

# Subhadip CHOWDHURY

Mathematics and Computational Sciences Department  
The College of Wooster  
1189 Beall Ave  
Wooster, OH - 44691, USA



+1(773)490-5763



+1(330)263-2473



[subhadipnet@gmail.com](mailto:subhadipnet@gmail.com)



[subhadipchowdhury.github.io](https://github.com/subhadipchowdhury)

## EDUCATION

---

2012-2018	<b>Ph.D. in Mathematics</b> , <i>The University of Chicago</i> • <b>Advisor</b> - Danny CALEGARI • <b>Dissertation Title</b> - Self-similarity of Ziggurat Fringes and Rigidity of Extremal Free Group Actions on the Circle	Chicago, IL
2014	<b>M.S. in Mathematics</b> , <i>The University of Chicago</i> • <b>Topic Proposal</b> - Stable Commutator Length and Quasimorphisms	Chicago, IL
2009-2012	<b>Bachelor of Mathematics with Honours</b> , <i>Indian Statistical Institute, Bangalore Centre</i> • First Division with Distinction	Bengaluru, KA, India

## ACADEMIC APPOINTMENTS

---

2020-2023	<b>Visiting Assistant Professor</b> , <i>The College of Wooster</i> • Introduction to Topology, Math 330 (Fall 2021) • Numerical Analysis, Math 327 (Spring 2022) • Chaotic Dynamical Systems, Math 299 (Spring 2023) • Teaching Apprenticeship, IDPT 398 (Spring 2022) • Putnam Seminar, Math 27901 (Fall 2021, Fall 2022) • Differential Equations, Math 221 (Fall 2020*) • Transition to Advanced Mathematics, Math 215 (Spring 2021*, Fall 2021, Fall 2022) • Multivariate Calculus, Math 212 (Spring 2022, Fall 2022) • Mathematical Foundations of Computing, Math 130 (Spring 2022, Spring 2023) • Theory of Integral Calculus, Math 125 (Fall 2022, half-semester) • Theory of Differential Calculus, Math 115 (Fall 2021, half-semester) • Applied Differential Calculus, Math 110 (Spring 2023, half-semester)	Wooster, OH
-----------	--	-------------

	<ul style="list-style-type: none"> <li>• Calculus and Analytic Geometry II, Math 112 (Spring 2021*)</li> <li>• Calculus and Analytic Geometry I, Math 111 (Fall 2020*)</li> </ul> <p>* online and hybrid versions</p>	
2018-2020	<b>Visiting Assistant Professor, Bowdoin College</b> <ul style="list-style-type: none"> <li>• Ordinary Differential Equations, Math 2208 (Fall 2019, Spring 2020)</li> <li>• Linear Algebra, Math 2000 (Spring 2019)</li> <li>• Multivariable Calculus, Math 1800 (Fall 2018, Spring 2019, Fall 2019, Spring 2020),</li> <li>• Differential Calculus, Math 1600 (Fall 2018)</li> </ul>	Brunswick, ME
Summer 2018	<b>Mathematics Instructor, Chicago Academic Achievement Program, The University of Chicago College</b> <ul style="list-style-type: none"> <li>• Proof-Based Methods in Mathematics</li> </ul>	Chicago, IL
2014-2018	<b>Graduate Instructor, The University of Chicago College</b> <ul style="list-style-type: none"> <li>• Mathematical Methods for Social Sciences, Math 195 ( Winter 2018, Fall 2017)</li> <li>• Linear Algebra, Math 196 (Summer 2017),</li> <li>• Calculus III, Math 153, (Winter 2017, Winter 2016, Spring 2015)</li> <li>• Calculus II, Math 152 (Fall 2016, Fall 2015, Winter 2015),</li> <li>• Calculus I, Math 151 (Fall 2014)</li> <li>• Elementary Functions and Calculus III, Math 133 (Spring 2016)</li> </ul>	Chicago, IL

