DANIEL B. LIMBRICK

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North Carolina A&T State University
Greensboro, NC 27411

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ACADEMIC INTERESTS

I lead the Automated Design for Emerging Processing Technologies (ADEPT) research laboratory at North Carolina A&T State University. My research focuses on the design of reliable and secure systems and emerging computing technologies. Topics of interest include:

- Fault-tolerant microprocessor design
- Computer hardware security
- Computer system simulation & emulation
- Three-dimensional integrated circuits

- Engineering education
- Electronic Design Automation (EDA)
- Computer architecture design
- Scalable & high-performance computing

EDUCATION

Ph.D., Electrical Engineering, *Vanderbilt University*, December 2012
Dissertation Title: *Impact of Logic Synthesis on Soft Error Rate of Digital Integrated Circuits*
Minor: Computer Science

M.S., Electrical Engineering, *Vanderbilt University*, December 2009
Thesis Title: *Embedding Temporal Signatures to Monitor Microarchitectural Control Flow*
Minor: Computer Science

B.S., Electrical Engineering, *Texas A&M University-College Station*, May 2007

PROFESSIONAL EXPERIENCE

SUMMER 2019 - PRESENT
Associate Professor (with tenure)
North Carolina A&T State University, Greensboro, NC
Department of Electrical and Computer Engineering

FALL 2013 - SPRING 2019
Assistant Professor
North Carolina A&T State University, Greensboro, NC
Department of Electrical and Computer Engineering

FALL 2012 - SUMMER 2013
Postdoctoral Fellow
Georgia Institute of Technology, Atlanta, GA
School of Electrical and Computer Engineering
Georgia Tech Computer-Aided Design (GTCAD) Group
Postdoctoral Advisor: Dr. Sung Kyu Lim

FALL 2007 - SUMMER 2012
Graduate Research Assistant
Vanderbilt University, Nashville, TN
Vanderbilt Security and Fault Tolerance (SAF-T) Group
Radiation Effects and Reliability (RER) Group

FALL 2007 - SPRING 2008	**Graduate Teaching Assistant** *Vanderbilt University, Nashville, TN* EECE 112 - Engineering Circuit Analysis
FALL 2006 - SUMMER 2007; SUMMER 2008	**Test Engineering Intern** *Hewlett Packard @ Research Park, College Station, TX* Firmware Division
SUMMER 2006	**Undergraduate Research Assistant** *Vanderbilt University, Nashville, TN* Summer Research Program in Hybrid and Embedded Systems
SUMMER 2004; SUMMER 2005	**Summer Intern** *Motorola/Freescale Semiconductors, Austin, TX* Computer Platform Division
SPRING 2003 - SUMMER 2004	**Undergraduate Research Assistant** *Texas A&M University, College Station, TX* Power Systems Automation Laboratory
SUMMER 2002; SUMMER 2001	**Summer Intern** *National Aeronautics and Space Administration (NASA), Houston, TX* Summer High School Apprenticeship Research Program (SHARP)

PUBLICATIONS AND SCHOLARLY WORK

BOOK CHAPTERS

[B1] Christopher Osiegbu, Seifemichael Amsalu, Fatemeh Afghah, **Daniel B. Limbrick**, and Abdollah Homaifar, "Toward Resident Behavior Prediction in Wireless Sensor Network-Based Smart Homes," in *Advances in Computer Communications and Networks: From Green, Mobile, Pervasive Networking to Big Data Computing*, Kewei Sha, Aaron Strigel, and Min Song, Eds., River Publishers, Series in Communications, pp. 345-362, 2016.

REFEREED JOURNAL ARTICLES

[J5] Ahmed Yiwere, Ebenezer Tachie-Menson, and **Daniel B. Limbrick**, "Evaluation of Discrete-Event Simulators and Satisfiability Solvers in the Calculation of Soft Error Propagation," *Transactions on Techniques in STEM Education*, Vol. 5, No. 1, pp. 8-17, 2019.

[J4] Bradley T. Kiddie, William H. Robinson, and **Daniel B. Limbrick**, "Single-Event Multiple-Transient Characterization and Mitigation via Alternative Standard Cell Placement Methods," *ACM Transactions on Design Automation of Electronic Systems*, Vol. 20, No. 4, pp. 1-22, 2015.

[J3] Dolores A. Black, William H. Robinson, Ian Wilcox, **Daniel B. Limbrick**, and Jeffrey D. Black, "Modeling of Single Event Transients with Dual Double-Exponential Current Sources: Implications for Logic Cell Characterization," *IEEE Transactions on Nuclear Science*, Vol. 62, No. 4, pp. 1540-1549, 2015.

[J2] **Daniel B. Limbrick**, Nihaar N. Mahatme, William H. Robinson, and Bharat L. Bhuva, "Reliability-Aware Synthesis of Combinational Logic With Minimal Performance Penalty," *IEEE Transactions on Nuclear Science*, Vol. 60, No. 4, pp. 2776-2781, 2013.

[J1] Nihaar N. Mahatme, Indranil Chatterjee, Akash Patki, **Daniel B. Limbrick**, Bharat L. Bhuva, Ronald D. Schrimpf and William H. Robinson, "An efficient technique to select logic nodes for single event transient pulse-width reduction," *Microelectronics Reliability*, Vol. 53, No. 1, pp. 114-117, 2013.

REFEREED CONFERENCE PRESENTATIONS WITH PROCEEDINGS

[C32] Yohannes Bekele, Ahmed Yiwere, and **Daniel B. Limbrick**, "Rowhammer Attacks on the Raspberry Pi 3B+," *Government Microcircuit Applications and Critical Technology Conference (GOMACTech)*, March 2021.

