

Milind Kulkarni

Professor and Interim Head

Elmore Family School of Electrical and Computer Engineering

Purdue University

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West Lafayette, IN 47907

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(updated October 2023)

EDUCATION

North Carolina State University

Raleigh, NC — B.S. in Computer Science (Summa Cum Laude & with Honors), 2002

North Carolina State University

Raleigh, NC — B.S. in Computer Engineering (Summa Cum Laude), 2002

Cornell University

Ithaca, NY — M.S. in Computer Science, 2005

Cornell University

Ithaca, NY — Ph.D. in Computer Science, 2008

ADMINISTRATIVE ACCOMPLISHMENTS

[1] **Data Science Curriculum Development**

Spring 2018–Spring 2020

I spearheaded efforts in the College of Engineering to introduce data science to the curriculum. This included introducing a new data science course that taught data analytics and Python (Spring 2018); this course eventually transformed into a new, required course for all ECE students (Fall 2019), the first required data science course for students in the College of Engineering. I also led efforts to draft data science standards for the College of Engineering.

[2] **ECE Concentrations**

Fall 2021–Summer 2023

I introduced *concentrations* into the ECE undergraduate curriculum, giving students the opportunity to add transcript-visible “tracks” to their degree. I standardized the structure of ECE concentrations, introduced a process for defining new ones, and oversaw the launch of the first concentrations in ECE degrees. I launched four concentrations for the BSEE degree and three concentrations for the BSCmpE degree.

[3] **Minor in AI/ML**

Fall 2021–Fall 2022

I designed and launched the first minor in AI/ML offered at Purdue. This 15-credit program allows non-ECE students to add a transcript-visible credential in AI/ML to their degree without requiring them to commit to a full major.

[4] **Teaching Assistant Programs**

Fall 2021

I led the expansion and standardization of ECE's undergraduate TA program, going from <100 students a semester to >300 students a semester. I oversaw the introduction of new required TA training programs for UTAs and GTAs.

[5] **Teaching Mentoring Program**

Fall 2021

I introduced a *teaching* mentoring program in ECE to complement our existing mentoring program. This involved matching new faculty members with existing faculty members who were accomplished teachers. These mentors were to provide advice regarding best practices, help with teaching concerns, and also to connect new faculty to a broader set of faculty in the School.

[6] **Activities as Interim Head**

Summer 2023–present

I have (i) overseen the hiring of two faculty members, including negotiating offers; (ii) helped steward gifts, including a >\$1M gift-in-kind from Keysight (which was initiated prior to my assumption of the role, but completed under my headship); (iii) restructured the Associate Head for Faculty Mentorship role to incorporate student mentorship; and (iv) reorganized the graduate office to improve efficiency and focus by introducing a Director of Graduate Admissions and a Director of Professional Masters Programs. I have also overseen the first steps of integrating the Purdue in Indianapolis campus, including managing courtesy appointments for IUPUI faculty, and the first steps of Purdue Computes, including working with Computer Science to form joint search committees.

AWARDS & HONORS

- [1] Department of Energy High Performance Computer Science Fellowship, 2004-2008.
- [2] “Optimistic Parallelism Requires Abstractions” selected to appear in Research Highlights in the Communications of the ACM.
- [3] “Structure-driven Optimizations for Amorphous Data-parallel Programs” nominated for best paper at PPOPP 2010. One of 3 nominees.
- [4] NSF CAREER Award (2012)
- [5] Wilfred “Duke” Hesselberth Award for Teaching Excellence (2012)
- [6] DOE Early Career Award (2013)
- [7] Purdue Seed for Success Award (2013)
- [8] Purdue Teaching for Tomorrow Fellow (2014–2015)
- [9] Ruth and Joel Spira Outstanding Teaching Award (2014)

- [10] College of Engineering Exceptional Early Career Teaching Award (2015)
- [11] Presidential Early Career Award for Scientists and Engineers (2016)
- [12] Purdue Seed for Success Award (2016)
- [13] Eta Kappa Nu Outstanding Teacher Award (2018)
- [14] Wilfred “Duke” Hesselberth Award for Teaching Excellence (2018)
- [15] University Faculty Scholar (2018–2023)
- [16] IEEE TCSE Distinguished Paper Award, IEEE International Conference on Software Testing, Verification, and Validation (for Conf. Pub #45) (2019)
- [17] IEEE Senior Member (2019)
- [18] Purdue Seed for Success Award (2019)
- [19] Purdue Seed for Success Award (2020)
- [20] College of Engineering Faculty Excellence Award for Online Education (2021)
- [21] Eta Kappa Nu Outstanding Professor Award (2021)
- [22] Eta Kappa Nu Outstanding Professor Award (2022)
- [23] Charles B. Murphy Outstanding Undergraduate Teaching Award (2022)
- [24] Best Paper Award, ACM International Conference on Supercomputing Award (for Conf. Pub #56) (2022)
- [25] ACM Distinguished Member (2022)
- [26] Eta Kappa Nu Outstanding Professor Award (2023)
- [27] Wilfred “Duke” Hesselberth Award for Teaching Excellence (2023)
- [28] Motorola Excellence in Teaching Award (2023)
- [29] Purdue University Book of Great Teachers (2023)

PROFESSIONAL EXPERIENCE

Postdoctoral Research Associate

Institute for Computational Engineering and Sciences (ICES)

The University of Texas at Austin, Austin, TX

May 2008 – August 2009

Assistant Professor

*School of Electrical and Computer Engineering
Purdue University, West Lafayette, IN
August 2009 – August 2015*

