

Hitesh Gakhar

INSTRUCTOR, DEPARTMENT OF MATHEMATICS, MICHIGAN STATE UNIVERSITY

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Employment

Department of Mathematics, Michigan State University

INSTRUCTOR

East Lansing, MI, United States

July 2023 - present

Department of Mathematics, The University of Oklahoma

POSTDOCTORAL ASSOCIATE

Norman, OK, United States

August 2020 - May 2023

Department of Mathematics, Michigan State University

GRADUATE ASSISTANT

East Lansing, MI, United States

August 2014 - May 2020

Education

Michigan State University

PH.D. IN MATHEMATICS

- Advisor: Jose Perea
- Dissertation: A topological study of toroidal dynamics

East Lansing, MI, United States

August 2014 - May 2020

Indian Institute of Science Education and Research - Mohali

B.S.-M.S. IN MATHEMATICS

- Advisor: Lingaraj Sahu
- Dissertation: Analysis of self adjoint operators

Mohali, Punjab, India

August 2009 - May 2014

Awards, Scholarships, & Travel Grants

AWARDS & SCHOLARSHIPS

8. *Audience Choice Award*, Graduate & Postdoc Research Symposium, The University of Oklahoma, April 2022
7. *Dissertation Completion Fellowship*, College of Natural Science, Michigan State University, Spring 2020
6. *Writing Fellowship*, The Graduate School, Michigan State University, September 2019
5. *Research Enhancement Award*, The Graduate School, Michigan State University, July 2019
4. *TA Award for Excellence in Teaching*, Department of Mathematics, Michigan State University, April 2019
3. *Dr. Paul and Wilma Dressel Endowed Scholarship*, Department of Mathematics, Michigan State University, April 2019
2. *IAS-INSANA-SAS Summer Research Fellowship*, May-July 2012, Granted by: Indian Academy of Sciences, Indian National Science Academy, & The National Academy of Sciences, India
1. *INSPIRE Fellowship*, August 2009-May 2014, Granted by: Department of Science and Technology, Ministry of Science and Technology, India

TRAVEL GRANTS

3. *Travel Grant to the JMM 2020*, American Mathematical Society, November 2019
2. *Travel Award*, The Graduate School, Michigan State University, October 2019
1. *Travel Grant to the AMS Sectional Meeting*, American Mathematical Society, August 2019

Publications

PREPRINTS

4. Luis Scoccola, **Hitesh Gakhar**, Johnathan Bush, Nikolas Schonsheck, Tatum Rask, Ling Zhou, Jose Perea, *Toroidal Coordinates: Decorrelating Circular Coordinates With Lattice Reduction*, Available on Request
3. **Hitesh Gakhar** and Jose A. Perea, *Sliding window persistence of quasiperiodic functions*, In: (March 08, 2021). [Preprint, arXiv:2103.04540](#), [math.AT, cs.CG, math.DS]
2. Joseph M. Melby, **Hitesh Gakhar**, and Jose A. Perea, *Persistent Lifts to p -Primary Coefficients*, Submitted
1. **Hitesh Gakhar** and Jose A. Perea, *Künneth Formulae in Persistent Homology*, In: (October 12, 2019). [Preprint, arXiv:1910.05656](#), [math.AT, cs.CG]

IN PREPARATION

2. **Hitesh Gakhar**, Joshua L. Mike, Jose A. Perea, and Luis Polanco, *Stability of sparse circular coordinates*, in preparation
1. **Hitesh Gakhar**, Joshua L. Mike, Jose A. Perea, and Luis Polanco, *Stability of multiscale $K(G,1)$ coordinates*, in preparation

Talks & Posters

Total Number of Talks and Posters = 44 (11 Invited, 16 Contributed to Conferences/Workshops, 11 Contributed Seminars, 6 Miscellaneous)