[C31] Semiu A. Olowogemo, Ahmed Yiwere, Bor-Tyng Lin, Hao Qiu, William H. Robinson, and **Daniel B. Limbrick**, "Electrical Masking Improvement with Standard Logic Cell Synthesis Using 45-nm Technology Node," *IEEE International Midwest Symposium on Circuits and Systems (MWSCAS)*, August 2020.

[C30] Hao Qiu, Xiaoxing Qiu, Semiu A. Olowogemo, Bor-Tyng Lin, William H. Robinson, and **Daniel B. Limbrick**, "Gem5Panalyzer: A Light-weight tool for Early-stage Archictectural Reliablity Evaluation & Prediction," *IEEE International Midwest Symposium on Circuits and Systems (MWSCAS)*, August 2020.

[C29] Yohannes Bekele and **Daniel B. Limbrick**, "Performance Evaluation of a Secure Microkernel on a Single-Board Computer," *Proceedings of the IEEE SoutheastCon*, March 2020.

[C28] Ahmed Yiwere, Taharat Tazrin, Janani Aravind, and **Daniel B. Limbrick**, "Post-Layout Gate Sizing for Zero Area-Delay-Penalty Soft Error Mitigation," *Government Microcircuit Applications and Critical Technology Conference (GOMACTech)*, March 2020.

[C27] Semiu A. Olowogemo, William H. Robinson, Ahmed Yiwere, Ebenezer Tachie-Menson, **Daniel B. Limbrick**, and Bor-Tyng Lin, "Pulse Broadening in Combinational Circuits with Standard Logic Cell Synthesis," *IEEE International Midwest Symposium on Circuits and Systems (MWSCAS)*, August 2019.

[C26] Semiu Olowogemo, William Robinson and **Daniel Limbrick**, "Effects of Voltage and Temperature Variations on the Electrical Masking Capability of Sub-65 nm Combinational Logic Circuits," *Proceedings of the IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems (DFTS)*, October 2018.

[C25] Monique Kirkman-Bey, Christopher Doss, and **Daniel B. Limbrick**, "Automatic Modeling and Parasitic Extraction of Differential Horseshoe-Shaped Transmission Lines for Millimeter-Wave Circuits," *Proceedings of the IEEE SoutheastCon*, April 2018.

[C24] Ahmed I. Abdul-Rahman and **Daniel B. Limbrick**, "Using Cone Partitioning for Faster SAT-Based Error Propagation Probability Calculation," *Government Microcircuit Applications and Critical Technology Conference (GOMACTech)*, March 2018.

[C23] Hao Qiu, Richard A. Peters, William H. Robinson, and **Daniel B. Limbrick**, "The Effects of Radiation-Induced Soft Errors on Hardware Implementations of Object-Tracking Algorithms," *60th IEEE International Midwest Symposium on Circuits and Systems (MWSCAS)*, August 2017.

[C22] William H. Robinson, **Daniel B. Limbrick**, Bradley T. Kiddie, Ahmed I. Abdul-Rahman, Bor-Tyng Lin, and Semiu A. Olowogemo, "Design-Based Variability in Simulating Single Event Transients," *17th European Conference on Radiation and Its Effects on Components and Systems (RADECS)*, September 2016.

[C21] Yosef Borga, **Daniel Limbrick**, and Sung Kyu Lim, "Physical Design Factors that Contribute to Routing Congestion in Monolithic 3D Integrated Circuits", *International Workshop on Logic & Synthesis (IWLS)*, June 2016.

[C20] **Daniel B. Limbrick**, "Work-In-Progress: Teaching Broadly-Applicable STEM Skills to High School Sophomores Using Linux and Smartphones," *American Society for Engineering Education (ASEE) Annual Conference*, June 2016. <u>**BEST IN SESSION AWARD**</u>

[C19] Christopher Osiegbu, Seifemichael Amsalu, Fatemeh Afghah, Abdollah Homaifar, and **Daniel B. Limbrick**, "Design and Implementation of an Autonomous Wireless Sensor-based Smart Home," *IEEE International Workshop on Wireless Mesh and Ad-Hoc Networking (WiMAN)*, August 2015.

[C18] Young-Joon Lee, **Daniel Limbrick**, and Sung Kyu Lim, "Power Benefit Study for Ultra-High Density Transistor-Level Monolithic 3D ICs", *ACM Design Automation Conference (DAC)*, June 2013.

[C17] Bradley T. Kiddie, William H. Robinson, and **Daniel B. Limbrick**, "Single-Event Multiple-Transients (SEMT): Circuit Characterization and Analysis," *IEEE Workshop on Silicon Errors in Logic - System Effects (SELSE)*, March 2013.

[C16] Trey Reece, **Daniel B. Limbrick**, Xiaowen Wang, Bradley T. Kiddie, and William H. Robinson, "Stealth Assessment of Hardware Trojans in a Microcontroller," *IEEE International Conference on Computer Design (ICCD)*, October 2012.

[C15] **Daniel B. Limbrick**, Nihaar N. Mahatme, and William H. Robinson, "Determining the Efficacy of Selective Node Hardening Techniques using Standard Cells," *13th European Conference on Radiation and Its Effects on Components and Systems (RADECS)*, September 2012.

[C14] **Daniel B. Limbrick** and William H. Robinson, "Impact of Logic Synthesis on Soft Error Rate of Digital Integrated Circuits," *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*, August 2012.

[C13] **Daniel B. Limbrick** and William H. Robinson, "Characterizing Single Event Transient Pulse Widths in an Open-Source Cell Library Using SPICE," *IEEE Workshop on Silicon Errors in Logic - System Effects (SELSE)*, March 2012.

