovsk, Russia), 2002–03

Course taught: Mathematical Analysis for 2nd year undergraduate students.

Meeting / Mini-Symposia Organisation

- **Adaptive algorithms for computational PDEs**

A two-day LMS funded workshop at the University of Birmingham (January 2016); jointly organised with Dr Daniel Loghin.

- **Finite elements for problems with singularities**

A mini-symposium at the International Conference on Mathematics of Finite Elements and Applications, MAFELAP 2013 (Uxbridge, UK); jointly organised with Prof. Serge Nicaise (Université de Valenciennes).

Other Professional and Administrative Experience

- Examiner for PhD Theses:

Mr Alexander Haberl, TU Wien (Vienna, Austria), 2018 (external reviewer);
Ms Manal AlQhtani, University of Birmingham, 2017 (internal examiner)

- Referee for

SIAM Journal on Numerical Analysis, IMA Journal of Numerical Analysis,
Journal of Scientific Computing, Numerical Methods for PDEs,
Applied Numerical Mathematics, BIT Numerical Mathematics,
Numerical Algorithms, Computers and Mathematics with Applications,
Mathematical Methods in the Applied Sciences,
Computational Methods in Applied Mathematics.

- Reviewer for Mathematical Reviews (since 2008).

- Member of the Local Scientific Committee for the 25th UKACM Conference on Computational Mechanics, University of Birmingham, 2017

- Head of the Applied Mathematics group (joint), School of Mathematics, University of Birmingham (since August 2018)

- Deputy Director of Year 1 Undergraduate Programmes in Mathematics, School of Mathematics, University of Birmingham (2015–17)
- Applied Mathematics seminar organiser (joint), School of Mathematics, University of Birmingham (2013–15)
- Numerical Analysis seminar organiser, School of Mathematics, University of Manchester (2010–12)
- Professional Society Membership: Society for Industrial and Applied Mathematics (SIAM).
- Fellow of the Higher Education Academy, UK (awarded in March 2016).