Lakshmi Ramesh

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Education

Universität Bielefeld - *Doctoral candidate*   2024 - 2027 (tentative)
Supervised by Prof. Martin Wahl and Prof. Bernd Sturmfels

RPTU Kaiserslautern - *Master of Science*   2021 - 2024
Mathematics with specialisation in Algebra, Geometry and Computer Algebra

Indian Institute of Science Education and Research Mohali - *BS-MS Dual degree*   2015 - 2020
Major in Mathematics

Publications

Invariant Theory   *Book chapter (Springer)*
 Wolfram Decker, Lakshmi Ramesh, Johannes Schmidt
Topics in invariant theory with examples in OSCAR - invariant rings of finite groups, **infinite linearly reductive groups** (my contribution) and Cox rings.

Projects

Algorithms for Free Resolutions over the Exterior Algebra with Parallel Structures   2023 - 2024
Masters Thesis project supervised by Dr. Janko Boehm, RPTU Kaiserslautern
Using the Berstein-Gel'fand-Gel'fand correspondence and the Tate resolution, one can compute the cohomology numbers of a coherent sheaf over project space. This requires computing the minimal free resolution of a module over the exterior algebra. I adapted Schreyer's new syzygy algorithm to the non-commutative setting of the exterior algebra, I have implemented the algorithm in Singular, and am parallelising it using the Singular- GPI Space interface.

Invariant Rings of Tori   2023 - 2024
I implemented the algorithm by Harm Derksen (using integer programming) to efficiently compute the fundamental invariants of tori in OSCAR. This project was funded by the SFB-TRR 195 project under the supervision of Prof. Max Horn and Prof. Wolfram Decker.

Invariant Rings of SLn   2023
I use Harm Derksen's algorithm to compute fundamental invariants of linearly reductive groups and Cayley's Omega process for SLn, and implemented invariant rings of reductive groups in OSCAR. This project was funded by the SFB-TRR 195 project under the supervision of Prof. Max Horn and Prof. Wolfram Decker.

Modules over Dedekind Domains   2022 - 2023
I developed functionality for modules over Dedekind domains in Hecke (dependency of OSCAR), including modules with torsion, quotient modules, module homomorphisms and elemental functionality. I also implemented a corrected version of Henry Cohen's algorithm for the Smith Normal Form, giving a canonical representation to a module over a Dedekind Domain. This project was funded by the SFB-TRR 195 project under the supervision of Prof. Claus Fieker.

Affine Group Schemes   2019 - 2020
Masters Thesis project supervised by Dr. Varadharaj Srinivasan, IISER Mohali
This project followed texts by W.C.Waterhouse and Eiichi Abe, and focused on group schemes as representable ring functors and the duality between affine group schemes and Hopf Algebras. I also studied the impact of the ground field or ring on geometric properties like connectedness, and special finiteness properties in the case of matrix groups.

Random Walks and Urn Problems

2017

In this summer project with Dr. Sreekar Vadlamani at TIFR(CAM), Bangalore, I studied and simulated fundamental problems in probability theory, focusing on random walks and urn problems using MATLAB.

Work Experience

Research Assistant, RPTU Kaiserslautern

2022 – 2024

This position is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through the SFB-TRR 195 project for 'Symbolic Tools in Mathematics and their Application'. I study algorithms in computer algebra related to algebraic number theory and algebraic geometry, and implement them in 'Open Source Computer Algebra Research system', OSCAR.

Tutor

2021

In this teaching role at *Tution Wayanad Online*, I prepared course material in mathematics and physics. I taught lessons and handled tutorials for high school students from around India over video call (due to the pandemic). I gained skills in teaching and designing learning material.

Scholarships

INSPIRE Scholarship

2015 – 2020

Awarded by the Government of India

The INSPIRE scholarship, awarded to the top percentile of school graduates who pursue pure sciences, is a scheme by the Ministry of Science and Technology of the Government of India.

Extra curriculars

Leadership

Convener of Student Representative Council

2017 – 2018

Elected as the head of the official student representative council for the 2017-18 term, I attended to all academic and other affairs of the 1300 students in the residential campus of IISER Mohali.

Culture

Music: I have performed with the University Choir (classical) Kaiserslautern and the Choir of the Versöhnungskirche Kaiserslautern in 2023. I am a trained Carnatic classical musician, with an interest to infuse Carnatic music with western classical concepts.

Dance: Trained in Indian classical dance Bharatanatyam, I have performed in many cities in India for over a decade.

Visual Arts: I am a visual artist, specialising in portraits in pen and ink, and watercolour. I have participated in two group exhibitions in the Museum Pfalzgalerie Kaiserslautern, and two exhibitions in Vielfalter Cafe Kaiserslautern, apart from being featured in magazines and exhibitions in the past.

Skills

Julia, Singular, GPI Space, Latex
OSCAR - github.com/Lax202

Languages

English, Tamil, Hindi - Fluent
German - Proficient
Spanish, French - Conversational