[C12] Trey Reece, **Daniel B. Limbrick**, William H. Robinson, "Design Comparison to Identify Malicious Hardware in External Intellectual Property," *IEEE International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom)*, November 2011.

[C11] **Daniel B. Limbrick**, Suge Yue, William H. Robinson, and Bharat L. Bhuva, "Impact of Synthesis Constraints on Error Propagation Probability of Digital Circuits," *Proceedings of the IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems (DFTS)*, October 2011.

[C10] Ryan C. Bickham, **Daniel B. Limbrick**, William H. Robinson, Bharat L. Bhuva, "An Analysis of Error Detection Techniques for Arithmetic Logic Units (ALUs)," *Government Microcircuit Applications and Critical Technology Conference (GOMACTech)*, March 2011.

[C9] Corey T. Toomey, Brian D. Sierawski, Andrew Sternberg, **Daniel B. Limbrick**, Bharat L. Bhuva, Lloyd W. Massengill, William H. Robinson, S.-J. Wen, R. Wong, S. Martin, "Statistical Fault Injection and Analysis at the Register Transfer Level Using the Verilog Procedural Interface," *Government Microcircuit Applications and Critical Technology Conference (GOMACTech)*, March 2011.

[C8] **Daniel B. Limbrick**, William H. Robinson, Bharat L. Bhuva, "Synthesis optimization trends on error propagation probability of combinational circuits," *IEEE Workshop on Silicon Errors in Logic - System Effects (SELSE)*, March 2011.

[C7] Dolores A. Black, Robert A. Reed, William H. Robinson, Jeffrey D. Black, **Daniel B. Limbrick**, and Kevin D. Dick, "Impact of Ion-Induced Transients on High-Speed Dual-Complementary Flip-Flop Designs," *Proceedings of the IEEE International Reliability Symposium (IRPS)*, April 2011.

[C6] **Daniel B. Limbrick**, Dolores A. Black, Kevin Dick, Nicholas M. Atkinson, Nelson J. Gaspard, Jeffrey D. Black, William H. Robinson, Arthur F. Witulski, "Impact of Logic Synthesis on Soft Error Vulnerability Using a 90-nm Bulk CMOS Digital Cell Library," *Proceedings of the IEEE SoutheastCon*, March 2011.

[C5] Dolores A. Black, Robert A. Reed, William H. Robinson, Jeffrey D. Black, **Daniel B. Limbrick**, and Kevin D. Dick, "Impact of Ion-Induced Meta-Stable Conditions on Clocked Operations Of DICE Flip-

Flops for Reconfigurable Devices," *Military and Aerospace Programmable Logic Devices Conference (MAPLD)*, November 2010.

[C4] Nihaar N. Mahatme, Indranil Chatterjee, Akash Patki, **Daniel B. Limbrick**, Ronald D. Schrimpf, Bharat L. Bhuva, and William H. Robinson, "An Efficient Technique to Select Logic Nodes for Single Event Transient Reduction," *11th European Conference on Radiation and Its Effects on Components and Systems (RADECS)*, September 2010.

[C3] **Daniel B. Limbrick**, Edward Ossi, Corey Toomey, Bharat Bhuva, William Robinson, "Characterization of Control Bit Errors in the MIPS R2000 Microprocessor," *Government Microcircuit Applications and Critical Technology Conference (GOMACTech)*, March 2010.

[C2] **Daniel B. Limbrick**, William H. Robinson, Bharat L. Bhuva, "Reliability-Aware Synthesis: XOR logic function case study," *IEEE Workshop on Silicon Errors in Logic - System Effects (SELSE)*, March 2010.

[C1] Edward J. Ossi, **Daniel B. Limbrick**, William H. Robinson, Bharat L. Bhuva, "Soft-error Mitigation at the Architecture-Level Using Berger Codes and Instruction Repetition," *IEEE Workshop on Silicon Errors in Logic - System Effects (SELSE)*, March 2009.

OTHER CONFERENCE PRESENTATIONS

[O2] **Daniel B. Limbrick**, "Performance Evaluation of ROS on an seL4-Based Raspberry Pi," in *seL4 Summit*, September 2019.

[O1] William H. Robinson, Bradley T. Kiddie, **Daniel B. Limbrick**, Trey Reece, Xiaowen Wang, and Qian Ding, "Reliability-aware logic synthesis of integrated circuits (ICs): Layout effects for multiple transients," in *IEEE/IFIP International Conference on Dependable Systems and Networks (DSN) - Fast Abstracts*, June 2012.

INVITED TALKS, KEYNOTES, AND TUTORIALS

[IT8] Daniel B. Limbrick, "Analysis of Hardware Faults in Secure and Reliable Computing Systems," presented at the Aerospace Corporation (virtual via Zoom), May 19, 2021.

[IT7] William H. Robinson, Daniel B. Limbrick, and Semiu Olowogemo "Cross-Layer Soft Error Analysis with Architectural Simulators and Boolean Satisfiability Solvers," (tutorial) presented at the International Conference on Computer Design (ICCD), Orlando, Florida, October 7, 2018.

[IT6] William H. Robinson and Daniel B. Limbrick, "Research Frameworks and Methodologies for Understanding the Soft Error Vulnerability, Reliability, and Resilience of Modern Architectures," (tutorial) presented at the International Symposium on Computer Architecture (ISCA), Los Angeles, California, June 2, 2018.

[IT5] Daniel B. Limbrick, "Digital Systems @ NC A&T," presented at Cisco Systems, Research Triangle Park, North Carolina, April 8, 2016.

