William DeMeo

CURRICULUM VITÆ

CONTACT INFORMATION

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RESEARCH INTERESTS

Universal algebra, logic, category theory, type theory, complexity, programming languages.

Applications: proof mechanization in Lean & Coq, big data analysis in Scala/Spark, machine learning.

EDUCATION

Doctor of Philosophy in Mathematics — University of Hawai'i at Mānoa 2012
Thesis: Congruence lattices of finite algebras — Advisor: Ralph Freese

Master of Science in Mathematics — New York University, Courant Institute 1998
Thesis: Approximating eigenvalues of large stochastic matrices — Advisor: Jonathan Goodman

Bachelor of Arts in Economics — University of Virginia 1994

ACADEMIC APPOINTMENTS

Postdoctoral Researcher — Algebra Dept, Charles University, Prague 2019–
Burnett Meyer Instructor — Mathematics Dept, University of Colorado, Boulder 2017–2019
Visiting Assistant Professor — Mathematics Dept, University of Hawai'i at Mānoa 2016–2017
Postdoctoral Associate — Mathematics Dept, Iowa State University, Ames 2014–2016
Visiting Assistant Professor — Mathematics Dept, Univ. South Carolina, Columbia 2012–2014

PROFESSIONAL EXPERIENCE

Senior Research Scientist — Textron Systems Corporation 2001–2006
Role: algorithm design and complexity analysis for image processing and dsp research.

GRANTS & AWARDS

NSF Research Grant (no. 1500218) 2015–2018
Project Title: *Algebras and algorithms, structure and complexity theory*
Role: postdoctoral fellow on a team with 6 senior scientists and 3 postdocs
Description: 3-yr collaborative research on algebraic approaches to constraint satisfaction problems

Magellan Scholar Grant 2013–2014
Project Title: *What does a nonabelian group sound like?*
Role: faculty mentor for undergraduate research
Description: see soundmath.github.io/GroupSound/GroupSound

ARCS Sarah Ann Martin Award for Outstanding Research in Mathematics — Honolulu 2011

Best Paper Award, International Symposium on Musical Acoustics — Nara 2004

PUBLICATIONS

Journal Articles

1. Bounded homomorphisms and finitely generated fiber products of lattices, with P. Mayr and N. Ruskuc; submitted for publication in *International Journal of Algebra & Computation (IJAC);* preprint link: arXiv:1907.08046 [math.LO]
2. Universal algebraic methods for constraint satisfaction problems, with Clifford Bergman; accepted for publication in *Logical Methods in Computer Science (LMCS);* preprint link: arXiv [cs.LO] 1611.02867
3. Polynomial-time tests for difference terms in idempotent varieties, with Freese and Valeriote; accepted for publication in *International Journal of Algebra & Computation (IJAC);* preprint link: diffTerm-ijac-draft-195036.pdf
4. Isotopic algebras with nonisomorphic congruence lattices *Algebra Universalis* **72**:295–298, 2014; preprint link: Isotopy-AU-2014.pdf
5. Expansions of finite algebras and their congruence lattices *Algebra Universalis* **69**:257–278, 2013; preprint link: DeMeo-Expansions-AU-2013.pdf

Publications (continued)

Refereed Conference Proceedings

6. Proceedings of Algebras and Lattices in Hawaii 2018 editor with K. Adaricheva, J. Hyndman; preprint link.
7. Topics in nonabelian harmonic analysis and DSP applications *Proceedings of the International Symposium on Musical Acoustics* Nara, Japan 2004 (best paper award); preprint link.
8. Characterizing musical signals with Wigner-Ville interferences *Proceedings of the International Computer Music Conference (ICMC);* Göteborg, Sweden 2002; preprint link.
9. Approximating eigenvalues of large stochastic matrices *Proceedings of the 8th Copper Mt. Conference on Iterative Methods* Colorado, USA 1998 preprint link.

Papers in Progress

Representing finite lattices as congruence lattices of finite algebras, with R. Freese and P. Jipsen.

Books in Progress

Category Theory: a concise course‡ with Charlotte Aten and Venanzio Capretta.

Categories & **A**lgebras & **T**ypes in Action: with computer-aided proofs, with Hyeyoung Shin.

Complex Analysis Exams‡

Real Analysis Exams‡

‡ Draft available at mathematicalanalysis.org.

