Nikita Agarwal

Professor, Department of Mathematics, University of Delhi, Delhi - 110007
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EDUCATION

Ph.D. Mathematics (2011)   University of Houston, Houston, Texas, USA
Advisor: Prof. Michael J Field
Thesis: Coupled Cell Networks: Interplay between architecture and dynamics

M.S. Mathematics (2007)   University of Houston, Houston, Texas, USA

B.A. (Hons.) Mathematics (2005)   Lady Shri Ram College for Women
University of Delhi, Delhi, India

PROFESSIONAL EXPERIENCE

Professor (2025-Present)   Department of Mathematics, University of Delhi, Delhi

Professor (2023-2025)   Department of Mathematics, Indian Institute of Science Education and Research (IISER) Bhopal

Associate Professor (2018-23)   Department of Mathematics, IISER Bhopal

Assistant Professor (2011-18)   Department of Mathematics, IISER Bhopal

Teaching/Research Assistant (2007-11)   Department of Mathematics
University of Houston, Houston, Texas, USA

FELLOWSHIPS / AWARDS

- *Distinguished Teacher Award, IISER Bhopal for exemplary teaching* (Semester 2, 2024-25)
- Research Fellowship by the *National Science Foundation* (NSF), USA, for Ph.D. (2007-11)
- Teaching Fellowship for *Academic Excellence* by the *University of Houston*, Texas, USA (2006-11)
- Anupama Dua *Merit Scholarship for Excellence in Academics* by the Department of Mathematics, *Lady Shri Ram College, University of Delhi* (2004 and 2005)
- *Best Student in Academics* Award by the Department of Mathematics, *Lady Shri Ram College, University of Delhi* (2002-03, 2003-04, 2004-05)
- *Second rank* in South Delhi Campus, University of Delhi (2002-03)

PROFESSIONAL ASSOCIATIONS

- Member, Committee of the *National Centre for Mathematics* (NCM) for Annual Foundation Schools, 2023-Present
- Member, Executive Committee of *Indian Women and Mathematics* (IWM), 2019-Present
- Member, Coordination Group of 'May 12 Initiative', *Committee for Women in Mathematics, International Mathematical Union* (CWM-IMU), 2019-2023

INTERNATIONAL ACADEMIC VISITS

- Department of Mechanical Engineering, *University of California, Santa Barbara*, USA (2024)
- Department of Mathematics, *University of Houston*, Texas, USA (2024)
- Department of Mathematics, *Boston University*, USA (2018)
- Department of Mathematics, *University of Porto*, Portugal (2009, 2012 and 2015)
- Centre for Interdisciplinary Computational & Dynamical Analysis, *University of Manchester*, UK (2010)
- School of Computing and Mathematics, *University of Exeter*, UK (2009)

RESEARCH

Interests: Ergodic Theory and Dynamical Systems, Mathematical Control Theory

Selected Research Publications

Ergodic Theory and Dynamical Systems

- N Agarwal, H Cheriyath and S N Tikekar, On the Perron root and eigenvectors of a non-negative integer matrix, *Linear Algebra and its Applications*, 698, 135-180 (2024)

- H Cheriyath and N Agarwal, Subshifts of finite type with a hole, *Journal of Australian Mathematical Society*, 115(1), 73-98 (2022)

- H Cheriyath and N Agarwal, On the Perron root and eigenvectors associated with a subshift of finite type, *Linear Algebra and Its Applications*, 633, 42-70 (2022)

- N Agarwal, S Dey, N K Dhanwani and K Rajeevsarathy, Liftable mapping classes of regular cyclic covers, *Houston Journal of Mathematics,* 47(1), 223-243 (2021)

- N Agarwal, The k-transformation on an interval with hole, *Qualitative Theory of Dynamical Systems*, 19(30) (2020)

- H Cheriyath and N Agarwal, Product of expansive Markov maps with hole, *Discrete and Continuous Dynamical Systems - Series A*, 39(10), 5743-5774 (2019)

- N Agarwal, C Conca, I Mishra, Approximate controllability of a semilinear elliptic problem with Robin condition in a periodically perforated domain, *Electronic Journal of Differential Equations*, 186, 1-24 (2017)

- N Agarwal, A Rodrigues and M J Field, Dynamics near the product of planar heteroclinic attractors, *Dynamical Systems*, 26(4), 447-481 (2011)

