CV-Ishan Thakkar

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Personal Information

Contact Information

Dr. Ishan G Thakkar
Assistant Professor
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Professional Experience

Assistant Professor
  August 2018 – Present
  Department of Electrical and Computer Engineering, University of Kentucky, Lexington, KY, USA

Community Coordinator
  June 2016 - July 2018
  University Housing, Colorado State University, Fort Collins, CO, USA

Graduate Research and Teaching Assistant
  August 2013 – May 2018
  Embedded Systems and High-Performance Computing (EPiC) Laboratory, Colorado State
  University, Fort Collins, CO, USA

Graduate Research Assistant
  January 2012 – May 2013
  Optoelectronics Research Group, Colorado State University, Fort Collins, CO, USA

Graduate Teaching Assistant
  January 2011 – December 2011
  Department of Electrical and Computer Engineering, Colorado State University, Fort Collins, CO,
  USA

Research Intern
  Summer 2011
  Microwave Systems Laboratory, Colorado State University, Fort Collins, CO, USA

Ad-hoc Lecturer
  June 2009 – July 2010
  Department of Computer Engineering, Venus International College of Technology, Gujarat, India

Project Intern
January 2009 – June 2009
Peach Technovations Pvt. Ltd., Gandhinagar, Gujarat, India

Education

Ph.D. in Electrical Engineering
August 2018
Colorado State University, Fort Collins, CO, USA
Dissertation: Design and Optimization of Emerging Interconnection and Memory Subsystems for Future Manycore Architectures
Advisor: Sudeep Pasricha

M.S. in Electrical Engineering
May 2013
Colorado State University, Fort Collins, CO, USA
Thesis: A plastic total internal reflection-based photoluminescence device for enzymatic biosensors
Advisor: Kevin Lear

B.E. in Electronics and Communication Engineering
June 2009
L.D. College of Engineering, Ahmedabad, Gujarat, India

Awards and Honors

1 – IEEE/ACM/SIGDA Design Automation Conference (DAC), Ph.D. Forum Travel Grant, Austin, Texas, USA, June 2017.

2 – Graduate Student Council of Colorado State University, Travel Award to Present a Peer-Reviewed Research Paper at the IEEE International Conference on VLSI Design (VLSID), Hyderabad, India, January 2017.

3 - IEEE Transactions on Multi-Scale Computing Systems (TMSCS), **Best Journal Paper Award Candidate** for the paper, "3D-ProWiz: An Energy-Efficient and Optically-Interfaced 3D DRAM Architecture with Reduced Data Access Overhead," January 2017.

4 – ACM System Level Interconnect Prediction (SLIP) Workshop, **Best Paper Award** for the paper, "A Comparative Analysis of Front-End and Back-End Compatible Silicon Photonic On-Chip Interconnects," Austin, Texas, USA, June 2016.

5 – IEEE IEEE International Symposium on Quality Electronic Design (ISQED), **Best Paper Award Finalist** for the paper "Process Variation Aware Crosstalk Mitigation for DWDM based Photonic NoC Architectures," Santa Clara, California, USA, March 2016.

Professional Society Membership

IEEE Member, 2018-Present

ACM Member, 2018-Present

ACM Student Member, 2016-2018

IEEE Student Member, 2014-2018

Research Activities

Research Interest Statement

My research broadly focuses on the design and optimization of advanced architectures and technologies for energy-efficient, reliable, and secure computing, for a wide scope of platforms including embedded systems, internet-of-things (IoT), and high-performance computing systems. More specific topics of interest include: 1) design of on-chip and inter-chip networks, 2) memory architecture design, 3) 3D integrated chip design, 4) design with emerging technologies, e.g., silicon photonics, phase change materials, spintronics, 5) self-adaptive and cognitive architectures, 6) manycore hardware security, 7) high-speed optical interfaces, 8) resource management techniques, and 9) optoelectronic/photonic sensors and communication devices.

Research Book Chapters

[BC1] - Sudeep Pasricha, Sai Vineel Reddy Chittamuru, Ishan Thakkar, "Enhancing Process Variation Resilience in Photonic NoC Architectures," Photonic Interconnects for Computer Systems – Understanding and Pushing Design Challenges, River Publishers, June 2017.