## MENTORING EXPERIENCE

---

2021-2023	<b>Advisor for Senior Independent Study</b> (Bachelor's Thesis), <i>College of Wooster</i> <ul style="list-style-type: none"> <li>• Lucy Wickham, 2022-2023  <i>"Tile Invariants and an Exploration of Tilings with Ribbon Pentominoes and L-Pentominoes"</i>.</li> <li>• Michael Curran, 2022-2023  <i>"Isometric Immersion: Hilbert's Theorem and the Case of the Hyperbolic Plane"</i></li> <li>• Ussama Mustafa, 2022-2023 (jointly with the CS department)  <i>"Exploring the Power of Generative Architectures such as GANs, Transformers, and VQGAN+CLIP through the Construction of an Illustrated Storybook Generator"</i></li> </ul>
-----------	--

	<ul style="list-style-type: none"> <li>• Sabrina Helck, 2021-2022 <i>"The Infinity Conundrum: Understanding Topics in Set Theory and the Continuum Hypothesis"</i>.</li> <li>• Molly Hutter, 2021-2022 <i>"In Hot Water! Using Numerical Analysis to show the Effects of Climate Change on the Great Lakes"</i>.</li> </ul>
Summer 2021, 2022	<p><b>Supervisor for Applied Methods and Research Experience, College of Wooster</b></p> <ul style="list-style-type: none"> <li>• <b>Summer '22:</b> Funded by Goodyear Tire and Rubber Company - Innovation Technology division, students were tasked with creating a comprehensive analysis application for their non-pneumatic tires using Python, converting multi-program routines involving complex data structures and cutting-edge numerical methods, into one standardized workflow. <b>Supervisees:</b> Ussama Mustafa, Praneel Panchigar, Kevin Yuan</li> <li>• <b>Summer '21:</b> A client-funded research project, where students were tasked with understanding trends in customer behavior at a regional grocery store chain, analyzing halo effects, and coming up with creative targeted programs to increase sales using customer segmentation techniques. <b>Supervisees:</b> Abigail Breitenbucher, Luke Pritchard, Maya Vasta, Kweku Yamoah</li> </ul>
Spring 2019	<p><b>Advisor for Intermediate Independent Study, Bowdoin College</b></p> <ul style="list-style-type: none"> <li>• Theo de Quillacq, 2020 - <i>Machine Learning</i></li> <li>• Arav Agarwal, 2020 - <i>Group Theory</i></li> </ul>
2014, 2016	<p><b>Advisor for Summer Research Experience for Undergraduates, University of Chicago</b></p> <ul style="list-style-type: none"> <li>• M. C. Welsh, 2016 - <i>Scissors congruence</i></li> <li>• S. Park, 2016 - <i>Rationality of zeta functions over finite fields</i></li> <li>• E. Hsiao, 2016 - <i>Canonical energy and black hole stability</i></li> <li>• L Linov, 2014 - <i>An introduction to knot theory and the knot group</i></li> <li>• J. H. Yoo, 2014 - <i>The Jordan-Chevalley decomposition</i></li> </ul>
2014-2016	<p><b>Directed Reading Program Mentor, University of Chicago</b></p> <ul style="list-style-type: none"> <li>• Met weekly with undergraduate students to guide mathematics reading projects</li> <li>• Dan Su, Winter 2016 - <i>Topology</i></li> <li>• Wenyu Chen, Fall 2015 - <i>The Dynamics of Circle Homeomorphisms</i></li> </ul>

	<ul style="list-style-type: none"> <li>• Weston Ungemach, Spring 2014 - <i>Discrete Group actions on Topological Spaces</i></li> </ul>
2014-2016	<b>WOMP Mentor, University of Chicago</b> <ul style="list-style-type: none"> <li>• Warm-up program organized and run by advanced graduate students for incoming grads in the math department</li> </ul>
2010-2011	<b>Instructor in Regional Mathematical Olympiad and National Mathematical Olympiad Training Camp</b> <ul style="list-style-type: none"> <li>• in Kolkata, West Bengal and Bangalore, Karnataka, India</li> </ul>

