MUHAMMAD RASHED

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EDUCATION

University of Central Florida, Orlando *January 2020 - present*
PhD in Computer Engineering, Department of ECE *(Expected in Fall 2023)*
Thesis: *Towards Energy-Efficient In-Memory Computing Systems (Supervisor: Prof. Rickard Ewetz)*

University of Texas at San Antonio, San Antonio *August 2018 - December 2019*
Graduate Coursework, Department of ECE

Bangladesh University of Engineering and Technology *May 2010- September 2015*
Bachelor of Science, Department of Electrical and Electronics Engineering

RESEARCH INTEREST

My research broadly aims to solve the computing-efficiency gap for data driven applications. An emerging solution strategy is to leverage non-volatile memory devices and perform energy-efficient in-memory computing. On this topic I have published 8 top-tier conference papers (average acceptance rate: 20%). My ICCAD'22 paper has received the IEEE/ACM William J. McCalla ICCAD Best Paper Award Nomination. My research interests includes topics, as follows:

- EDA for Emerging Computing Paradigms and Architectures
- Artificial Intelligence
- Hardware Accelerators
- Computer-Aided Design

SELECTED PATENTS AND PUBLICATIONS

[**TCAD'23**] **M Rashed**, S. Thijssen, F Yao, SK Jha, and R Ewetz, "STREAM: Towards READ-based In-Memory Computing for Streaming Based Processing for Data-Intensive Applications", IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2023.

[**DAC'23**] S. Thijssen, **M Rashed**, SK Jha, and R Ewetz, "UpTime: Towards Flow-based In-Memory Computing with High Fault-Tolerance", in 60th Design Automation Conference (DAC), 2023 (accepted).

[**ASP-DAC'23**] **M Rashed**, SK Jha, and R Ewetz, "Discovering the In-Memory Kernels of 3D Dot-Product Engines", 28th Asia and South Pacific Design Automation Conference, 2023.

[**ICCAD'22**] **M Rashed**, SK Jha, and R Ewetz, "Logic Synthesis for Digital In-Memory Computing", 41st International Conference On Computer Aided Design (ICCAD), 2022. **(Best paper nomination)**

[**DAC'22**] **M Rashed**, A Awad, SK Jha, and R Ewetz, "Towards Resilient Analog In-Memory Deep Learning via Data Layout Re-Organization", 59th Design Automation Conference (DAC), 2022.

[**DATE'22**] **M Rashed**, SK Jha, F Yao and R Ewetz, "Hybrid Digital-Digital In-Memory Computing", 25th Design Automation and Test in Europe Conference (DATE), 2022.

[**ASP-DAC'22**] **M Rashed**, S. Thijssen, F Yao, SK Jha, and R Ewetz, "STREAM: Towards READ-based In-Memory Computing for Streaming based Data Processing", 27th Asia and South Pacific Design Automation Conference (ASP-DAC), 2022.

[**ICCAD'21**] **M Rashed**, SK Jha, and R Ewetz, "Hybrid Anlog-Digital In-Memory Computing", 40th International Conference On Computer Aided Design (ICCAD), 2021.

[**MICRO'21**] M Chowdhuryy, **M Rashed**, A Awad, R Ewetz, and F Yao, "LADDER: Architecting Content and Location-aware Writes for Crossbar Resistive Memories", 54th International Symposium on Microarchitecture (MICRO), 2021.

[**ICAEE'17**] **M Rashed**, M Zaman, M Islam and M Raihan, "An analysis on the required reinforcement for embedding a nuclear power plant in a generic power system", 4th International Conference on Advances in Electrical Engineering (ICAEE), 2017.

[**EICT'17**] S Saha, S Ukil and **M Rashed**, "Numerical investigation on the performance of new ultra-thin CZTS solar cell using SCAPS", 3rd International Conference on Electrical Information and Communication Technology (EICT), 2017.

[**ICAEE'17**] A Dewanjee, N Dey, **M Rashed**, A Muhury and J Dhar, "High performance cost effective formalin detector using conductivity property", 4th International Conference on Advances in Electrical Engineering (ICAEE), 2017.