- N Agarwal, Inflation of strongly connected networks, *Mathematical Proceedings of the Cambridge Philosophical Society*, 150, 367-384 (2011)

- N Agarwal and M J Field, Dynamical equivalence of network architecture for coupled dynamical systems II: general case, *Nonlinearity*, 23, 1269-1290 (2010)

- N Agarwal and M J Field, Dynamical equivalence of network architecture for coupled dynamical systems I: asymmetric inputs, *Nonlinearity*, 23 1245-1268 (2010)

Mathematical Control Theory

- S Tripathi and N Agarwal, Stability of bimodal planar linear switched systems, *European Journal of Control*, 70, 100767 (2023)

- S Tripathi and N Agarwal, Stability of bimodal planar switched linear systems with both stable and unstable subsystems, *International Journal of Systems Science*, 53(15), 3254-3285 (2022)

- N Agarwal, Stabilizing Graph-dependent linear switched systems with unstable subsystems, *European Journal of Control*, 53, 20-28 (2019)

- N Agarwal, A simple loop dwell time approach for stability of switched systems, *SIAM Journal on Applied Dynamical Systems*, 17(2), 1377-1394 (2018)

Other Publications

- N Agarwal, R Shah and G Venkataraman, Maryam Mirzakhani: The Master Artist of Curved Surfaces, *Resonance – Journal of Science Education*, Volume 23, Issue 3 (March 2018), 253-262.

- Review of Secrets of the Surface: The Mathematical Vision of Maryam Mirzakhani (movie), *Bhāvanā - The Mathematics Magazine* (October 2021)

- Review of Elements of Dynamical Systems: Texts and Readings in Mathematics, Vol. 79. Anima Nagar, Riddhi Shah and Shrihari Sridharan (eds). Hindustan Book Agency, New Delhi, 2020, *Current Science* (July 2021)

- N Agarwal and K Sinha, For the joy of doing mathematics - Interview with Rajinder Jeet Hans-Gill, *Bhāvanā - The mathematics magazine* (July 2024)

- N Agarwal, A Habib and G Venkataraman, Indian Women and Mathematics (book chapter), *Association for Women in Mathematics: The First Fifty Years, an AWM-Springer book*, Edited by Janet Beery, Sarah Greenwald, and Cathy Kessel, Springer, AWMS, Volume 28 (2022)

- N Agarwal et al., May 12: Celebrating Women in Mathematics From One Idea to One Hundred Events, *Notices of the American Mathematical Society* (December 2019)

EXTRAMURAL FUNDING

Research Projects

- 'Study of Switched Dynamical Systems using Spectral Properties of Network Topology' funded by the *Science and Engineering Research Board, Department of Science and Technology* (SERB, DST) under Young Scientists Scheme (YSS)
  Sole PI, Duration: 2015-18, Amount: Rs. 15,66,000/-

- 'Ergodic Properties of Open Dynamical Systems' funded by the *Science and Engineering Research Board, Department of Science and Technology* (SERB, DST) under Core Research Grant Scheme (CRG)
  Sole PI, Duration: 2019-23, Amount: Rs. 24,44,200/-

- 'Dynamical Properties of Countable Markov Shifts' funded by the *Science and Engineering Research Board, Department of Science and Technology* (SERB, DST) under MATRICS Scheme
  Sole PI, Duration: 2024-27, Amount: Rs. 6,60,000/-

- 'Center for Research on Environment and Sustainable Technologies' (CREST) - FAST programme funded by the *Ministry of Education*
  Co-PI, Duration: 2014-18, Amount: Rs. 4 Cr.