Associate Professor

*School of Electrical and Computer Engineering
Purdue University, West Lafayette, IN
August 2015 – August 2021*

Co-Director

*Center for Programming Principles and Software Systems (PurPL)
Purdue University, West Lafayette, IN
August 2019–present*

Associate Head of Teaching and Learning

*School of Electrical and Computer Engineering
Purdue University, West Lafayette, IN
July 2020 – June 2023*

Professor

*School of Electrical and Computer Engineering
Purdue University, West Lafayette, IN
August 2021 – present*

Director

*Intel-Purdue oneAPI Center of Excellence
Purdue University, West Lafayette, IN
March 2023 – present*

Academic Lead for Online Education, College of Engineering

*College of Engineering
Purdue University, West Lafayette, IN
July 2023 – present*

Interim Head

*School of Electrical and Computer Engineering
Purdue University, West Lafayette, IN
July 2023 – present*

PROFESSIONAL AND HONOR SOCIETY MEMBERSHIPS

Society for Industrial and Applied Mathematics (SIAM)

Member 2010–present
Member of SIAM activity groups on Supercomputing (SIAM SC)

Association of Computing Machinery (ACM)

Member 2008–present

Distinguished Member 2022–present

Member of Special Interest Group on Programming Languages (SIGPLAN)

Institute of Electrical and Electronics Engineering (IEEE)

Member 2008–2019

Senior Member 2019–present

Member of Computer Society

Honor Society of Phi Kappa Phi

Member 2001–present

CONSULTING WORK

[1] **Consultant for FWDNEXT**

Fall 2019

Advised FWDNEXT, a Purdue AI hardware startup, on compilers for their novel hardware platform.

[2] **Faculty Mentor/Consultant for ASEE**

Fall 2020, Fall 2021

Provide mentoring for faculty from MSIs preparing proposals for NSF's CISE-MSI program.

RESEARCH GRANTS AND CONTRACTS RECEIVED

[1] **Adaptive Run-time Systems for Parallel Irregular Programs**

Co-Principal Investigator (PI: Richard Buckius)

PRF XR Research Grant, #204533

6/1/10–5/31/11. \$16,795

[2] **Intel Corporation**

Principal Investigator

Unrestricted Gift

\$35,000

[3] **“CAREER: Toward a locality-enhancing transformation framework for irregular programs”**

Principal Investigator

National Science Foundation, Award No. CCF-1150013

2/1/12–1/31/17. \$418,786.00

[4] **“SLEEC: Semantics-rich Libraries for Effective Exascale Computation”**

Overall Principal Investigator (Joint project. co-PIs: Samuel Midkiff, Vijay Pai, Arun Prakash, Purdue University; Michael Parks, Sandia National Labs)

Department of Energy, Office of Science, ASCR, Award No. DE-FC02-12ER26104

9/1/12–8/31/15. \$1,500,000

- [5] **“Collaborative Research: Conceptualizing an Institute for Using Inter-domain Abstractions to Support Inter-disciplinary Applications”**
Co-Principal Investigator (Joint project. Overall PI: Samuel Midkiff, Purdue University; co-PIs: Vijay Pai, Arun Prakash, James Caruthers, Purdue University; David Padua, John Hart, Philippe Geubelle, UIUC; Keshav Pingali, Ron Elber, Chandrajit Bajaj, University of Texas)
National Science Foundation, Award No. OCI-1216809
10/1/12–9/31/13. \$495,036
- [6] **“Compiler and Run-time Approaches to Enable Large Scale Irregular Programs”**
Principal Investigator
Department of Energy, Office of Science, ASCR, Award No. DE-SC0010295 (Early Career Award)
7/15/13–7/14/18. \$750,000
- [7] **“XPS: CLCCA: On the Hunt for Correctness and Performance Bugs in Large-scale Programs”**
Principal Investigator (co-PIs: Saurabh Bagchi, Michael Gribskov)
National Science Foundation, Award No. CCF-1337158
9/15/13–8/31/15. \$260,331
- [8] **“XPS: CLCCA: On the Hunt for Correctness and Performance Bugs in Large-scale Programs (Supplemental REU)”**
Principal Investigator (co-PI: Saurabh Bagchi)
National Science Foundation, Award No. CCF-1337158
9/15/13–8/31/15. \$16,000
- [9] **“II-New: A Cluster of Nodes with 32 Cores and 256-GB Memory to Enable Many-Core Systems Research and Education”**
Co-Principal Investigator (PI: T.N. Vijaykumar; co-PIs: Mithuna Thottethodi, Vijay Pai, Antony Hosking, Purdue University)
National Science Foundation, Award No. CRI-1405939
8/1/14–7/31/17. \$286,300
- [10] **“CI-EN: Enhancing the Cetus Compiler Infrastructure”**
Co-Principal Investigator (PI: Samuel Midkiff, Purdue University)
National Science Foundation, Award No. CRI-1405954
9/1/14–8/31/17. \$563,944
- [11] **“SHF: Small: Collaborative Research: Hybrid Static-Dynamic Analyses for Region Serializability”**
Principal Investigator
(Joint project. Overall PI: Michael D. Bond, Ohio State University)
National Science Foundation, Award No. CCF-1422178
9/1/14–8/31/17. \$438,706