[IT4] Daniel B. Limbrick, "Electronic Design Automation for Emerging Technologies and Harsh Environments," presented at North Carolina A&T University, Greensboro, North Carolina, May 8, 2013.

[IT3] Daniel B. Limbrick, "Electronic Design Automation for Emerging Technologies and Harsh Environments," presented at Southern Methodist University, Dallas, Texas, March 20, 2013.

[IT2] Daniel B. Limbrick, "Impact of Logic Synthesis on the Soft Error Rate of Digital Integrated Circuits," presented at University of Southern California, Los Angeles, California, April 19, 2012.

[IT1] Daniel B. Limbrick, "Impact of Logic Synthesis on the Soft Error Rate of Digital Integrated Circuits," presented at University of Maryland, College Park, Maryland, April 9, 2012.

WORKSHOP PRESENTATIONS

[W8] Daniel B. Limbrick, "Advice to Undergraduates. . . or how I decided on attending graduate school," presented at the Louis Stokes Alliance for Minority Participation Symposium, Prairie View, Texas, March 3, 2017.

[W7] Daniel B. Limbrick, "Advice to Graduate Students. . . or what I did with my PhD," presented at the Louis Stokes Alliance for Minority Participation Symposium, Prairie View, Texas, March 3, 2017.

[W6] Daniel B. Limbrick, "Simulation, Analysis, and Mitigation of Silent Data Corruptions in Exascale Computing Systems," presented at the Sustainable Research Pathways Workshop, Berkeley, CA, December 7, 2016

[W5] Daniel B. Limbrick, "Panel: Addressing Challenges in Fostering Diversity in Design Automation," panelist at the CRAW/CDC/NSF Discipline Specific Workshop on Diversity in Design Automation, San Francisco, CA, June 1, 2014

[W4] Daniel B. Limbrick, "Reliability-Aware Logic Synthesis and Physical Design for Digital Integrated Circuits," presented at the Academic Research Leadership Symposium, Nashville, TN, March 29, 2014

[W3] Daniel B. Limbrick and Jacqueline Fairley, "Postdoc: Where and Why Do It?" presented at the National Society of Black Engineers (NSBE) National Convention, Nashville, TN, March 28, 2014

[W2] Daniel B. Limbrick, "Electronic Design Automation for Emerging Technologies and Harsh Environments" presented at the Building Future Faculty Workshop @ North Carolina State University, Raleigh, NC, April 4, 2013

[W1] Daniel B. Limbrick, "Impact of Logic Synthesis on the Soft Error Rate of Digital Integrated Circuits" presented at the Future Faculty Workshop @ Rice University, Houston, TX, September 11, 2012

SPONSORED RESEARCH ACTIVITIES

EXTERNALLY-SPONSORED RESEARCH (TOTAL: $5,219,723)

*Funding as a Single Investigator, Total: **$1,135,919***
*Funding for Collaborative Projects as Lead Principal Investigator, Total: **$1,575,000***
*Funding for Collaborative Projects as Co-Principal Investigator, Total: **$2,508,804***

Title: Athena: AI-Driven Next-generation Networks at the Edge
Sponsor: Duke University (Subaward)
Prime Sponsor: National Science Foundation
Period of Performance: October 1, 2021 to September 30, 2026
Lead PI: Daniel Limbrick
Amount: $575,000

Title: Physical Implementation of a Radiation-Hardened-By-Construction Microprocessor
Sponsor: Office of Naval Research
Period of Performance: July 1, 2021 to June 30, 2024
Lead PI: Daniel Limbrick
Amount: Total: $954,536

Title: Application of Artificial Intelligence to Cybersecurity for Protecting National Critical Infrastructure
Sponsor: University of Texas-San Antonio (Subaward)
Prime Sponsor: Department of Energy/National Nuclear Security Administration
Period of Performance: March 22, 2021 to March 21, 2026
Lead PI: Xiaohong Yuan
Co-PIs: Daniel Limbrick, Kelvin Bryant
Amount: $1,082,578

Title: Resilience Analysis of Autonomous Small Satellites
Sponsor: Aerospace Corporation
Period of Performance: October 1, 2020 to September 30, 2021
Lead PI: Daniel Limbrick
Amount: Total: $30,000

Title: MRI: Acquisition of a Testbed of Connected Autonomous MicroTransit Vehicles
Sponsor: National Science Foundation
Period of Performance: July 15, 2020 to June 30, 2022
Lead PI: Ali Karimoddini
Co-PIs: Daniel Limbrick, Leila Beni, Allison Sullivan, Mahmoud Mahmoud
Amount: Total: $550,000

Title: Excellence in Research: Real-time Fault Diagnosis for Self-Driving Vehicles
Sponsor: National Science Foundation
Period of Performance: June 1, 2020 to May 31, 2023
Lead PI: Daniel Limbrick
Co-PIs: Abdollah Homaifar, Ali Karimoddini, Siobahn Day
Amount: $1,000,000

Title: IGE: Research Engineer Identity: Development and Assessment
Sponsor: National Science Foundation
Period of Performance: July 1, 2019 to June 30, 2022
Role: Investigator
Lead PI: Balasubramanian Ram
Co-PIs: Chrysafis Vogiatzis, Tobin Walton, Juanda Johnson-Taylor, Stephanie Teixeira-Poit
Amount: $461,226

Title: Resilience Analysis of an seL4-based Autonomous Vehicle
Sponsor: Air Force Office of Scientific Research (AFOSR)
Period of Performance: June 3, 2019 to July 26, 2019
Lead PI: Daniel Limbrick
Amount: $15,300