Funding for Conferences/Workshops

- Annual Foundation School, funded by the *National Center for Mathematics* (NCM), 2024, Amount: ~ Rs. 9,50,000/-

- National Conference on Topology and Dynamics, funded by the *Science and Engineering Research Board, Department of Science and Technology (SERB, DST)*, 2016, Amount: Rs. 1,00,000/-

- Conference Support Grant for Topology and Dynamics, funded by the *National Board for Higher Mathematics, Department of Atomic Energy (NBHM, DAE)*, 2015, Amount: Rs. 2,75,000/-

ACADEMIC ADVISING

- **Ph.D. Theses**

  o Haritha Cheriyath, Ergodic Properties of Open Dynamical Systems, Graduated in 2021
    Visiting Fellow at Tata Institute of Fundamental Research, Mumbai (2021-23)
    Currently: *Postdoc at the Centre for Mathematical Modeling, University of Chile*
  o Swapnil Tripathi, Stabilizing bimodal planar linear switched systems, Graduated in 2022
    Currently: *Postdoc at Kadir Has University, Turkey*
  o Rohan Mahure (Expected: 2027)
  o Sagar Khurana (Expected: 2028)

  Masters Theses

  o Saraf Janhavi Neetin, 'Fractal Geometry' (2024-25)
  o Vikas, 'Game of Ducci Sequences' (2022-23)
  o Prasanna Brahme, 'Garden of Eden Theorem and Subshifts of Finite Type' (2021-22)
    Currently: *PhD student at the University of Houston, Texas, USA*
  o Aditya Thorat, 'Graph-directed Iterated Function Systems and Tilings' (2020-21)
    Currently: *PhD student at TIFR CAM, Bangalore*
  o Chinmayee Talele, 'Conjugacy in Subshifts of Finite Type' (2020-21)
    Currently: *Solution Advisor at Deloitte USI, Mumbai*
  o Shriya Gehlot, 'Symbolic Dynamics' (2018-19)
    Currently: *PhD student in Operations and Decision Sciences at IIM Ahmedabad*
  o Mohammed Rameez Qureshi, 'Game Theory and Strategic Bargaining' (supervised with Arya
    Kumar Srustidhar Chand, Economic Sciences in 2017-18)
    Currently: *PhD student at PhD at Trinity College, Dublin, Ireland*
  o Haritha Cheriyath, 'Open Dynamical Systems' (2016-17)
    Currently: *Postdoc at the Centre for Mathematical Modeling, University of Chile*
  o Sourabh Goyal, 'Application of Max-Plus Algebra in Designing Railway Time-table' (2014-15)
    Currently: Infosys
  o Mahesh Sunkula, 'Stability Analysis of Switched Coupled Dynamical Systems' (2012-13)
    Currently: *Assistant Professor of Practice in Mathematics, Purdue University, USA*

- **Postdoctoral Fellows**

  o Sharvari Neetin Tikekar, Generalized subshifts of finite type, 2023
    Currently: *Postdoc at Dipartimento di Matematica, Università di Pisa, Italy*
  o Indira Mishra, Approximate controllability of boundary value problems, 2018-20
    Currently: *Visiting faculty at Indian Institute of Information Technology Bhopal*

- Guided students from IISER Bhopal and other colleges/universities during summer/winter breaks

RESEARCH TALKS (SELECTED)

- Plenary Talk 'Symbolic Dynamics, Combinatorics on Words and Escape Rate', *39th Annual Conference of the Ramanujan Mathematical Society*, Bangalore, December 2024
- 'Escape in Open Systems', Department Seminar, *IIIT Delhi*, December 2024
- 'Open Dynamical Systems: Revisiting the Perron Frobenius Theorem', Dynamical Systems Seminar, *University of Houston*, Texas, USA, September 2024
- 'Escape in Subshifts of Finite Type', *American Mathematical Society (AMS) Sectional Meeting*, San Antonio, Texas, USA, September 2024
- 'Escape in Open Dynamical Systems' in the *Women in Mathematics Day, Panjab University*, May 2024
- 'Escape Rate in Subshifts of Finite Type with a Markov measure', *International Conference on Pure and Applied Mathematics, JDMC, University of Delhi*, March 2024
- 'Escape in Open Dynamical Systems', Bangalore Probability Seminar, *ICTS Bangalore*, March 2024
- 'Subshifts of Finite Type with a Hole', *Inter IISER-NISER Meet*, IISER Kolkata, June 2022

