Anand Deopurkar | Curriculum Vitae

Mathematical Sciences Institute, The Australian National University

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Academic qualifications

Harvard University **Cambridge, MA**
Ph.D., Advisor: Joseph Harris *2008–2012*
Thesis: *Alternate compactifications of Hurwitz spaces*

Massachusetts Institute of Technology (MIT) **Cambridge, MA**
S.B., Mathematics with Computer Science *2004–2008*

Academic employment

Australian National University (ANU) **Canberra, Australia**
Lecturer *2018–*

University of Georgia **Athens, GA**
Assistant Professor (Limited Term) *2016–2017*

Columbia University **New York, NY**
J. F. Ritt Assistant Professor *2012–2016*

Academic awards

- Award for excellence in teaching, 2014.
  Departmental award at Columbia University based on evaluations by students and observations by senior faculty.
- Jon A. Bucsela prize, 2006.
  Departmental award at MIT for the top graduating mathematics major.
- Rogers family prize, 2006.
  Departmental award at MIT for best summer research.
- William Lowell Putnam competition: 2004 (Rank 16–25), 2005 (Honorable mention), 2007 (Honorable mention).
- International Mathematical Olympiad: 2004 (Silver medal), 2003 (Bronze medal).

Six most significant research publications

- *Modular compactifications of the space of marked trigonal curves*.
  Advances in Mathematics, 248(0):96–154, 2013.
  Estimated contribution: 100%.
  Journal impact factor: 1.494, h5-index: 48, Google Scholar citations: 4.
  Google Scholar journal rank 2 in Algebra, ERA/AustMS journal category A* with rank 2 in Pure Mathematics.

  "*[The paper] uses cutting-edge techniques to shed new light on a classical and widely-studied subject and introduces new techniques such as [...]. This very original paper will guide future work [in this area].*" (Referee report)

- *Stable log surfaces, admissible covers, and canonical curves of genus 4* (with Changho Han).
  Transactions of the American Mathematical Society, to appear.
  Estimated contribution: 70%.
  Journal impact factor: 1.34, h5-index: 43, Google Scholar citations: 9.
  Google Scholar journal rank 3 in Algebra, ERA/AustMS journal category A*.

  "*I am deeply impressed by this paper. It adopts a very original approach to a very difficult problem [...] and solves it in the first open case [...] by cleverly combining essentially all of the modern machinery of moduli theory. [...] this result will be hard to transcend or replicate by other means.*" (Referee report)

- *Covers of stacky curves and limits of plane quintics*.
  Estimated contribution: 100%.

Journal impact factor: 1.34, h5-index: 43, Google Scholar citations: 2.
Google Scholar journal rank 3 in Algebra, ERA/AustMS journal category A*.

"*The paper is extremely impressive, and has interesting results that lead to further questions. The question [studied] is classical and thus interesting to a wide audience [...]*" (Referee report)

- *The canonical syzygy conjecture for ribbons*.
  Mathematische Zeitschrift, 288(3), 1157–1164, 2018.
  Estimated contribution: 100%.
  Journal impact factor: 0.881, h5-index 25, Google Scholar citations 6.
  Google Scholar journal rank 12 in Algebra, ERA/AustMS journal category A.

  "*[The paper gives] an important result: it sheds light on the full Green's conjecture, that is still open, and it has useful applications to the study of the canonical model of the moduli space of curves. [It] is surely important and very interesting for a wide audience.*" (Referee report)

- *Toward GIT stability of syzygies of canonical curves* (with Maksym Fedorchuk and David Swinarski).
  Algebraic Geometry (Foundation Compositio Mathematica), 3:1–22, 2016.
  Estimated contribution: 50%.
  Journal impact factor: 0.91, h5-index:19, Google Scholar citations 5.
  Google Scholar journal rank 19 in Geometry.

  "*The main result is very nice and the proof is very explicit.*" (Referee report)

- *Compactifications of Hurwitz spaces*.
  International Mathematics Research Notices, 2014(14):3863–3911, 2013.
  Estimated contribution: 100%.
  Journal impact factor: 1.291, h5-index: 39, Google Scholar citations 7.
  ERA/AustMS journal category A.