## CURRICULUM DEVELOPMENT

---

Spring 2023	Created <b>Chaotic Dynamical Systems</b> (M29904) course, <i>College of Wooster</i> <ul style="list-style-type: none"> <li>• Developed new content including syllabus, course notes, exams, and OCTAVE projects.</li> </ul>
Spring 2021	<b>Calculus Review and Restructure, College of Wooster</b> <ul style="list-style-type: none"> <li>• Helped subdivide gateway courses to fine-tune student placement and increase accessibility</li> <li>• created new MCQ question bank for placement tests</li> </ul>

## OTHER PROFESSIONAL SERVICE

---

2015-2018	Administration of the <b>University of Chicago College Calculus Accreditation Exam</b> , under the supervision of Jitka STEHNOVA and John BOLLER Duties included - <ul style="list-style-type: none"> <li>• Creating a MCQ question bank (2018)</li> <li>• Grading subjective answers</li> <li>• Designing sorting criteria and algorithm</li> <li>• Processing large data sets using Excel and Python</li> </ul>
2021-2023	<b>Primary Faculty Advisor, The Student Mathematical Association of America Club, College of Wooster</b> <ul style="list-style-type: none"> <li>• Student organization promoting opportunities for community development within the mathematics department and for increasing mathematics awareness on and around campus</li> </ul>
Summer 2021	<b>Guide for incoming international students in STEM, College of Wooster</b> <ul style="list-style-type: none"> <li>• Supported by GLCA Internationalization grant</li> </ul>

2018-2020	<b>Co-organizer, Problem Solving Session, Bowdoin College</b> <ul style="list-style-type: none"> <li>• Training undergraduates in problem solving strategies for <i>Putnam Competition</i></li> </ul>
2019-2020	<b>Co-organizer, Student of Color Study Group, Bowdoin College</b> <ul style="list-style-type: none"> <li>• Weekly study group for underrepresented students in Math, CS and Physics</li> </ul>
2019	<b>Judge, MAA Undergraduate Poster Session, JMM 2019, Baltimore, MD</b>
2015	<b>Judge, QED Young Math Symposium, Math Circles of Chicago</b> <ul style="list-style-type: none"> <li>• Chicago's only youth math symposium</li> </ul>
2014	<b>Organizer &amp; Moderator, AWM Postdoc Panel, University of Chicago</b> <ul style="list-style-type: none"> <li>• Regarding application process, job market etc.</li> </ul>
2014-2018	Webmaster and active member of the UChicago chapter of <i>Association for Women in Mathematics</i>
2014-2019	Member of the American Mathematical Society

## PROFESSIONAL DEVELOPMENT

---

August 2020-2022	<b>Inclusive Teaching Workshops, College of Wooster</b> <ul style="list-style-type: none"> <li>• Three-hour workshops every August run by STEM Success Initiative.</li> <li>• Workshops include: inclusive practices for teaching, grading, and assessment; supporting diverse students.</li> </ul>
June 2021-2022	<b>The Grading Conference</b> <ul style="list-style-type: none"> <li>• Online two-day conference every June supported by NSF</li> <li>• Topics include: Alternate grading practices (e.g. standards-based, specifications-based, etc.) to best support student learning, promote diversity, equity, and inclusion in the classroom</li> </ul>
2013-2014	<b>College Fellow, University of Chicago</b> <ul style="list-style-type: none"> <li>• Teaching Assistant for Honors Calculus I-III, Math 161-163 taught by Eugenia CHENG</li> </ul>
2013-2017	<b>Grader for First year graduate courses, University of Chicago</b> <ul style="list-style-type: none"> <li>• Riemannian Geometry taught by André NEVES (Spring 2017)</li> <li>• Differential Topology taught by Danny CALEGARI (Winter 2016)</li> <li>• Differential Geometry taught by Sidney WEBSTER (Winter 2015)</li> <li>• Algebraic Topology taught by Danny CALEGARI (Fall 2013)</li> </ul>

## RESEARCH INTERESTS

---

Low dimensional dynamics and topology, specifically nonabelian group actions on the circle. Application of algebraic topology to formal language theory. Related topics in complex dynamics and big mapping class groups.

