Rishabh Ravi

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Indian Institute of Technology Bombay
borlaugg
https://borlaugg.github.io/portfolio/

Education

2020 – **Indian Institute of Technology Bombay, India** 9.33/10 GPA
Bachelors and Masters of Technology in Electrical Engineering
Specialization in Electronic Systems (ES)

Publications and Preprints

SCAM: Secure Shared Cache Partitioning Scheme
Rishabh Ravi, Varun Venkitraman, Tejeshwar, Virendra Singh
Submitted to the Asia and South Pacific Design Automation Conference (ASPDAC), 2025

Research Experience

2024 **Extending Vortex support for CUDA** *Guide: Prof. Hyesoon Kim | GaTech*
- Added support for CUDA's **PTX ISA** instructions **VOTE** and **SHFL** to the **RISC-V GPU** Vortex
- Extended the RISC ISA to map the instructions while ensuring minimal use of logical elements and verified the Verilog implementation using the RTL simulator

2024 **SCAM: Secure Shared Cache Partitioning Scheme** *Guide: Prof. Virendra Singh | IITB*
- Developed a secure, dynamic cache partitioning algorithm that outperformed PASS-P by **1%**
- Improved the performance by capping the partition to ensure complete L2 utilization and selectively transferring clean, exclusive and dead lines to minimize writeback, and back invalidation latencies

2023 **Subsampling of Correlated Graph Signals** *Guide: Prof. Satish Mulleti | IITB*
- Developed an algorithm to subsample by node deletion and reconstruct graph signals generated by a linear combination of different moments of the graph Laplacian; using low-rank approximations
- Proved that the reconstruction error for deleting $\geq$ **2** nodes was dependent on the nature of the graph and had **perfect reconstruction** for the deletion of just one node

2023 **A Review of Commercial Accelerator Architectures** *Guide: Mr. Sunil Shenoy*
The presentation can be found here *Sr. Vice President Emeritus, Intel*
- Explored literature by NVIDIA, Google, Intel, and Groq on **hardware accelerators** for applications in data center chips and cards and performed a comparative study on peak performance
- Inferred that developing application-specific hardware, implementing memory slicing, and having larger caches and faster interconnects were key for high-performance

Academic Achievements

2021 – **Ranked 1** in ES specialization and **2** overall in the department of Electrical Engineering based on academic performance

2024 Secured a **perfect 10** Semester Performance Index in **Senior Year**

2023 Designed a 2D Mapping System that ranked among the **top 3** projects in the Electrical Design Lab out of 70+ projects.

2021 Among the **top 30** students to be awarded Change of Branch to Electrical Engineering on excellent academic performance

Academic Achievements (continued)

2020 Achieved All India Rank **878** in **JEE Advanced 2020** out of 150,000 candidates.

2020 Secured **99.82 percentile** in **JEE Mains 2020** out of 1,100,000 candidates.

Professional Internships

2023 **Modem Firmware Engineer** *Guide: Mr. Dileep Lingamallu | Qualcomm*

- Revived a **GPRS-specific** modem firmware and virtual platform for applications in **smartwatches**
- Created test case scenarios, emulating L1 commands, to assess and validate functionality by maintaining signal-to-noise ratio within defined **21 dB** thresholds, affirming the accuracy of decoded data

2022 **Parallel Computing & Profiling** *Guide: Mrs. Tanmaya Karmakar | Nvidia*

- Worked in a team to parallelize **ANUGA**, an open-source hydrodynamic modeling software, by profiling and running time analysis of the program on **Nvidia Nsight Systems**
- Identified hot spots of the program that required parallelization to increase performance

Technical Projects

2023-24 **tinyVTA: FPGA-based Accelerator for Neural Networks** *Guide: Prof. Sachin Patkar Singh*
The detailed report can be found here *Course Project*