- [12] **“XPS: FULL: FP: Collaborative Research: Taming parallelism: optimally exploiting high-throughput parallel architectures”**
 Overall Principal Investigator
 (Joint project. co-PI: Kunal Agrawal, Washington University in St. Louis)
National Science Foundation, Award No. CCF-1439126
9/1/14–8/31/18. \$659,821
- [13] **“SLEEC: Semantics-rich Libraries for Effective Exascale Computation (Renewal)”**
 Overall Principal Investigator (Joint project. co-PIs: Samuel Midkiff, Arun Prakash, Purdue University; Michael Parks, Sandia National Labs)
Department of Energy, Office of Science, ASCR, Award No. DE-FC02-12ER26104
9/1/15–8/31/16. \$250,000
- [14] **“Hazards SEES: Bridging Information, Uncertainty, and Decision-Making in Hurricanes using an Interdisciplinary Perspective”**
 Co-Principal Investigator
 (Joint project. Overall PI: Satish Ukkusuri, Purdue University; co-PIs: Seungyoon Lee, Purdue University; Pamela Murray-Tuite, Virginia Tech; Yue Ge, Daniel Klenow, North Dakota State University)
National Science Foundation, Award No. SEES-1520338
11/1/15–10/31/19. \$2,475,000
- [15] **“SI2-SSI: Collaborative Research: ParaTreet: Parallel Software for Spatial Trees in Simulation and Analysis”**
 Principal Investigator
 (Joint project. Overall PI: Tom Quinn, University of Washington; co-PIs: Magdalena Balazinska, University of Washington; Laxmikant Kale, John Hart, UIUC; Derek Richardson, Wolfgang Losert, University of Maryland; Orion Lawlor, University of Alaska)
National Science Foundation, Award No. SEES-1520338
9/1/16–8/31/17. \$473,584
- [16] **“SPX: Collaborative Research: Eat your Wheaties: Multi-Grain Compilers for Parallel Builds at Every Scale”**
 Principal Investigator
 (Joint project. Overall PI: Ryan Newton, Indiana University; co-PIs: Sam Tobin-Hochstadt, Indiana University; Kunal Agrawal, Washington University in St. Louis)
National Science Foundation, Award No. CCF-1725672
8/15/17–7/31/21. \$800,000
- [17] **“IDSEE: Foundations of the Data Mind: An Interlocking Modules Approach”**
 Principal Investigator
 (Co-PIs: Michael Fosmire, Sarah Huber, Wei Zakharov, Libraries; Taylor Davis, Daniel Kelly, Philosophy)
PRF

1/1/18–12/31/18, \$75,000

- [18] **“Multi-modal Energy-optimal Trip Scheduling in Real-time (METS-R) for Transportation Hubs”**
Co-principal Investigator
(Joint project. Overall PI: Satish Ukkusuri, Purdue; Stan Sobolevsky, NYU)
Department of Energy
10/1/18–9/30/20. \$949,984
- [19] **“Model Mining: Learning Models of Safety Critical Systems”**
Principal Investigator
(Co-PI: Karen Marais, AAE)
PRF
8/15/19–8/14/20. \$61,600
- [20] **“HACCLE: High-Assurance Compositional Cryptography: Languages and Environments (Phase I)”**
Principal Investigator
(Co-PIs: Jeremiah Blocki, Benjamin Delaware, Christina Garman, Aniket Kate, Hemanta Maji, Tiark Rompf, Roopsha Samanta)
Intelligence Advanced Research Projects Activity (LARPA)
6/3/19–6/2/20. \$1,856,446
- [21] **“SHF: Small: A Composable, Sound, Optimization Framework for Loops and Recursion”**
Principal Investigator
National Science Foundation (NSF)
10/1/19–9/30/22. \$450,000
- [22] **“SPX: Write Once, Run on Anything: Verified, Tuned Accelerator Kernels from High Level Specifications”**
Principal Investigator
(Co-PIs: Saurabh Bagchi, Felix Lin, Xiaokang Qiu)
National Science Foundation (NSF)
10/1/19–9/30/23. \$1,250,000
- [23] **“Computing Contact Problems with Self-Conforming Hybrid Materials” (Phase I)**
Co-Principal Investigator
(Joint Project. Overall PI: Andres Arrieta Diaz, Purdue; Ilias Bilionis, Purdue; Andy Sarles, UT-Knoxville)
Defense Advanced Research Projects Agency (DARPA)
11/15/19–5/15/21. \$500,000
- [24] **“Computing Contact Problems with Self-Conforming Hybrid Materials” (Phase II)**
Co-Principal Investigator

(Joint Project. Overall PI: Andres Arrieta Diaz, Purdue; Ilias Bilonis, Purdue; Andy Sarles, UT-Knoxville)
Defense Advanced Research Projects Agency (DARPA)
11/15/19–5/15/21. \$500,000

- [25] **Adobe Research**
Principal Investigator
Unrestricted Gift
\$20,000
- [26] **“EMERGENCY: A Unified Framework for Discovering, Modeling, Analyzing & Mitigating Adversarial Emergent Computations”**
Co-Principal Investigator
(Joint Project. Overall PI: Tevfik Bultan, UCSB; Giovanni Vigna, UCSB; Yu Feng, UCSB; Aravind Machiry, Purdue)
Defense Advanced Research Projects Agency (DARPA)
9/1/22–8/31/23. \$800,000
- [27] **“PPoSS: LARGE: A Full-Stack Architecture for Sparse Computation”**
Principal Investigator
(Joint Project. Overall PI: Daniel Sanchez, MIT; Mengjia Yan, Joel Emer, Manya Ghobadi, MIT; Fred Kjolstad, Alex Aiken, Stanford; Dimitris Skarlatos, CMU; Kunal Agrawal, Washington University)
National Science Foundation (NSF)
10/1/22–9/30/27. \$550,000
- [28] **“Language Support for Privacy Preserving Computation”**
Co-Principal Investigator
(PI: Benjamin Delaware)
Cisco Systems
7/1/22–6/30/22. \$163,059

