MD HASIBUL AMIN

Ph.D. Student | University of South Carolina | Columbia, SC

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Education

- **University of South Carolina** *Jan 2021-present*
  PhD in Computer Engineering
  Research topic: Processing-in-Memory (PIM), ML System Optimization, ML software-hardware co-design, ML/AI Hardware Accelerators

- **University of South Carolina** *Aug 2022-May 2024*
  MS in Computer Engineering
  Selected Courseworks: Advanced Digital Design, Computer Architecture, Pattern Recognition, Robotics, Analysis of Algorithms

- **Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh** *Feb 2015-Apr 2019*
  Bachelor of Science in Electrical and Electronic Engineering (EEE)
  Research topic: Ab initio study of Carbon Nanotubes
  Thesis title: Ab initio investigation of dopants for ultrahigh conductivities in single wall carbon nanotubes

Research Experience

- **Graduate Research Student** *Jan 2021-present*
  Intelligent Circuits, Architectures, and Systems Lab, University of South Carolina
  Advisor: Dr. Ramtin Zand, Assistant Professor, University of South Carolina

  – Designed and implemented a hybrid TPU-PIM architecture for 1-bit LLMs, improving computational efficiency and reducing memory bottlenecks [*link*]
  Heterogeneous Integration | Large Language Model (LLM) | LLM Accelerator

  – Extended the ISA of the RISC-V microarchitecture to support PIM devices as a co-processor using the gem5 simulator system
  Computer Architecture | ISA Extension | PIM co-processor

  – Developed software-hardware co-design framework for PIM systems based on weight sharing and mixed-precision quantization along with evolutionary search [*link*] [*code*]
  Software-hardware Co-design | Neural Architecture Search (NAS) | Weight-sharing | Mixed-precision Quantization | Evolutionary Algorithm

  – Implemented Verilog RTL and HLS designs for approximate TPU circuits; automated benchmarking with Python and TCL scripts [*paper*]
  Digital Design | Approximate TPU | Verilog RTL | HLS Design

  – Optimized crossbar circuit performance by modeling interconnect parasitics and analog partitioning [*paper*]
  Crossbar modeling | Interconnect parasitics | Partitioning | Reliability analysis

  – Built a Python-based SPICE simulation framework for in-memory accelerator circuit analysis [*paper*]
  Analog PIM | Simulation Framework | Python scripting | SPICE circuit design

- **Undergraduate Research Student** *May 2018-Dec 2019*
  Nanoscale Simulation, Characterization and Fabrication Lab, BUET
  Advisor: Dr. Ahmed Zubair, Professor, Department of EEE, BUET

  – Investigated the effect of various dopants such as I_2, $AuCl_3$ on various carbon nanotube molecules using Density functional theory (DFT) [*paper*]
  Density Functional Theory | Carbon nanotubes | Conductivity analysis | Dopants

Professional Experience

- **Graduate Research/Teaching Assistant** *Jan 2021-present*
  Department of Computer Science and Engineering, University of South Carolina

- **Lecturer, Department of Electrical and Electronic Engineering** *Jan 2020-May 2020*
  Daffodil International University, Dhaka, Bangladesh

Technical Skills

- **Hardware Design:** Verilog, SystemVerilog, HLS
- **Architectural Simulation:** gem5, MNSIM, NeuroSim
- **Programming Languages:** C, C++, Java, Python, MATLAB, TCL
- **EDA Tools:** Cadence Virtuoso, Synopsys Design Compiler, HSPICE
- **Machine Learning:** PyTorch, TensorFlow, Quantization Techniques

Selected Academic Projects

- Training a transformer-based language model for novel antimicrobial peptide generation *Spring 2024*
- RTL design and FPGA implementation of a 3-stage pipelined RISC-V microarchitecture *Fall 2021*
- RTL design of a 32-bit single-cycle MIPS microarchitecture *Fall 2021*
- Circuit design for a Leaky Integrate-and-Fire (LIF) spiking neuron *Spring 2021*

Peer Review Service

- ISCAS-2023, GLSVLSI-2023, MWSCAS-2023, JETCAS *2023*
- ISVLSI-2024, GLSVLSI-2024 *2024*
- ISCAS-2025 *2025*

Selected Publications

- M. H. Amin, M. Mohammadi, and R. Zand. Multi-objective Neural Architecture Search for In-memory Computing. IEEE Computer Society Annual Symposium on VLSI (ISVLSI '24) *2024*
- Mohammed E Elbtity, Md Hasibul Amin, Hossam Hassan, et al. Design Automation and Quantitative Analysis of Approximate Arithmetic Circuits. TechRxiv. *2024*
- M. H. Amin, M. E. Elbtity, and R. Zand. IMAC-Sim: A Circuit-level Simulator For In-Memory Analog Computing Architectures. In Proceedings of the Great Lakes Symposium on VLSI 2023 (GLSVLSI '23) *2023*
- M. E. Elbtity, B. Reidy, M. H. Amin, and R. Zand. Heterogeneous Integration of In-Memory Analog Computing Architectures with Tensor Processing Units. GLSVLSI '23. *2023*
- M. H. Amin, M. E. Elbtity and R. Zand. Xbar-Partitioning: A Practical Way for Parasitics and Noise Tolerance in Analog IMC Circuits. IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS) *2022*
- M. H. Amin, M. Elbtity, M. Mohammadi, R. Zand. MRAM-based Analog Sigmoid Function for In-memory Computing. GLSVLSI '22. *2022*
- M. H. Amin, M. Elbtity and R. Zand. Interconnect Parasitics and Partitioning in Fully-Analog In-Memory Computing Architectures. IEEE International Symposium on Circuits and Systems (ISCAS). *2022*
- M. L. Rahman, M. H. Amin and A. Zubair. Ab initio Theoretical Investigation of Dopants for Ultrahigh Conductivities in Single Wall Carbon Nanotubes. IEEE Region 10 Conference (TENCON). *2019*

Poster Presentations

- A Python Framework for SPICE Circuit Simulation of In-Memory Analog Computing Circuits. *2022*
  IBM-IEEE CAS/EDS - AI Compute Symposium 2022, IBM Think Lab, NY
- Reliability-Aware Deployment of DNNs on In-Memory Analog Computing Architectures. *2022*
  IBM-IEEE CAS/EDS - AI Compute Symposium 2022, IBM Think Lab, NY
- Electronic Structure Study of Halogen and Gold Halide Doped Carbon Nanotubes. *2020*
  APS March Meeting 2020, Denver, Colorado