

# MICHAEL ZUZAK

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## ACADEMIC APPOINTMENTS

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**Assistant Professor, Department of Computer Engineering**

August 2022 - Present

*Rochester Institute of Technology*

- Research Interests: Hardware Security, Electronic Design Automation, Computer Architecture, Side-Channel Analysis

## EDUCATION

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**Ph.D., Electrical Engineering**

August 2017 - April 2022

*University of Maryland, College Park*

- ARCS/MWC Named Graduate Scholar, Future Faculty Fellow
- Advisor: Prof. Ankur Srivastava
- Thesis: Designing Effective Logic Obfuscation: Exploring Beyond Gate-Level Boundaries

**M.S., Electrical Engineering**

August 2014 - May 2016

*University of Maryland, College Park*

- Advisor: Prof. Donald Yeung
- Thesis: Exploiting Multigrain Parallelism on Heterogeneous Processors

**B.S., Electrical Engineering (Cum Laude)**

August 2010 - May 2014

*University of Maryland, College Park*

- University of Maryland Honors College, University Honors Citation

## RESEARCH EXPERIENCE

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**University of Maryland, College Park**

August 2017 - August 2022

*Graduate Research Assistant with Prof. Ankur Srivastava*

- Research Area: Hardware Security - Protecting integrated circuits from hardware trojans, piracy, and reverse engineering

**Naval Research Laboratory, Surface Electronic Warfare Systems Branch**

August 2015 - June 2018

*Electronics Engineer (Full-Time)*

- Research Area: Digital Signal Processing - Wide-band, high-speed digital signal processing for digital RF memories
- Primary contributor of digital design and digital signal processing capabilities for currently fielded urgent operational needs (UON) system for U.S. Navy

**University of Maryland, College Park**

August 2014 - May 2016

*Graduate Researcher with Prof. Donald Yeung*

- Research Area: Computer Architecture - Novel execution models for heterogeneous systems

## PUBLICATIONS

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### Journals:

- [J1] **M. Zuzak**, Y. Liu, and A. Srivastava, "Security-Aware Resource Binding to Enhance Logic Obfuscation," in IEEE Trans. on Computer Aided Design of Integrated Circuits and Systems (TCAD), 2022 (**Under Review**)
- [J2] **M. Zuzak**, Y. Liu, and A. Srivastava, "Evaluating the Security of Logic-Locked Probabilistic Circuits," in IEEE Trans. on Computer Aided Design of Integrated Circuits and Systems (TCAD), 2021
- [J3] Y. Liu, **M. Zuzak**, Y. Xie, A. Chakraborty, A. Srivastava, "Robust and Attack Resilient Logic Locking with a High Application-Level Impact," in ACM Journal on Emerging Technologies in Computing Systems (JETC), 2021
- [J4] **M. Zuzak**, Y. Liu, and A. Srivastava, "Trace Logic Locking: Improving the Parametric Space of Logic Locking," in IEEE Trans. on Computer Aided Design of Integrated Circuits and Systems (TCAD), 2020
- [J5] A. Chakraborty, N. Jayasankaran, Y. Liu, J. Rajendran, O. Sinanoglu, A. Srivastava, Y. Xie, M. Yasin, and **M. Zuzak**, "Keynote: A Disquisition on Logic Locking," in IEEE Trans. on Computer Aided Design of Integrated Circuits and Systems (TCAD), 2019

- [J6] D. Gerzhoy, X. Sun, **M. Zuzak**, and D. Yeung, "Exploiting Nested MIMD-SIMD Parallelism on Heterogeneous Micro-processors," in ACM Transactions on Architecture and Code Optimization (TACO), 2019