INVITED TALKS

11. *Topology Tales: Adventures in Bending, Stretching, and Twisting*, Raising A Mathematician Training Program, May 12, 2023
10. *What is topology and how is it used in data science?*, Graduate Student Seminar, Department of Mathematics, The University of Oklahoma, October 31, 2022
9. *Stability of Eilenberg-MacLane Coordinates*, Applied Algebraic Topology Research Network Seminar, October 12, 2022
8. *What is topology and how is it used in data science?*, Math Club, The University of Oklahoma, March 03, 2022
7. *Shapes, Products, and Data*, Math Alumni Seminar Series, IISER Mohali, January 29, 2022
6. *Persistent Künneth Formulae and Applications*, Seminars on Geometry and Topology, India, July 30, 2021
5. *An Introduction to Persistent Homology*, Seminars on Geometry and Topology, India, July 23, 2021
4. *Künneth Formulae in Persistent Homology*, Redbud Topology Conference, The University of Oklahoma, November 8, 2020
3. *A topological analysis of quasiperiodicity using persistent Künneth formulae*, Machine Learning Seminar, University of Ottawa, February 28, 2020
2. *Persistent homology and quasi-periodicity in time series data*, Topology, Analysis and Geometry Seminar, Central Michigan University, October 11, 2019
1. *Quasiperiodicity, Sliding Window Embeddings and the Künneth theorems*, Topology, Geometry and Data Analysis Seminar, The Ohio State University, Columbus, October 1, 2019

CONTRIBUTED TALKS: CONFERENCES AND WORKSHOPS

16. *Toroidal Coordinates: Decorrelating Circular Coordinates With Lattice Reduction*, Symposium of Computational Geometry, University of Texas, Dallas, June 15, 2023
15. *Stability of sparse circular coordinates*, Western AMS Sectional Meeting, Virtual, May 15, 2022
14. *Stability of sparse circular coordinates*, Spring 2022 OK-AR MAA Meeting, April 08, 2022
13. *How to find the shape of planar curves using graph paper!*, Graduate and Postdoctoral Research Symposium, The University of Oklahoma, March 04, 2022
12. *Sliding window persistence of quasiperiodic functions*, Topological Data Analysis Workshop, The Institute for Mathematical and Statistical Innovation, Chicago, April 30, 2021, ([Video Available Here](#))
11. *A theoretical analysis of quasiperiodicity using persistent Künneth formulae*, AATRN-ATMCS, January 12, 2021, ([Video Available Here](#))
10. *A theoretical analysis of quasiperiodicity using persistent Künneth formulae*, Algebraic Topology: Methods, Computation, and Science (Canceled due to COVID-19), The Ohio State University, Columbus, June 2020
9. *Sliding Window Embeddings of quasiperiodic functions*, AMS Contributed Paper Session on Topology and Knot Theory, Joint Mathematics Meeting, Denver, January 16, 2020
8. *Sliding Window Embeddings of quasiperiodic functions*, AMS Sectional Meeting, University of Florida, Gainesville, November 3, 2019
7. *Künneth Formulae in Persistent Homology*, AMS Sectional Meeting, University of Wisconsin, Madison, September 15, 2019
6. *Künneth Formulae in Persistent Homology*, First Midwest student conference: Geometry and Topology meet data analysis and machine learning, The Ohio State University, Columbus, June 2, 2019
5. *Künneth Formulae in Persistent Homology*, 17th Graduate Student Topology and Geometry Conference, University of Illinois at Urbana Champaign, March 30, 2019
4. *Künneth Formulae in Persistent Homology*, Knots in Washington XLVII, George Washington University, Washington D.C., January 21, 2019
3. *Künneth Formulae in Persistent Homology*, AMS Contributed Paper Session on General Topology, Algebraic Topology, and Topology of Manifolds, Joint Mathematics Meeting, Baltimore, January 17, 2019
2. *Persistent Künneth Formula (Poster)*, Theory and Foundations of TGDA, The Ohio State University, Columbus, May 21, 2018
1. *Sliding window embeddings of quasiperiodic functions*, 16th Graduate Student Topology and Geometry Conference, University of Illinois at Chicago, April 8, 2018

CONTRIBUTED SEMINARS

11. *Stability of Eilenberg-MacLane Coordinates*, Topology and Data Science Seminar, Department of Mathematics, The University of Oklahoma, October 03, 2022
10. *What are Circular Coordinates?*, Topology and Data Science Seminar, Department of Mathematics, The University of Oklahoma, May 02, 2022
9. *An Introduction to Persistent Homology*, Topology and Data Science Seminar, Department of Mathematics, The University of Oklahoma, September 17, 2021
8. *A topological analysis of quasiperiodicity using persistent Künneth formulae*, Topology and Data Science Seminar, Department of Mathematics, The University of Oklahoma, October 20, 2020
7. *A topological analysis of quasiperiodicity using persistent Künneth formulae*, Graduates Reminisce Online On Topology (GROOT) Summer Seminar, July 31, 2020
6. *Topology and Toroidal Dynamics*, Topological Data Analysis Seminar, Department of Computational Mathematics Science & Engineering, Michigan State University, April 13, 2020

