

Dr Olga Maleva PhD

Senior Lecturer in Pure Mathematics

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About

Olga Maleva is a Senior Lecturer in Pure Mathematics.

Olga has published research papers in leading mathematical journals and has been awarded research grants by the European Commission and the Royal Society. Her current research is supported by a grant from the Engineering and Physical Sciences Research Council. At the moment, she is supervising a postdoctoral advisee and a doctoral student.

Olga has been invited speaker to a number of international research conferences and has given numerous research seminars in the UK and abroad.

School web page: **web.mat.bham.ac.uk/~malevao** (<http://web.mat.bham.ac.uk/~malevao>)

Qualifications

- PhD in Mathematics, The Weizmann Institute of Science, Israel, 2003
- MSc equivalent in Mathematics with distinction, Saint Petersburg State University, Russia, 1998

Biography

Olga Maleva defended her MSc Thesis in 1998 at the Saint Petersburg State University, Russia and went on to study for a PhD in the area of Geometric and Functional Analysis at the Weizmann Institute of Science in Israel.

After the completion of her PhD at the end of 2003, Olga was awarded the Marie Curie Intra-European fellowship which she held for two years at the University College London. She then worked for one year as a Director of Studies at Emmanuel College, University of Cambridge, and after that on EPSRC grant together with Professor David Preiss at the University of Warwick, before moving to the present permanent post in 2008.

In 2008 Olga started as a Lecturer in Pure Mathematics in the University of Birmingham. She is teaching various courses in Analysis to undergraduate and graduate students.

Teaching

- Single Honours Mathematics (G100, G103, G141)
- Mathematics Majors: Mathematics with Business Management (G1N2); Mathematics with Engineering (J920); Mathematics with Philosophy (G1V5)
- Joint Honours Mathematics: Mathematics & Computer Science (GG14); Pure Mathematics & Computer Science (GGC4); Mathematics & Sport Science (GC17); Mathematics & Music (GW13); Mathematics & Philosophy (GV15)
- Theoretical Physics and Applied Mathematics (FG31)
- Mathematics Minors: French Studies and Mathematics (GR11); German Studies and Mathematics (GR12)
- Natural Sciences (CFG0, FCG0)

Postgraduate supervision

Olga is interested in supervising PhD students in the following areas:

- Geometric Analysis
- Problems in Analysis with measure theoretic flavour

Research

RESEARCH THEMES

- Differentiability of Lipschitz mappings
- Null sets
- Geometric measure theory

- Nonlinear quotient mappings
- Geometry of Banach spaces
- Regularity of mappings in Banach spaces

RESEARCH ACTIVITY

The directions in Olga's research to date are Lipschitz quotient mappings and null sets in Banach spaces.

Her current research addresses the questions to determine the sigma-ideal generated by sets of points of non-differentiability of Lipschitz functions on normed spaces.

In a series of papers joint with Doré (her current postdoctoral advisee) Olga is developing a method of constructing small sets with the universal differentiability property: every function satisfying the Lipschitz condition on the space is differentiable at a point from this set. The methods used for this purpose combine ideas from analysis and descriptive set theory. This circle of questions relates analytic properties of Lipschitz maps and the geometry of null sets.

Olga's earlier work was focused on problems in non-linear analysis in normed spaces, and in particular, on Lipschitz quotient mappings. Lipschitz quotient mappings generalise both linear projections and bi-Lipschitz deformations and exhibit highly non-trivial topological properties even in the finite-dimensional case, which leads to an intricate interplay between the geometry of these mappings and the non-linear structure of Banach spaces. In particular, Olga has undertaken an in-depth study of the topology of level sets and point preimages under Lipschitz quotient mappings.

Subsequently Olga found an unexpected application of Lipschitz quotient mappings in the study of differentiability in infinite-dimensional spaces. She applied the theory of Lipschitz quotient mappings in order to construct in infinite-dimensional Banach spaces null subsets which "almost contain" every Lipschitz curve. The null sets in question have the property that there exists a Lipschitz function differentiable at no point of the set. This surprising result covers as a particular case a theorem by Lindenstrauss, Preiss and Tiser.

Part of Olga's research has been and is devoted to extending the notion of differentiability to functions on metric spaces without linear structure. In particular, a new, intrinsic metric characterisation of purely 1-unrectifiable subsets of the finite-dimensional Euclidean space, which yields a remarkable metric version of the Besicovitch-Federer projection theorem, was obtained in a joint work with Kun and Máthé; further results were obtained in a joint work with Duda.

Publications

Selected:

- M. Dore and O. Maleva, A universal differentiability set in Banach spaces with separable dual, *Journal of Functional Analysis* 261 (2011), 1674-1710.
- Maleva, O., Doré, M., A compact universal differentiability set with Hausdorff dimension one, *Israel Journal of Mathematics*, (to appear).
- M. Dore and O. Maleva, A compact null set containing a differentiability point of every Lipschitz function, *Mathematische Annalen*, no. 3, vol. 351 (2011), 633-663.
- Maleva, O., Duda, J. (2007), Metric derived numbers and continuous metric differentiability via homeomorphisms, *De Gruyter Proceedings in Mathematics*, 2007: 307-330.
- Maleva, O. (2007), Unavoidable sigma-porous sets, *Journal of the London Math. Soc.*, 76, No 2: 467-478.
- Maleva, O., Kun, G., Mathe, A. (2006), Metric characterization of pure unrectifiability, *Real Analysis Exchange*, 31, No. 1: 195-214.
- Maleva, O. (2005), On Lipschitz ball non collapsing functions and uniform co-lipschitz mappings of the plane, *Abstract and Applied Analysis*, 2005, No. 5: 543-562.
- Maleva, O. (2005), Components of level sets of uniform co-lipschitz functions on the plane, *Proceedings of the AMS*, 133, No. 3: 841-850.