Title: Reliability-Aware Synthesis and Physical Design Algorithms for Standard Cell-Based Integrated Circuit Design
Sponsor: Naval Surface Warfare Center Crane Division (NSWC-Crane)
Period of Performance: May 1, 2019 to January 31, 2020
Lead PI: Daniel Limbrick
Amount: $40,000

Title: Support for 2018 - 2019 NCAT Senior Design Project
Sponsor: Sandia National Laboratories
Period of Performance: August 20, 2018 to May 10, 2019
Lead PI: Mookesh Dhanasar
Co-PIs: Daniel Limbrick
Amount: $15,000

Title: Tracking Error Propagation for Large Circuits Deterministically
Sponsor: Southeastern Center for Electrical Engineering Education (SCEEE)
Period of Performance: July 1, 2017 to June 30, 2018
Lead PI: Daniel Limbrick
Amount: $25,500

Title: CI-NEW: Developing a Community Infrastructure for Reliability-Aware Cross-Layered Design of Integrated Circuits
Sponsor: National Science Foundation
Period of Performance: September 1, 2016 to August 31, 2020

Lead PI: William H. Robinson, Vanderbilt University
Co PIs: Daniel Limbrick (Lead PI at NC A&T)
Amount: $250,000 (Total: $400,000)

Title: Processor Functional Safety Analysis in the face of Radiation-Induced Soft Errors
Sponsor: kVA
Period of Performance: August 17, 2016 to May 17, 2017
Lead PI: Daniel Limbrick
Amount: $18,750

Title: Professor-In-Residence
Sponsor: Cisco Systems
Period of Performance: July 5, 2016 to August 11, 2016
Lead PI: Daniel Limbrick
Amount: $12,000

Title: Simulation of Soft Errors in Extraterrestrial Environments
Sponsor: North Carolina Space Grant Consortium, New Investigator Award
Period of Performance: July 1, 2016 to June 30, 2017
Lead PI: Daniel Limbrick
Amount: $12,500

Title: Hardware/Software Resilience Co-Design Tools for Extreme-scale High-Performance Computing
Sponsor: Oak Ridge National Laboratory, HBCU/MEI Faculty Summer Research Program
Period of Performance: June 5, 2014 to August 13, 2014
Lead PI: Daniel Limbrick
Amount: $27,333

INTERNALLY-SPONSORED RESEARCH (TOTAL - $260,941)

Title: Security Vulnerability Testing of an seL4-based Embedded Systems Against Physical Attacks
Sponsor: North Carolina A&T State University, Center of Excellence in Cybersecurity Research, Education and Outreach (CREO)
Period of Performance: May 1, 2020 to July 30, 2020
Role: Principal Investigator
Amount: $5,000

Title: Tracking Error Propagation for Large Circuits Deterministically
Sponsor: North Carolina A&T State University, Department of Electrical and Computer Engineering
Period of Performance: July 1, 2017 to June 30, 2018
Role: Principal Investigator
Amount: $25,500 (Matching Funds)

Title: Simulation of Soft Errors in Extraterrestrial Environments
Sponsor: North Carolina A&T State University, Department of Electrical and Computer Engineering
Period of Performance: July 1, 2016 to June 30, 2017
Role: Principal Investigator
Amount: $12,500 (Matching Funds)

Title: Research Equipment for ADEPT Laboratory
Sponsor: North Carolina A&T State University, College of Engineering Research Equipment Funding
Period of Performance: April 1, 2015 to August 31, 2015
Role: Principal Investigator
Amount: $77,765

Title: Development of a Linux Teaching Laboratory
Sponsor: North Carolina A&T State University

>> **Period of Performance:** February 1, 2014 to August 31, 2014
>> **Role:** Principal Investigator
>> **Amount:** $40,000

>> **Title:** Assistive robot for geriatric and handicap application
>> **Sponsor:** North Carolina A&T State University, College of Engineering
>> **Period of Performance:** October 1, 2013 to August 31, 2014
>> **Role:** Co-Principal Investigator
>> **Lead PI:** Abdollah Homaifar
>> **Other PIs:** Fatemah Afghah, Ali Karimoddini
>> **Amount:** $100,176

HONORS AND AWARDS RECEIVED

NORTH CAROLINA A&T STATE UNIVERSITY

- Department of Navy Distinguished Fellow (2021)

- NC A&T Centers of Excellence: Summer Seed Funding for Preliminary R&D Efforts and Portfolio Development (2020)

- U.S. Air Force Research Lab Summer Faculty Fellowship Program (2019)

- Southeastern Center for Electrical Engineering Education (SCEEE) Development Fund Grant for Junior Faculty (2017)

- IEEE Senior Member (2017)

- Woody Everett Award, Best in Session, Computers in Education Division, American Society for Engineering Education (ASEE) (2016)

- North Carolina Space Grant New Investigators Program (2016)

- Oak Ridge National Laboratory HBCU/MEI Faculty Summer Research Program (2014)

GEORGIA INSTITUTE OF TECHNOLOGY

- National Science Foundation FACES Postdoctoral Fellowship (2012 - 2013)

VANDERBILT UNIVERSITY

- Vanderbilt University Provost Graduate Fellowship (2007 - 2012)

- Alfred P. Sloan Foundation Minority PhD Program Sloan Fellow (2007 - 2012)

- National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM) Fellowship (2007 - 2008)

TEXAS A&M UNIVERSITY

- National Society of Black Engineers (NSBE) Academic Technical Bowl (ATB) Regional 1st place (2003)

- NSBE Undergraduates Students in Technical Research (USTR) Regional 1st place (2003)

- Texas A&M University Department of Physics Mechanics Scholar (2002)

- National Achievement Scholar (2002)

- National Merit Commended Scholar (2002)

