Curriculum Vitae — Dr Mark Grant

Contact details

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Education

- **University of Manchester, UK** — Sep 2002 to Dec 2005
  Ph. D – supervised by Prof. Peter J Eccles — Graduated May 2006
  Thesis title – 'Bordism of Immersions'
- **University of Edinburgh, UK** — Oct 1998 to May 2002
  MA Mathematics – First Class Honours — Graduated Jul 2002

Positions held

- **University of Aberdeen, UK**
  Senior Lecturer — Aug 2018 to present
  Lecturer — Sep 2014 to Aug 2018
- **Newcastle University, UK** — Sep 2013 to Aug 2014
  Lecturer
- **University of Nottingham, UK** — Sep 2011 to Jun 2013
  Lecturer
- **University of Edinburgh, UK** — Sep 2008 to Aug 2011
  Lecturer
- **Durham University, UK** — Jan 2006 to Sep 2008
  Research Associate

Research interests

- **Applied Algebraic Topology** – topological complexity of robot motion planning, applications of topology to soft matter physics
- **Algebraic Topology** – Lusternik–Schnirelmann category, rational homotopy theory, algebraic topology of smooth manifolds
- **Differential Topology** – immersions and their self-intersections, cobordism theory, connections with homotopy theory
- **Cohomology of groups** – finiteness properties of torsion-free groups, equivariant group cohomology

Papers and preprints

1. *Projective span of Wall manifolds* (with Baylee Schutte), preprint `arXiv:2311.14107`
2. *Comparison of equivariant cohomological dimensions* (with K. Li, E. Meir and I. Patchkoria), to appear in Israel J. Math.
3. *Parametrised topological complexity of group epimorphisms*, Topol. Methods Nonlinear Anal. **60** (2022), no. 1, 287–303.
4. *Equivariant dimensions of groups with operators* (with E. Meir and I. Patchkoria), Groups Geom. Dyn. **16** (2022), no. 3, 1049–1075.
5. *Isotopy and homeomorphism of closed surface braids* (with A. Sienicka), Glasgow Math. J. **63** (2021), no. 2, 297–306.
6. *The Topological Period-Index Conjecture for spin^c 6-manifolds* (with D. Crowley), Ann. K-Theory, **5-3**, (2020), 605–620.
7. *Topological complexity of symplectic manifolds* (with S. Mescher), Math. Z. **295** (2020), 667–679.
8. *Morita Invariance of Equivariant Lusternik-Schnirelmann Category and Invariant Topological Complexity* (with A. Ángel, H. Colman and J. Oprea), Theory Appl. Categ. **35** (2020), 179–195.
9. *Directed topological complexity of spheres* (with A. Borat), J. Appl. Comput. Topol. **4** (2020), 3–9.
10. *Hopf Invariants for sectional category with applications to topological robotics* (with J. González and L. Vandembroucq), Q. J. Math. **70** (2019), no. 4, 1209–1252.
11. *Bredon cohomology and robot motion planning* (with M. Farber, G. Lupton and J. Oprea), Algebr. Geom. Topol. **19** (2019), 2023–2059.
12. *Symmetrized topological complexity*, J. Topol. Anal. **11** (2019), no. 2, 387–403.
13. *An upper bound for topological complexity* (with M. Farber, G. Lupton and J. Oprea), Topology Appl. **255** (2019), 109–125.
14. *Hopf invariants, topological complexity, and LS-category of the cofiber of the diagonal map for two-cell complexes* (with J. González and L. Vandembroucq), Contemp. Math. **702** (2018), 133–150.
15. *Topological complexity of subgroups of Artin's braid groups* (with D. Recio-Mitter), Contemp. Math. **702** (2018), 165–176.
16. *Realizing homology classes up to cobordism* (with A. Szűcs and T. Terpai), Osaka J. Math. **54** (2017), no. 4, 803–807.
17. *The Poincaré–Hopf Theorem for line fields revisited* (with D. Crowley), J. Geom. Phys. **117** (2017), 187–196.

18. *A mapping theorem for topological complexity* (with G. Lupton and J. Oprea), Algebr. Geom. Topol. **15** (2015), 1643–1666.

19. *Sequential motion planning of non-colliding particles in Euclidean spaces* (with J. González), Proc. Amer. Math. Soc. **143** (2015), 4503–4512.

20. *New lower bounds for the topological complexity of aspherical spaces* (with G. Lupton and J. Oprea), Topology Appl. **189** (2015), 78–91.

21. *Homologies are infinitely complex* (with A. Szűcs), Topol. Methods Nonlinear Anal. **45** (2015), no. 1, 55–61.

22. *Spaces of topological complexity one* (with G. Lupton and J. Oprea), Homology Homotopy Appl. **15** (2013), no. 2, 73–81.

23. *On realizing homology classes by maps of restricted complexity* (with A. Szűcs), Bull. Lond. Math. Soc. **45** (2013), no. 2, 329–340.

