University of Birmingham

Dr Alex Bespalov

Lecturer in Applied Mathematics

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About

Dr Alex Bespalov is a member of the Applied Mathematics group in the School of Mathematics. Alex is a numerical analyst with expertise in a range of modern computational methods and techniques. His research aims at the design, analysis and implementation of robust and accurate numerical algorithms for solving mathematical problems coming from real-life applications.

School web-page: **web.mat.bham.ac.uk/A.Bespalov/ (http://web.mat.bham.ac.uk/A.Bespalov/)**

Qualifications

- PhD in Computational Mathematics, Russian Academy of Sciences, 1999

Biography

Alex obtained his PhD in Computational Mathematics from the Russian Academy of Sciences in 1999.

Before joining the University of Birmingham, Alex held postdoctoral research positions at Universidad de Concepción (Chile), Brunel University, and the University of Manchester.

Teaching

Teaching Programmes

- Computational Methods and Frontiers
- Computational Methods & Programming

Postgraduate supervision

Alex is happy to discuss potential supervision of PhD research projects in Numerical Analysis with motivated and suitably qualified candidates.

Research

RESEARCH THEMES

- numerical solution of partial differential and boundary integral equations;
- numerical methods for uncertainty quantification;
- high order (p- and hp-) finite element and boundary element methods;
- error estimation, error control, and adaptivity;
- singularities and their numerical approximation;
- applications to electromagnetics, linear elasticity, and fluid dynamics

RESEARCH ACTIVITY

Alex specialises in Numerical Analysis. As a mathematician, he is interested to see how intrinsic properties of mathematical models (e.g., differential equations) influence their numerical approximations. He uses these insights together with advanced methods of applied analysis to provide mathematical justification of robust and accurate numerical algorithms tailored to specific problems of practical interest.

One direction of Alex's research concerns numerical methods for problems with uncertain (or, random) data. Here, the focus is on developing efficient algorithms to deal with highly-dimensional discrete problems stemming from stochastic finite element approximations. This research is within a rapidly evolving area of uncertainty quantification, which is at the forefront of modern computational science. In this area, Alex has established research links with Dr Catherine Powell and Professor David Silvester at the University of Manchester.

Alex's research in stochastic finite element method goes hand in hand with his expertise in and passion for high-order polynomial approximations. He also studies these in the context of finite element and boundary element methods for deterministic PDE problems posed over non-smooth (not necessarily bounded) domains. Here, non-smoothness of physical domain is one of key points when thinking of practical applications, e.g., in civil engineering (crack detection) and electromagnetics (radar design). In this area of research Alex has collaborative ties with Professor Norbert Heuer (Pontificia Universidad Católica de Chile), Professor Ralf Hiptmair (ETH Zurich, Switzerland), Dr Matthias Maischak (Brunel University, UK), and Professor Serge Nicaise (Université de Valenciennes, France).

Other activities

- Alex is a reviewer for Mathematical Reviews (since 2008)

Publications

Bespalov, A., Powell, C. and Silvester, D., (2012), A priori error analysis of stochastic Galerkin mixed approximations of elliptic PDEs with random data, SIAM Journal on Numerical Analysis, Vol. 50, Issue 4, pp. 2039-2063. **dx.doi.org/10.1137/110854898 (http://dx.doi.org/10.1137/110854898)**

Bespalov, A. and Heuer, N., (2011), A new H(div)-conforming p-interpolation operator in two dimensions, ESAIM: Mathematical Modelling and Numerical Analysis, Vol. 45, Issue 2, pp. 255-275. **dx.doi.org/10.1051/m2an/2010039 (http://dx.doi.org/10.1051/m2an/2010039)**

Bespalov, A., Heuer, N. and Hiptmair, R., (2010), Convergence of the natural hp-BEM for the electric field integral equation on polyhedral surfaces, SIAM Journal on Numerical Analysis, Vol. 48, Issue 4, pp. 1518-1529. **dx.doi.org/10.1137/090766620 (http://dx.doi.org/10.1137/090766620)**

Bespalov, A. and Heuer, N., (2010), Natural p-BEM for the electric field integral equation on screens, IMA Journal of Numerical Analysis, Vol. 30, No. 3, pp. 595-628. **dx.doi.org/10.1093/imanum/drn072 (http://dx.doi.org/10.1093/imanum/drn072)**

Bespalov, A. and Heuer, N., (2010), 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, Issue 7, pp. 705-718. **dx.doi.org/10.1016/j.apnum.2010.03.012 (http://dx.doi.org/10.1016/j.apnum.2010.03.012)**

Bespalov, A. and Heuer, N., (2010), 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, No. 2, pp. 377-400. **dx.doi.org/10.1093/imanum/drn052 (http://dx.doi.org/10.1093/imanum/drn052)**

Bespalov, A. and Heuer, N., (2009), Optimal error estimation for H(curl)-conforming p-interpolation in two dimensions, SIAM Journal on Numerical Analysis, Vol. 47, Issue 5, pp. 3977-3989. **dx.doi.org/10.1137/090753802 (http://dx.doi.org/10.1137/090753802)**

Bespalov, A. and Heuer, N., (2008), The hp-version of the boundary element method with quasi-uniform meshes in three dimensions, ESAIM: Mathematical Modelling and Numerical Analysis, Vol. 42, Issue 5, pp. 821-849. **dx.doi.org/10.1051/m2an:2008025 (http://dx.doi.org/10.1051/m2an:2008025)**

Bespalov, A. and Heuer, N., (2007), The p-version of the boundary element method for weakly singular operators on piecewise plane open surfaces, Numerische Mathematik, Vol. 106, No. 1, pp. 69-97. **dx.doi.org/10.1007/s00211-006-0058-6 (http://dx.doi.org/10.1007/s00211-006-0058-6)**

Arroyo, D., Bespalov, A. and Heuer, N., (2008), On the finite element method for elliptic problems with degenerated and singular coefficients, Mathematics of Computation, Vol. 76, No. 258, pp. 509-537. **dx.doi.org/10.1090/S0025-5718-06-01910-7 (http://dx.doi.org/10.1090/S0025-5718-06-01910-7)**

Bespalov, A. and Heuer, N., (2005), The p-version of the boundary element method for hypersingular operators on piecewise plane open surfaces, Numerische Mathematik, Vol. 100, No. 2, pp. 185-209. **dx.doi.org/10.1007/s00211-005-0590-9 (http://dx.doi.org/10.1007/s00211-005-0590-9)**

Bespalov, A., (2003), Orthogonal systems of singular functions and numerical treatment of problems with degeneration of data, Advances in Computational Mathematics, Vol. 19, pp. 159-182. **dx.doi.org/10.1023/A:1022862704316 (http://dx.doi.org/10.1023/A:1022862704316)**