- 'Stability of Switched Systems', *Symposium on International Women in Mathematics Day*, IIT Patna, May 2022
- '2020 Abel Prize Talk', *IISER Thiruvananthapuram*, October 2020
- 'Chaos in Order and Order in Chaos', *Inaugural Workshop of Women in Mathematics Association, IIIT Delhi*, April 2019
- 'Chaos in Order and Order in Chaos', *Institute of Excellence in Higher Learning Bhopal*, February 2019
- 'Stability of Switched Dynamical Systems', *Annual Conference of the Indian Women and Mathematics*, Shiv Nadar University, Greater Noida, June 2018
- 'Ergodic Properties of Open Dynamical Systems', *33rd Annual Conference of the Ramanujan Mathematical Society*, University of Delhi, June 2018
- 'Ergodic Properties of Open Dynamical Systems', Mathematics Colloquium, *Ashoka University*, February 2018
- 'Ergodic Properties of Open Dynamical Systems', *Symposium for South Asian Women in Mathematics*, Kathmandu, Nepal, October 2017
- 'Ergodic Properties of Open Dynamical Systems', Mathematics Colloquium, *IIT Kanpur*, August 2017
- 'Open dynamical systems: β-expansion map on an interval with a hole', *Nanyang Technological University, Singapore*, May 2017
- 'Beta Transformation on an Interval with Hole', *The International Conference of The Indian Mathematics Consortium-American Mathematical Society*, Banaras Hindu University, Varanasi, December 2016
- 'Beta Transformation on an Interval with Hole', *Topology and Dynamics Conference, IISER Bhopal*, December 2015
- 'Networks with dynamic topology', *AMS-EMS-SPM International Meeting*, Porto, Portugal, June 2015
- 'Equivariant dynamical systems', *Discussion Meeting on Geometric and Ergodic Aspects of Group Actions, TIFR Mumbai*, April 2015
- 'Product Dynamics', *28th Annual Conference of Ramanujan Mathematical Society*, Reva Institute of Technology and Management, Bangalore, 2013
- 'An interesting phenomena: a mix of continuous and discrete dynamics', Dynamical Systems Seminar, *University of Porto*, Portugal, 2012
- 'Coding of Dynamical Systems', Mathematics Department Seminar, *IISER Bhopal*, October 2022
- 'Two Torchbearers of Probability and Dynamics', Mathematics Department Seminar, *IISER Bhopal*, March 2021
- 'The Illumination Problem', Mathematics Department Seminar, *IISER Bhopal*, February 2018
- 'Bifurcation Analysis Techniques for Equivariant Nonlinear ODEs', Mathematics Dept. Seminar, *IISER Bhopal*, 2013
- 'Product Dynamics', Mathematics Department Seminar, *IISER Bhopal*, 2011
- 'Strongly Connected Inflation of Coupled Cell Networks', *8th AIMS Conference on Dynamical Systems, Differential Equations and Applications*, Dresden, Germany, 2010
- 'Strongly Connected Inflation of Coupled Cell Networks', *Network Dynamics and Synchronization, CICADA, University of Manchester*, 2010
- 'Dynamical equivalence of networks of coupled dynamical systems', Dynamical Systems Seminar, *University of Porto*, 2009
- 'Dynamical equivalence of networks of coupled dynamical systems', *Workshop on Network Dynamics*, SECAM, School of Engineering, Computing & Math, *University of Exeter*, 2009
- 'Dynamical equivalence of networks of coupled dynamical systems II', Dynamical Systems Seminar, *University of Houston*, 2009

PANEL DISCUSSIONS

- 'Women in Mathematics', *Inaugural meeting of the Asian and Oceanian Women in Mathematics, ICTS Bangalore*, April 2023
- 'Math as a Career', *Inaugural Workshop of Women in Mathematics Association, IIIT Delhi*, April 2019
- 'IITs and IISERs Role in Technology and Innovation', *Young Investigators Meet, Massachusetts Institute of Technology (MIT) Boston*, USA, May 2018
- 'Math Education and Outreach', *Symposium for South Asian Women in Mathematics, Kathmandu, Nepal*, October 2017

- 'Women in Math', *Symposium for South Asian Women in Mathematics, Kathmandu, Nepal*, October 2017
- 'Mathematics Education', *International Conference of The Indian Mathematics Consortium - American Mathematical Society*, Banaras Hindu University, Varanasi, December 2016

COURSES DEVELOPED AND TAUGHT

I have received letters of appreciation for my teaching from the Chairperson of the Academic Senate, IISER Bhopal, and the Chair of the Department of Mathematics at the University of Houston.