PROFESSIONAL SOCIETY ACTIVITIES

ACM SIGPLAN Symposium on Principles and Practices of Parallel Programming (PPoPP)

Program Committee Member & Session Chair. January 2010
Program Committee Member. January 2011
External Review Committee Member. January 2012
External Review Committee Member. January 2013
Program Committee Member & Session Chair. February 2014
External Review Committee Member. February 2015
Program Committee Member. February 2019
Program Committee Member. February 2021
Program Committee Chair. February 2023
External Review Committee Member. February 2024

**ACM SIGPLAN Workshop on Transactional Computing
(TRANSACT)**

Program Committee Member. April 2010

**IEEE International Parallel & Distributed Processing Symposium
(IPDPS)**

Program Committee Member. May 2011

Program Committee Member. May 2012

Program Committee Member. May 2013

Program Committee Member. May 2018

**International Conference on Parallel Architecture and
Compilation Techniques (PACT)**

Program Committee Member. September 2011

Program Committee Member. September 2021

**ACM SIGPLAN Conference on Programming Languages Design
and Implementation (PLDI)**

External Review Committee Member. June 2011

Program Committee Member. June 2014

External Review Committee Member. June 2015

Program Committee Member. June 2017

External Program Committee Member. June 2018

External Program Committee Member. June 2020

Program Committee Member. June 2021

Program Committee Member. June 2022

General Chair. June 2024

**International Conference for High Performance Computing,
Networking, Storage and Analysis (Supercomputing)**

Program Committee Member & Session Chair. November 2012

Program Committee Member. November 2013

Program Committee Member & Session Chair. November 2014

Program Committee Member. November 2017

Program Committee Member. November 2019

**ACM SIGPLAN Conference on Object Oriented Programming
Languages, Systems and Applications (OOPSLA)**

Program Committee Member. October 2014

Program Committee Member. October 2016

Program Committee Member. December 2022

**IEEE International Symposium on Performance Analysis of
Systems and Software (ISPASS)**

Program Committee Member. April 2018

Program Committee Member. April 2023

ACM SIGPLAN Workshop on Memory Systems Performance and Correctness (MSPC)

Program Committee Co-Chair. June 2014

ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)

Program Committee Member. March 2019

Program Committee Member. March 2020

Program Committee Member. March 2021

International Conference on Compiler Construction (CC)

Technical Program Chair. February 2019

Steering Committee Member. February 2019–present

International Conference on Parallel Processing (ICPP)

Software Track Chair. August 2020

International Symposium on Computer Architecture (ISCA)

Program Committee Member. June 2022

Programming Languages Mentoring Workshop (PLMW)

Panelist, June 2015

Organizer, June 2018

Organizer, June 2019

Organizer, June 2020

Steering Committee Chair, January 2022–January 2023

Steering Committee Member, June 2020–present

PH.D. STUDENTS SUPERVISION COMPLETED

Youngjoon Jo

Ph.D, Electrical and Computer Engineering

December, 2013, “Automatically optimizing tree-traversal algorithms”

Bowen Zhou

Ph.D, Computer Science (Co-advised with Saurabh Bagchi)

December, 2014, “Techniques for detecting scalability bugs”

Nabeel AlSaber

Ph.D, Electrical and Computer Engineering

May, 2015, “SemCache: Semantics aware caching for effective GPU offloading”

M. Hasan Jamal

Ph.D, Electrical and Computer Engineering

December, 2015, “Semantics-aware optimization framework for multi-scale computational methods”

Kanak Mahadik

Ph.D, Electrical and Computer Engineering (Co-advised with Saurabh Bagchi)

August, 2017, “Techniques for Scaling Computational Genomics Applications”

Jad Hbeika

Ph.D., Electrical and Computer Engineering

May, 2019, “Techniques for Managing Irregular Control Flow on GPUs”

Jianqiao Liu

Ph.D., Electrical and Computer Engineering

May, 2019, “Optimizations for N -Body Problems on Heterogeneous Systems”

Nikhil Hegde

Ph.D., Electrical and Computer Engineering

August, 2019, “Distributed Execution of Recursive Irregular Applications”

Laith Sakka

Ph.D., Electrical and Computer Engineering

December, 2019, “Techniques for Automatic Fusion of General Tree Traversals”

Christopher Wright

Ph.D., Electrical and Computer Engineering

May, 2021, “Emulation for Multiple Instruction Set Architectures”

Nouraldin Jaber

Ph.D., Electrical and Computer Engineering (Co-advised with Roopsha Samanta)

August, 2022, “Parameterized Verification and Synthesis for Distributed Agreement-Based Systems”

Charitha Saumya

Ph.D., Electrical and Computer Engineering

August, 2023, “Taming Irregular Control Flow with Targeted Compiler Transformations”

Kirshanthan Sundararajah

Ph.D., Electrical and Computer Engineering

August, 2023, “Composable, Sound Transformations for Nested Recursion and Loops”

MASTER’S THESIS SUPERVISION COMPLETED

Kanad Sinha

M.S., Electrical and Computer Engineering

May, 2011, “Techniques for fine-grained, multi-site computation offloading”

Yusheng Weijiang

M.S., Electrical and Computer Engineering

May, 2015, “Tree dependence analysis”

Shruthi Balakrishna

M.S., Electrical and Computer Engineering

May, 2015, “Characterization of vectorization strategies for recursive algorithms”

Nouraldin Jaber

*M.S., Electrical and Computer Engineering
August, 2015, "Data structure-aware computation offloading"*