#### Conferences:

- [C1] **M. Zuzak**, Y. Liu, I. McDaniel, and A. Srivastava, "A Combined Logical and Physical Attack on Logic Obfuscation," in Proceedings of the ACM/IEEE International Conference on Computer-Aided Design (ICCAD), 2022
- [C2] Y. Liu, **M. Zuzak**, D. Xing, I. McDaniel, P. Mittu, O. Ozbay, A. Akib, and A. Srivastava, "A Survey on Side-Channel-based Reverse Engineering Attacks on Deep Neural Networks," in Proceedings of the IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), 2022
- [C3] **M. Zuzak**, Y. Liu, and A. Srivastava, "A Resource Binding Approach to Logic Obfuscation," in Design Automation Conference (DAC), 2021 (**Best Paper Candidate**)
- [C4] B. Tan, S. Garg, R. Karri, Y. Liu, **M. Zuzak**, ..., W. Savage, "Independent Verification and Validation of Security-Aware EDA Tools and IP," in Design Automation Conference (DAC), 2021
- [C5] **M. Zuzak** and A. Srivastava, "ObfusGEM: Enhancing Processor Design Obfuscation Through Security-Aware On-Chip Memory and Data Path Design," in Proceedings Intl. Symposium on Memory Systems (MEMSYS), 2020
- [C7] A. Mondal, **M. Zuzak**, and A. Srivastava, "StatSAT: A Boolean Satisfiability Attack on Logic Locking for Probabilistic Circuits," in Proceedings of the Design Automation Conference (DAC), 2020
- [C8] Y. Liu, **M. Zuzak** and A. Srivastava, "Strong Anti-SAT: Secure and Effective Logic Locking," in Proceedings of International Symposium on Quality Electronic Design (ISQED), 2020
- [C9] Y. Liu, A. Mondal, A. Chakraborty, **M. Zuzak**, N. Jacobson, D. Xing, and A. Srivastava, "A Survey on Neural Trojans," in Proceedings of International Symposium on Quality Electronic Design (ISQED), 2020
- [C10] **M. Zuzak**, M. Fitelson, S. Montano, and A. Srivastava, "Provable Detection and Location of Hardware Trojans with Linear Hybrid Cellular Automata," in Proceedings of Government Microcircuit Applications and Critical Technology Conference (GOMACTECH), 2020
- [C11] **M. Zuzak** and A. Srivastava, "Memory Locking: An Automated Approach to Processor Design Obfuscation," in Proceedings IEEE Computer Society Annual Symposium on VLSI (ISVLSI), 2019
- [C12] Z. Yang, **M. Zuzak**, and A. Srivastava, "HMCTherm: A Cycle-accurate HMC Simulator Integrated with Detailed Power and Thermal Simulation," in Proceedings Intl. Symposium on Memory Systems (MEMSYS), 2018
- [C13] **M. Zuzak** and D. Yeung, "Exploiting Multi-Loop Parallelism on Heterogeneous Microprocessors," in Proceedings of the International Workshop on Programmability and Architectures for Heterogeneous Multicores (MULTIPROG), 2017 (**Awarded Best Paper**)

#### Book Chapters:

- [B1] Y. Liu, A. Mondal, A. Chakraborty, **M. Zuzak**, N. Jacobson, D. Xing, and A. Srivastava, "Neural Trojans," in Encyclopedia of Cryptography, Security and Privacy, 2021

#### Technical Reports:

- [T1] **M. Zuzak**, "Designing Effective Logic Obfuscation: Exploring Beyond Gate-Level Boundaries" (**Ph.D. Thesis**)
- [T2] B. Tan, R. Karri, N. Limaye, A. Sengupta, ..., **M. Zuzak**, A. Srivastava, et al., "Benchmarking at the Frontier of Hardware Security: Lessons from Logic Locking," in arXiv preprint arXiv:2006.06806, 2021
- [T3] **M. Zuzak**, "Exploiting Nested Parallelism on Heterogeneous Processors" (**M.S. Thesis**)