   At IISER Bhopal, I have developed courses in Probability and Statistics (Undergraduate), Real Analysis (Ph.D.), Ergodic Theory (Masters/Ph.D.), Ordinary Differential Equations (Ph.D.), Complex Analysis (Masters/Ph.D.)

Courses Taught
- MTH 101: Calculus 1 (Sem 2, 2024-25)
- MTH 407/607: Complex Analysis I (Sem 1, 2024-25)
- (Reading course) Ergodic Theory (Sem 1, 2024-25)
- MTH 603: Real Analysis (Sem 2, 2023-24)
- MTH 303: Real Analysis I (Sem 1, 2023-24, Sem 1, 2020-21)
- MTH 304: General Topology (Sem 2, 2022-23)
- MTH 505/623: Ergodic Theory (Sem 1, 2022-23, Sem 2, 2017-18, Sem 1, 2012-13)
- MTH 201: Multivariable Calculus (Sem 1, 2021-22)
- MTH 304: General Topology (Sem 2, 2020-21)
- Transfer Operator and Decay of Correlations (Sem 2, 2017-18)
- Stability Analysis and Bifurcation Theory (Sem 1, 2017-18)
- MTH 503/614: Functional Analysis (Sem 2, 2016-17)
- MTH 404: Measure and Integration (Sem 2, 2015-16)
- MTH 606: Ordinary Differential Equations (Sem 1, 2015-16)
- MTH 202: Probability and Statistics (Sem 2, 2014-15, Sem 2, 2011-12)
- MTH 403: Real Analysis II (Sem 1, 2014-15)
- MTH 102: Linear Algebra (Sem 2, 2013-14)
- MTH 503: Functional Analysis – *e-course to students at IISER Bhopal and IISER Mohali (through National Knowledge Network)* (Sem 1, 2013-14)
- MTH 409: Optimization Techniques (Sem 2, 2011-12)
- MTH 201: Multivariable Calculus and Diff. Equations (Sem 1, 2011-12)

At the University of Houston (2006-11)
- Teaching Assistant for Honors Calculus, Calculus I and III
- Tutor - *Center for Academic Support and Assessment* (CASA) for Calculus; Linear Algebra, Differential Equations, Probability-Statistics, Real-Complex Analysis, Stochastic Processes

SOCIAL OUTREACH ACTIVITIES TO PROMOTE MATHEMATICS IN INDIA

Training Workshops

- 'Qualitative behavior of dynamical Systems', Lecture in the Refresher course on Mathematics on the theme 'Mathematics with an Emphasis on Topology, Analysis and Applications' for University and College teachers, *University of Delhi*, February 2024
- 'Van der Waerden's Theorem: Topology, Dynamics and Number Theory', Lecture in the Refresher course on Mathematics on the theme 'Mathematics with an Emphasis on Topology, Analysis and Applications' for University and College teachers, *University of Delhi*, September 2022
- Tutor for a series of lectures on 'Basic Ergodic Theory' in *Advanced Instructional School in Ergodic Theory and Dynamical Systems, IIT Delhi*, December, 2017
- Delivered series of lectures on 'Canonical Forms of Linear Operators and Differential Equations', *Winter School in Mathematics, IISER Bhopal*, December 2014

College Level Talks

- 'Mystery of Pi', *Pi Day Celebrations, JDMC, University of Delhi*, March 2024
- 'Regularities within irregularities (Fractal Geometry)' in the Summer School for Women in Mathematics and Statistics, *ICTS Bangalore*, June 2024
- 'Unfolding the billiards table', in Continuum, Department Event, *IISER Bhopal*, February 2024
- 'Life and Works of Maryam Mirzakhani – First Women Fields Medalist'
  - Maitreyi College, University of Delhi, June 2023
  - National Level FDP organized by Department of Mathematics and Statistics, RBVRR Women's College, Narayanaguda, Hyderabad, May 2022
  - Canadian Society for History and Philosophy of Mathematics, Canada, December 2020
  - St. Xavier's College Kerala, May 2020
  - Sacred Heart College Kerela, May 2020
- 'Women in Mathematics', RPS Degree College, Haryana, May 2021
- 'Mathematics of Chaos', SNS College of Technology, Coimbatore, May 2020
- 'Chaos in Order and Order in Chaos' (under the Visitors Programme of the Indian Women and Mathematics), Chandra Shekhar Azad Govt. Lead College Sehore, February 2019
- 'Career Opportunities in Mathematics', Institute of Excellence in Higher Learning Bhopal, for MSc students, March 2017

