Mohith Raju Nagaraju

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EDUCATION

Indian Institute of Science (IISc), Bangalore, India *2019 - Present*
Master and Bachelor of Science (Research) *Expected completion: July 2024*
Major in Mathematics
CGPA - 9.5/10

PREPRINT

Conformal Tilings, Combinatorial Curvature, and the Type Problem
arXiv:2311.08233 (submitted)

PROJECTS

Gauge theory and Kapustin-Witten equations (Master thesis) *Aug 2023 - Present*
Mentor: Prof. Ved Datar *IISc, Bangalore*

Studied Yang-Mills theory, Uhlenbeck's gauge fixing, and the construction of anti-self-dual connections on S^4 (ADHM theorem). The end goal is to investigate the conjectural relationship between the solutions of the Kapustin-Witten equations and the colored Jones polynomial.

Conformal tilings of Riemann surfaces (Bachelor thesis) *Aug 2022 - Apr 2023*
Mentor: Prof. Subhojoy Gupta *IISc, Bangalore*

Bishop and Rempe show that all non-compact Riemann surfaces can be conformally tiled using equilateral triangles. I proved that non-compact hyperbolic surfaces that have a cusp do not admit an edge-to-edge conformal tiling using n-gons for $n \geq 7$. Also, I studied the relationship between the combinatorics of a conformal tiling and the conformal type of the Riemann surface it tiles. This answers a special case of the type problem for conformal tilings posed by Bowers and Stephenson (2017).

Complex dynamics (Visiting students' research program) *May - Jul 2023*
Mentor: Prof. Sabyasachi Mukherjee *TIFR, Mumbai (online)*

Studied local fixed point theory: Koenigs linearization, Leau-Fatou parabolic petals, Écalle-Malgrange-Voronin classification of parabolic germs, and Cremer non-linearizability of generic indifferent fixed points. Also studied global theory of rational maps: repelling cycles are dense in the Julia set, Sullivan's classification of Fatou components, and landing of external rays on Julia set of polynomials.

Riemann surfaces and the uniformization theorem (Summer project) *May - Jul 2022*
Mentor: Prof. Ved Datar *IISc, Bangalore*

Studied the one-to-one correspondence between genus 1 surfaces, $\mathbb{C}/\Lambda$, and elliptic curves using the Weierstrass $\wp$ function. Also studied the Poisson equation $\Delta f = \rho$ on Riemann surfaces and used it to prove the uniformization theorem and a special case of the Riemann-Roch theorem.

Representation theory of S_n and A_n using combinatorics (Summer project) *Jun - Jul 2021*
Mentor: Prof. Pooja Singla *IIT, Kanpur (online)*

Studied the combinatorial Robinson–Schensted–Knuth correspondence between semistandard Young tableau and certain non-negative integer matrices. Then, used the correspondence to calculate the number and multiplicities of the irreducible representations and the character table of S_n.

SELECTED TALKS AND PRESENTATIONS

- **Principal bundles and Chern-Weil theory** *Oct 2023*
  Gauge theory learning seminar, IISc.
- **A discrete version of the Bonnet-Myers theorem for polygonal surfaces** *Jul 2023*
  Students' topology & geometry seminar (graduate students' seminar), IISc. slides.
- **A glimpse into complex dynamics** *Jun 2023*
  Visiting students' research program (VSRP), TIFR, Mumbai. slides.
- **Conformal tilings: a bizarre set of tilings generated by Schwarz reflections** *Jan 2023*
  Prime time seminar (graduate students' seminar), IISc. slides.
- **An introduction to Riemann surfaces** *Aug 2022*
  Undergraduate mathematics seminar, IISc. slides.
- **Sparsity bound for the factors of sparse polynomials and their deterministic factorization** *Mar 2022*
  Topics in complexity theory (algebraic complexity theory) course, IISc. slides.
- **Decision procedure for real arithmetic (Tarski–Seidenberg theorem)** *May 2021*
  Mathematical logic and theorem proving course, IISc. slides.

SCHOLASTIC ACHIEVEMENTS

- **Participant of Visiting Students' Research Program 2023, TIFR**: one of 21 students selected across India for summer research at TIFR, Mumbai.
- **Second prize in Madhava mathematics competition 2021**: math competition on analysis and algebra for undergraduate students across India.
- **Secured top quartile for individuals in Simon Marais undergraduate mathematics competition 2020**: similar to the William Lowell Putnam competition for undergraduate students across 10 nations.
- **KVPY-SX fellowship and scholarship, 2019-2024**: five year scholarship and contingency grant offered by the Department of Science and Technology, Govt. of India, to 104 selected undergraduates.

RELEVANT COURSES

Algebraic topology (planned)	-	Complex analysis	A+
Riemannian geometry (ongoing)	-	Topology	A+
Partial differential equations (ongoing)	-	Ordinary differential equations	A+
Introduction to the calculus of variations	A	Analysis II - measure and integration	A+
Introduction to differentiable manifolds	A+	Algebra II	A+
Functional analysis	A+	Algebra I	A+
Introduction to algebraic topology	A+	Algebraic combinatorics	A

LEADERSHIP AND COMMUNITY SERVICE

- **Volunteer of FPSAC 2022 conference** *Jul 2022*
  – Managed poster presentation videos and compiled them into poster marathon videos
- **Core team member of NoteBook Drive (NBD) IISc** *Aug 2019 - Jun 2022*
  (Student-run group to support and mentor children from weak socio-economic backgrounds)
  – Co-organized annual notebook distribution for 25 schools *May - Jun 2022*
  – Co-coordinator of the core team *May 2021 - April 2022*
  – Co-organized 4 online events to draw in new volunteers *Nov 2020 & Nov 2021*
  – Conducted science outreach and mentorship for high school students *Aug 2019 - Mar 2020*
- **Logistics coordinator of Pravega (IISc's science festival)** *May 2020 - Aug 2021*
  – Managed the logistics of various science, cultural, and workshop events