24. *Topological complexity of motion planning in projective product spaces* (with J. González, E. Torres-Giese and M. Xicoténcatl), Algebr. Geom. Topol. **13** (2013), no. 2, 1027–1047.

25. *On self-intersection invariants*, Glasgow Math. J. **55** (2013), no. 2, 259–273.

26. *Equivariant topological complexity* (with H. Colman), Algebr. Geom. Topol. **12** (2012), no. 4, 2299–2316.

27. *Self-intersections of Immersions and Steenrod Operations* (with P. J. Eccles), Acta Math. Hungar. **137** (2012), no. 4, 272–281.

28. *Topological complexity, fibrations and symmetry*, Topology Appl. **159** (2012), no. 1, 88–97.

29. *Topological complexity of configuration spaces* (with M. Farber), Proc. Amer. Math. Soc. **137** (2009), no. 5, 1841–1847.

30. *Topological complexity of motion planning and Massey products*, In "Algebraic Topology—Old and New: M. M. Postnikov Memorial Conference" M. Golasiński et al (eds), Banach Center Publ. **85** (2009), 193–203.

31. *Robot motion planning, weights of cohomology classes, and cohomology operations* (with M. Farber), Proc. Amer. Math. Soc. **136** (2008), no. 9, 3339–3349.

32. *Symmetric Motion Planning* (with M. Farber), In "Topology and Robotics", M. Burger, M. Farber, R. Ghrist and D. Koditschek (eds), Contemp. Math. **438** (2007), 85–104.

33. *Topological complexity of collision free motion planning algorithms in the presence of multiple moving obstacles* (with M. Farber and S. Yuzvinsky), In "Topology and Robotics", M. Burger, M. Farber, R. Ghrist and D. Koditschek (eds), Contemp. Math. **438** (2007), 75–83.

34. *Bordism Groups of Immersions and Classes Represented by Self-intersections,* (with P. J. Eccles), Algebr. Geom. Topol. **7** (2007), 1081–1097.

35. *Bordism classes represented by multiple point manifolds of immersed manifolds,* (with P. J. Eccles), Proc. Steklov Inst. Math. **252** (2006), no. 1, 47–52.

Editorial Work

- **(Book)** *Topological complexity and related topics*, M. Grant, G. Lupton and L. Vandembroucq (eds), Contemp. Math. **702**, (2018), 176pp.
- **(Journal)** Apr 2017 to present – Editor of *Proceedings of the Royal Society of Edinburgh Section A: Mathematics*
- **(Special Issue)** Jun 2021 to present – Managing Editor of Special Issue *Manifolds and K-Theory: Memorial volume in honour of Andrew Ranicki* of the *Proceedings of the Royal Society of Edinburgh Section A: Mathematics*

Undergraduate teaching

- **(Lecturer at University of Aberdeen, 2014 to present)** 'Algebra' (Level 1), 'Engineering Mathematics 1' (Level 1 service), 'Linear Algebra 1' (Level 2), 'Mathematical Foundations of Everyday Life' (Level 3), 'Metric and Topological Spaces' (Level 3), 'Geometry' (Level 3/4), 'Project' (Level 4)
- **(Lecturer at Newcastle University, 2013 to 2014)** 'Survey Mathematics' (Level 2 service), 'Group Project Module' (Level 3), 'The Foundations of Calculus' (Level 2)
- **(Lecturer at University of Nottingham, 2011 to 2013)** 'Analytical and Computational Foundations' (Level 1), 'Metric and Topological Spaces' (Level 3)
- **(Lecturer at University of Edinburgh, 2008 to 2011)** 'Applicable Mathematics 1' and 'Applicable Mathematics 2' (Level 1 service), 'Numbers and Rings' (Level 3), 'Individual Project' (Level 4)

Postgraduate teaching

- **(Lecturer at University of Aberdeen, 2017–2020)** 'Algebraic Topology' (SMSTC graduate course)
- **(Lecturer at University of Nottingham, 2011–2013)** 'Foundations of Advanced Analysis' (MMath course)
- **Ph. D students:** David Recio-Mitter (University of Aberdeen, 2015–2018), Baylee Schütte (University of Aberdeen, 2021–present)
- **Internal Examiner** of Ph. D. theses at the University of Edinburgh and the University of Aberdeen
- **External Examiner** of Ph. D. theses at the University of Manchester, the University of Southampton and CINVESTAV, México.

Administration

- **Current roles:** Director of Undergraduate Teaching in Mathematics, School Representative on Quality Assurance Committtee, Member of Teaching Committee for Mathematics.