School Level Talks

- Lectures/Interactive Sessions during 'Outreach activity' for Class IX and XI students at IISER Bhopal
  - Chaos and Order, 2022
  - Hyperbolic Geometry, 2019
  - Sequences and Series, 2013
- Lectures for Class VI to VIII Students *in Hindi*, Rashtriya Avishkar Abhiyan, Department of Education and Literacy, MoE
  - Mathematics of Shapes, November 2022
  - Mathematics in Nature, April 2021
- Invited Lecture/Interactive Session on 'The Magical World of Calculus - Limits, Continuity and Differentiation' at the Sagar Public School, Bhopal, for Class XI and XII students, August 2017
- Lecture/Interactive Session on 'Primes' during Ishan Vikas Programme for school students at IISER Bhopal, December 2015 (with another colleague)

CONFERENCES/WORKSHOPS ORGANIZATION

- 'Indian Women and Mathematics: Annual Conference', *IIT Patna*, July 2025 (*funded by the National Board for Higher Mathematics, NBHM, DAE*)
- 'Summer School for Women in Mathematics and Statistics, *ICTS Bangalore*, June 2025
- 'Annual Foundation School – II', *SRM University, Andhra Pradesh*, May-June 2025 (*funded by the National Center for Mathematics, NCM*)
- 'Annual Foundation School – II', IISER Bhopal, May-June 2024 (funded by the NCM)
- 'Indian Women and Mathematics: Annual Conference', IISER Bhopal, July 2023 (funded by the IWM Project of the National Board for Higher Mathematics, NBHM, DAE)
- 'May 12 at IISER Bhopal: Workshop on International Women in Mathematics Day', May 2023
- 'Indian Women and Mathematics: Regional Workshop on Research and Opportunities', VNIT Nagpur, December 2022 (funded by the National Board for Higher Mathematics, NBHM, DAE)
- '8th Indian School on Logic and its Applications' - A Virtual School, IISER Bhopal, December 2020
- 'Regional Workshop on Research and Career Opportunities in Mathematics' of Indian Women and Mathematics at IISER Bhopal, October 2017 (funded by the National Board for Higher Mathematics, NBHM, DAE)
- 'Topology and Dynamics Conference', IISER Bhopal, December 2015 (funded by SERB, DST and NBHM, DAE)
- 'Conference on Harmonic Analysis and Operator Theory', IISER Bhopal, March 2014 (partially funded by DST)

PROFESSIONAL SERVICE

- Member on student selection committees for KVPY fellowship, 2013, 2017 and 2018
- Reviewer for Annales of the Institut Henri Poincaré - D, Nonlinearity, Discrete and Continuous Dynamical Systems, Systems & Control Letters, European Journal of Control, MathSciNet Mathematical Reviews

ADMINISTRATIVE EXPERIENCE AT IISER BHOPAL

Institute Level
- Dean, Faculty Affairs, 2018-19
- Vice-Chairperson, IISERs Joint Admissions Committee, 2014
- Head-in-charge, Department of Humanities and Social Sciences (additional charge), 2016-17
- Convener, National Advisory Committee for Economic Sciences, 2017
- Convener, Heads and Deans Group, 2014-17
- Chairperson, Grievance Redressal Committee, 2023-25
- Presiding Officer, Internal Complaints Committee, 2023-25
- Member, Users' Committee for Community Creche & Pre-School, 2023-25
- Member, IISERs Joint Admissions Committee, 2013
- Member, Grievance Redressal Committee, 2022-23
- Member, Internal Complaints Committee, 2022-23
- Member, Academic Senate, 2012-19, 2024-25
- Member, Shopping Complex & Commercial Establishments Committee, 2015-19
- Member (Women Representative), Management Committee for Cooperative Community Crèche & Pre-School, 2013-16
- Expert Member/Chair on several staff selection committees at IISER Bhopal

Department Level
- Head-in-charge, Department of Mathematics, 2014-17
- Convener/Member, DUGC/DPGC Mathematics, 2011-13, 2025
- Chair/Committee Member on several student selection committees for academic programmes at IISER Bhopal