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),** *Feb 2015-Apr 2019*
  Dhaka, Bangladesh
  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

Honors and Awards

- 2025 CSE Graduate Research Symposium Best Poster Award - 2nd Place   *March 2025*

- IEEE ISCAS 2022 Student Participation Grant   *May 2022*

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

- <u>M. H. Amin</u>, 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, <u>Md Hasibul Amin</u>, Hossam Hassan, et al. Design Automation and Quantitative Analysis of Approximate Arithmetic Circuits. TechRxiv.   *2024*

- <u>M. H. Amin</u>, 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, <u>M. H. Amin</u>, and R. Zand. Heterogeneous Integration of In-Memory Analog Computing Architectures with Tensor Processing Units. GLSVLSI '23.   *2023*

- <u>M. H. Amin</u>, 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*

- <u>M. H. Amin</u>, M. Elbtity, M. Mohammadi, R. Zand. MRAM-based Analog Sigmoid Function for In-memory Computing. GLSVLSI '22.   *2022*

- <u>M. H. Amin</u>, 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, <u>M. H. Amin</u> 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. *IBM-IEEE CAS/EDS - AI Compute Symposium 2022*, IBM Think Lab, NY   *2022*

- Reliability-Aware Deployment of DNNs on In-Memory Analog Computing Architectures. *IBM-IEEE CAS/EDS - AI Compute Symposium 2022*, IBM Think Lab, NY   *2022*

- Electronic Structure Study of Halogen and Gold Halide Doped Carbon Nanotubes. *APS March Meeting 2020*, Denver, Colorado   *2020*