
CURRICULUM VITAE

Matthew Anderson

CONTACT INFO

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EDUCATION

University of Wisconsin-Madison

Ph.D., Computer Sciences, August 2012
• Advisor: Dieter van Melkebeek
• Minor: Mathematics
M.S., Computer Sciences, May 2009

Carnegie Mellon University

B.S., Computer Science, May 2004
B.S., Physics, May 2004

RESEARCH INTERESTS

Theory of Computing, Computational Complexity, Algebraic Complexity, Circuit Complexity, Descriptive Complexity, Derandomization, Lower Bounds, High Performance Computing, Virtual Reality

RESEARCH & TEACHING EXPERIENCE

Union College

Assistant Professor

Fall 2019 – Present

Visiting Assistant Professor

Fall 2014 – Summer 2019

Responsible for teaching six undergraduate courses per year, advising students, supervising senior projects, performing research, and providing service to the college.

Courses taught:

- Intro to CS: Game Development (CSC 105), Fall 2015, Fall 2017, Fall 2018, Spring 2019
- Intro to CS: Can Computers Think? (CSC 106), Spring 2016.
- Intro to CS: Scientific Computing (CSC 108), Fall 2019.
- Intro to CS for Engineers (CSC 109), Fall 14, Winter 2015, Winter 2016, Spring 2017.
- Data Structures Lab (CSC 150L), Spring 2015, Winter 2017.
- Modeling & Simulation (CSC 235), Winter 2015.
- CS of Computer Games (CSC 245), Winter 2017.
- Algorithm Design & Analysis (CSC 250), Spring 2016, Spring 2017, Spring 2018, Spring 2019.
- Operating Systems (CSC 335), Spring 2015, Spring 2018.
- Theory of Computing (CSC 350), Fall 2015, Fall 2017.
- Programming Languages (CSC 370), Fall 2014, Winter 2017, Fall 2018.
- Computer Graphics (CSC 385), Winter 2018.
- Special Topics: Computer Security (CSC 483), Winter 2018.

Independent studies: Programming Languages, Summer 2016; Computational Complexity Theory Reading Group, Summer 2017; Quantum Computing, Fall 2018; Operating Systems (3), Spring 2019.

Simons Institute for the Theory of Computing, University of California, Berkeley

Fellow August 2016 – December 2016
Performed research in descriptive complexity in Logical Structures in Computation program.

Technion, Israel Institute of Technology

Postdoctoral Researcher April 2014 – August 2014
Performed postdoctoral research in circuit complexity under the supervision of Prof. Amir Shpilka.

University of Cambridge

Research Associate July 2012 – March 2014
Performed postdoctoral research in descriptive complexity under the supervision of Prof. Anuj Dawar.

University of Wisconsin-Madison

Research Assistant Summer 2009 – Summer 2012
Performed research pursuant to a Ph.D. under the supervision of Prof. Dieter van Melkebeek.

Instructor Fall 2005 – Fall 2006
Taught Introduction to Computer Programming (CS 302). Responsible for lectures, grades, and office hours. Shared responsibility in developing homework assignments and exams.

Teaching Assistant Various Semesters, 2004 – 2009
Assisted instructors with their courses by performing the following duties: leading labs, developing homework assignments, grading exams and homework, and holding office hours. Assisted in the following courses: Introduction to Computer Programming (CS 302), Introduction to Data Structures (CS 367), Introduction to Numerical Methods (CS 412), Introduction to Computer Networks (CS 640), Principles of Programming Languages (CS 704).

University of California, Los Angeles

Summer Researcher Summer 2003
Contributed to Fortran computer simulations studying construction tolerances for the Linac Coherent Light Source being built at the SLAC National Accelerator Laboratory.

Carnegie Mellon University

Undergraduate Teaching Assistant Fall 2001, Fall 2002 – Fall 2003
Assisted a graduate teaching assistant during discussion sections of the introductory physics course. Shared responsibility for grading, helping students in small groups, and tutoring.

Tutor Fall 2002 – Spring 2003
Staffed physics course center that provided tutoring for all upper-level undergraduate physics courses.

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- PUBLICATIONS [J6] M. Anderson, M. A. Forbes, R. Saptharishi, A. Shpilka, and BL. Volk. *Identity Testing and Lower Bounds for Read- k Oblivious Algebraic Branching Programs*. ACM Transactions on Computation Theory (TOCT), volume 10, issue 1, pages 3:1–28, 2018.
- [J5] M. Anderson and A. Dawar. *On Symmetric Circuits and Fixed-Point Logics*. Theory of Computing Systems (TOCS), volume 60, issue 3, pages 521–551, 2017.
- [C5] M. Anderson, M. A. Forbes, R. Saptharishi, A. Shpilka, and BL. Volk. *Identity Testing and Lower*

Bounds for Read-k Oblivious Algebraic Branching Programs. In Proceedings of the 31st Annual IEEE Conference on Computational Complexity (CCC), pages 30:1–30:25, 2016.

