NAVID ANJUM AADIT

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Research Interests

Large-scale **probabilistic computing** with **Ising/Boltzmann machines**. Probabilistic bit (p-bit) **systems** are realized on **CMOS** platforms with **FPGA** prototypes, using hardware–software co-design and scalable **multi-chip** architectures. Applications include **combinatorial optimization**, **machine learning**, **AI sampling**, and **quantum-inspired non-local algorithms**.

Education

- **Ph.D. Candidate: Computer Engineering** **01/2021 – Expected Fall (Dec) 2025**
  University of California, Santa Barbara
  OPUS Lab
- **Master of Science: Electrical Engineering** **12/2020**
  University of California, Irvine
  Burke Lab; Nano-Optics and Bio-Technology Lab
- **Bachelor of Science: Electrical and Electronic Engineering** **03/2016**
  Bangladesh University of Engineering and Technology
  Nanoscale Science & Technology Lab

Selected Publications

** Equal contribution*

Journal Articles

J1. **Navid Anjum Aadit**, Andrea Grimaldi, Mario Carpentieri, Luke Theogarajan, John M Martinis, Giovanni Finocchio, and Kerem Y Camsari (2022). "Massively parallel probabilistic computing with sparse Ising machines". In: ***Nature Electronics*** 5.7. [TechXplore] [ScienceDaily] [ACM TechNews], pp. 460–468

J2. Srijan Nikhar*, Sidharth Kannan*, **Navid Anjum Aadit***, Shuvro Chowdhury, and Kerem Y Camsari (2024). "All-to-all reconfigurability with sparse and higher-order Ising machines". In: ***Nature Communications*** 15.1, p. 8977

J3. Shaila Niazi, Shuvro Chowdhury, **Navid Anjum Aadit**, Masoud Mohseni, Yao Qin, and Kerem Y Camsari (2024). "Training deep Boltzmann networks with sparse Ising machines". In: ***Nature Electronics***, pp. 1–10

J4. M Mahmudul Hasan Sajeeb, **Navid Anjum Aadit**, Shuvro Chowdhury, Tong Wu, Cesely Smith, Dhruv Chinmay, Atharva Raut, Kerem Y Camsari, Corentin Delacour, and Tathagata Srimani (2025). "Scalable connectivity for Ising machines: Dense to sparse". In: ***Physical Review Applied*** 24.1, p. 014005

J5. Nihal Sanjay Singh, Keito Kobayashi, Qixuan Cao, Kemal Selcuk, Tianrui Hu, Shaila Niazi, **Navid Anjum Aadit**, Shun Kanai, Hideo Ohno, Shunsuke Fukami, and Kerem Y Camsari (2024). "CMOS plus stochastic nanomagnets enabling heterogeneous computers for probabilistic inference and learning". In: ***Nature Communications*** 15.1, p. 2685

J6. Andrea Grimaldi, Luis Sánchez-Tejerina, **Navid Anjum Aadit**, Stefano Chiappini, Mario Carpentieri, Kerem Camsari, and Giovanni Finocchio (2022). "Spintronics-compatible approach to solving maximum-satisfiability problems with probabilistic computing, invertible logic, and parallel tempering". In: ***Physical Review Applied*** 17.2, p. 024052

J7. Shuvro Chowdhury, Andrea Grimaldi, **Navid Anjum Aadit**, Shaila Niazi, Masoud Mohseni, Shun Kanai, Hideo Ohno, Shunsuke Fukami, Luke Theogarajan, Giovanni Finocchio, Supriyo Datta, and Kerem Y Camsari (2023). "A full-stack view of probabilistic computing with p-bits: devices, architectures, and algorithms". In: ***IEEE Journal on Exploratory Solid-State Computational Devices and Circuits*** 9.1, pp. 1–11

J8. Tae Joon Park, Kemal Selcuk, Hai-Tian Zhang, Sukriti Manna, Rohit Batra, Qi Wang, Haoming Yu, **Navid Anjum Aadit**, Subramanian K. R. S. Sankaranarayanan, Hua Zhou, Kerem Y. Camsari, and Shriram Ramanathan (2022). "Efficient probabilistic computing with stochastic perovskite nickelates". In: ***Nano Letters*** 22.21, pp. 8654–8661

Conference Papers

C1. **Navid Anjum Aadit**, Masoud Mohseni, and Kerem Y Camsari (2023). "Accelerating Adaptive Parallel Tempering with FPGA-based p-bits". In: ***2023 VLSI*** *Technology and Circuits Symposium*. IEEE, pp. 1–2

C2. **Navid Anjum Aadit**, Andrea Grimaldi, Mario Carpentieri, Luke Theogarajan, Giovanni Finocchio, and Kerem Y Camsari (2021). "Computing with invertible logic: Combinatorial optimization with probabilistic bits". In: ***2021 IEDM*** *International Electron Devices Meeting*. IEEE, pp. 40–3

C3. **Navid Anjum Aadit**, Andrea Grimaldi, Giovanni Finocchio, and Kerem Y Camsari (2022). "Physics-inspired Ising computing with ring oscillator activated p-bits". In: ***2022 NANO*** *International Conference on Nanotechnology*. IEEE, pp. 393–396

C4. Andrea Grimaldi*, Kemal Selcuk*, **Navid Anjum Aadit***, Keito Kobayashi, Qixuan Cao, Shuvro Chowdhury, Giovanni Finocchio, Shun Kanai, Hideo Ohno, Shunsuke Fukami, and Kerem Y Camsari (2022). "Experimental evaluation of simulated quantum annealing with MTJ-augmented p-bits". In: ***2022 IEDM*** *International Electron Devices Meeting*. IEEE, pp. 22–4

