

# Daniel Tolosa

Algebraic Topology | Topological Data Analysis | Math Biology

dtolosav@asu.edu  
www.linkedin.com/in/daniel-tolosa  
website: danieltolosa.com

## Education

Ph.D. in Mathematics 2024  
**Purdue University** (*Advisor: Manuel Rivera*) West Lafayette, Indiana USA  
B.S. in Mathematics 2017  
**National University of Colombia** Bogotá, Colombia

## Employment

Presidential Postdoctoral Fellow 2025 –  
**School of Mathematical and Statistical Sciences**, Arizona State University Tempe, AZ, USA  
Visiting Postdoctoral Researcher Fall 2024 & Summer 2025  
**Max Planck Institute for Molecular Cell Biology and Genetics** Dresden, Germany  
Harrington group  
Graduate Data Science Researcher 2023 – 2024  
**The Data Mine**, Purdue University West Lafayette, IN USA  
Academic Tutor 2012 – 2013  
**SLEG (Smart Learning Educational Group)** Bogotá, Colombia

## Publications and Preprints

- D. Lee, K. Maggs, **D. Tolosa**. *Transcriptomic circle bundles*. In preparation.
- V. Galgano, H. Harrington, **D. Tolosa**. *Discrete signatures of persistence landscapes*. In preparation.
- A. Carnero-Bravo, S. Goyal, S. Martínez-Alberga, C. Ng, C. Roitzheim, **D. Tolosa**. *Left and right Bousfield localization on posets*. In preparation.
- **D. Tolosa**, A. Volkening. *Quantifying biological pattern formation: a time-dynamic persistent homology approach*. In preparation.
- M. Rivera, **D. Tolosa**. *Cyclic homology of categorical coalgebras and the free loop space*. Submitted. arXiv:2403.08116.
- **D. Tolosa**. *Hochschild and cyclic theory for categorical coalgebras: an algebraic model for the free loop space and its equivariant structure* (Ph.D. Thesis). Purdue University, 2024.

## Talks and Posters

### Invited Talks

- *Alumni speaker: A topological journey* Recruiting event, Purdue University, 2025.
- *Topological methods for quantifying time-dynamics in biological pattern formation* Joint Mathematical Meetings, Special Session in Results on curves inspired by applications, Seattle, WA, 2025.
- *A topological description of collective behavior* Math Biology seminar, Arizona State University.
- *Loops spaces* Geometry seminar, TU Dresden, 2024.
- *Topological methods for quantifying time-dynamics in biological pattern formation* Postdoc seminar, Max Planck Institute for Molecular Cell Biology and Genetics, 2024.

- *An algebraic model for the free loop space as an  $S^1$ -space* Joint Mathematical Meetings, Special Session in Equivariant techniques in stable homotopy theory, San Francisco, CA, 2024.
- *An algebraic model for the free loop space as an  $S^1$ -space* Joint Mathematical Meetings, Special Session in Equivariant techniques in stable homotopy theory, San Francisco, CA, 2024.
- *Quantifying biological pattern formation: a time-dynamic persistent homology approach*, Topology Data Analysis Seminar, Michigan State University, 2023.
- *Cyclic homology of categorical coalgebras and the free loop space*, Topology Seminar, Michigan State University, 2023.
- *Cyclic homology of categorical coalgebras and the free loop space*, Topology Seminar, University of Minnesota, 2023.
- *An algebraic model for the free loop space as an  $S^1$ -space*, Topology Seminar, Indiana University, 2023.
- *An algebraic model for the free loop space as an  $S^1$ -space*, Topology Seminar, Purdue University, 2023.
- *Quantifying biological pattern formation: a time-dynamic persistent homology approach*, Applied Geometry and Topology Seminar (Online), Potsdam University, Germany, 2023.
- *An algebraic model for the free loop space as an  $S^1$  space*, Algebra and Geometry Seminar, University of Genova, Italy, 2023.
- *Topological techniques to quantify biological pattern formation*, AMS Spring Sectional Meeting, University of Cincinnati, 2023.
- *Whitehead's theorem for Model Categories*, Student Topology Seminar, Purdue University, 2021.
- *An introduction to persistent homology using zebrafish-skin patterns*, Student Topology Seminar, Purdue University, 2021.
- *Goppa Codes in PQ-Crypto* Code Theory Seminar, Universidad de los Andes, Colombia, 2017.

## Contributed Talks

- *Future directions in the intersection of Cyclic Homology Theory, Equivariant Homology Theory, and Topological Data Analysis*, Student Topology Seminar, Purdue University, 2023.
- *An algebraic model for the free loop space as an  $S^1$  space*, Midwest Topology Seminar, UIUC, 2023.
- *Quantifying biological pattern formation in time*, Synergies between TDA and Life Sciences Workshop (Online), Heidelberg University, Germany, 2023.
- *An algebraic model for the  $S^1$ -homology of the free loop space* Graduate Research Day, Purdue University, 2022.
- *Time dynamics in Topological Data Analysis of Zebrafish Patterns* Student Colloquium, Purdue University, 2022.
- *Goppa and McEliece codes* Post-Quantum Cryptography Seminar, Universidad del Rosario, Colombia, 2017.
- *Finite fields in code-based cryptography* Post-Quantum Cryptography Seminar, Universidad del Rosario, Colombia, 2017.
- *Gröbner Bases, Stillman's Conjecture and F5 algorithms* UREP-C Symposium, Purdue University, 2016.
- *Bridges between Algebra and Geometry* Next Generation Researchers, Lafayette, IN, 2016.
- *Recent developments on Cerny's Conjecture* CS and Discrete Mathematics Seminar, National University of Colombia, 2016.
- *The Euler Characteristic: development through history and complexity* (CIMPA Summer School) Geometric, Algebraic and Topological Methods for Quantum Field Theory, Villa de Leyva, Colombia, 2015.

