Lindsey Kuper

Cumulative Biobibliography
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Computer Science and Engineering Department
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Research interests

I work on language-based approaches to building parallel and distributed software systems that are correct and efficient. The unifying principle and goal of my work is to use high-level abstractions to express software systems in a way that not only does not compromise performance, but actually enables it.

Employment history

Baskin School of Engineering, University of California, Santa Cruz
July 2018– *Assistant Professor*, Computer Science and Engineering

Intel Labs, **Intel Corporation**, Santa Clara, CA
Feb. 2016–May 2018 *Research Scientist*, Parallel Computing Lab
Sept. 2014–Jan. 2016 *Research Scientist*, Programming Systems Lab

School of Informatics and Computing, Indiana University, Bloomington, IN
Jan. 2009–Aug. 2014 *Research Assistant* and *Associate Instructor*

Mozilla Corporation, Mountain View, CA
May 2012–Aug. 2012 *Research Engineering Intern*, Rust programming language team
March 2011–Aug. 2011 *Research Engineering Intern*, Rust programming language team

GrammaTech, Inc., Ithaca, NY
May 2010–Aug. 2010 *Software Engineering Intern*

Bedford, Freeman and Worth Publishing Group, New York, NY and Portland, OR
July 2006–June 2008 *Associate Project Manager*

IBCTV, LLC, Chicago, IL and Portland, OR
Aug. 2004–June 2006 *Web Designer/Developer*

internalDrive, Inc., Austin, TX and Evanston, IL
June–Aug. 2004 *Instructor*, digital music editing and web design
June–Aug. 2003 *Instructor*, digital music editing, web design, and stop-motion animation

Education

2015 Ph.D., Computer Science, Indiana University School of Informatics and Computing
Research committee: Ryan R. Newton (chair), Lawrence S. Moss, Amr Sabry, Chung-chieh Shan
Dissertation: *Lattice-based Data Structures for Deterministic Parallel and Distributed Programming*

2010 M.S., Computer Science, Indiana University School of Informatics and Computing

2004 B.A., Computer Science and Music (with honors), Grinnell College

Honors and awards

2020 Google Faculty Research Award

2013 PLMW 2013 travel award for POPL

2012 PLMW 2012 travel award for POPL

2010 CRA-W Grad Cohort Workshop invitation and travel award

2009 CRA-W Grad Cohort Workshop invitation and travel award

2009 Google Workshop for Women Engineers invitation and travel award

2008–09 Indiana University Graduate Women in Science Fellowship

2000–04 National Merit Scholarship

Grants

2020 PI: Gift from Amazon Web Services, Inc. to support research toward programming-language-level enforcement of distributed data consistency properties ($78,000)

2020 PI: Google Faculty Research Award, "Consistency-Aware Solvers for Trustworthy Distributed Systems" ($59,961)

2012–15 Collaborator: Co-wrote (with PI Ryan Newton) NSF grant CCF-1218375, "Generalizing Monotonic Data Structures for Expressive, Deterministic Parallel Programming", which funded my dissertation work ($377,315)

Scholarly and creative work

Note: † denotes a student co-author who was one of my advisees.

Conference and workshop papers (all peer-reviewed)

C9. Yiyun Liu, James Parker, Patrick Redmond†, **Lindsey Kuper**, Michael Hicks, and Niki Vazou. "Verifying replicated data types with typeclass refinements in Liquid Haskell." *ACM Conference on Object-Oriented Programming Languages, Systems, and Applications (OOPSLA 2020)*, October 2020.

C8. **Lindsey Kuper** and Peter Alvaro. "Toward domain-specific solvers for distributed consistency." *3rd Summit on Advances in Programming Languages (SNAPL 2019)*, Providence, RI, May 2019.

C7. **Lindsey Kuper**, Guy Katz, Justin Gottschlich, Kyle Julian, Clark Barrett and Mykel J. Kochenderfer. "Toward scalable verification for safety-critical deep networks." *Conference on Systems and Machine Learning (SysML) 2018*, Stanford, CA, February 2018. (Poster available.)

C6. Todd A. Anderson, Hai Liu, **Lindsey Kuper**, Ehsan Totoni, Jan Vitek and Tatiana Shpeisman. "Parallelizing Julia with a non-invasive DSL." *31st European Conference on Object-Oriented Programming (ECOOP 2017)*, Barcelona, Spain, June 2017.