  "*This paper presents a large number of important results. [...] The techniques of proof reflect the state-of-the-art in a number of areas. [...] This paper also develops new techniques which are applied in particular to give a beautiful description of the moduli space of crimping.*" (Referee report)

Two most significant education achievements

- Development and delivery of advanced courses in algebraic geometry. (ANU, 2018–2020)
  - Designed and taught a new advanced undergraduate course in algebraic geometry. It had twice as much enrolment than comparable courses at this level, received a 4.9/5.0 SELT score for *valuable learning experience*, and led to numerous requests for a follow-up course. It will become a regularly offered course at the MSI.
  - Designed 3 ASC-level Special Topics Courses related to algebraic geometry tailored to student backgrounds and interests. Students in these course have successfully proceeded to further research or research-led coursework.
- Design and delivery of large (150–200 student) courses for non-maths majors. (Columbia University, 2012–2016).
  - These courses received consistently high student evaluations (over 4.5/5.0).
  - I won the Columbia Mathematics Department's Award for Excellence in Teaching based on feedback from students and evaluation by senior faculty.

Research grants

- Discovery Early Career Researcher Award (DECRA), 2018–2021.
  Funded by the Australian Research Council.
  Grant amount: AUD 328,075.
  Principal investigator.

- AMS–Simons Travel Grant, 2016–2018.
  Funded by the American Mathematical Society and the Simons Foundation.
  Grant amount: USD 4000.
  Principal investigator.

Publications

- *Stable log surfaces, admissible covers, and canonical curves of genus 4* (with Changho Han).
  Transactions of the AMS, to appear.
  Estimated contribution: 70%.
  Journal impact factor: 1.34, h5-index: 43, Google Scholar citations: 9.
  Google Scholar journal rank 3 in Algebra, ERA/AustMS journal category A*.

- *Syzygy divisors on Hurwitz spaces* (with Anand Patel).
  Contemporary Mathematics, vol. 703, 209–222, 2018.
  Google Scholar citations: 5.
  Refereed proceedings of the American Mathematical Society's Special Session on *Higher genus curves and fibrations in mathematical physics and arithmetic geometry*, 2016.

- *The canonical syzygy conjecture for ribbons*.
  Mathematische Zeitschrift, 288(3), 1157–1164, 2018.
  Estimated contribution: 100%.
  Journal impact factor: 0.881, h5-index 25, Google Scholar citations 6.
  Google Scholar journal rank 12 in Algebra, ERA/AustMS journal category A.

- *Covers of stacky curves and limits of plane quintics*.
  Transactions of the AMS, 371, 549–588.
  Estimated contribution: 100%.
  Journal impact factor: 1.34, h5-index: 43, Google Scholar citations: 2.
  Google Scholar journal rank 3 in Algebra, ERA/AustMS journal category A*.

- *The Picard rank conjecture for the Hurwitz spaces of degree up to five* (with Anand Patel).
  Algebra and Number Theory, 9(2):459–492, 2015.
  Estimated contribution: 50%
  Journal impact factor: 0.85, h5-index: 22, Google Scholar citations: 11.
  Google Scholar journal rank 15 in Algebra.

- *Gröbner techniques and ribbons* (with Maksym Fedorchuk and David Swinarski).
  Albanian Journal of Mathematics, 8(1):55–70, 2014.
  Estimated contribution: 20%
  Google Scholar citations: 8

- *Toward GIT stability of syzygies of canonical curves* (with Maksym Fedorchuk, David Swinarski).
  Algebraic Geometry (Foundation Compositio Mathematica), 3:1–22, 2016.

- *Sharp slope bounds for sweeping families of trigonal curves* (with Anand Patel).
  Mathematical Research Letters, 20(3):868–884, 2013.
  Estimated contribution: 70%
  Journal impact factor: 0.85, h5-index: 20, Google Scholar citations: 9.
  Google Scholar journal rank 17 in Geometry, ERA/AustMS journal category A.

- *Modular compactifications of the space of marked trigonal curves*.
  Advances in Mathematics, 248(0):96–154, 2013.
  Estimated contribution: 100%.
  Journal impact factor: 1.494, h5-index: 48, Google Scholar citations: 4.
  Google Scholar journal rank 2 in Algebra, ERA/AustMS journal category A* with rank 2 in Pure Mathematics.