Peer-Reviewed Journal Publications

[J6] - Sai Vineel Reddy Chittamuru*, Ishan Thakkar*, Sudeep Pasricha, "LIBRA: Thermal and Process Variation Aware Reliability Management in Photonic Networks-on-Chip," accepted in IEEE Transactions on Multi-Scale Computing Systems (TMSCS), 2018. (*these authors contributed equally)

[J5] - Ishan Thakkar, Sudeep Pasricha, "DyPhase: A Dynamic Phase Change Memory Architecture with Symmetric Write Latency and Restorable Endurance," accepted in IEEE Transactions on Computer Aided Design (TCAD), 2017.

[J4] - Sai Vineel Reddy Chittamuru*, Ishan Thakkar*, Sudeep Pasricha, "HYDRA: Heterodyne Crosstalk Mitigation with Double Microring Resonators and Data Encoding for Photonic NoCs," IEEE Transactions on Very Large-Scale Integration (TVLSI), 2017. (* these authors contributed equally)

[J3] - Ishan Thakkar, Sudeep Pasricha, "3D-ProWiz: An Energy-Efficient and Optically-Interfaced 3D DRAM Architecture with Reduced Data Access Overhead," IEEE Transactions on Multi-Scale Computing Systems (TMSCS), vol. 1, no. 3, pp. 168-184, Sept 2015. **(Best Paper Candidate)**

[J2] - Ishan Thakkar, Sudeep Pasricha, "3D-WiRED: A Novel WIDE I/O DRAM with Energy-Efficient 3-D Bank Organization," IEEE Design & Test, vol. 32, no. 4, pp. 71-80, Aug 2015.

[J1] - Ishan Thakkar, Kevin L Lear, Jonathan Vickers, Brian Heinze and Kenneth Reardon, "A plastic total internal reflection photoluminescence device for enzymatic biosensing," Lab Chip, vol. 13, no. 34, pp. 4775-4783, Dec 2013.

Peer-Reviewed Conference Publications (20-30% acceptance rate)

[C15] - Sudeep Pasricha, Sai Vineel Reddy Chittamuru, Ishan Thakkar, Varun Bhat, "Securing Photonic NoCs from Hardware Trojans," IEEE/ACM International Symposium on Networks-on-Chip (NOCS), Oct 2018.

[C14] - Sudeep Pasricha, Sai Vineel Reddy Chittamuru, Ishan Thakkar, "Cross-Layer Thermal Reliability Management in Silicon Photonic Networks-on- Chip," ACM Great Lakes Symposium on VLSI (GLSVLSI), 2018.

[C13] - Sai Vineel Reddy Chittamuru, Ishan Thakkar, Varun Bhat, Sudeep Pasricha, "SOTERIA: Exploiting Process Variations to Enhance Hardware Security with Photonic NoC Architectures," IEEE/ACM Design Automation Conference (DAC), to appear, June 2018.

[C12] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "Improving the Reliability and Energy-Efficiency of High-Bandwidth Photonic NoC Architectures with Multilevel Signaling," IEEE/ACM International Symposium on Networks-on-Chip (NOCS), Oct 2017.

[C11] - Sai Vineel Reddy Chittamuru, Ishan Thakkar, Sudeep Pasricha, "Analyzing Voltage Bias and Temperature Induced Aging Effects in Photonic Interconnects for Manycore Computing," ACM System Level Interconnect Prediction Workshop (SLIP), Jun 2017.

[C10] - Ishan Thakkar, Sudeep Pasricha, "DyPhase: A Dynamic Phase Change Memory Architecture with Symmetric Write Latency," IEEE International Conference on VLSI Design (VLSID), Jan 2017.

[C9] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "Mitigation of Homodyne Crosstalk Noise in Silicon Photonic NoC Architectures with Tunable Decoupling," ACM/IEEE International Conference on Hardware/Software Codesign and System Synthesis (CODES+ISSS), Oct 2016. (*26% acceptance rate*)

[C8] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "Run-Time Laser Power Management in Photonic NoCs with On-Chip Semiconductor Optical Amplifiers," IEEE/ACM International Symposium on Networks-on-Chip (NOCS), Aug 2016.

[C7] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "A Comparative Analysis of Front-End and Back-End Compatible Silicon Photonic On-Chip Interconnects," ACM System Level Interconnect Prediction Workshop (SLIP), Jun 2016. **(Best Paper Award)**

[C6] - Sai Vineel Reddy Chittamuru, Ishan Thakkar, Sudeep Pasricha, "PICO: Mitigating Heterodyne Crosstalk Due to Process Variations and Intermodulation Effects in Photonic NoCs," IEEE/ACM Design Automation Conference (DAC), Jun 2016.