- [J4] C. Etherington, M. Anderson, E. Bach, J. Butler, and P. Stanica. *A Parallel Approach in Computing Correlation Immunity up to Six Variables.* International Journal of Foundations of Computer Science (IJFCS), volume 27, issue 4, pages 511–528, 2016.
- [J3] M. Anderson, A. Dawar, and B. Holm. *Solving Linear Programs without Breaking Abstractions.* Journal of the ACM (JACM), volume 62, issue 6, pages 48:1–48:26, 2015.
- [J2] M. Anderson, D. van Melkebeek, and I. Volkovich. *Deterministic Polynomial Identity Tests for Multilinear Bounded-Read Formulae.* Computational Complexity, volume 24, issue 4, pages 695–776, 2015.
- [C4] M. Anderson, and A. Dawar. *On Symmetric Circuits and Fixed-Point Logics.* In Proceedings of the 31st International Symposium on Theoretical Aspects of Computer Science (STACS), pages 41–52, 2014.
- [C3] M. Anderson, A. Dawar, and B. Holm. *Maximum Matching and Linear Programming in Fixed-Point Logic with Counting.* In Proceedings of the 28th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS), pages 173–182, 2013.
- [J1] M. Anderson, D. van Melkebeek, N. Schweikardt, and L. Segoufin. *Locality from Circuit Lower Bounds.* SIAM Journal on Computing (SICOMP), volume 41, issue 6, pages 1481–1523, 2012.
- [C2] M. Anderson, D. van Melkebeek, and I. Volkovich. *Derandomizing Polynomial Identity Testing for Multilinear Constant-Read Formulae.* In Proceedings of the 26th Annual IEEE Conference on Computational Complexity (CCC), pages 273–282, 2011.
- [C1] M. Anderson, D. van Melkebeek, N. Schweikardt, and L. Segoufin. *Locality of Queries Definable in Invariant First-Order Logic with Arbitrary Built-in Predicates.* In Proceedings of the 38th International Colloquium on Automata, Languages and Programming (ICALP), Part II, pages 368–379, 2011. Invited to the special issue for selected papers from the conference.

WORK IN
PREPARATION

- [P2] M. Anderson, Z. Ji, and A. Yang. *Matrix Multiplication: Verifying Strong Uniquely-Solvable Puzzles.* 20 pages.
- [P1] M. Anderson. *Lower Bounds for Symmetric Circuits.* 5 pages.

WORK IN
PROGRESS

M. Anderson and J. Kimber. *Matrix Multiplication: Searching for Strong Uniquely-Solvable Puzzles.*
M. Anderson and I. Scilipoti. *A Virtual Reality Interface for Robot Control.*

THESES

M. Anderson. *Advancing Algebraic and Logical Approaches to Circuit Lower Bounds.* University of Wisconsin-Madison, Ph.D. Thesis, 2012.
M. Anderson. *QCNMR: Simulation of a Nuclear Magnetic Resonance Quantum Computer.* Carnegie Mellon University, Senior Honors Thesis, 2004.

SUMMER RESEARCH
FELLOWS

Supervised Union College undergraduate summer fellows working on my research: Z. Ji (2016), Z. Ji (2017), A. Yang (2017), J. Kimber (2018), I. Scilipoti (2018), A. Dhasmana (2019), K. Doney (2019), C. Munoz (2019), J. Ramirez (2019).

PRESENTATIONS

Privacy, Trust, and Identity

- Union College Academy for Lifelong Learning, Schenectady, New York, October 2018.

Computer-Aided Search for Matrix Multiplication Algorithms

- Logical Structures in Computation Reunion Workshop, Berkeley, California, December 2017.

Derandomization, Lower Bounds, and Polynomial Identity Testing

- Union College, Schenectady, New York, April 2017.

Solving Linear Programs without Breaking Abstractions

- Rutgers University, New Brunswick, New Jersey, March 2017.

NP-Completeness and Gerrymandering

- Berkeley Math Circle, Berkeley, California, November 2016.

Symmetry, Logics, and Circuits

- Simons Institute, Berkeley, California, October 2016.

Maximum Matching and Linear Programming in Fixed-Point Logic with Counting

- RWTH Aachen University, Aachen, Germany, January 2014.
- Symposium on Logic in Computer Science, New Orleans, Louisiana, June 2013.

On Symmetric Circuits and Fixed-Point Logics

- Simons Institute, Berkeley, California, November 2018.
- Symposium on Theoretical Aspects of Computer Science, Lyon, France, March 2014.
- Symposium on Logic in Computer Science, New Orleans, Louisiana, June 2013.

