MUHAMMAD RASHED

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SUMMARY

I am a PhD candidate in computer engineering at the University of Central Florida (UCF). My expected graduation date is Spring 2024 and I am on the academic job market for tenure-track assistant professor positions starting Fall 2024. My research interests include EDA for emerging computing paradigms and architectures, computer-aided design, and, artificial intelligence. On this topic, I have **published 16 top-tier journals and conference papers**. I have a total of **8 publications on the prestigious CSRanking list**. My ICCAD'22 paper was nominated for the **IEEE/ACM William J. McCalla ICCAD Best Paper Award**.

EDUCATION

University of Central Florida, Orlando *January 2020 - present*
PhD in Computer Engineering, Department of ECE *(Expected in Spring 2024)*
Thesis: *Towards Energy-Efficient In-Memory Computing Systems using Design Automation*
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

AWARDS AND HONORS

- IEEE/ACM William J. McCalla **ICCAD Best Paper Award Nomination** 2022
- **Best Research Video Award** at the Design Automation Conference (DAC) 2021
- Acknowledgment of the XORG Paper as a **Publicity Paper at DAC** 2022
- David T. and Jane M. Donaldson Memorial Graduate Scholarship 2022
- IEEE/ACM DATE PhD Forum Best Doctoral Dissertation Competition Finalist 2023
- IEEE/ACM DAC PhD Forum Best Doctoral Dissertation Competition Finalist 2022
- NSF Travel Grant (2021−2024), DATE Travel Grant (2023), UCF SGA Travel Grant (2023−2024), ACM Travel Grant (2022)
- The Presentation Fellowship by UCF Graduate Studies 2021−2023
- 3MT Research Finalist at the University of Texas at San Antonio 2019
- Education Board Scholarship for HSC, SSC and JSC result 2005−2015

RESEARCH PAPER PUBLICATIONS

Major Research Topics:

- Electronic Design Automation (EDA) for Emerging Computing Paradigms
- Artificial Intelligence (AI) and Machine Learning (ML)
- Computer-aided Design (CAD) for Very Large-Scale Integration (VLSI)
- Computer Architecture

Peer-Reviewed Publications:

[P19] **[ASP-DAC'24]** S Thijssen, **M Rashed**, SK Jha, and R Ewetz, "READ-based In-Memory Computing using Sentential Decision Diagrams", 29th Asia and South Pacific Design Automation Conference (ASP-DAC), 2024. (accepted)

[P18] **[ASP-DAC'24]** S Thijssen, **M Rashed**, SK Jha, and R Ewetz, "Towards Area-Efficient Path-Based In-Memory Computing using Graph Isomorphisms", 29th Asia and South Pacific Design Automation Conference (ASP-DAC), 2024. (accepted)

[P17] **[ICCAD'23]** **M Rashed**, S Thijssen, SK Jha, and R Ewetz, "Automated Synthesis for In-Memory Computing", 42nd International Conference On Computer Aided Design (ICCAD), 2023. (accepted) **[CSRanking]**

[P16] **[ICCAD'23]** **M Rashed**, S Thijssen, SK Jha, H Zheng, and R Ewetz, "Path-based Processing using In-Memory Systolic Arrays for Accelerating Data-Intensive Applications", 42nd International Conference On Computer Aided Design (ICCAD), 2023. (accepted) **[CSRanking]**

[P15] **[ICCAD'23]** S Thijssen, S. Singireddy, **M Rashed**, SK Jha, and R Ewetz, "Verification of Flow-Based Computing Systems using Bounded Model Checking", 42nd International Conference On Computer Aided Design (ICCAD), 2023. (accepted) **[CSRanking]**

[P14] **[ICCD'23]** S. Singireddy, **M Rashed**, S Thijssen, SK Jha, and R Ewetz, "Input-Aware Flow-Based In-Memory Computing", 41st International Conference on Computer Design (ICCD), 2023. (accepted)

[P13] **[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 (TCAD), 2023

[P12] **[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. **[CSRanking]**

[P11] **[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 (ASP-DAC), 2023.

[P10] **[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)** **[CSRanking]**

[P9] **[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. **(Publicity Paper)** **[CSRanking]**

[P8] **[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.

[P7] **[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.

[P6] **[ICCAD'21]** **M Rashed**, SK Jha, and R Ewetz, "Hybrid Analog-Digital In-Memory Computing", 40th International Conference On Computer Aided Design (ICCAD), 2021. **[CSRanking]**

[P5] **[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. **[CSRanking]**

***Prior to PhD*:**

[P4] **[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.

[P3] **[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.

[P2] **[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.

[P1] **[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.

Under Revision/Under Review Publications:

[U5] **[TCAD'23]** **M Rashed**, S Thijssen, SK Jha, and R Ewetz, "LOGIC: Logic Synthesis for Digital In-Memory Computing", IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), 2023. (under review).