Thomas Kennell

*M.S., Electrical and Computer Engineering
August, 2022, "Designing Agora: a shared multi-user programming environment"*

GRADUATE STUDENTS CURRENTLY SUPERVISED

Raghav Malik

Ph.D., Electrical and Computer Engineering

Vani Nagarajan

Ph.D., Electrical and Computer Engineering

Durga Mandarapu

Ph.D., Computer Science

Vidush Singhal

Ph.D., Electrical and Computer Engineering

Adhitha Dias

Ph.D., Electrical and Computer Engineering

Pratyush Das

Ph.D., Computer Science (Co-advised with Xuehai Qian)

Fouad Afiouni

M.S., Electrical and Computer Engineering

ECE PROJECT SUPERVISION COMPLETED

Sergei Uversky

ECE 496, Fall 2013, "Generally Optimizing Tree Traversals on GPUs"

Aline Esquenazi

ECE 296, Fall 2015, "Testing Interface for Command Line Programs"

Qifan Chang

ECE 496, Fall 2019, "Distributed Dynamic Programming"

Vidush Singhal

ECE 496, Spring 2020, "Fused and Parallel Tree Traversals"

Benjamin Gottfried

ECE 496, Spring 2020, "Optimizing Point Cloud Algorithms"

Yi En (Andrew) Gan

ECE 496, Spring 2020, "GPU Processing of kNN Query Points in Groups"

Chieh-En Li

ECE 496, Spring 2020, "Approximate k-Nearest Neighbor on GPUs"

Kabir Sheth

ECE 296, Fall 2021, "Infrastructure for Vectorized FHE"

Kabir Sheth

ECE 496, Fall 2022, "Coyote: A Compiler for Vectorizing Encrypted Arithmetic Circuits"

Logan Anderson

ECE 496, Fall 2022, "Interactive Visualization of Sparse Tensor Computations"

Logan Anderson

ECE 496, Spring 2023, "Autoscheduler for Sparse Tensor Computations"

COURSES DEVELOPED

ECE 29595 – Introduction to Data Science

Spring 2018, Spring 2019

ECE 29595 – Introduction to Data Science [Online]

Online offerings starting Summer 2019

ECE 20875 – Python for Data Science

Fall 2019

ECE 573.1 – Introduction to Compilers: Compiler Basics

Fall 2020 [online]

ECE 573.2 – Introduction to Compilers: Code Generation

Fall 2020 [online]

ECE 573.3 – Introduction to Compilers: Optimization

Fall 2020 [online]

COURSES TAUGHT

ECE 468 – Introduction to Compilers and Translation Systems Engineering

Fall 2010, Fall 2011, Fall 2012, Fall 2013, Fall 2014, Fall 2015, Fall 2017, Fall 2020

ECE 663 – Advanced Optimizing Compilers

Spring 2010

ECE 573 – Compiler and Translation Systems Engineering

Fall 2009, Spring 2011, Fall 2011, Fall 2012, Fall 2013, Fall 2014, Fall 2015, Fall 2020

ECE 573.1/.2/.3 – Introduction to Compilers [online]

Fall 2020, Fall 2021

ECE 264 – Advanced C Programming

Spring 2017, Fall 2021

ECE 29595 – Introduction to Data Science

Spring 2018, Spring 2019

ECE 20875 – Python for Data Science

Fall 2019

ECE 36900 – Discrete Mathematics for Computer Engineering

Spring 2022, Fall 2022, Spring 2023

EPICS – Harnessing the Data Revolution

Fall 2021, Spring 2022, Fall 2022, Spring 2023, Fall 2023

SCHOOL COMMITTEE ACTIVITIES

Graduate Admissions

Member, Fall 2009 – Fall 2014

Associate Director, Fall 2014 – Summer 2020

Curriculum Committee

Member, Fall 2012 – Fall 2014

Undergraduate Committee

Co-chair, Fall 2020 – Spring 2023

ABET Committee

Member, Fall 2022 – Spring 2023

UFS/Rising Stars Committee

Member, Fall 2022 – Summer 2023

ENGINEERING-WIDE COMMITTEE ACTIVITIES

Computational Science and Engineering

ECE representative to CS&E program, Fall 2009 – Summer 2021

Purdue Engineering Initiatives: Initiative in Data Engineering and Applications

Faculty representative, Fall 2019 – Summer 2020

Dean's Engineering Advisory Council

Faculty representative, Fall 2019 – Summer 2022

Undergraduate Advisory Committee

ECE representative, Fall 2020 – Summer 2023

First-Year Engineering Committee

Member, Fall 2021 – Summer 2023

Engineering Area Promotions Committee

Member, Fall 2023 – Present

UNIVERSITY-WIDE COMMITTEE ACTIVITIES

Purdue Young Faculty Association (PYFA)