C5. Kemal Selcuk, **Navid Anjum Aadit**, et al. (2025). DAC-Free p-bits: Asynchronous Self-Coloring and On-Chip Annealing. *Submitted to 2025 IEDM*

Book Chapters

B1. **Muhammad Navid Anjum Aadit**, Sharadindu Gopal Kirtania, Farhana Afrin, Md Kawsar Alam, and Quazi Deen Mohd Khosru (2017). "High electron mobility transistors: performance analysis, research trend and applications". In: ***Different Types of Field-Effect Transistors-Theory and Applications***, pp. 45–64

Preprints

P1. Masoud Mohseni, Artur Scherer, K Grace Johnson, Oded Wertheim, Matthew Otten, **Navid Anjum Aadit**, et al. (2024). "How to Build a Quantum Supercomputer: Scaling Challenges and Opportunities". In: ***arXiv preprint arXiv:2411.10406***

P2. Shuvro Chowdhury, **Navid Anjum Aadit**, Andrea Grimaldi, Eleonora Raimondo, Atharva Raut, P Aaron Lott, Johan H Mentink, Marek M Rams, Federico Ricci-Tersenghi, Massimo Chiappini, et al. (2025). "Pushing the Boundary of Quantum Advantage in Hard Combinatorial Optimization with Probabilistic Computers". In: ***arXiv preprint arXiv:2503.10302*** *(in review at* ***Nature Communications****)*

Awards and Honors

- **Bell Labs Prize 2023 (Bronze)** **10/2023**
  Team award with Prof. Kerem Y Camsari; NOKIA Bell Labs, Murray Hill, NJ.
  Media Coverage: UCSB News, Bell Labs Blog
- **Misha Mahowald Prize 2025 (Neuromorphic Engineering)** **01/2025**
  Group award led by Prof. Kerem Y Camsari.
  Media Coverage: Official Announcement, UCSB News
- **UCSB Graduate Division PhD Dissertation Fellowship** **Fall/2025**
- **NSF MRSEC Research Fellowship** **10/2020 – 12/2020**
  University of California, Irvine
- **DTEI Fellowship** **06/2020 – 09/2020**
  University of California, Irvine
- **Dean's Scholarship** **02/2011 – 03/2016**
  Bangladesh University of Engineering and Technology

Experience

- **HAV Computer Engineer Intern (Siemens)** **06/2025 – 09/2025**
  Siemens Industry Software Inc., Wilsonville, OR
  Scaled to **1 million nodes** on 18× VP1902; worked on inter-FPGA communication to preserve solution quality and throughput.

- **Research Intern (NASA)** **04/2023 – 09/2023**
  Universities Space Research Association – NASA QuAIL Lab, Mountain View, CA
  Developed adaptive parallel tempering and non-equilibrium Monte Carlo; FPGA acceleration for optimization and ML sampling.
- **Graduate Research and Teaching Assistant (UCSB)** **01/2021 – Present**
  University of California, Santa Barbara
  Research in probabilistic computing, FPGA systems, and distributed multi-chip scaling.
  TA: ECE15A: Fundamentals of Logic Design.
  TA: ECE 153a / ECE 253 (Hardware/Software Interfaces; Embedded System Design).
- **Graduate Teaching Assistant (UCI)** **09/2019 – 08/2020**
  University of California, Irvine
  TA: ICS 6B (Boolean Algebra), ICS 32 (Python Programming), ICS 60 (Computer Games and Society).

Technical Skills

- **FPGA and Embedded Systems:** Vivado, Verilog, SystemVerilog, VHDL, HLS, RTL design
- **Programming Languages:** MATLAB, Python, C, C++, Mathematica
- **Simulation Tools:** COMSOL, Cadence, SPICE, L-edit

Professional Service

Reviewer for: IEEE Transactions on Affective Computing, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, PLOS One, Digital Discovery, IEEE Transactions on Nanotechnology, Nature Scientific Reports, Communication Physics, IEEE Access.

Upper-Division Coursework

Statistical Mechanics to Quantum Computing, Neuromorphic Computing, Robustness in Machine Learning, Theoretical Machine Learning, Computer Architecture, Hardware/Software Interface, VLSI and CMOS Design, Advanced Semiconductor Devices, Analog IC Design, Advanced Electromagnetics.

Talks

Invited

- CMOS + stochastic MTJ: Heterogeneous probabilistic computers for optimization and sampling — **RIEC, Tohoku University** (International Symposium on Brain Functions and Brain Computer).
- Probabilistic Computing on FPGAs: Extreme Scale Ising Machines with Distributed p-computers — **Siemens Digital Industries Software**, Wilsonville, Oregon (remote).
- Scaling Probabilistic Computers for Sustainable Computing — **Semiconductor Research Corporation (SRC) Annual Meeting**.

Conference

- Extreme Scale Ising Machines with Distributed p-computers — **International Workshop on Ising Machines (IISM)**, Evanston (Chicago), Illinois.
- Accelerating Adaptive Parallel Tempering with FPGA-based p-bits — **VLSI Symposium**, Kyoto, Japan.
- Experimental evaluation of simulated quantum annealing with MTJ-augmented p-bits — **IEDM**, San Francisco, CA.