## PUBLICATIONS AND PREPRINTS

---

- **Ziggurat fringes are self-similar.** *Ergodic Theory and Dynamical Systems*,  
doi:10.1017/etds.2015.75

In this paper, we give explicit formulae for fringe lengths of the Calegari-Walker Ziggurats – i.e. graphs of extremal rotation numbers associated to positive words in free groups. These formulae reveal (partial) integral projective self-similarity in ziggurat fringes, which are low-dimensional projections of characteristic polyhedra on the bounded cohomology of free groups. This explains phenomena observed experimentally by Gordenko and Calegari-Walker.

- **A Topological proof that  $O_2$  is 2-MCFL.**  
arxiv.org/abs/1710.04597

In this paper, we give a new proof of Salvati's theorem that the group language  $O_2$  is 2 multiple context free using homology theory. Unlike Salvati's proof, our arguments do not use any idea specific to two-dimensions. This raises the possibility that the argument might generalize to  $O_n$ .

## INVITED TALKS

---

March 2022	<i>Joint Mathematical Meetings - Project NExT session on Re-Imagining Grading: The Whys and Hows</i> , virtual, USA
Jan 2022	<i>Ohio Speaker's Circuit</i> , Kenyon College, OH, USA
Jan 2021	<i>Joint Mathematical Meetings - AMS Special Session on Quantization for Probability Distributions and Dynamical Systems</i> , Virtual, USA
Mar 2019	<i>Bowdoin College Department Seminar</i> , Bowdoin College, Brunswick, ME, USA
Apr 2018	<i>American Mathematical Society Spring Southeastern Sectional Meeting</i> , Vanderbilt University, Nashville, TN, USA
Jan 2018	<i>Joint Mathematical Meetings - AMS Special Session on Dynamical Systems: Smooth, Symbolic, and Measurable</i> , San Diego, California, USA
Sep 2017	<i>American Mathematical Society Fall Eastern Sectional Meeting - Special Session on Geometric Group Theory</i> , SUNY, Buffalo, USA

Dec 2016	<i>Canadian Mathematical Society Winter Meeting - Session on Geometric Group Theory and Topology in Low Dimensions</i> , ON, Canada
----------	---

## EXPOSITORY TALKS IN STUDENT SEMINARS

---

Feb 2020	<i>Rotation Number and Dynamics on the Circle</i> , College of Wooster
Oct 2019	<i>Scissor's Congruence and Hilbert's 3rd Problem</i> , Bowdoin College
Nov 2018	<i>The Illumination Problem and Rational Billiards</i> , Bowdoin College
Apr 2018	<i>Rotation Number and Dynamics on the Circle</i> , Bowdoin College
Apr 2018	<i>Explorations in Circle Packings</i> , University of Chicago
Apr 2017	<i>Hilbert's 3rd Problem and the Dehn Invariant</i> , University of Chicago
Dec 2015	<i>Combinatorics of chessboard puzzles about domination, independence and tours</i> , University of Chicago
Nov 2013	<i>Cut-Copy-Paste - Algebra and Tiling</i> , University of Chicago
Feb 2013	<i>Stable Commutator Length</i> , University of Chicago

## AWARDS AND SCHOLARSHIPS

---

2012-2013	<b>McCormick Fellowship</b> , University of Chicago Awarded by the Admissions Committee to a small number of highly rated applicants to the Ph.D. program of the Department of Mathematics, for an amount of \$9000 over two years.
2012	<b>S.H. Aravind Gold Medal</b> , Indian Statistical Institute Awarded for outstanding performance in B. Math, to the student with highest CGPA in the program.
2011	<b>Summer Research Fellowship</b> , Indian Academy of Science
2009	<b>Bronze medal, 50th International Mathematical Olympiad</b> , Germany
2009	<b>National Board of Higher Mathematics scholarship</b> , Department of Atomic Energy, Government of India
2008	<b>Kishore Vaigyanik Protsahan Yojana fellowship</b> , Department of Science and Technology, Government of India
2007	<b>National Talent Search Examination scholarship</b> , National Council of Education Research and Training, India

## SKILLS AND LANGUAGES

---

Technical Language	C, Python, Haskell, Mathematica, Octave, PHP, HTML, CSS, $\text{\LaTeX}$ , MS Office English, Bengali, Hindi - fully proficient in speaking, reading, and writing
--------------------	--