Locality from Circuit Lower Bounds

- Midwest Theory Day, Chicago, Illinois, November 2011.
- Colloquium on Automata, Languages and Programming, Zurich, Switzerland, July 2011.

Deterministic Polynomial Identity Tests for Multilinear Bounded-Read Formulae

- Indiana State University, Terre Haute, Indiana, March 2012.
- University of Michigan, Ann Arbor, Michigan, January 2012.
- Conference on Computational Complexity, San Jose, California, June 2011.
- Dagstuhl Seminar on the Computational Complexity of Discrete Problems, Germany, March 2011.
- Midwest Theory Day, Chicago, Illinois, December 2010.

SENIOR PROJECTS

Two-term senior projects supervised at Union College.

- D. Agadzhanova. *Improving Polynomial Time Approximation Algorithms for TSP*. 2019.
- N. Lockwood. *Geometry-Mapped Line Stylization*. 2019.
- R. Quiogue. *Preventing Browser Fingerprinting by Randomizing Canvas*. 2019.
- I. Scilipoti (with A. Cass). *A Virtual Reality Interface for Terrain Modeling*. 2019.
- H. Aung. *Generative Adversarial Networks for Dynamic Rendering of Terrain Textures*. 2018.
- D. Lee. *Blockchain Consensus: Secure and Fast Transactions*. 2018.
- S. Manwaring. *Combining VR and Gamification to Improve Academic Performance*. 2018.
- A. Pieper. *Heuristic Algorithms for Bike Route Generation*. 2018.
- L. Badini. *Program Satisfaction Based on the Perception of Bugs as Features*. 2017.
- J. Enquist. *The Effects of Intermittent Gaming On Word Memorization*. 2017.
- Y. Lan. *Detecting Confusion Using Eye-Tracking and Machine Learning Techniques*. 2017.
- J. Cohen. *SoundByte: An iOS Application to Enhance Music Discovery*. 2016.
- J. Curbow. *Blending Two Automatic Playlist Generation Algorithms*. 2016.
- J. Loew. *Examining the Viability of MINIX 3 as a Consumer Operating System*. 2016.
- S. DiIorio. *Optimizations for Rendering Realistic Lens Flares in Polynomial Optics*. 2015.

- A. Ivarson (with J. Spinelli). *Examining Self-Modifying Code*. 2015.
- J. Kline (with W. Zwicker). *Analysis of the PeerRank Method for Peer Grading*. 2015.

SERVICE

Committee Member

- Division 4 Liaison to Information Technology Services (ITS), Union College, Fall 2015 – Present. Provided feedback on college-wide technology policy and communicated these policies with faculty in my division. Bought faculty concerns to the attention of ITS. Helped improve and raise awareness of a new data classification policy and its impacts.
- CS Department System Administrator Search Committee, Union College, 2016.
- CS Department Liaison to Notice-Choose-Tell, Union College, 2015.
- CS Graduate Admissions, University of Wisconsin-Madison, Spring 2005.

Coach

Fall 2005 – Spring 2009, Fall 2014 – Present

Helped to prepare teams of students for participation in the ACM International Collegiate Programming Contest (ICPC). Responsibilities include leading discussions with students, selecting and solving practice problems, organizing practices, managing logistics, and acting as a chaperon.

Reviewer

Ongoing

Symposium on Theory of Computing (STOC), Symposium on Foundations of Computer Science (FOCS), Conference on Computational Complexity (CCC), Transactions on Computation Theory (ToCT), SIAM Journal on Computing (SICOMP), Workshop on Randomization and Computation (RANDOM), Computability in Europe (CiE), Logical Methods in Computer Science (LMCS), Artificial Life, ACM India Doctoral Dissertation Award, ACM ICPC North American Qualifier

PROFESSIONAL
EXPERIENCE

Netrics Inc., Princeton, NJ

Software Intern

Summer 2001, 2002

Developed a software testing suite, executed performance studies and implemented optimizations for database search software running on multi-processor servers.

PROGRAMMING
LANGUAGES

Python, C/C++, Java, Javascript, ML, Scheme, MATLAB, Mathematica, Fortran, QBasic, L^AT_EX

HONORS, AWARDS,
AND GRANTS

Stanley Black & Decker Research Grant – 2019
 Cisco Systems Distinguished Graduate Fellowship – 2011
 SIGACT STOC Student Travel Grant – 2011
 Vilas Travel Grant – 2011
 ACM ICPC World Finalist, Head Coach – 2009
 ACM ICPC World Finalist, Assistant Coach – 2006, 2007, 2008
 ACM ICPC World Finalist, Contestant – 2005
 Honor Society Member: Phi Beta Kappa, Phi Kappa Phi, Lambda Sigma
 National Society of Collegiate Scholars Member – 2001
 AP Scholar with Distinction – 2000

ORGANIZATION
MEMBERSHIP

Association for Computing Machinery, Computational Complexity Foundation