## Poster Sessions

- *Quantifying biological pattern formation in time*, 3rd workshop on Computational Persistence (ComPer), Purdue University, 2023.
- *Quantifying biological patterns using persistent homology* PULSe Orientation Faculty Poster Session, Purdue University, 2023.
- *Uncertainty analysis of Alzheimer’s Disease cell-free mRNA assay classifier* The Data Mine Symposium, Purdue University, 2023.
- *Cerny’s Conjecture and the method of extension* Graduation Poster Session Class of 2017, National University of Colombia, 2017.
- *Gröbner Bases Computation* C-SAP Academic Event, Purdue University, 2016.

## Academic Activities and Service

- **Panelist**, *Alumni panel at recruiting event*, Purdue University . . . . . 2025
- **Panelist**, *Graduate students speak to future mathematicians*, Purdue University . . . . . 2023
- **Panelist**, *Basic Skills Workshop*, Purdue University . . . . . 2023
- **Panelist**, *Ask a mathematician, Math Summer Camp*, Purdue University . . . . . 2023
- **Poster Session Judge**, *SURF Symposium*, Purdue University . . . . . 2023
- **Co-Organizer**, *Topology Student Seminar*, Purdue University . . . . . 2022 – 2024
- **Poster Session Judge**, *Fall Undergraduate Research Expo*, Purdue University . . . . . 2022
- **Participant** *Math challenges in biology contest*, NSF-Simons Center for Quantitative Biology 2022
- **Member**, *Anti-racist reading group*, Purdue University . . . . . 2019 – 2024
- **Member**, *Post-quantum cryptography research group*, Rosario University, Colombia . . . . . 2017
- **Visiting Scholar**, *Undergraduate Research Experience*, Purdue University . . . . . 2016
- **Visiting Scholar**, *Undergraduate Research Experience*, University of Bologna, Italy . . . . . 2013

## Teaching

### Instructor of Record

- *Linear Algebra with Applications* , Arizona State University . . . . . Spring 2025
- *Applied Calculus 2* (2 Sections), Purdue University . . . . . Spring 2022
- *Applied Calculus 1* (2 Sections), Purdue University . . . . . Fall 2021

### Teaching Assistant (Recitation)

- *Multivariate Calculus* (3 Sections), Purdue University . . . . . Fall 2019, Summer 2021, Spring 2022
- *Linear algebra and differential equations* (2 sections), Purdue University . . . . . Fall 2020
- *Discrete mathematics and applications* (2 sections), Purdue University . . . . . Summer 2020
- *Calculus 2* (2 sections), Purdue University . . . . . Fall 2018 and Spring 2019
- *ODEs and Linear Algebra* (1 section), National University of Colombia . . . . . Spring 2016
- *Fundamentals of mathematics* (1 section), National University of Colombia . . . . . Fall 2015

## Advising and Mentoring

- *Undergraduate thesis committee*, Ron Balanay, Arizona State University . . . . . 2025
- *Undergraduate reading program*, Daniel Armeanu, Purdue University . . . . . Spring 2024
- *UREP-C: Mentoring a visiting scholar*, Mateo Matijasevick, Purdue University . . . . . Spring 2021

## Awards and Honors

- Teaching Academy Graduate Teaching Award, Purdue University . . . . . 2024
- Service Award: topology seminar organizer, Purdue University . . . . . 2024
- Excellence in Graduate Teaching Award, Purdue University . . . . . 2023
- Summer research grant awarded by Purdue University. . . . . Summer 2023
- Summer research assistantship supported by NSF grant. . . . . Summer 2022

## Relevant Courses and Certifications

- *Algebraic Methods for Biochemical Reaction Networks*, MSRI Summer School at Max Planck Institute, Germany . . . . . 2023
- CS 59000 (*Data Eng. 1*), Purdue University, USA . . . . . 2020
- CS 50024 (*Data Eng. 2*), Purdue University, USA . . . . . 2020
- *Fundamentals of Biochemistry*, National University of Colombia . . . . . 2018
- *Scientific Programming with Python*, Konrad Lorenz University, Colombia . . . . . 2017

## Programming Skills

- **Languages:** Python, Matlab, Macaulay2, LaTeX, SQL, noSQL.
- **Specializations:** Scientific Computing, Topological Data Analysis, Abstract Algebra, Scientific Writing, statistical analysis of RNAseq data.

## Language Skills

- **English:** Bilingual Proficiency (C2 Level).
- **Spanish:** Native Language.
- **Italian:** Bilingual Proficiency (C2 Level).
- **French:** Intermediate (B2 Level).