co-Chair, 6/2010 – 5/2011

Integrative Data Science Initiative (IDSI) Curriculum Committee

CoE representative, Spring 2020 – Summer 2023

JOURNAL ARTICLES

- [1] **An Experimental Study of Self-Optimizing Dense Linear Algebra Software**
Milind Kulkarni and Keshav Pingali
Proceedings of IEEE. 96(5):832–848, 2008
- [2] **Optimistic Parallelism Requires Abstractions**
Milind Kulkarni, Keshav Pingali, Bruce Walter, Ganesh Ramanarayanan, Kavita Bala and L. Paul Chew
Research Highlights. Communications of the ACM (CACM). 52(9):89–97, 2009
- [3] **Debugging High-Performance Computing Applications at Massive Scales**
Ignacio Laguna, Dong H. Ahn, Bronis R. de Supinski, Todd Gamblin, Gregory L. Lee, Martin Schulz, Saurabh Bagchi, Milind Kulkarni, Bowen Zhou, Zhezhe Chen and Feng Qin
Communications of the ACM (CACM). 58(9):72–81, 2015
- [4] **Exploiting Semantics of Temporal Multi-scale Methods to Optimize Multi-level Mesh Partitioning**
M. Hasan Jamal, Arun Prakash and Milind Kulkarni
International Journal of Numerical Methods in Engineering (IJNME). 12(1):58–85, 2017
- [5] **A-RESCUE 2.0. A High Fidelity, Parallel, Agent-based Evacuation Simulator**
Hemant Gehlot, Xianyuan Zhan, Xinwu Qian, Christopher Thompson, Milind Kulkarni and Satish Ukkusuri
Journal of Computing in Civil Engineering (JCCE). 33(2), 2019
- [6] **Processor-Oblivious Record and Replay**
Robert Utterback, Kunal Agrawal, I-Ting Angelina Lee and Milind Kulkarni
ACM Transactions on Parallel Computing (ToPC). 6(4):20:1–28, 2019

- [7] **Extracting SIMD Parallelism from Recursive Task-Parallel Programs**
Bin Ren, Shruthi Balakrishna, Youngjoon Jo, Sriram Krishnamoorthy, Kunal Agrawal and Milind Kulkarni
ACM Transactions on Parallel Computing (ToPC). 6(4):24:1–37, 2019
- [8] **Scalable Genome Assembly through Parallel *de Bruijn* Graph Construction for Multiple *k*-mers**
Kanak Mahadik, Christopher Wright, Milind Kulkarni, Saurabh Bagchi and Somali Chaterji
Nature Scientific Reports. 9:14882, 2019
- [9] **Vision Paper: Grand Challenges in Resilience: Autonomous System Resilience through Design and Runtime Measures**
Saurabh Bagchi, Vaneet Aggarwal, Somali Chaterji, Fred Douglass, Aly El Gamal, Jiawei Han, Brian J. Henz, Henry Hoffman, Suman Jana, Milind Kulkarni, Felix Xiaozhu Lin, Karen B. Marais, Prateek Mittal, Shaoshuai Mou, Xiaokang Qiu and Gesualdo Scutari
IEEE Open Journal of the Computer Society. 1:155–172, 2020
- [10] **Challenges in Firmware Re-Hosting, Emulation, and Analysis**
Christopher Wright, William A. Moeglein, Saurabh Bagchi, Milind Kulkarni and Abraham Clements
ACM Computing Surveys (CSUR). 54(1):5:1–36, 2022

REFEREED CONFERENCE PROCEEDINGS AND PRESENTATIONS

- [1] **Optimistic Parallelism Requires Abstractions**
Milind Kulkarni, Keshav Pingali, Bruce Walter, Ganesh Ramanarayanan, Kavita Bala and L. Paul Chew
Presented paper.
Programming Languages Design and Implementation (PLDI) 2007
San Diego, CA. June 2007. Pages 211–212
- [2] **Optimistic Parallelism Benefits From Data Partitioning**
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- [51] **D2P: From Recursive Formulations to Distributed Memory Codes**

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- [55] **Quicksilver: Modeling and Parameterized Verification for Distributed Agreement-based Systems**
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- [56] **HACCLE: Metaprogramming for Secure Multi-Party Computation**
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- [56] **SparseLNR: Accelerating Sparse Tensor Computations Using Loop Nest Restructuring**

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- [58] **Unirec: A Unimodular-like Framework for Nested Recursion and Loops**
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- [62] **RT-DBSCAN: Accelerating DBSCAN using Ray Tracing Hardware**
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- [63] **RT-kNNS Unbound: Using RT Cores to Accelerate Unrestricted Neighbor Search**
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POSTERS, BRIEF ANNOUNCEMENTS, ETC.

- [1] **Brief Announcement: Locality-Aware Load Balancing for Speculatively-Parallelized Irregular Applications**
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Symposium on Parallelism in Algorithms and Architectures (SPAA) 2010
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- [2] **Brief Announcement: Locality-enhancing Transformations for Tree Traversal Algorithms**
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- [3] **Poster: WuKong: Effective Diagnosis of Bugs at Large System Scales**
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- [4] **Poster: SemCache++: Semantics-aware Caching for Efficient Multi-GPU Offloading**
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- [5] **Poster: MANGO: scalable modularity for transparently elastic cloud applications**
Wei-Chiu Chuang, Charles Killian and Milind Kulkarni
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- [6] **Poster: Exploiting Domain Knowledge to Optimize Mesh Partitioning for Multiscale Methods**
M. Hasan Jamal, Milind Kulkarni and Arun Prakash
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Austin, TX. November 2015.
- [7] **Position Paper: Beyond Big Data-Rethinking Programming Languages for Non-Persistent Data**
Milind Kulkarni and Yung-Hsiang Lu
International Conference on Cloud Computing and Big Data (CCBD) 2015.
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- [8] **Position Paper: Programming Language Support for Analyzing Non-Persistent Data**
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- [9] **Poster: SPIRIT: A Runtime System for Distributed Irregular Tree Applications**
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Presented paper.
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Ottawa, Canada. June 2006.
- [2] **On the Scalability of an Automatically Parallelized Irregular Application**
Martin Burtscher, Milind Kulkarni, Dimitrios Proutzos and Keshav Pingali
21st Annual Workshop on Languages and Compilers for Parallel Computing (LCPC)
Edmonton, Canada. July–August 2008. Pages 109–123
- [3] **Towards Architecture Independent Metrics for Multicore Performance Analysis**
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Third Workshop on Hot Topics in Measurement & Modeling of Computer Systems (HotMetrics) 2010
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- [4] **Abhranta: Localizing Bugs that Manifest at Large System Scales**
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- [5] **Programming Model Support for Dependable, Elastic Cloud Applications**
Wei-Chiu Chuang, Bo Sang, Charles Killian and Milind Kulkarni
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- [6] **Optimizing the LULESH Stencil Code using Concurrent Collections**
Chenyang Liu and Milind Kulkarni
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Austin, TX. November, 2015.
- [7] **Evaluating Performance of Task and Data Coarsening in Concurrent Collections**
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29th International Workshop on Languages and Compilers for Parallel Computing (LCPC) 2016
Rochester, NY. September, 2016.
- [8] **Locality-aware Task-parallel Execution on GPUs**
Jad Hbeika and Milind Kulkarni
29th International Workshop on Languages and Compilers for Parallel Computing (LCPC) 2016
Rochester, NY. September, 2016.