- *Compactifications of Hurwitz spaces*.
  International Mathematical Research Notices, 2014(14):3863–3911, 2013.
  Estimated contribution: 100%.
  Journal impact factor: 1.291, h5-index: 39, Google Scholar citations 7.
  ERA/AustMS journal category A.

Pre-prints

- *The Thurston compactification of the space of stability conditions: some rank 2 cases*
  (with Asilata Bapat, Anthony Licata).
  Pre-print.

- *Anticanonical tropical cubic del Pezzos contain exactly 27 lines* (with MarÃ◌a AngÃľlica Cueto).
  Pre-print, arXiv:1906.08196.
- *Ramification divisors of general projections* (with Eduard Duryev, Anand Patel).
  Pre-print, arXiv:1901.01513.
- *Vector bundles and finite covers* (with Anand Patel).
  Pre-print, arXiv:1608.01711.
- *Class of the Hodge eigenbundle using orbifold Riemann–Roch*.
  Appendix to *Cyclic covering morphisms on* $\overline{M}_{0,n}$ by Maksym Fedorchuk.

Teaching

At the Australian National University

- MATH3349: *Foundations of algebraic geometry*, 2020.
  Responsible for course design, coordinating and leading discussion groups, assessment.
  Enrolment: 20 + auditors.
- MATH3354/6216: *Advanced topics in algebra (classical algebraic geometry)*, 2019.
  Convenor and lecturer (3 lectures/week).
  Responsible for course design, lecturing, assessment, and coordination.
  Enrolment: 37 + auditors.
  SELT score 4.9/5.0 for "valuable learning experience", 4.6/5.0 for "developed my ability to think".
- MATH3349: *Reading course on Elliptic curves and modular forms by Neil Koblitz*, 2018.
  Responsible for guiding self-study, writing of a short expository paper, and assessment.
  Enrolment: 2.
- MATH3349: *Special topics course on computational polynomial algebra* (with Markus Hegland), 2018.
  Responsible for course design, and guiding/assessing student presentations and expository papers.
  Enrolment: 4 + auditors.
- *Special topics course on Algebraic curves and Riemann surfaces by Rick Miranda*, 2018.
  Responsible for course design, guiding self-study and discussions, and assessment.
  Enrolment: 3.

At the University of Georgia

- Math 1113: *Precalculus*, 2017.
  Lecturer (3 lectures/week).
  Responsible for lecturing and assessment.
  Enrolment: 19.
- Math 8320: *Algebraic curves*, 2017.
  Convenor and lecturer (2 lectures/week)
  Responsible for course design, lecturing, and assessment.
  Enrolment: 8.
- Math 2260: *Calculus 2*, 2017.
  Lecturer (3 lectures/week).
  Responsible for lecturing and assessment.
  Enrolment: 19.
- Math 2250: *Calculus 1*, 2016.
  Lecturer (2 lectures/week for 2 sections).
  Responsible for lecturing and assessment.
  Enrolment: 18 and 16.

At Columbia University

- MATHV2500: *Analysis and optimization*, 2016.
  Convenor and lecturer (2 lectures/week for 2 sections).

Responsible for course design, lecturing, assessment, and managing a team of 6 tutors.
Enrolment: 105 and 45.

- MATHV3951: *Undergraduate Seminar: Young tableaux in algebra and geometry*, 2015.
  Convenor and coordinator (1 meetings/week).
  Responsible for course design and guiding/assessing student presentations and expository papers.
  Enrolment: 17.
- MATHV1101: *Calculus 1*, 2015.
  Convenor and lecturer (2 lectures/week for 2 sections)
  Responsible for lecturing, assessment, and managing a team of 4 tutors.
  Enrolment: 66 and 85.
- MATHG6293: *Moduli of curves*, 2014.
  Convenor and lecturer (2 lectures/week).
  Responsible for course design and lecturing.
  Enrolment: 5 + auditors.
- MATHV1101: *Calculus 1*, 2014.
  Convenor and lecturer (2 lectures/week).
  Responsible for lecturing, assessment, and managing a team of 4 tutors.
  Enrolment: 92.
- MATHW4042: *Modern algebra 2*, 2014.
  Convenor and lecturer (2 lectures/week).
  Responsible for course design, lecturing, and assessment.
  Enrolment: 23.
- MATHW4041: *Modern algebra 1*, 2013.
  Convenor and lecturer (2 lectures/week).
  Responsible for course design, lecturing, and assessment.
  Enrolment: 47.
- MATHV1201: *Calculus 3*, 2013.
  Convenor and lecturer (2 lectures/week for 2 sections)
  Responsible for lecturing, assessment, and managing a team of 5 tutors.
  Enrolment: 101 and 96.
- Calculus 2, 2012.
  Convenor and lecturer (2 lectures/week).
  Responsible for lecturing, assessment, and managing a team of 2 tutors.
  Enrolment: 57.