C5. **Lindsey Kuper**, Aaron Todd, Sam Tobin-Hochstadt and Ryan R. Newton. "Taming the parallel effect zoo: extensible deterministic parallelism with LVish." *35th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2014)*, Edinburgh, UK, June 2014.

C4. **Lindsey Kuper** and Ryan R. Newton. "Joining forces: toward a unified account of LVars and convergent replicated data types." *5th Workshop on Determinism and Correctness in Parallel Programming (WoDet 2014)*, Salt Lake City, UT, March 2014.

C3. **Lindsey Kuper**, Aaron Turon, Neelakantan R. Krishnaswami and Ryan R. Newton. "Freeze after writing: quasi-deterministic parallel programming with LVars." *41st ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL 2014)*, San Diego, CA, January 2014.

C2. **Lindsey Kuper** and Ryan R. Newton. "LVars: lattice-based data structures for deterministic parallelism." *2nd ACM SIGPLAN Workshop on Functional High-Performance Computing (FHPC 2013)*, Boston, MA, September 2013.

C1. Andrew W. Keep, Michael D. Adams, **Lindsey Kuper**, William E. Byrd and Daniel P. Friedman. "A pattern matcher for miniKanren, or, how to get into trouble with CPS macros." *10th Annual Workhop on Scheme and Functional Programming (Scheme 2009)*, Boston, MA, August 2009.

Technical reports

TR3. **Lindsey Kuper**, Aaron Turon, Neelakantan R. Krishnaswami and Ryan R. Newton. "Freeze after writing: quasi-deterministic parallel programming with LVars." (56 pages) Indiana University Technical Report TR710, November 2013.

TR2. **Lindsey Kuper** and Ryan R. Newton. "A lattice-theoretical approach to deterministic parallelism with shared state." (60 pages) Indiana University Technical Report TR702, October 2012.

TR1. David Cok, John Phillips, Scott Wisniewski, Suan Hsi Yong, Nathan Lloyd, **Lindsey Kuper**, Denis Gopan and Alexey Loginov. "Safety in numbers." (105 pages) ONR project final report, November 2010.

Invited articles

I1. **Lindsey Kuper**. "My first fifteen compilers." *PL Perspectives* (the SIGPLAN blog), July 2019.

Patents

P2. "Detecting mobile device sensor malfunctions." **Lindsey Kuper** and Justin E. Gottschlich. U.S. Patent 10,591,313 (US 20190101410 A1), issued March 17, 2020.

P1. "Autonomous vehicle advanced sensing and response." Barath Lakshamanan, Linda L. Hurd, Ben J. Ashbaugh, Elmoustapha Ould-Ahmed-Vall, Liwei Ma, Jingyi Jin, Justin E. Gottschlich, Chandrasekaran Sakthivel, Michael S. Strickland, Brian T. Lewis, **Lindsey Kuper**, Altug Koker, Abhishek R. Appu, Prasoonkumar Surti, Joydeep Ray, Balaji Vembu, Javier S. Turek, and Naila Farooqui. U.S. Patent 10,332,320 (US 20180300964 A1), issued June 25, 2019.

Peer-reviewed artifacts

These are software artifacts that have been formally evaluated separately from the companion paper.

A2. Todd A. Anderson, Hai Liu, **Lindsey Kuper**, Ehsan Totoni, Jan Vitek and Tatiana Shpeisman. "Parallelizing Julia with a non-invasive DSL (Artifact)." *Dagstuhl Artifacts Series*, 2017.

A1. **Lindsey Kuper**, Aaron Todd, Sam Tobin-Hochstadt and Ryan R. Newton. "Taming the parallel effect zoo: extensible deterministic parallelism with LVish." PLDI 2014 Artifact Evaluation Process, 2014.)

Selected open source software contributions

2015–17 Contributor to ParallelAccelerator.jl, a library and compiler for high-performance, high-level array-style programming in Julia.

2014–15 Contributor to River Trail, a library, JIT compiler, and web browser extension to enable parallel programming in JavaScript.

2013–15 Contributor to LVish, the Haskell library for deterministic and quasi-deterministic parallel programming based on my dissertation work on LVars.