[C5] - Sai Vineel Reddy Chittamuru, Ishan Thakkar, Sudeep Pasricha, "Process Variation Aware Crosstalk Mitigation for DWDM based Photonic NoC Architectures," IEEE International Symposium on Quality Electronic Design (ISQED), Mar 2016. **(Best Paper Award Finalist)**

[C4] - Ishan Thakkar, Sudeep Pasricha, "Massed Refresh: An Energy-Efficient Technique to Reduce Refresh Overhead in Hybrid Memory Cube Architectures," IEEE International Conference on VLSI Design (VLSID), Jan 2016.

[C3] - Ishan Thakkar, Sudeep Pasricha, "A Novel 3D Graphics DRAM Architecture for High-Performance and Low-Energy Memory Accesses," IEEE International Conference on Computer Design (ICCD), Oct 2015.

[C2] - Sudeep Pasricha, Ishan Thakkar, "Re-architecting DRAM memory systems with 3D Integration and Photonic Interfaces," Memory Architecture and Organization Workshop (MeAOW), Oct 2014. (Invited)

[C1] - Ishan Thakkar, Sudeep Pasricha, "3D-Wiz: A Novel High Bandwidth, Optically Interfaced 3D DRAM Architecture with Reduced Random Access Time," IEEE International Conference on Computer Design (ICCD), Oct 2014.

Peer-Reviewed PhD Forum

[PF1] - Ishan Thakkar, "Design and Optimization of Emerging Network-Memory Subsystems for Future Manycore Architectures," at the ACM/IEEE Design Automation Conference (DAC) PhD Forum, June 2017.

Conference Tutorials

[TU1] - A. T-Sanial, Sudeep Pasricha, P. Pande, K. Chakrabarty, "3D Integration: Quo Vadis?" Full day tutorial at IEEE Design Automation and Test in Europe Conference, (DATE), Mar 2017. <u>My Contributions</u>: helped with the preparation of the material presented by Sudeep Pasricha.

Invited Talks

[T2] - Ishan Thakkar, "VBTI Aging: Yet Another Critical Design Challenge for Microring Resonator Based Silicon Photonic Interconnects," Silicon Photonics for High-Performance Computing Workshop (SPHPC), May 2018.

[T1] - Sudeep Pasricha, Ishan Thakkar, "Re-architecting DRAM memory systems with 3D Integration and Photonic Interfaces," Memory Architecture and Organization Workshop (MeAOW), Oct 2014.

Conference Poster Presentations

[CP5] - Ishan Thakkar, "Design and Optimization of Emerging Network-Memory Subsystems for Future Manycore Architectures," in PhD Forum at the ACM/IEEE Design Automation Conference (DAC), June 2017.

[CP4] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "Mitigation of Homodyne Crosstalk Noise in Silicon Photonic NoC Architectures with Tunable Decoupling," ACM/IEEE International Conference on Hardware/Software Codesign and System Synthesis (CODES+ISSS), Oct 2016. (26% acceptance rate)

[CP3] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "Run-Time Laser Power Management in Photonic NoCs with On-Chip Semiconductor Optical Amplifiers," IEEE/ACM International Symposium on Networks-on-Chip (NOCS), Aug 2016.

[CP2] - Sai Vineel Reddy Chittamuru, Ishan Thakkar, Sudeep Pasricha, "PICO: Mitigating Heterodyne Crosstalk Due to Process Variations and Intermodulation Effects in Photonic NoCs," IEEE/ACM Design Automation Conference (DAC), Jun 2016.

[CP1] - Ishan Thakkar, Sudeep Pasricha, "A Novel 3D Graphics DRAM Architecture for High-Performance and Low-Energy Memory Accesses," IEEE International Conference on Computer Design (ICCD), Oct 2015.

Research Posters (Non-Conference)

[P2] - Ishan Thakkar, Sai Vineel Reddy Chittamuru, Sudeep Pasricha, "A Comparative Analysis of Front-End and Back-End Compatible Silicon Photonic On-Chip Interconnects," ACM/IEEE Design Automation Conference Work in Progress (WIP), Jun 2016.

[P1] - Ishan Thakkar, Sudeep Pasricha, "Improving the Performance and Power Efficiency of Memory with 3D Stacking and High-Bandwidth Optical Interfacing," CSU Ventures Innovation Forum, Apr 2016.