INVITED TALKS

- [1] **“Optimistic Parallelism Benefits From Data Partitioning”**
Intel, Santa Monica, CA. March 26, 2008
IBM T.J. Watson Research Labs, Yorktown Heights, NY. January 31, 2008
- [2] **“The Galois Project”**
CScADS Autotuning Workshop, Snowbird, UT. July 9, 2008
- [3] **“Architecture Independent Metrics for Characterizing Parallelism and Locality”**
ScalPerf Workshop, Bertinoro, Italy. September 23, 2010
- [4] **“Exploiting the Commutativity Lattice”**
Verification of Concurrent Data-Structures (Verico), Austin, TX. January 29, 2011
Dagstuhl Workshop, “Abstractions for Scalable Multicore Computing,” Wadern, Germany, April 19, 2012
- [5] **“Finding and Exploiting Parallelism in Irregular Applications”**
NEC Labs, Princeton, NJ. April 29, 2009
Computer Science Department, Indiana University, Bloomington, IN. April 29, 2010
Department of CS & E, Ohio State University, Columbus, OH. April 22, 2011
- [6] **“Automatically Enhancing Locality in Irregular Applications”**
Illinois-Intel Parallelism Center (I2PC), University of Illinois-Urbana Champaign. September 29, 2011
Parallel Computing Laboratory (ParLab), University of California-Berkeley. February 13, 2012

Lawrence Berkeley National Laboratories, Berkeley, CA. April 6, 2012
Hewlett-Packard Labs, Palo Alto, CA. April 9, 2012
Department of Computer Science, University of Texas–Austin. April 24, 2012
Department of Computer Science, University of California–Riverside. May 14, 2012
Department of Electrical Engineering and Computer Science, University of California–Irvine. May 15, 2012
Department of Computer Science and Engineering, University of California–San Diego. May 16, 2012
Department of Computer Science, University of California–Los Angeles. May 17, 2012
Department of Computer Science, University of Washington. May 8, 2013
Microsoft Research, Seattle, WA. May 9, 2013
Department of Computer Science, University of Chicago. May 4, 2014
School of Engineering and Applied Science, Harvard University, Boston, MA. May 9, 2014
Department of Electrical Engineering and Computer Science, MIT, Boston, MA. May 10, 2014
School of Computer Science, University of Massachusetts–Amherst. May 12, 2014
Department of Computer Science, Rice University, Houston, TX. May 13, 2014
Department of Computer Science, North Carolina State University, Raleigh, NC. April 17, 2015

- [7] **“General Transformations for GPU Execution of Tree Traversals”**
NVIDIA GPU Technology Conference, San Jose, California, March 27, 2014

- [8] **“Efficiently Detecting Cross Thread Memory Dependences to Enforce Stronger Memory Models”**
Dagstuhl Workshop, “Concurrent Computing in the Many Core Era,” Wadern, Germany, January 6, 2015

- [9] **“Regularizing the Irregular: Analyses and Transformations for Recursive, Irregular Applications”**
ACM Workshop on Functional High Performance Computing (FHPC) [Invited Keynote]. Vancouver, BC, Canada. September 3, 2015
MathWorks [Remote Presentation]. Natick, MA. November 6, 2015
Department of Computer Science and Engineering, Washington University in St. Louis [Departmental Colloquium]. St. Louis, MO. November 13, 2015
Department of Computer Science, Indiana University [Departmental Colloquium]. Bloomington, IN. April 8, 2016
Department of Computer Science and Engineering, University of Washington. Seattle, WA. June 8, 2016

- [10] **“Strong Memory Models”**
ACM Workshop on Dynamic Analysis (WODA). Vancouver, BC, Canada. October 23, 2017

- [11] **“Efficient GPU-Only Tree Walks in ChaNGa”**
Workshop on Charm++ and its Applications. University of Illinois, Urbana-Champaign. May 2, 2019

- [12] **“A Framework for Compositional Transformations of Recursion and Loops”**
Symposium on Languages and Compilers for Parallel Computing (LCPC) [Invited Talk]. Atlanta, GA. October 23, 2019
Department of Computer Science, University of Rochester [Departmental Colloquium]. November 6, 2023
Department of Computer Science, University of Illinois–Urbana Champaign. December 4, 2023

PATENTS GRANTED AND PENDING

- [1] **Programming Model to Exploit Parallelism in Multi-core Systems**
Keshav Pingali and Milind Kulkarni
US Patent #8,863,104. Oct 14, 2014
- [2] **Opportunistic Inter-path Reconvergence for GPUs**
Milind Kulkarni and Jad Hbeika
US Patent #11,726,785. August 15, 2023