RESEARCH TRAINING AND SUPERVISION

DOCTORAL DISSERTATIONS SUPERVISED

- **Janani Aravind**, Ph. D. in Electrical Engineering (expected May 2023)
- **Yohannes Bekele**, Ph. D. in Electrical Engineering (expected May 2023)
- **Ahmed Yiwere**, Ph. D. in Electrical Engineering (expected May 2022)
- **Monique Kirkman-Bey**, Ph. D. in Electrical Engineering (expected May 2022)
  (co-advised with Dr. Numan Dogan)

DOCTORAL DISSERTATION COMMITTEES

- **Farren Stackhouse**, Ph. D. in Rehabilitation Counseling & Rehabilitation Counselor Education - May 2021
- **Jannatun Naher**, Ph. D. in Electrical Engineering - May 2020
- **Saina Ramyar**, Ph. D. in Electrical Engineering - August 2019
- **Yasmin Gay**, Ph. D. in Rehabilitation Counseling & Rehabilitation Counselor Education - May 2019
- **Shrikant Jadhav**, Ph. D. in Electrical Engineering - May 2018
- **Alejandro White**, Ph. D. in Electrical Engineering - May 2018

MASTER'S THESES SUPERVISED

- **Judith Hernandez-Campillo**, M.S. in Electrical Engineering (expected May 2023)
- **Dawood Rauf**, M.S. in Electrical Engineering (expected May 2023)
- **Ebenezer Tachie-Menson**, M.S. in Electrical Engineering - May 2019
- **Ahmed Issa Abdul-Rahman**, M.S. in Electrical Engineering - May 2017
- **Yosef Borga**, M.S. in Electrical Engineering - December 2015
- **Miriam Njuguna**, M.S. in Electrical Engineering - December 2015

NON-THESIS MASTER'S DEGREES SUPERVISED

- **Roopa Ganta**, M.S. in Electrical Engineering - May 2015

MASTER'S THESIS COMMITTEES

- **Brian Baity**, M.S. in Electrical Engineering - August 2019
- **Shimika Bowers**, M.S. in Electrical Engineering - August 2015
- **Monique Kirkman-Bey**, M.S. in Electrical Engineering - August 2014

UNDERGRADUATE RESEARCH SUPERVISED

- **Theron-Howard Barr**: Buffer overflow exploit exploit on a Raspberry Pi (Fall 2021)
- **Daniel Bryant**: Uninitialized variable exploit on a Raspberry Pi (Fall 2021)
- **Kayla Henry**: Null pointer dereferencing exploit on a Raspberry Pi (Fall 2021)
- **Arianna Williams**: Stack smashing exploit on a Raspberry Pi (Fall 2021)

- **Deriech Cummings**: Integer overflow exploit on a Raspberry Pi (Fall 2021)

- **Toinje' Maxson**: Return-oriented programming exploit on a Raspberry Pi (Fall 2021)

- **Essence McClinton**: Heap overflow exploit on a Raspberry Pi (Fall 2021)

- **Stanton Trueheart**: Code injection exploit on a Raspberry Pi (Fall 2021)

- **Michael Umelo**: GDB-based fault injection of the ARM Cortex M0 (Spring 2021)

- **TayTiana Bryant**: GDB-based fault injection of the ARM Cortex M0 (Fall 2020 - Spring 2021)

- **Fred Boadu**: GDB-based fault injection of the ARM Cortex M0 (Fall 2020)

- **Seth Kerr**: GDB-based fault injection of the ARM Cortex M0 (Fall 2020)

- **Daniel Luque-Garcia**: Demonstrating Integrated Circuit Design using Jupyter Notebooks (Fall 2019)

- **Raegan Brown**: Computing the Architectural Vulnerability Factor of RISC Processors using gem5 (Spring 2018)

- **Lance Davis**: Implementing the Rowhammer Attack; Simulation of Soft Errors for High-Performance Computing Applications (Fall 2017 - Fall 2019)

- **Bryandon McElroy**: Simulation and Implementation of Autonomous Algorithms (Fall 2017 - Fall 2019)

- **Cebron Williams**: Implementing ROS on the Raspberry Pi (Fall 2017 - Fall 2019)

- **Davidson Metis**: Simulation of Soft Errors in Extraterrestrial Environments (Summer 2017 - Spring 2018)

- **Dennis Azorlibu**: Simulation of Soft Errors in Extraterrestrial Environments (Spring 2017)

- **Luke Abers**: Digital Systems Modeling for Identity and Verification (Summer 2016)

- **Leroy Harrill**: Digital Systems Modeling for Identity and Verification (Summer 2016)

- **Dominiqueca Edwards**: Simulation of Soft Errors in Extraterrestrial Environments (Spring 2017 - Spring 2018); Injecting Faults in Binary Adders (Fall 2015 - Spring 2016)

- **Katrina Rosemond**: Simulation of Soft Errors in Extraterrestrial Environments (Spring 2017 - Spring 2018); Water Testing with Digital Microfluidics (Fall 2015 - Spring 2016)

- **Matthew Bartley**: Digital Circuit Simulations Using Xilinx ISE and Modelsim in Linux (Summer 2015)

SENIOR DESIGN TEAMS SUPERVISED

- **"Development of Raspberry Pi HAT for CubeSats"**
  Students: Genea Taylor, Lauren Dunn, Christopher Brown, Anthony Allen
  Other Advisors: Dr. John Kelly
  Period: Fall 2021 - Spring 2022

- **"Development of Raspberry Pi HATs for Secure Autonomous Systems"**
  Students: Melayna Harley, Tyler Houston, Phillip Gibson, Cebron Williams
  Other Advisors: Dr. John Kelly
  Period: Spring 2021 - Fall 2021

