

# Shahram Babaie

Ph.D. Candidate, CSE Department, University at Buffalo, State University of New York

📍 Buffalo, NY, USA

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## SUMMARY STATEMENT

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Quantum Computing Researcher (Ph.D. Candidate) specializing in distributed quantum computing (DQC) and quantum error correction (QEC), with expertise in multi-QPU qubit allocation, distributed code design (topological and qLDPC), and performance evaluation. Skilled in circuit-level simulation and QEC-driven analysis and compilation using Stim, Qiskit, Cirq, PyMatching, and Python (NumPy, SciPy, Matplotlib). Builds on a prior Ph.D. in Computer Engineering and a strong knowledge foundation in reliability, computer architecture, information theory, and fault-tolerant algorithms; collaborates effectively with interdisciplinary teams to bring together diverse backgrounds for problem-solving and breakthroughs. Enthusiastic about gaining hands-on experience with fabricated quantum systems, leading toward a full-time industry role.

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## EXPERIENCE

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### **Research on Distributed qLDPC codes.....** *University at Buffalo* **Feb. 2025 - Present**

- Proposed 5 qubit-allocation strategies, i.e., role-based, balanced, multiway-spectral, ILP-based, and community-based, for allocating hypergraph product (HGP) and balanced product (BP) codes across multiple QPUs.
- Assessed their effectiveness in terms of implementation overheads and QPU load balance (overall and type-specific load).
- Developed guidelines for implementing distributed QEC (DQEC) codes across heterogeneous QPUs.
- Research findings have been submitted for publication in the manuscript titled "Efficient Qubit Allocation Strategies for Distributed Quantum LDPC Codes", which is currently under review.

### **Research on leveraging DQC in QEC .....** *University at Buffalo* **Jan. 2025-Feb. 2025**

- Investigated the opportunities and challenges of DQC-based implementations for topological and HGP codes.
- Discussed open challenges and outlined future research directions for transitioning from monolithic QEC to DQEC.
- The manuscript "Distributed Quantum Error Correction: Advancements and Future Research Directions" is under review.

### **Research on Distributed CSS code.....** *University at Buffalo* **Aug. 2024-Dec. 2024**

- Pioneered a novel quantum bit-phase-flip error correction methodology based on CSS codes and utilizing GHZ states across 7 QPUs with lower implementation overheads.
- Results were published at the 45th IEEE International Conference on Distributed Computing Systems (ICDCS 2025).

### **Research on DQEC.....** *University at Buffalo* **Dec. 2023-Aug. 2024**

- Conducted research on DQC-based implementations of QEC codes for bit-flip or phase-flip error correction across 3 QPUs to address physical qubit limitations per QPU.
- The findings of this research were published at the 2025 IEEE International Conference on Quantum Communications, Networking, and Computing (QCNC 2025).
- Acknowledged by Robert Sutor in the "About the Author" section of the book (2024) "Dancing with Qubits" book for contributing insight and inspiration.

### **Programming a Quantum Simulator....** *University at Buffalo* **Oct. 2023-Dec. 2023**

- Developed a Python-based quantum simulator from scratch, implementing fundamental single-, two-, and three-qubit quantum gates.
- Designed a simplified Qiskit-like interface in Python, supporting simulation, measurement, 2D drawing, and histogram functions.

### **Teacher/Research Assistantship.....** *University at Buffalo* **Jan. 2023-Present**

- Assisted in lectures, graded assignments, and held office hours for over 150 students per semester.
- Taught the "Modern Networking Concepts" course in the Summer 2024 and 2025; earned average feedback scores of 91/100; and students described it as an "enjoyable" course.

**Faculty Member**.... *Islamic Azad University, Tabriz, Iran*

**Sep. 2006 – Dec. 2022**

- Led the CE Department as Head (2009-2012) and Deputy (2006-2009), managed 1500+ students, supervised 100+ M.Sc. theses in Computer Architecture, Computer Networks, Fault-tolerance, and Reliability.
  - Published 60+ peer-reviewed papers in Communication Networks, Computer Hardware, and Reliability.
  - Directed design, implementation, and commercialization of 4 educational kits and preteen toys.
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## EDUCATION

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### **Ph.D. Candidate in Computer Science**

University at Buffalo, State University of New York • USA • Jan. 2023-present

### **Ph.D. in Computer Engineering (Computer Architecture)**

Islamic Azad University, Science and Research Branch • Tehran, Iran • 2012

### **M.Sc. in Computer Engineering (Computer Architecture Systems)**

Islamic Azad University, Science and Research Branch • Tehran, Iran • 2006

### **B.Sc. in Computer Engineering (Hardware)**

Sadjad University of Technology • Mashhad, Iran • 2004

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## TECHNICAL SKILLS

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**Programming Languages:** Python (NumPy, SciPy, Matplotlib), C/C++, and MATLAB.

**Simulation and Modeling Tools:** NS-3, ModelSim, Packet Tracer, and HPSIM.

**Quantum-Specific Skills:** Qiskit, Cirq, Stim, Crumble, Quirk, PyMatching.

**Others:** Wireshark, HTML, LaTeX, Git, and GitHub.

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## LANGUAGES

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English (Proficient)

Persian (Native)

Turkish (Native)

Kurdish (Beginner)

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