2011–14 Contributor to the first ten releases of the Rust programming language, and various pre-release versions.

Professional activities

Talks and panel appearances

Oct. 14, 2020 "LVars: lattice-based data structures for deterministic parallel and distributed programming." (Guest lecture for CS294-170: Programming the Cloud, UC Berkeley)

Jan. 21, 2020 "Reasoning Under Uncertainty in SMT Solving, Research, and Life." (Programming Languages Mentoring Workshop at POPL 2020, New Orleans, LA)

July 24, 2019 "A few big ideas from distributed systems." (Blizzard Entertainment, Inc., Irvine, CA)

July 2, 2019 "Toward domain-specific solvers for distributed consistency." (Shonan Meeting No. 143: Programming Language Support for Data-Intensive Applications, Hayama, Japan)

May 16, 2019 "Toward domain-specific solvers for distributed consistency." (SNAPL 2019, Providence, RI)

Feb. 6, 2019 "Domain-specific SMT solving for neural network verification or anything else." (IFIP Working Group 2.16 (Programming Language Design), Portland, OR)

Jan. 24, 2019 "Abstractions for expressive, efficient parallel and distributed computing." (Jane Street Tech Talk, New York, NY)

March 5, 2018 "Abstractions for expressive, efficient parallel and distributed computing." (UC Santa Cruz, Santa Cruz, CA)

May 8, 2017 "Proving that safety-critical neural networks do what they're supposed to!" (The Recurse Center, New York, NY)

Jan. 18, 2017 "A tour of ParallelAccelerator.jl: a library and compiler for high-level, high-performance scientific computing in Julia." (Center for Computer Research in Music and Acoustics, Stanford University, Palo Alto, CA)

June 24, 2016 "A tour of ParallelAccelerator.jl: a library and compiler for high-level, high-performance scientific computing in Julia." (JuliaCon 2016, Cambridge, MA)

April 14, 2016 "Prospect: a library and compiler for high-level, high-performance scientific computing in Julia." (University of California–Berkeley, Berkeley, CA)

Jan. 19, 2016 Panelist, Young Researcher Panel, Programming Languages Mentoring Workshop at POPL 2016, St. Petersburg, FL

Oct. 29, 2015 "Prospect: finding and exploiting parallelism in a productivity language for scientific computing." (SPLASH-I 2015, Pittsburgh, PA)

Oct. 28, 2015 Panelist, "The Future of Programming Languages and Programmers" panel, SPLASH 2015, Pittsburgh, PA

May 26, 2015 "LVars for distributed programming, or, LVars and CRDTs join forces." (IFIP Working Group 2.8 (Functional Programming), Kefalonia, Greece)

Jan. 31, 2015 "LVars: lattice-based data structures for deterministic parallel and distributed programming." (Compose::Conference, New York, NY)

March 24, 2014 "LVars: lattice-based data structures for deterministic parallel and distributed programming." (The Recurse Center, New York, NY)