#### POSTER PRESENTATIONS/INVITED TALKS

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- [P1] **M. Zuzak**, "New Horizons in Hardware Security," at Rochester Institute of Technology (RIT), 2021
- [P2] **M. Zuzak**, "Designing Obfuscated Systems for Enhanced Hardware-Oriented Security," at SIGDA Design Automation Conference (DAC) PhD Forum, 2021
- [P3] **M. Zuzak**, "Securing Hardware in a Globalized Supply-Chain," at ARCS Scholar Reception, 2020
- [P4] **M. Zuzak**, "Building Functional ICs with Approximate Keys," at CSAW'19 Logic Locking Conquest Finals, 2019
- [P5] **M. Zuzak**, "Achieving Hardware Security: Design and Fabrication of Secure Integrated Circuits," at ARCS Scholar Reception, 2019
- [P6] **M. Zuzak** and A. Srivastava, "Memory Locking: An Automated Approach to Processor Design Obfuscation," in Design Automation Conference (DAC), 2019

## OPEN-SOURCE SOFTWARE

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### **CLAP Attack-** A Combined Logical and Physical Attack on Logic Obfuscation

- The CLAP attack is an open-source attack on logic obfuscation utilizing both logical and physical leakage to reverse-engineer the key of an obfuscated circuit. The physical portion of the CLAP attack logically guides an electro-optical probe to extract key leakage through electro-optical frequency mapping (EOFM). The logical portion of the CLAP attack relies on the open-source SAT attack toolkit by Subramanyan et al.

### **ObfusGEM** - A Cycle-Accurate Processor Design Obfuscation Simulator

- ObfusGEM is a simulation framework for the evaluation of processor design obfuscation. It implements an error injection framework inspired by the architectural error resilience community to close-the-loop between gate-level obfuscation and its application-level impact. We provide a library of existing hardware security techniques and configurations along with ObfusGEM to enable the design and evaluation of hardware security configurations for specific architectures or devices.

### **StatSAT** - A Statistical Boolean Satisfiability Attack on Logic Locking

- StatSAT is an open-source SAT-based attack against probabilistic circuits that have been secured by logic locking.

### **HMCTherm** - A Cycle-Accurate Simulator for the Hybrid Memory Cube with Built-In Thermal Analysis

- HMCTherm is a comprehensive simulation framework for a Stacked-Memory-on-CPU architecture. Given the architectural description of a multi-core CPU using hybrid memory cubes (HMC), HMCTherm can simulate the 3D thermal profile (both transient and static) of the HMCs for an arbitrary computing workload.

## TEACHING EXPERIENCE

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### **University of Maryland, College Park**

Spring 2021

*Co-Teacher with Prof. Ankur Srivastava*

- Co-Teacher for joint Undergraduate/Graduate course titled Digital CMOS VLSI Design (ENEE640)

### **University of Maryland, College Park**

Fall 2014, Spring 2015

*Graduate Teaching Assistant*

- Teaching Assistant for Undergraduate/Graduate Advanced Verilog Design Course (ENEE359F) for 2 semesters
- Awarded Department of Electrical and Computer Engineering Distinguished Teaching Assistant Award

## PROFESSIONAL SERVICE

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### **Reviewer For:**

- IEEE Transactions on Computer Aided Design of Integrated Circuits and Systems (TCAD)
- ACM Journal on Emerging Technologies in Computing Systems (JETC)
- Springer Analog Integrated Circuits and Signal Processing
- 2021 IEEE/ACM International Symposium on Microarchitecture (MICRO)
- 2021 IEEE/ACM Design Automation Conference (DAC)
- 2020 IEEE International Symposium on Circuits and Systems (ISCAS)

## HONORS AND AWARDS

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- Best Paper Candidate at the Design Automation Conference (DAC) 2021
- Future Faculty Fellow for the Clark School of Engineering at the University of Maryland, College Park
- Department of Electrical and Computer Engineering Distinguished Teaching Assistant Award
- ARCS/MWC Named Graduate Scholar (2019-2021)
- Edison Memorial Graduate Fellowship, Naval Research Laboratory
- Clark School of Engineering Distinguished Graduate Fellowship
- CSAW 2019 Logic Locking Conquest Finalist
- Best Paper at MULTIPROG-2017
- On the Spot Award, Naval Research Laboratory
- Northrop Grumman Master's Fellowship
- NSF Student Travel Grant for ISVLSI 2019
- University of Maryland Dean's Scholarship
- Association of Old Crows' (AOC) Scholarship