

**EDUCATION**

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| <b>Department of ECE, PES University</b><br><i>B.Tech. in Electronics and Communication Engineering (VLSI)</i> | Bengaluru, India               |
| • Advisor: Prof. Kaustav Bhowmick  | 2022 - 2026 (expected)         |
| • Research area: Architectures for Quantum Machine Learning  |                                |
| <b>Kendriya Vidyalaya Hebbal</b><br><i>Grade X and Grade XII</i>   | Bengaluru, India<br>2020, 2022 |

**RESEARCH INTERESTS**

Quantum computer architecture and coupling map design; quantum error correction and fault-tolerant computation; randomized and probabilistic algorithms for quantum systems; hardware-software co-design for scalable quantum processors; resource estimation and quantification of quantum *advantage*.

**INTERNSHIPS**

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| <b>Predoctoral Fellow (SPARKS)   Dept. of CSA, IISc</b>  | 2025.11 – Present |
| • Awarded one of the four predoctoral fellowships, to work on the intersection of theoretical computer science and quantum computer architecture, advised by Prof. Sumit K Mandal. The work will focus on problems in quantum compilation, scheduling and scalable error correction architectures. |                   |

  

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| <b>Dept. of CSA, IISc   Advisor: Prof. Sumit K Mandal</b>   | 2024.02 – 2025.10 |
| • Developed analytical models to estimate quantum processor fidelity and execution time based on coupling maps and platform-specific hardware constraints, validated on real quantum hardware with >98% accuracy.<br>• Proposed an efficient algorithm to generate coupling maps that guarantee high fidelity, showing increment of upto 35% in circuit fidelity.<br>• This work won the <b>3rd Prize</b> in the ACM Student Research Competition at 58th MICRO in the UG category. |                   |

**PUBLICATIONS**

1. Prateek P. Kulkarni and Sumit K. Mandal. Near-Ramanujan Graphs are All You Need to Achieve Maximum Quantum Fidelity. *58th IEEE/ACM Annual International Symposium on Microarchitecture (MICRO), ACM Student Research Competition*, 2025. [3rd Place]
2. Ramaseshan R, Abhishek Kumar V S, Adith Rajeev, Prathik V, Aditya Aravind, Prateek P. Kulkarni, Kaustav Bhowmick. A Generalized Hamiltonian Approach for Designing Simple Single Photon-based Optical Quantum Devices. *J Supercomput* 81, 1395, 2025. [Springer Nature]

**SELECTED PROJECTS**

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|---|------------------|
| <b>SQLFormer: Declarative Transformer Inference Using Only SQL Queries</b><br><i>Github Repository</i>  | 2025.06 – 2025.7 |
| • Implemented the full Transformer forward pass using only SQL queries, expressing attention and normalization via JOINs, aggregations, and window functions.<br>• Benchmarked across PostgreSQL, DuckDB, and PyTorch, providing correctness and performance analysis in an accompanying paper. |                  |

  

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| <b>PipSim: Real-Time RISC-V Pipeline Simulator with Visualization for Instruction Hazards</b><br><i>Github Repository</i>  | 2025.02 – 2025.02 |
| • Developed a Python-based simulator with real-time visualization of instruction flow, hazards, and pipeline behavior for 5-stage RISC-V.<br>• Integrated data forwarding and branch prediction; Currently extending with advanced features such as superscalar execution and deeper pipeline support. |                   |

## SELECTED PROJECTS

**RegDyno.Ai: High-Accuracy Time-Series Prediction using Custom Distribution Modeling**  
Patent Published, Journal No. 1/2025

2023.12 – 2024.06

- Built a custom distribution-based model achieving 15–25% improvement over state-of-the-art forecasting methods (ARIMA, LSTM, Prophet).
- Deployed a production-ready pipeline with automated noise reduction; novel methodology led to patent publication.

**surface2cirquit: Automated Surface Code to Quantum Circuit Conversion with Optimization**  
Github Repository

2024.06 – 2024.08

- Created an automated pipeline for Surface Code to Quantum Circuit conversion with syndrome extraction and optimization.
- Reduced gate count by 20–40% and enabled seamless integration with Qiskit, Cirq, and other error correction frameworks.

## SKILLS

**Programming:** Python, Julia, C, MATLAB.

**Tools/Platforms:** Vivado, gem5, Qiskit, QuNetSim, Cirq, PennyLane.

**Languages:** English, Kannada, Hindi

## SELECTED TALKS

**Systems Day 2025** | Computer Science and Automation, IISc 2025.01

- Selected among ~20 researchers nationwide to present a poster; presented on multi-core quantum computing with superconducting qubits.

**Workshop on Automata and Games for Synthesis** | 45th FSTTCS 2025.12

- Selected to present a short talk on: *Quantum Communication Exponentially Speeds-up Circuit Synthesis*

## AWARDS AND HONORS

- **Pre-Doctoral Fellow**, SPARKS Programme, CSA, IISc (~1/4 positions) 2025.10
- **3rd Place**, ACM SRC at MICRO 2025, UG Category 2025.10
- **Student Travel Grant**, MICRO 2025 – \$580 for ACM SRC presentation 2025.09
- **Q-Pragathi Funding**, KITS, Govt. of Karnataka – 1.2L INR 2024.09
- **Funded Internship**, ISFCR Long-Term Internship (declined), PES University 2024.01
- **National Runner-up**, Explain The Concept, Pravega (Undergrad Fest), IISc 2019.02

## ACADEMIC SERVICES

**Teaching Assistant for:** *Quantum Transport and Logic Gates*,  
PES University, Spring 2025, (Credits: 4, Class size: ~90)

**Program Committee for:** HPCA 2026 - AE (Artifact Evaluation)

**Reviewer for:** IEEE Transactions on Quantum Engineering (TQE)

## REFERENCES

**Prof. Sumit K. Mandal**,  
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Dept. of CSA, Indian Institute of Science (IISc), Bangalore  
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**Prof. Kaustav Bhowmick**,  
Associate Professor,  
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