At Harvard University

- MATH21b: *Linear algebra*, 2012.
  Lecturer (3 lectures/week), and a part of a team of about 10 lecturers.
  Responsible for lecturing and assessment.
  Enrolment: About 20.
- MATH287y: *Algebraic curves*, 2011.
  Tutor (1 tutorial/week).
  Enrolment: About 20
- MATH1b: *Calculus 2*, 2010.
  Lecturer (3 lectures/week), and a part of a team of about 10 lecturers.
  Responsible for lecturing and assessment.
  Enrolment: About 20.
- MATH1a: *Calculus 1*, 2009.
  Lecturer (3 lectures/week), and a part of a team of about 10 lecturers.

Responsible for lecturing.
Enrolment: About 20.

Supervision

- Donghoon Shin, *Honours* (1 year), MSI, ANU, 2021, expected. Joint with Danesh Jogia (Australian Signals Directorate).
- Ben Leedom, *Honours* (1 year), MSI, ANU, 2020, expected.
- Diclehan Erdal, *Masters* (1 year), MSI, ANU, 2019.
- Adwait Sengar, *Masters* (1 year), MSI, ANU, 2019. Joint with Uri Onn.
- Sean Carroll, *Summer Research Scholar* (6 weeks), MSI, ANU, 2018. Joint with Asilata Bapat.
- Dhruva Kelkar, *Future Research Scholar* (6 weeks), MSI, ANU, 2019.
- Sridhar Venkatesh, *Future Research Scholar* (6 weeks), MSI, ANU, 2019.
- Kyle Broder, *Honours* (1 semester), MSI, ANU, 2018. Joint with Alex Isaev.
- Likun Yao, *Honours* (1 semester), MSI, ANU, 2018. Joint with Amnon Neeman.

Service

Service to the School, College, or University (ANU)

- Co-organising the algebra and topology special year at the MSI at ANU, 2022 (with James Borger, Martin Helmer, and Amnon Neeman).
  Specifically, co-organising a large international conference in algebraic geometry as a part of the special year (with Jarod Alper, Martin Helmer, Amnon Neeman, and Behrouz Taji) as a part of the special year.
- Served on the thesis committee of Abhishek Bharadwaj at ANU, 2020.
- Served on the *Future Research Talent* selection committee at the MSI at ANU, 2019.
  As a committee of 3 members, we selected students from top Indian universities to visit and conduct a short research project at the ANU.
- Served on the director search committee at the MSI at ANU, 2019.
  As a committee of 9 members, we made targeted efforts to invite applications from excellent candidates for the position of MSI director.
- Member of the formal liaison committee at the MSI at ANU, 2019.
  As a committee of 4 members, we hosted candidates interviewing for continuing positions, collected the opinions of the MSI community about the candidates, and conveyed these opinions to the selection committee.
- Co-organised the workshop *Polynomial algebraic developments in optimisation and computation* at ANU (with Markus Hegland), 2018.
- Conducted training sessions in algebraic geometry at the *D21 workshop* at the Australian Signals Directorate, 2018.

Service to the School, College, or University (Pre-ANU)

- Organised the *Fairly informal reading seminar and tea (FIRST)* at the University of Georgia, 2016.
- Co-organised the graduate student algebraic geometry seminar at Columbia University, 2016 (with Johan de Jong).
- Conducted Putnam competition preparation sessions at Columbia University, 2015.
- Served on the thesis committees of Natasha Potashnik, Zachary Maddock, and Xuanyu Pan at Columbia University, 2012–2016.
- Organised the student algebraic geometry seminar at Harvard/MIT, 2010–2011.