March 21, 2014 "LVars: lattice-based data structures for deterministic parallel and distributed programming." (Intel Labs, Santa Clara, CA)
March 4, 2014 "LVars: lattice-based data structures for deterministic parallel and distributed programming." (University of Utah, Salt Lake City, UT)
March 2, 2014 "Joining forces: toward a unified account of LVars and convergent replicated data types." (WoDet 2014, Salt Lake City, UT
Jan. 27, 2014 "LVars: lattice-based data structures for deterministic parallel and distributed programming." (Microsoft Research, Mountain View, CA)
Jan. 23, 2014 "Freeze after writing: quasi-deterministic parallel programming with LVars." (POPL 2014, San Diego, CA)
Oct. 31, 2013 "LVars: lattice-based data structures for deterministic parallelism." (Mozilla Corporation, Mountain View, CA)
Oct. 29, 2013 "LVars: lattice-based data structures for deterministic parallelism." (RICON West 2013, San Francisco, CA)
Sept. 23, 2013 "LVars: lattice-based data structures for deterministic parallelism." (FHPC 2013, Boston, MA)
June 10, 2013 "LVars: lattice-based data structures for deterministic parallelism." (The Recurse Center, New York, NY)
Jan. 30, 2013 "A lattice-based approach to deterministic parallelism." (MPI-SWS, Saarbrücken, Germany)
Jan. 25, 2013 "A lattice-based approach to deterministic parallelism." (POPL 2013 student talk session, Rome, Italy)
Sept. 14, 2012 "A lattice-based approach to deterministic parallelism with shared state." (Aarhus University, Aarhus, Denmark)
Aug. 16, 2012 "A lattice-based approach to deterministic parallelism with shared state." (University of California–Berkeley, Berkeley, CA)
Aug. 9, 2012 "Rust typeclasses turn trait-er." (Mozilla Corporation, Mountain View, CA)
April 5, 2012 "Hacking the Rust object system at Mozilla." (Grinnell College, Grinnell, IA; hosted by the Grinnell Alumni Scholars Program)
Aug. 18, 2011 "Some pieces of the Rust object system: extension, overriding, and self." (Mozilla Corporation, Mountain View, CA)
Feb. 23, 2011 "Parametric polymorphism through run-time sealing, or, theorems for low, low prices!" (Northeastern University, Boston, MA)
Aug. 20, 2010 "A system for testing specifications of CPU semantics, or, what I did on my summer vacation." (GrammaTech, Inc., Ithaca, NY)

Leadership positions in professional organizations

Feb. 2019– President of the Board of Directors of the Exclamation Foundation, the nonprofit organization that oversees the !!Con and !!Con West conferences
2020 Co-chair, Programming Languages Mentoring Workshop (PLMW) @ ICFP 2020
2015–18 Steering committee member and publicity chair, ACM SIGPLAN International Conference on Functional Programming (ICFP)
2018 Program co-chair, 2018 Workshop on Domain-Specific Language Design and Implementation (DSLDI 2018)
2017 Program co-chair, 2017 Workshop on Domain-Specific Language Design and Implementation (DSLDI 2017)
2017 General chair, Off the Beaten Track 2017
2016 Program chair, Off the Beaten Track 2016

Program committee membership and other reviewing service

2021 Program committee, 42nd ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2021)
Program committee, 26th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS 2021)

2020 External review committee, 41st ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2020)
Reviewer, POPL 2020

2019 Panelist, National Science Foundation, Directorate for Computer & Information Science & Engineering
Program committee, 10th Workshop on Programming Languages and Operating Systems (PLOS 2019)
Program committee, Workshop on Principles and Practice of Consistency for Distributed Data (PaPoC) 2019
External review committee, 40th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2019)

2018 Program committee, 2018 ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA 2018)
Program committee, SPLASH 2018 Doctoral Symposium
Program committee, 2018 Workshop on Principles and Practice of Consistency for Distributed Data (PaPoC 2018)
External review committee, 39th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2018)

2017 Program committee, 22nd ACM SIGPLAN International Conference on Functional Programming (ICFP 2017)

2016 Panelist, National Science Foundation, Directorate for Computer & Information Science & Engineering
Program committee, 2016 Workshop on Domain-Specific Language Design and Implementation (DSLDI 2016)
External review committee, 30th European Conference on Object-Oriented Programming (ECOOP 2016)
External review committee, 43rd ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL 2016)
Reviewer, PODC 2016

2015 Program committee, 27th Symposium on the Implementation and Application of Functional Programming Languages (IFL 2015)
Program committee, Onward! Papers 2015
Program committee, 2015 Workshop on Principles and Practice of Consistency for Distributed Data (PaPoC 2015)
Program committee, Off the Beaten Track 2015
Reviewer, PLDI 2015
Reviewer, *Distributed Computing*

2014 Program committee, 26th Symposium on the Implementation and Application of Functional Programming Languages (IFL 2014)
Program committee, ACM SIGPLAN Haskell Symposium 2014

2013 Reviewer, ICFP 2013
Reviewer, PPoPP 2013

2012 Reviewer, *ACM Transactions on Programming Languages and Systems (TOPLAS)*
Reviewer, PLPV 2012

Media appearances

2020 "Not your Typical Tech Conference: !!Con West Brings Joy, Excitement, and Surprise to Computing." *Santa Cruz Tech Beat*, March 2020.
2019 "The thrill of computing: Inaugural !!Con West Conference revels in the playful side of high tech, letting participants 'experience computing viscerally'." *UC Santa Cruz Magazine*, March 2019.
2018 "#267: Cute and Squishy." *Embedded.fm* podcast, Nov. 8, 2018.
2016 "Epsiode 13: Lindsey Kuper on a new kind of computing conference." *PG Podcast*, Aug. 23, 2016.