- **Former roles:** Exams Officer for Mathematics (2021-2023), Local representative of Edinburgh Mathematical Society (2021-2023), Digital Learning Representative for Mathematics (2017–2020), Head of Research for Mathematics (2019–2020), Organizer of Topology seminar (2016–2018), Recruitment Officer for Mathematics (2014–2016)

Conference organization and other service

- Sep 2022 – Co-organizer of "Classifying Spaces in Homotopy Theory: in Honour of Ran Levi's 60th birthday" at ICMS, Edinburgh
- Jun 2018 – Co-organizer of "International Conference on Manifolds, Groups and Homotopy" at Sabhal Mòr Ostaig, Isle of Skye
- Sep 2017 – Co-organizer of Topology sessions at joint meeting of the Edinburgh and Catalan Maths Societies
- 2016 to 2022 – Co-organizer of the Scottish Topology Seminar (supported by the Glasgow Mathematical Journal Trust)
- Feb 2016 – Co-organizer of MF Oberwolfach mini-workshop on 'Topological complexity and related topics' (with G. Lupton and L. Vandembroucq)
- 2015 to 2016 – Co-organizer of UK research network in Applied Algebraic Topology (with J. Brodzki, M. Farber, J. Grbić, V. Kurlin and D. Schütz)
- Mar 2012 – Organizer of the 83$^{\text{rd}}$ meeting of the Transpennine Topology Triangle, held at the University of Nottingham (supported by the LMS) Mathematics', a conference for potential graduate students held at Durham University
- **Referee for:** J. Topol., Geom. Dedicata, J. Lond. Math. Soc., Proc. Amer. Math. Soc., Commun. Contemp. Math., Math. Proc. Cambridge Philos. Soc., Algebr. Geom. Topol., Topology Appl., Topol. Methods Nonlinear Anal., Bol. Soc. Mat. Mexicana, Contemp. Math., Banach Center Publ., J. Mechanisms Robotics, Publ. Mat., J. Topol. Anal., Forum Math., J. Applied and Computational Topology, Ann. Math. Artif. Intell., Results Math., Bull. Aust. Math. Soc., Topology Proc.
- **Reviewer for** Mathematical Reviews and Zentralblatt Math
- **Grant reviewer for** EPSRC, National Science Centre (Poland), Research Foundation – Flanders (Belgium)

Grants awarded

- 2020 – Awarded £19,000 from the ICMS, Edinburgh and grants from the Glasgow Mathematical Journal Trust Fund (£3,000) and Edinburgh Mathematical Society Research Support Fund (£1,500) to organize the workhop "Classifying Spaces in Homotopy Theory: in Honour of Ran Levi's 60th birthday" (with D. Kishimoto and S. Theriault)
- May 2018 – London Mathematical Society Undergraduate Bursary (£1440) to work with Miss Agata Sienicka on a project "Geometric and topological aspects of the theory of braids"

- Nov 2017 – London Mathematical Society Scheme 1 grant (£6,000) and grants from the Glasgow Mathematical Journal Trust Fund (£4,000) and Edinburgh Mathematical Society Research Support Fund (£700) for International Conference on Manifolds, Groups and Homotopy, Sabhal Mòr Ostaig, Isle of Skye (with D. Crowley, R. Hepworth, J. Kędra, R. Levi and A. Libman)
- Nov 2015 – London Mathematical Society Scheme 3 grant (£2,000) and grants from the Glasgow Mathematical Journal Trust Fund (£1,135) and Institute of Mathematics and its Applications (£600) to continue Applied Algebraic Topology research network into second year (with J. Brodzki, M. Farber, J. Grbić, V. Kurlin and D. Schütz)
- Sep 2014 – London Mathematical Society Scheme 3 grant (£2,000) and Edinburgh Mathematical Society Research Support Fund (£1,200) to establish UK research network in Applied Algebraic Topology (with J. Brodzki, M. Farber, J. Grbić, V. Kurlin and D. Schütz)
- Apr 2013 – Institute of Mathematics and its Applications small grant (£300) to attend Applied Topology conference in Będlewo, Poland in July 2013
- May 2010 – Royal Society International Travel Grant (£2,300) to visit Prof. Aniceto Murillo at the University of Málaga

Selected invited talks

- May 2022 – British Topology Meeting, Durham, UK
- May 2022 – Casa Matematica Oaxaca, México – Workshop on Topological Complexity and Motion Planning
- Jan 2019 – Kyoto University, Japan – Workshop on Applied Topology (two 1 hour lectures)
- Sep 2018 – Wrocław, Poland – UMI–SIMAI–PTM Joint meeting (invited session speaker)
- Aug 2018 – Kyoto University, Japan – Mapping Spaces in Algebraic Topology (plenary lecture)
- Oct 2016 – Amiens, France – Colloque 2016 du GDR 2875, Topologie Algébrique et Applications – "Topological complexity of configuration spaces"
- Apr 2016 – British Applied Mathematics Colloquium, Oxford, UK – "A survey of Farber's topological complexity"
- Apr 2015 – Université Internationale de Casablance, Morocco – Colloque MASSIF 2 – "Topology and robot motion planning"
- Feb 2015 – IST, Lisbon, Portugal – XXI Oporto meeting on Geometry, Topology and Physics – "Hopf invariants for sectional category with applications to Topological Robotics"
- Jul 2014 – CIEM, University of Cantabria, Spain – Applied Algebraic Topology workshop – "A mapping theorem for topological complexity"