Service to the discipline

- Refereed for the *Journal of the European Mathematical Society*, *Journal of Differential Geometry*, *Journal of Algebraic Geometry*, *Annales Scientifiques de l'Ã‰cole Normale SupÃ©rieure*, *Algebra and Number Theory*, *Journal fÃ¼r die reine und angewandte Mathematik*, *manuscripta mathematica*, *Advances in Geometry*, *Mathematical Research Letters*.

- Served as an expert reviewer for the *Mathematical Reviews* of the American Mathematical Society.
- Co-organising the workshop *Trends in the classification of algebraic varieties and their sheaves* at the Banff International Research Station, Oaxaca, Mexico, 2021 (with Jarod Alper and Cesar Lozano Huerta)
- Co-organised the workshop *Stability and moduli spaces* at the American Institute of Mathematics, 2017 (with Maksym Fedorchuk, Ian Morrison, and Xiaowei Wang).
- Co-organised the *Summer workshop in algebraic geometry* at the University of Georgia, 2016 (with Angela Gibney and Nicola Tarasca).
- Lectured in the *Workshop on birational geometry and stability of moduli stacks and spaces of curves* in Hanoi, Vietnam, 2014.
- Co-organised the poster session at the *Algebraic Geometry North-Eastern Series (AGNES)* conference in Boston College, 2013 (with Anand Patel).

Outreach

- Consulted with the Australian Associated Press through the ANU Media Team on fact-checking 2 social media claims involving mathematics.
- Spoke to year 11/12 students in the Canberra Mathematics Enrichment Program about current research in mathematics, 2019.
- Conducted a session for year 11/12 students in the Canberra Mathematics Enrichment Program about symmetry of plane figures with hands-on activities, 2019.
- Gave a general lecture on *The work of Claire Voisin* on the Women in Mathematics day at MSI, 2019.
- Served on the award committee for the *BH Neumann Prize* for best student talk in AustMS, 2018.
- Gave a general lecture on *The work of Caucher Birkar* in the Fields Medal Colloquium at MSI, 2018.
- Gave expository talks to undergraduate students visiting the Tata Institute of Fundamental Research, India (2018) and to high school students in US/Canada Mathcamp (2017).

Collegiality and collaboration

- Developed collaborations with the applied mathematics group at the MSI (and more broadly), evidenced by my
  - speaking in the *Workshop on algebraic geometry, approximation, and optimization* at *MATRIX* in Creswick, Vic on *Quadrature and algebraic geometry*,
  - co-organising the workshop *Polynomial algebraic developments in optimisation and computation* at MSI (with Markus Hegland),
  - co-teaching the special topics course on computational polynomial algebra (with Markus Hegland),
  - research visit to Vera Roschina at RMIT, Melbourne, Vic.
- Developed collaborations with the Australian Signals Directorate, evidenced by my
  - joint Honours student Donghoon Shin with Danesh Jogia,
  - continuing engagement on the *D21 research project* with Ralph Buchholz, Tamiru Jarso, Peter Price, and Zsoltan Bacskai,
  - continuing role as an expert algebraic geometry through courses and special workshops.
- Developed collaborations with the Research School of Computer Science, evidenced by my joint Honours student Haotian Weng with Artem Lenskiy.

Invited Talks and Presentations

In conferences or workshops

- Workshop on triangulated categories in geometry and representation theory, Sydney, 2019.
  Groups, spherical twists, and stability conditions. (Part of a series with Asilata Bapat and Anthony Licata.)
- Character varieties and topological quantum field theory, Auckland, New Zealand, 2018.
  Geometry of Hurwitz spaces.