- Implemented an accelerator for floating point operations such as block **matrix-multiply-accumulate** and **activation function** of DNN inference to an **FPGA**
- Verified the correctness by testing against the **MNIST dataset** using a large, fully connected model on the **Xilinx ZCU104 FPGA** and observing consistent results across all 128 test examples

2022-23 **RISC Processor Design** *Guide: Prof. Virendra Singh*
The code can be found here *Course Project*

- Developed a six-stage pipelined processor that achieved a peak performance of **1.94 cycle/instruction**, which included a forwarding and hazard unit to tackle pipelining hazards
- Expanded this to a 2-way fetch superscalar processor handling out-of-order execution

2023 **Hand Held 2D Mapping System** *Guide: Prof. Siddharth Tallur*
The report can be found here *Course Project*

- Created a robot that remotely yet accurately mapped its trajectory in a **2-dimensional plane**
- Utilized an **IMU** and a **rotary encoder** to obtain position readings, and a **Bluetooth module** for real-time transmission to a computer to plot the path traced against light intensity

2023 **Model based Embedded System Design** *Guide: Prof. Paritosh K Pandya*
The video can be found here *Course Project*

- Developed an embedded system using model-based design for **autonomous valet-parking**
- Designed an algorithm for line following, track color inversion, and parking-space identification

2020-22 **Matsya, Autonomous Underwater Vehicle (AUV)** *Guide: Prof. Leena Vachhani*
AUV-IITB is a team of 40+ students working on the design and development of an AUV

- Deployed the sixth iteration of **Matsya**, an Autonomous Underwater Vehicle (AUV), capable of **self-navigation** and performing tasks as described by the International RoboSub competition
- Migrated the logic of the electrical stack to work on **STM32G4** from the ATmega328P, enabling higher **operation speeds** provided by the increased I/O ports and better-suited **ISA**
- Implemented 2-Dimensional **SLAM** (Simultaneous Localization and Mapping) and localized the object in a 2-Dimensional map using sensor and motion readings and an **Extend Kalman Filter**

Mentorship

2023 - 24 **DAMP Mentor** *Student Mentorship Programme*
Appointed as a mentor from a pool of 80+ applicants based on ethics, interviews, and extensive peer reviews. Guided and mentored six sophomores on a one-to-one basis in their academic and co-curricular pursuits.

2022 **RnD Head** *AUV - IITB*
Mentored a batch of recruits to AUV-IITB as the RnD head and helped train them. It involved providing resources, solving doubts, and demonstrating the functionality of the AUV.

Teaching

Teaching assistant at IIT Bombay for the following courses.

Year	Course	Instructor
2024	EE 709 Testing and Verification of VLSI Circuits (Head TA)	Prof. Madhav Desai
	EE 779 Advanced Topics in Signal Processing	Prof. Satish Mulleti
2023	MA 106 Linear Algebra (Head TA), MA 111 Integral Calculus	
2022	MA 205 Complex Analysis , MA 207 Partial Differential Equations	

Courses Taken

Digital Systems	VLSI CAD*, VLSI Lab, Testing and Verification of VLSI Circuits, Algorithmic Design of Digital Systems, VLSI Design, Embedded Systems, Digital Systems, Digital Systems Lab
Computer Architecture	High-Performance Scientific Computing*, Advanced Topics in Computer Architecture, Advanced Computer Architecture, Microprocessors, Microprocessors Lab

**to be completed by Nov 2024*

Technical Skills

Languages C/C++, Python, Verilog, System Verilog, VHDL, Assembly, CUDA, Bash, Perl, MATLAB, GNU Octave, LaTeX

Software Vivado, VTune, Quartus, GEM5, SNIPER simulator, Arduino, Keil, CubeMX, EAGLE PCB Design, NGSPICE, GNU Radio

Extracurricular

Football

- Participated in and won numerous football tournaments at both school and college levels.
- Represented the college football team at a third-division football league.

National Service Scheme

- Engaged in public speaking and outreach activities focusing on environmental education
- Empowered attendees with the significance of individual actions in preserving resources