SOFTWARE ARTIFACTS

- [1] **ParaMeter**
A profiling tool for studying parallelism in irregular applications
<http://iss.ices.utexas.edu/parameter/>
- [2] **LoneStar Benchmark Suite**
A suite of irregular applications that are amenable to optimistic parallelization
<http://iss.ices.utexas.edu/lonestar/>
- [3] **The Galois System**
A speculative parallelization system for irregular applications
<http://iss.ices.utexas.edu/galois/>
- [4] **TreeSplicer**
A compiler toolkit for enhancing locality in tree-based irregular programs
<https://engineering.purdue.edu/plcl/treesplicer/>
- [5] **SimTree**
A C++ compiler for transforming applications for easy vectorization
<https://engineering.purdue.edu/plcl/simtree/>
- [6] **Octet**
A dynamic analysis framework for tracking cross-thread dependences
<http://sourceforge.net/p/jikesrvm/research-archive/43/>
- [7] **EnfoRSer**
A dynamic analysis for enforcing bounded region serializability
<http://sourceforge.net/p/jikesrvm/research-archive/48/>

- [8] **Tree Dependence Analysis**
A static analysis to reason about dependences in tree-based recursive code
<https://bitbucket.org/plcl/tree-dependence-analysis>
- [9] **VectorCilk**
A transformation framework to expose vectorization opportunities in recursive, task-parallel programs
<https://engineering.purdue.edu/plcl/vectorcilk/index.php>
- [10] **Treelogy**
A benchmark suite of various tree traversal programs
<https://bitbucket.org/plcl/treelogy>
- [11] **TreeFuser**
A compiler framework for fusing general recursive tree traversal functions
<https://bitbucket.org/plcl/treefuserrelease>
- [12] **Gibbon**
A compiler for functional programs on serialized data
<https://github.com/iu-parfunc/gibbon>
- [13] **Grafter**
A compiler framework for performing fine-grained fusion for heterogeneous trees
https://bitbucket.org/plcl/grafter_pldi2019/
- [14] **PolyRec**
A compositional framework for transforming nested loops and recursion
<https://bitbucket.org/plcl/polyrec/>

SHORT COURSES TAUGHT, WORKSHOPS ORGANIZED, ETC.

- [1] **“Parallelizing Irregular Applications Through the Exploitation of Amorphous Data Parallelism”**
Short course taught.
Principles and Practices of Parallel Programming, Bangalore, India. January 10, 2010
- [2] **“Parallelizing Irregular Applications Through the Exploitation of Amorphous Data Parallelism”**
Short course taught.
Programming Languages Design and Implementation, Toronto, CA. June 6, 2010
- [3] **“Exploiting Domain Semantics and High-Level Abstractions in Computational Science”**
Birds of a Feather session. Organizer.
Supercomputing, Salt Lake City. November 14, 2012

- [4] **“Leveraging Abstractions and Semantics in High Performance Computing (LASH-C)”**
Workshop. Organizer
co-located with Principles and Practices of Parallel Programming, Shenzhen, China.
February 23, 2013.

- [5] **“ACM SIGPLAN Workshop on Memory Systems Performance and Correctness (MSPC)”**
Workshop. Organizer, Program committee co-chair
co-located with Programming Languages Design and Implementation, Edinburgh, UK.
June 13, 2014.

- [6] **“2015 Midwest PL Summit”**
Workshop. Organizer.
West Lafayette, IN.
December 4, 2015.

- [7] **“Workshop on Compiler Infrastructures for Research and Education (WCIRE)”**
Workshop, Organizer
co-located with Programming Languages Design and Implementation, Barcelona, Spain
June 23, 2017

- [8] **“8th ACM SIGPLAN Programming Languages Mentoring Workshop (PLMW)”**
Workshop, Organizer
co-located with Programming Languages Design and Implementation, Philadelphia, PA
June 19, 2018

- [9] **“28th International Conference on Compiler Construction”**
Conference, Technical Program Chair
Washington, DC.
February 16–17, 2019

- [10] **“12th ACM SIGPLAN Programming Languages Mentoring Workshop (PLMW)”**
Workshop, Organizer
co-located with Programming Languages Design and Implementation, Phoenix, AZ
June 23, 2019

- [11] **“2019 Midwest PL Summit”**
Workshop, Organizer.
West Lafayette, IN.
September 23, 2019

- [12] **“Extending Loop Transformations to Irregular Applications”**
Short course taught
co-located with Principles and Practices of Parallel Programming (PPoPP), San Diego, CA

February 23, 2020

- [13] **“16th ACM SIGPLAN Programming Languages Mentoring Workshop (PLMW)”**
Workshop, Organizer
co-located with Programming Languages Design and Implementation, London, England
June 16, 2020

- [14] **“49th International Conference of Parallel Processing (ICPP)”**
Conference, Software Track Chair
Calgary, Alberta, Canada
August 17–20, 2020

- [15] **“Transforming Loops and Recursion”**
Short course taught
Programming Languages Implementation Summer School (PLISS)
Bertinoro, Italy
October 24–29, 2022

- [15] **“28th ACM SIGPLAN Annual Symposium on Principles and Practice of Parallel Programming”**
Conference, Technical Program Chair
Montreal, Canada
February 25–March 1, 2023

- [16] **“PLDI ’24: ACM SIGPLAN Conference on Programming Languages Design and Implementation”**
Conference, General Chair
Copenhagen, Denmark
June 24–28, 2024