- Number theory session at the Australian Mathematical Society's annual meeting (AustMS) 2018, Adelaide, 2018.
  On the geometric Steinitz problem.
- Algebraic surfaces and related topics, Xiamen, China, 2018.
  Moduli of almost K3 log surfaces and curves of genus 4.
- Workshop on algebraic geometry, approximation, and optimization, MATRIX, Creswick, Vic, 2018.
  Quadrature and algebraic geometry.
- Workshop on topics in algebraic geometry, University of North Carolina, Chapel Hill, NC, 2017.
  Vector bundles and finite covers.
- Conference on moduli and birational geometry, Korea, 2016.
  Vector bundles and finite covers.
- Workshop on cycles on moduli spaces, geometric invariant theory, and dynamics, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, 2016.
  Cycles on Hurwitz spaces.
- Joint mathematics meetings, Seattle, WA (Higher genus curves and fibrations of higher genus curves in mathematical physics and arithmetic geometry II), 2016.
  Picard groups of Hurwitz spaces.
- Joint mathematics meetings, Seattle, WA (Moduli spaces in algebraic geometry I), 2016.
  Limits of plane quintics via covers of stacky curves.
- Boston College–Northeastern algebraic geometry conference, Boston, MA, 2015.
  Limits of plane quintics via covers of stacky curves.
- SIAM applied algebraic geometry conference, Daejeon, Korea, 2015.
  Syzygies of canonical curves and the geometry of $\overline{M}_g$.
- Mathematisches Forschungsinstitut Oberwolfach, Germany, 2015.
  GIT stability of syzygies of curves (mini talk)..
- Conference on moduli and birational geometry, Postech, Pohang, Korea, 2013.
  Towards GIT stability of syzygies of canonical curves.

In seminars

- University of California, San Diego, 2020.
  Apparent boundaries of projective varieties.
- Indian Institute of Science, Bengaluru, India, 2018.
  What are ribbons and what do they tell us about Riemann surfaces.
- Monash University, Melbourne, Vic, 2018.
  What are ribbons and what do they tell us about Riemann surfaces.
- Algebra and topology seminar, ANU, Canberra, ACT, 2018.
  On the critical loci of finite maps.
- University of Georgia, Athens, GA, 2017.
  Vector bundles and finite covers.
- Indian Institute of Science Education and Research, Pune, India, 2017.
  Quivers and their representations.
- Emory University, Atlanta, GA, 2017.
  Vector bundles and finite covers.
- Indian Institute of Science Education and Research (IISER), Pune, 2016.
  Vector bundles and finite covers.
- University of South Carolina, Columbia, SC, 2016.
  Ribbons and Green's conjecture.

- University of Georgia, Algebraic Geometry Seminar, 2016.
  Ribbons and Green's conjecture.
- University of Georgia, Oberseminar in Algebra, Geometry, and Number Theory, 2016.
  The algebra of canonical curves and the geometry of their moduli space.
- Purdue University, West Lafayette, IN, 2015.
  Syzygies, GIT, and the moduli space of curves.
- Ohio State University, Columbus, OH, 2015.
  Limits of plane curves via stacky branched covers.
- Harvard/MIT, Cambridge, MA, 2015.
  Syzygies, GIT, and the log minimal model program for $\overline{M}_g$.
- Courant Institute, New York University, New York, NY, 2015.
  Picard groups of Hurwitz spaces.
- Indian Institute for Science Research and Education, Pune, India, 2015.
  The birational geometry of $\overline{M}_g$.
- Stony Brook University, Stony Brook, NY, 2015.
  Syzygies of canonical curves and birational geometry of $\overline{M}_g$.
- Yale University, New Haven, CT, 2014.
  GIT stability of syzygies of canonical curves.
- Boston College, Boston, MA, 2014.
  Toward GIT stability of syzygies of canonical curves.
- AMS sectional meeting, Philadelphia, PA (Geometry of algebraic varieties), 2013.
  Toward GIT stability of syzygies of canonical curves.
- Stanford University, Palo Alto, CA, 2013.
  Alternate compactifications of Hurwitz spaces.
- Princeton University, Princeton, NJ, 2013.
  Compactifying spaces of branched covers.
- Rice University, Houston, TX, 2012.
  Alternate compactifications of Hurwitz spaces.
- Harvard/MIT, Cambridge, MA, 2011.
  Compactifications of Hurwitz spaces.
- Columbia University, New York, NY, 2011.
  Compactifications of Hurwitz spaces.
- Stony Brook University, Stony Brook, NY, 2011.
  Compactifications of Hurwitz spaces.
- Brown University, Providence, RI, 2011.
  Compactifications of Hurwitz spaces.

Other elements of research practice

- Software (`sage` code) for computing and visualising braid group actions on triangulated categories (with Asilata Bapat).
  `https://github.com/asilata/cobracat`.
- Software (`macaulay2` code) for testing GIT stability of syzygy points (with David Swinarski).
  `https://github.com/deopurkar/mcsyzygy`.