- **"Data Analysis of Autonomous Systems using Sensor Fusion"**
  Students: Johnathan Lunsford, Zichen Li, Terence Thurman
  Other Advisors: Dr. Mookesh Dhanasar (Dept. of Mechanical Engineering), Quincey Lowery (Sandia National Laboratories)
  Period: Fall 2018 - Spring 2019

- **"Hardware Acceleration for Autonomous Driving Car"**
  Students: Michael Smith, Zachary Brown, Lily Kamphasook, Bishnu Paudel
  Other Advisors: Christopher Riedle (Cisco Systems)
  Period: Fall 2017 - Spring 2018

HIGH SCHOOL RESEARCH SUPERVISED

- **Avery Corbin** (Fall 2020 - Spring 2021)

- **Jessica Jaimes** (Fall 2020 - Spring 2021)

- **Carl Lapiz** (Fall 2020 - Spring 2021)

- **Evan Smith** (Fall 2020 - Spring 2021)

- **Michael Kumoluyi** (Fall 2019 - Spring 2020)

- **Ifaa Lemu** (Fall 2019 - Spring 2020)

- **Lucas Williams** (Fall 2019 - Spring 2020)

- **Benjamin Tubaugh** (Fall 2018 - Spring 2019)

- **Nolan Wright** (Fall 2018 - Spring 2019)

- **Miles Davis** (Fall 2017 - Spring 2018)

- **Darian Whitaker** (Fall 2017 - Spring 2018)

TEACHING EXPERIENCE

UNDERGRADUATE COURSES TAUGHT

ECEN 375 - Computer Architecture and Organization

This undergraduate course covers the design, organization and architecture of computer systems. Topics include central processing unit architecture, instruction set architecture, instruction level parallelism, microcode, system interconnections, memory systems, input/output systems; interrupt handling, peripherals and communications networks.

- Spring 2021, Fall 2020, Spring 2020, Fall 2019, Spring 2019 (+COMP 375), Fall 2018 (+COMP 375), Spring 2018 (+COMP 375), Fall 2017 (+COMP 375)

ECEN 427 - Introduction to Microprocessors

This undergraduate course introduces the fundamentals of microprocessors, microcomputers, and microcontrollers. Both software and hardware concepts are dealt with. Software concepts include assembly language, machine code, flowcharts, and development/debugging techniques. Hardware concepts included communication ports, interrupts, memory, and common microcontroller subsystems.

- Spring 2019

ECEN 433 - Microprocessors Laboratory

This undergraduate course provides practical experience in microprocessor hardware and software, interfacing, and applications. Microprocessor evaluation boards and simulators are utilized throughout the course.

- Spring 2019 (2 sections)

ECEN 327 - Digital Logic

This undergraduate course involves the study of fundamental combinational and sequential logic circuit analysis/design. Combinational concepts covered include Boolean algebra, k-maps, basic logic gates, and small/medium scale integrated circuits. Sequential concepts covered include basic latches/flip-flops, counters, memory registers, and basic synchronous systems.

- Spring 2014, Fall 2013

ECEN 328 - Digital Logic Laboratory

This undergraduate course deals with the implementation of basic combinational and sequential logic systems. Small and medium scale integrated circuits are utilized in addition to programmable logic devices.

- Fall 2017 (2 sections), Spring 2017 (2 sections), Fall 2016 (2 sections), Spring 2016 (2 sections), Fall 2015 (2 sections), Spring 2015 (2 sections), Fall 2014 (2 sections), Spring 2014 (2 sections), Fall 2013 (2 sections)

GRADUATE COURSES TAUGHT

ECEN 626 - Electronic Design Automation (formerly 685/885 Special Topics)

This graduate course covers the following electronic design automation concepts: logic synthesis, partitioning, floorplanning, global routing, detailed routing, compaction, and performance-driven layout. Also discussed are the applications of a number of important optimization techniques, such as network flow, Steiner tree, scheduling, simulated annealing, generic algorithm, and linear/convex programming.

- Spring 2020, Fall 2018, Spring 2017, Fall 2015, Spring 2015, Spring 2014

ECEN 885 - Hardware Security (Special Topics)

This graduate course will prepare students to be an hardware security researchers. The course will cover hardware security at all abstraction levels (chips, PCBs, systems, and systems of systems), with a focus on attacks on internet-of-things and embedded systems. Students will demonstrate an understanding of the basic attacks using a hardware platform.

- Spring 2021

ECEN 685 - Digital System Verification (Special Topics)

This graduate course prepares students to be entry-level industrial standard cell ASIC verification engineers. The course gives the student an understanding of issues and tools related to ASIC verification, with a focus on the methodologies supported by the SystemVerilog language. Students verify complex digital functional blocks, finding most of the contained bugs, using SystemVerilog. Students also demonstrate an understanding of the basic methodologies used in ASIC Verification and their implementation using SystemVerilog.

- Fall 2020, Spring 2018, Fall 2016

ECEN 721 - Fault-Tolerant Digital System Design

This graduate course covers reliability, test generation, self-checking techniques, principles and applications of fault-tolerant design techniques.