[**ICECE'16**] M Nadim, **M Rashed**, A Muhury and S Mominuzzaman, "Estimation of optimum tilt angle for PV cell: A study in perspective of Bangladesh", 9th International Conference on Electrical and Computer Engineering (ICECE), 2016.

WORK EXPERIENCE

University of Central Florida *January 2020 - present*
Graduate Research Assistant

- Developed an efficient 3D dot product engine (DPE) architecture that achieves 2.02X, 2.37X, and 2.45X improvements in area, energy, and latency respectively over 2D DPE. [ASP-DAC'23]
- Developed a logic synthesis framework for digital in-memory computing. The framework improves the area-latency of multiplication operation by 77% and 20% over the state-of-the-art. [ICCAD'22]
- Developed a data layout re-organization framework for analog in-memory deep learning. The framework improves precision in hardware by up to 3.2X. [DAC'22]
- Developed design automation infrastructure for hybrid analog-digital in-memory computing. The hybrid paradigm achieved 2.5X overhead improvement over state-of-the-art paradigms. [ICCAD'21, DATE'22]
- Proposed a streaming based in-memory computing architecture for evaluating Boolean logic. The architecture improves performance over state-of-the-art with up to 20X by eliminating expensive and error prone WRITE operations. [ASP-DAC'22, TCAD'23]
- Delivered an effective and low-cost location and data aware processor-side architecture for memristor based memory systems. The framework called LADDER achieves 13.2% performance improvement over state-of-the-art designs. [MICRO'21]

University of Texas at San Antonio *August 2018 - December 2019*
Graduate Research Assistant

- Developed secure automated vehicular communication protocol between OBU and RSU units.

Abul Khair Steel Melting Limited *October 2015 - June 2018*
Technical Management

- Supervised electrical power distribution in the Main Receiving Sub-Station (MRSS).
- Supervised the routine electrical maintenance to circumvent breakdowns. Reduced equipment shut-down by two occurrences per year.

SKILLS

- *Programming language*: C++, Python, MATLAB and Verilog.
- *VLSI Tools*:
  - Synthesis Tool: ABC, YOSYS, SIS
  - FPGA Software: Xilinx Vivado Design Suite
  - Profiler: ARM Forge
- *Operating Systems and Software*: Linux, Windows, Office Software, Latex, AutoCad.

TEACHING EXPERIENCE

- **C++ and Data Structures** (UTSA)
  Object-oriented programming including data abstraction, inheritance, operator overloading and polymorphism. Application of OOP to study various data structures including stacks, queues, linked lists, trees, binary trees and graphs.
- **Engineering Analysis and Computation** (UCF)
  Engineering analysis and computation with structured constructs. Subscripted variables, functions, input/output. Applications in embedded systems and examples in numerical methods.
- ***Guest Lecture:*** **Computer-Aided Design of VLSI** (UCF)
  An introduction to computer-aided design (CAD) for very large scale integration (VLSI). The focus is on algorithms and data structures that are used within logic synthesis.

PROFESSIONAL SERVICE

- Session Chair, Design Automation Conference (DAC) 2022
- Technical Reviewer, IEEE Transactions on Emerging Topics in Computing 2022
- Technical Reviewer, International Conference on Computer Design (ICCD) 2021, 2022
- Technical Reviewer, The Great Lakes Symposium on VLSI (GLSVLSI) 2021, 2022
- Technical Reviewer, International Conference on AI Circuits and Systems (AICAS) 2022, 2023

AWARDS AND HONORS

- IEEE/ACM William J. McCalla **ICCAD Best Paper Award Nomination** (2022)
- David T. and Jane M. Donaldson Scholarship in the amount of $4,000.00 (2022)
- DATE Travel Grant (2023)
- UCF SGA Travel Grant (2023)
- NSF Travel Grant (2021,2022,2023)
- ACM Travel Grant (2022)
- **Best Research Video Award** at the Design Automation Conference (DAC) Young Fellow (2021)

- The Presentation Fellowship by UCF Graduate Studies (2021, 2022)
- 3MT Research Finalist at the University of Texas at San Antonio (2019)