5. *Sliding window embeddings of quasiperiodic functions*, Graduate Student Geometry & Topology Seminar, Department of Mathematics, Michigan State University, March 13, 2019
4. *Künneth Formulae in Persistent Homology*, Graduate Student Geometry & Topology Seminar, Department of Mathematics, Michigan State University, November 14, 2018
3. *Dualities in Persistent Cohomology*, Graduate Student Geometry & Topology Seminar, Department of Mathematics, Michigan State University, January 17 & 24, 2018
2. *Persistent Homology*, Graduate Student Geometry & Topology Seminar, Department of Mathematics, Michigan State University, April 13, 2017
1. *Serre Spectral sequences*, Graduate Student Geometry & Topology Seminar, Department of Mathematics, Michigan State University, November 19, 2015

OTHER TALKS

6. *(Intro to) Sliding Window Persistence*, Tutorial-a-thon, AATRN-WinCompTop, April 2021, ([Video Available Here](#))
5. *A topological study of toroidal dynamics*, Ph.D. Dissertation Defense, Department of Mathematics, Michigan State University, April 20, 2020
4. *Analysis of Self Adjoint Operators (Poster)*, M.S. Thesis Poster Presentations, Indian Institute of Science Education and Research Mohali, April 12, 2014
3. *Analysis of Self Adjoint Operators*, M.S. Thesis Mid-Year Presentation, Indian Institute of Science Education and Research Mohali, November 27, 2013
2. *Dr. Isomorpheus's Introduction to Game Theory (Poster)*, Mathematics Day Celebration, Indian Institute of Science Education and Research–Mohali, October 25, 2013
1. *Google PageRank*, Mathematics Club, Indian Institute of Science Education and Research Mohali, February 14, 2012

Conference Organization

Special Session on Topological Persistence: Theory, Algorithms, and Applications

AMS SECTIONAL MEETING, GEORGIA INSTITUTE OF TECHNOLOGY

Atlanta, GA

March 18-19, 2023

AMS Special Session on Data Science at the Crossroads of Analysis, Geometry, and Topology (a Mathematics Research Communities session)

JOINT MATHEMATICS MEETING 2023

Boston, MA

January 05, 2023

Special Session on Computational Topology and Applications

AMS SECTIONAL MEETING (MOVED ONLINE; ORIGINALLY AT UNIVERSITY OF DENVER)

Denver, CO

May 14-15, 2022

15th Graduate Student Topology and Geometry Conference

MICHIGAN STATE UNIVERSITY

East Lansing, MI

April 8-9, 2017

Undergraduate Advising & Mentoring

- **Kaden Schaberg** (December 2022 - May 2023): • Undergraduate Reading Student in Elementary Differential Geometry
- **Anishka Peter** (March 2022 - December 2022): • Undergraduate Honors Thesis Mentee • Graduated in December 2022
- **Mark Ramirez** (February 2021 - May 2022): • Undergraduate Honors Thesis Mentee • Graduated in May 2022 • Joined Georgia Institute of Technology's Masters Analytics (Analytical Tools) in Fall 2022

Teaching

Note: (x) represents the number of students in a single section, (x + y) represents the number in two sections taught

LEARNING MANAGEMENT EXPERIENCE

D2L

SUMMER 2023 - PRESENT, SUMMER 2018 - FALL 2019

Michigan State University

Canvas

FALL 2020 - SPRING 2023

The University of Oklahoma

COURSES TAUGHT AS THE INSTRUCTOR-OF-RECORD

MTH 309: Linear Algebra I

SUMMER 2023

Michigan State University

MATH 3980: Honors Research

FALL 2022, SUMMER 2021

The University of Oklahoma

MATH 3333: Linear Algebra I

FALL 2022 (36 + 36), SPRING 2022 (62), SPRING 2021 (79, ONLINE)

The University of Oklahoma

MATH 3113: Intro. to Ordinary Differential Equations

SPRING 2023 (65)

The University of Oklahoma

MATH 2443: Calculus and Analytic Geometry IV

FALL 2021 (33 + 32), FALL 2020 (43 + 42, ONLINE)