- Fall 2019, Spring 2016

OTHER TEACHING ACTIVITIES

- GRE Math Workshop Lecturer (Fall 2010, Fall 2011)
- Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP) Tutor (Fall 2010)

SERVICE

PROFESSIONAL AFFILIATIONS

- Institute of Electrical and Electronics Engineers (IEEE)
  - □ Senior Member (2017 - Present)
  - □ Member (2012 - 2017)
  - □ Student Member (2007 - 2012)
  - □ Computer Society (2011 - Present)
  - □ Solid-State Circuits Society (2021 - Present)
    - ∗ Adhoc Committee on Diversity (2021 - Present)
  - □ Computer Society (2011 - Present)
    - ∗ Technical Committee on Dependable Computing and Fault Tolerance (2019 - Present)
- Association for Computing Machinery (ACM)
  - □ Member (2012 - Present)
  - □ Student Member (2010 - 2012)
- American Society for Engineering Education (ASEE)
  - □ Member (2014 - Present)
- SAE International (formerly Society of Automotive Engineers)
  - □ Professional Member (2017 - Present)
- Academic Research and Leadership Network (ARL)
  - □ Member (2014 - Present)
- National Society of Black Engineers
  - □ Collegiate Member (2002 - 2012)
  - □ Pre-College Initiative (PCI) Member (1998-2002)

ORGANIZING COMMITTEE MEMBER

- Academic Research and Leadership Symposium (2015)
  - □ Faculty Development Track Co-chair
- 9th Workshop on Silicon Errors in Logic - System Effects (2013)
  - □ Session Chair

ORGANIZING COMMITTEE VOLUNTEER

- 31st IEEE International Conference on Computer Design (2013)
  - □ Registration Committee Volunteer
- Parallel Architectures and Compilation Techniques (2009)
  - □ Registration Committee Volunteer

PEER REVIEWER

- Book Reviews
    - Elsevier - "Digital Design and Computer Architecture - ARM Edition," Sarah Harris and David Harris, Elsevier, 1st edition, 2015. (2019)
- Conference/Journal Paper Reviews
    - IEEE Transactions on Computers (2021)
    - IEEE International Physics Reliability Symposium (IRPS) (2019)
    - IEEE Transactions on Nuclear Science (2021, 2020, 2019, 2018, 2017, 2016, 2013)
    - Microelectronics Reliability Journal (2018, 2014, 2013)
    - ASEE National Conference (2016)
    - ASEE Southeastern Section Conference (2016)
    - Design Automation Conference (DAC) (2013)
    - IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS) (2011)
    - Wiley's Security and Communication Networks Journal (2010)
- Grant/Fellowship Panels
    - NSF Division of Computing and Communication Foundations (CCF) Panel (2017, 2016)
    - National Defense Science and Engineering Graduate (NDSEG) Panel (2016)
    - NSF Directorate for Computer & Information Science & Engineering Panel (2016, 2015)
    - ASEE/DoD SMART Scholarship for Service Program Judge (2014)

FACULTY SERVICE AT NORTH CAROLINA A&T STATE UNIVERSITY

Department of Electrical and Computer Engineering Service

- **Senator**, Faculty Senate, Electrical and Computer Engineering (January 2018 - May 2020)
    - Member, Nominations Committee (August 2019 - May 2020)
- **Chair**, Undergraduate Scholarship Committee for the Electrical and Computer Engineering Department (Spring 2017 - Present)
- Member, Computer Engineering Curriculum Committee (2013 - Present)
- Co-Advisor, NC A&T's Autodrive Challenge Team (A3: Aggies' Autonomous Auto) (Fall 2017 - Present)
    - Year 2 (May 2019) Competition Results: 2nd Place
    - Year 1 (May 2018) Competition Results: 4th Place
- **Chair**, Laboratory Operations and Safety Committee for the Electrical and Computer Engineering Department (Fall 2018 - Spring 2019)
- Member, Faculty Search Committee - Radio Frequency (Fall 2018 - Spring 2019)
- Member, Faculty Search Committee - Controls (Fall 2018 - Spring 2019)
- Member, Student Services Search Committee for Electrical and Computer Engineering Department (Spring 2018 - Summer 2018)
- Member, Faculty Search Committee - Controls (Fall 2017 - Spring 2018)
- Member, Chair Search Committee for Electrical and Computer Engineering Department (2017)

- **Chair**, Committee on Funding Graduate Program (2014 - 2015)

College of Engineering Service

- Co-Advisor, NC A&T's Autodrive Challenge Team (A3: Aggies' Autonomous Auto) (Fall 2017 - Present)
- Member, Chair Search Committee for Electrical and Computer Engineering Department (2017)
- Judge, NC A&T College of Engineering Graduate Research Poster Competition (2014, 2015, 2016)

University Service

- Member, Search Committee for the Endowed Professor and Director of the Center of Excellence in Entrepreneurship and Innovation (Fall 2020 - Present)
- University Partnership Program Manager, Air Force Research Laboratory Information Directorate (Fall 2020 - Present)

SERVICE AND ACTIVITIES AT VANDERBILT UNIVERSITY

- Vice President for Diversity Affairs Selection Committee (2009)
- National Society of Black Engineers
  - □ Graduate Student Representative (2008-2009)

SERVICE AND ACTIVITIES AT TEXAS A&M UNIVERSITY

- National Society of Black Engineers
  - □ Regional Academic Excellence Chair (2004-2005)
  - □ Chapter Telecommunications Chair (2004-2005)
  - □ Chapter Academic Excellence Chair (2003-2004)

DIVERSITY AND OUTREACH EFFORTS

- STEM Scholars Program Founder and Director (Fall 2015 - Present)
  - □ Partnership between NC A&T and STEM Early College at NC A&T
  - □ Bi-weekly seminar with high school sophomores
  - □ Teaches Linux, algorithms, and research
- Digital Systems Training Academy (Spring 2016 - Spring 2018)
  - □ Partnership between NC A&T and Cisco
  - □ Weekly workgroup with undergraduates
  - □ Teaches Linux, Verilog, TCL, shell scripting, and research
- FIRST LEGO League Jr. Robotics Coach - Cone Elementary School, Greensboro, NC (Fall 2014)