Patents Submitted

[PAT2] - U.S. provisional patent application serial no. 62/681862, titled "Hardware Security for Photonic Communication Architectures," filed on 6/7/2018.
Inventors: Sai Vineel Reddy Chittamuru, Sudeep Pasricha, Ishan Thakkar

[PAT1] - U.S. provisional patent application serial no. 61/970,155, titled "Low Cost Chemical and Biochemical Sensor," filed on 3/25/14.
Inventors: Ishan Thakkar, Kevin L Lear, Kenneth F Reardon

Educational Activities

M.S. Student Projects Supervised

Varun Kilenje, PNoCs Security. Electrical and Computer Engineering, Colorado State University. Graduated in May 2018

Rohit Kudre, 3D DRAM Optimization. Electrical and Computer Engineering, Colorado State University. Graduated in December 2017

Sai Kiran Koppu, PNoC Optimization. Electrical and Computer Engineering, Colorado State University. Graduated in May 2017

Teaching at UK

EE685-001   Digital Computer Structure   Fall 2018

Other Teaching Experience

Guest Lecture
April 2018
On the topic of "On-Chip Communication and Interconnection Networks On-Chip (NoCs)" in a graduate level course, Computer Organization and Design, at Colorado State University

Guest Lecture
October 2017
On the topic of "On-Chip Communication: Buses and Networks-on-Chip (NoCs)" in a graduate level course, Hardware-Software Design for Embedded Systems at Colorado State University

Guest Lecture
September 2016
On the topic of "On-Chip Communication: Buses and Networks-on-Chip (NoCs)" in a graduate level course, Hardware-Software Design for Embedded Systems, at Colorado State University

Guest Lecture
August 2016
On the topic of "System C Tutorial" in a graduate level course, Hardware-Software Design for Embedded Systems, at Colorado State University

Guest Lecture
October 2015
On the topic of "On-Chip Communication: Buses and Networks-on-Chip (NoCs)" in a graduate level course, Hardware-Software Design for Embedded Systems, at Colorado State University

Teaching Assistant
Fall 2015

For a graduate level course, Computer Organization and Design

Teaching Assistant
Fall 2011
Taught assembly level programming to junior students in an undergraduate course, Introduction to Microprocessors

Teaching Assistant
Spring 2011
For a graduate level course, Engineering Risk Analysis

Expert Lectures
Summer 2010
On "Preparing for Quantitative Aptitude Tests" to senior-level undergraduate students at Genesis Consultants, Institute for Management and Foreign Studies (IMFS), India

Ad-hoc Lecturer
Fall 2009 and Spring 2010
Taught two full courses, "Basics of programming using C and C++" and "Elements of Electrical Engineering" to sophomore undergraduate students at the Venus International College of Technology (VICT), Gandhinagar, Gujarat, India

Expert Lecture
September 2010
On the topic of "Robust Hardware Design for Remotely Controlled Robocars" to undergraduate students at the Venus International College of Technology (VICT), Gandhinagar, Gujarat, India

Professional Development (Participation)

DAC Early Career Workshop
IEEE/ACM Design Automation Conference (DAC), June 2017

Entering Mentoring
Certificate course at Colorado State University, June 2017

NSF Day Workshop
University of Wyoming, May 2017

Interacting with Federal Funding Agencies
Seminar at the Information Science and Technology Center (ISTeC), Colorado State University, April 2015

Professional Service

Conference Organizing Committee Member

Publicity Chair
8th International Green and Sustainable Computing Conference (IGSC), 2017

Conference Technical Program Committee (TPC) Member

32nd International Conference on VLSI Design and 18th International Conference on Embedded Systems, 2019

9th International Green and Sustainable Computing Conference (IGSC), 2018

31st International Conference on VLSI Design and 17th International Conference on Embedded Systems, 2018

8th International Green and Sustainable Computing Conference (IGSC), 2017

Activities as a Reviewer/External Reviewer

Elsevier Journal of Parallel and Distributed Computing, 2018-Present

Springer Design Automation for Embedded Systems, 2018-Present

IEEE/ACM Design and Automation Conference (DAC), 2018

IEEE/ACM Design Automation Conference (DAC), 2017

Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2016-Present

IEEE/ACM International Symposium on Networks-on-Chip (NOCS), 2016

Transactions on Embedded Computing Systems, 2016-Present

Transactions on Multi-Scale Computing Systems, 2015-Present

IEEE Transactions on Very Large-Scale Integration Systems, 2015-Present

Transactions on Design Automation of Electronic Systems, 2015

Journal on Emerging Technologies in Computing Systems, 2014-Present