The University of Oklahoma

MTH 299: Transitions

FALL 2019 (20), FALL 2018 (25), SUMMER 2018 (11)

Michigan State University

MTH 235: Differential Equations

SUMMER 2016 (25), SPRING 2016 (20)

Michigan State University

MTH 234: Calculus III

SUMMER 2017 (11)

Michigan State University

MTH 133: Calculus II

SPRING 2019 (31)

Michigan State University

MTH 132: Calculus I

SUMMER 2019 (14)

Michigan State University

MTH 124: Survey of Calculus I

SUMMER 2015

Michigan State University

COURSES TAUGHT AS THE RECITATION INSTRUCTOR

MTH 299: Transitions

SPRING 2017

Michigan State University

MTH 234: Calculus III

FALL 2016

Michigan State University

MTH 133: Calculus II

FALL 2015, SPRING 2015, FALL 2014

Michigan State University

TEACHING LEADERSHIP

Lead Teaching Assistant, Mathematics Learning Center

SPRING 2019, SPRING 2017, FALL 2016, SPRING 2016

Duties: Supervising the Mathematics Learning Center, Observing Under-graduate and Graduate tutors

Michigan State University

Lead Teaching Assistant, Center for Instructional Mentoring

SPRING 2019, SPRING 2018, SPRING 2017, FALL 2016

Duties: Observing Graduate Teaching Assistants for 'Calculus III' and 'Differential equations', Providing feedback, One on one mentoring, Conducting exam reviews for 'College Algebra'

Michigan State University

Teaching Observation Assistant

FALL 2019, FALL 2018, FALL 2017

Duties: Observing Undergraduate Learning Assistants & Graduate Teaching Assistants, Providing feedback

Michigan State University

Overall Coordinator for Summer B

SUMMER 2017

Duties: Supervising instructors teaching 100-level and 200-level courses, One on one mentoring for a first time Graduate Teaching Assistant, Observations & feedback

Michigan State University

Academic Service

REFEREEING

3. Foundations of Computational Mathematics
2. Journal of Applied and Computational Topology
1. Boletin de la Sociedad Matematica Mexicana (transl. *Bulletin of the Mexican Mathematical Society*)

SEMINAR ORGANIZATION

2. *Co-Organizer*, Topology and Data Science Seminar, Department of Mathematics, The University of Oklahoma, Fall 2022, Spring 2022, Fall 2021
1. *Co-Organizer*, Graduate Student Geometry & Topology Seminar, Department of Mathematics, Michigan State University, Spring 2018

COMMITTEES

7. *Member*, Interdisciplinary Committee, Department of Mathematics, The University of Oklahoma, September 2020 - May 2023
6. *Member*, Math Club Committee, Department of Mathematics, The University of Oklahoma, September 2020 - May 2023
5. *Member*, Awards Committee, College of Natural Science Student Advisory Council, August 2019 - May 2020
4. *Mathematics Representative*, College of Natural Science Student Advisory Council, August 2019-May 2020
3. *Graduate Student Representative*, Graduate Program Subcommittee, Strategic Planning Committee, Department of Mathematics, Michigan State University, February 2019-April 2019
2. *Graduate Student Representative*, Graduate Studies Committee, Department of Mathematics, Michigan State University, August 2018-July 2019
1. *Mathematics Representative*, Opportunity Cell, IISER Mohali, October 2011 - December 2012 and August 2013 - April 2014

OUTREACH ACTIVITIES

5. *Math Club Faculty Organizer*, OU Math Club, September 2022 - January 2023
4. *Volunteer for the Math Bowl Competition*, OU Math Day, The University of Oklahoma, November 2022
3. *Volunteer Presenter*, KVPY Summer Science Camp, IISER Mohali, June 2011
2. *Science Exhibition Coordinator*, National Science Day, IISER Mohali, February 2011
1. *Volunteer Presenter*, National Science Day, IISER Mohali, February 2010

Professional Affiliations

4. Member of the Applied Algebraic Topology Research Network, December 2018-present
3. Member of the American Mathematical Society, 2022-present, 2014-2020
2. Member of the Association of Women in Mathematics, Student Chapter, Michigan State University, February 2018 - May 2020
1. Member of the Mathematical Association of America, 2015-2016

References

Available on request