[U4] **[TCAD'23]** S Thijssen, **M Rashed**, SK Jha, and R Ewetz, "PATH: Evaluation of Boolean Logic using Path-based In-Memory Computing Systems", IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), 2023. (in revision).

[U3] **[DATE'24]** **M Rashed**, S Thijssen, D Simon, SK Jha, and R Ewetz, "Towards Processing In-Memory with Low Latency using Execution Sequence Optimization", 27th Design Automation and Test in Europe Conference (DATE), 2024. (under review)

[U2] **[DATE'24]** S Thijssen, **M Rashed**, SK Jha, and R Ewetz, "Efficient Runtime Management of Crossbars for Path-based In-Memory Computing", 27th Design Automation and Test in Europe Conference (DATE), 2024. (under review)

[U1] **[ISCAS'24]** H. Chugh, **M Rashed**, F. Yao, and R Ewetz, "Side Channel Attack in ReRAM Crossbar", IEEE International Symposium on Circuits and Systems (ISCAS), 2024. (under review)

TALKS/POSTER PRESENTATIONS

[T3] **[DATE'22]** PhD Forum, in 26th Design Automation and Test in Europe Conference (DATE) 2023
[T2] **[DAC'22]** PhD Forum, in 59th Design Automation Conference (DAC) 2022
[T1] **[DAC'21]** Young Fellow Program, in 58th Design Automation Conference (DAC) 2021

GRANT PROPOSAL WRITING EXPERIENCE

I have assisted my supervisor Prof. Rickard Ewetz with 7 grant proposal submissions on EDA and AI to the National Science Foundation (NSF), Department of Energy (DOE), and, Cyber-Florida. To date, the proposals have been awarded a total grant of **$825,000**.

Selected Proposals:

- Collaborative Research: FMitF: Track I: Synthesis and Verification of In-Memory Computing Systems using Formal Methods. **(Awarded $750,000)**.
- Security-Aware In-Memory Neural Networks for Cyber-Physical Systems **(Awarded $75,000)**.
- An Analysis of Semiconductor Workforce Development using National Science Foundation Support at Hispanic Serving Institutions in the United States.
- Collaborative Research: Elements: Cyberinfrastructure for End-to-End Design, Synthesis, and Validation of In-Memory Computing Systems.

PROFESSIONAL EXPERIENCE

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

- Developed a logic synthesis framework for digital in-memory computing. The framework improves the area-latency of multiplication operations by 77% and 20% over the state-of-the-art. [P10], [P17]
- Designed an in-memory systolic array system using path-based in-memory computing. The system is 23X faster than traditional systolic arrays. [P16]
- 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. [P11]
- Developed a data layout re-organization framework for analog in-memory deep learning. The framework improves precision in hardware by up to 3.2X. [P9]
- 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. [P6], [P8]
- Proposed a streaming-based in-memory computing architecture for evaluating Boolean logic. The architecture improves performance over state-of-the-art by up to 20X by eliminating expensive and error-prone WRITE operations. [P13], [P7]

- 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. [P5]

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 Substation (MRSS).
- Supervised the routine electrical maintenance to circumvent breakdowns. Reduced equipment shut-down by two occurrences per year.

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/ Course Development:*** **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.

MENTORING EXPERIENCE

I have mentored 9 graduate students + 7 undergraduate students + 9 high-school (10-12 grades) students + 1 industry affiliate. (Diversity: 6 female advisees, 2 black students, 2 Hispanic students, 1 first-gen college student, and, 1 student with a learning disability)

Selected Advisees

- Sven Thijssen, Ph.D. student @UCF, Achievements: [P19], [P18], [P15], [P12], [U4], [U2]
- Hardik Chugh, MS student @UCF, Achievements: [U1]
- Suraj Singireddy, Ph.D. student @UTSA, Achievements: [P14]
- Austin Ramos, undergraduate student @UTSA

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

SKILLS

- *Programming Language*: C++, Python, MATLAB and Verilog.
- *EDA Tools*: Design Compiler, ABC, YOSYS, SIS, Vivado Design Suite, CACTI 7, ARM Forge
- *Operating Systems and Software*: Linux, Windows, Office Software, Latex, AutoCad.

TRAINING

- Responsible Conduct of Research for Engineers- Stage 2 (CITI) 2023
- Authorship, Credit and Collaborative Scholarship (UCF) 2022
- Doing the Right Thing: Know About Research Misconduct (UCF) 2022
- at-risk for University and College Faculty and Stuff (UCF) 2020
- at-risk Friends in College (UCF) 2020
- Employee Code of Conduct & Speak Up Whistleblower Training (UCF) 2020
- Academic Integrity Module (UCF) 2020
- Responsible Conduct of Research for Engineers- Stage 1 (CITI) 2020
- Teaching Assistant Training (UTSA) 2019