Other professional activities

2013–14 Three week-long invited residencies (summer 2013, fall 2014, winter 2014) at the Recurse Center, a free, self-directed educational retreat for programmers

University and public service

Service to the Department

2019–21 Member of Undergraduate Curriculum Committee
2019–20 Member of Graduate Admissions Committee
2018–19 Member of Faculty Recruitment Committee for Software Foundations

Service to the Baskin School of Engineering

April 12, 2019 Panelist for presentation to CSin3 cohort students on BSOE graduate programs, CSU Monterey Bay

Service to the University

Jan. 30, 2019 Faculty Dinner, Scientist in Residence Program, Oakes College
Oct. 11, 2018 Panelist, *Word from the W.I.S.E. (Women in Science and Engineering)* event, Oakes College

Other outreach

2014– Co-founder and organizer of the !!Con and !!Con West conferences of ten-minute talks on the joy, excitement, and surprise of computing
2015 Program committee member, *Tiny Transactions on Computer Science* volume 3, the premier venue for peer-reviewed computer science research of $\leq$140 characters

At Indiana University

2013–14 Student member of Graduate Education Committee, Computer Science Program
2010–14 Website and mailing list administrator, Programming Languages Group
2011–13 Officer, Computer Science Club
2010–12 Organizer, Programming Languages Colloquium Series
2012 Co-organizer and program committee member, Indiana Celebration of Women in Computing (InWIC) 2012
2010–11 President, Computer Science Graduate Student Association
2010–11 Steering Committee member, Women in Informatics and Computing

Mentoring and student advising

Doctoral students

Dates	Relationship	Degree Year	Name and Activities
Summer 2020–present	Primary Supervisor		Patrick Redmond
Fall 2019–present	Primary Supervisor		Gan Shen
Spring 2019	Other Advisor		Kamala Ramasubramanian Member of Qualifying Examination Committee, Member of Dissertation Committee Title: "Solving distributed systems problems by analyzing explanations in aggregate"

Master's students

Dates	Relationship	Degree Year	Name and Activities
Winter 2020–present	Primary Supervisor		Farhad Yalmaz
Fall 2019	Other Advisor	2019	Ana McTaggart Member of Master's Project Committee Title: "FLORAM: improving the efficiency of Oblivious RAM with formal languages"

Undergraduate students

Dates	Relationship	Degree Year	Name and Activities
Fall 2019–Spring 2020	Other Advisor	2020	Matthew Rhea
Spring 2013	Other Advisor	2015	Isaiah Weating Mentor for undergraduate research project Awarded third place in Indiana University Undergraduate Research Opportunities in Computing (UROC) poster competition for "Parallel Programming with LVars", May 2013

Courses taught

2020-21

Quarter	Name	Enrolled	Co-taught	% Evals Retd.
Fall	CSE232 Distributed Systems			

2019-20

Quarter	Name	Enrolled	Co-taught	% Evals Retd.
Fall	CSE290Q Topics in Programming Languages: SMT Solving and Solver-Aided Systems	8	no	50%
Winter	CSE30 Programming Abstractions: Python	231	no	15%
Spring	CSE138 Distributed Systems	99	no	40%

2018-19

Quarter	Name	Enrolled	Co-taught	% Evals Retd.
Fall	CMPS290S Advanced Topics in Computer Systems: Languages and Abstractions for Distributed Programming	6	no	67%
Spring	CMPS128 Distributed Systems	84	no	55%

At Indiana University (Associate Instructor)

Fall 2011	CSCI H211 Introduction to Computer Science, Honors, taught by Will Byrd
Spring 2010	CSCI C311 Programming Languages, taught by Dan Friedman
Fall 2009	CSCI B521 Programming Language Principles, taught by Dan Friedman
Fall 2009	CSCI C311 Programming Languages, taught by Dan Friedman
Spring 2009	CSCI C311 Programming Languages, taught by Dan Friedman