Summer Schools Attended

Midlands Graduate School in the Foundations of Computing Science Topics: lambda calculus, category theory, univalent type theory in Agda	University of Birmingham April 14–18, 2019
Oregon Programming Languages Summer School Topics: parallelism and concurrency	University of Oregon July 3–21, 2018
Computer-aided Mathematical Proof Topics: bringing proof technology into mainstream mathematics	Cambridge University July 10–14, 2017
Oregon Programming Languages Summer School Topics: dependent, gradual, substructural type systems	University of Oregon June 26–July 8, 2017
Midlands Graduate School in the Foundations of Computing Science Topics: type theory, denotational semantics, category theory	University of Birmingham April 11–15, 2016
Oregon Programming Languages Summer School Topics: type theory, logic, semantics, verification	University of Oregon June 16–28, 2014
Midlands Graduate School in the Foundations of Computing Science Topics: simply typed lambda calculus, domain theory, category theory	University of Nottingham April 22–26, 2014
LMS/EPSRC Short Course in Computational Group Theory Topics: permutation & finitely presented groups, constructive recognition	University of St. Andrews Jul 29–Aug 2, 2013
NATO ASI on Computational Noncommutative Algebra	Il Ciocco, Italy, 2003

Data Science Credentials

Big Data Analysis with Scala and Spark 4-week Coursera course; grade: 93.4%	École Polytechnique Fédérale de Lausanne Verified Certificate earned 24 Nov 2017
Functional Programming Principles in Scala 6-week Coursera course; grade: 100%	École Polytechnique Fédérale de Lausanne Verified Certificate earned 17 Nov 2016
Functional Program Design in Scala 4-week Coursera course; grade: 100%	École Polytechnique Fédérale de Lausanne Verified Certificate earned 6 Aug 2016
Parallel Programming in Scala 4-week Coursera course; grade: 100%	École Polytechnique Fédérale de Lausanne Verified Certificate earned 27 Jun 2016
Startup Engineering 12-week Coursera course; grade: 99.3%	Stanford University Verified Certificate earned 23 Sep 2013

Synergistic Activities

Organizer, *BLAST 2019 Conference*	Boulder 2019
Organizer, *Algebras and Lattices in Hawai'i Conf. to honor Freese, Lampe & Nation*	Honolulu 2018
Organizer, *Workshop on Computational Universal Algebra*	Louisville 2013
Referee for *Algebra Universalis*, *Order*, and *J. Logic & Analysis*	2012–present
Editor for *Algebra Universalis*	2018–present

University of Colorado, Boulder

Served on doctoral candidacy exam committee for the following ph.d. students:

Jordan DuBeau; exam topics: group theory, model theory, set theory.
Ali Latfi; exam topics: category theory, commutative algebra, model theory.
Athena Sparks; exam topics: computability theory, group theory, model theory.
Michael Wheeler; exam topics: category theory, model theory, set theory.

Served on dissertation defense committee for
Jeffrey Shriner; thesis title: Hardness results for the subpower membership problem.

Iowa State University

REU mentor for Charlotte Aten (mathematics major, University of Rochester)
Honors thesis advisor for Joshua Thompson (mathematics major, honors program)
Putnam Exam mentor at weekly exam practice meetings
Undergraduate Tea cohost of weekly undergraduate student gatherings
Iowa 4-H Youth Conference volunteer mentor (link)

University of South Carolina

Honors thesis mentor for Matthew Corley (computer science major, honors program)
South Carolina High School Math Contest exam design committee
Faculty mentor for Pi Mu Epsilon (math honors society)

Teaching Experience

University of Colorado, Boulder (as Burnett Meyer Instructor)

Math 2001: Discrete Mathematics	Spring 2019
Math 2001: Discrete Mathematics	Fall 2018
Math 3140: Abstract Algebra	Fall 2018
Math 6000: Model Theory (graduate course)	Spring 2018
Math 2130: Linear Algebra	Spring 2018
Math 2130: Linear Algebra	Fall 2017

University of Hawaii (as Visiting Assistant Professor)

Math 215: Applied Calculus	Spring 2017
Math 480: Senior Seminar	Spring 2017
Math 244: Calculus IV	Fall 2016
Math 321: Introduction to Advanced Math	Fall 2016

Iowa State University (as Postdoctoral Associate)

Math 317: Linear Algebra	Spring 2016
Math 317: Linear Algebra	Fall 2015
Math 160: Survey of Calculus	Fall 2015
Math 207: Elementary Linear Algebra	Spring 2015
Math 165: Calculus I	Spring 2015
Math 301: Abstract Algebra	Fall 2014
Math 165: Calculus I	Fall 2014

Teaching Experience (continued)

University of South Carolina (as Visiting Assistant Professor)

Math 700: Linear Algebra (graduate course)	Spring 2014
Math 141: Calculus I	Spring 2014
Math 374: Discrete Structures	Fall 2013
Math 122: Calculus for Business and Social Sciences	Fall 2013
Math 374: Discrete Structures	Spring 2013
Math 122: Calculus for Business and Social Sciences	Spring 2013
Math 241: Vector Calculus	Fall 2012
Math 122: Calculus for Business and Social Sciences	Fall 2012

University of Hawaii (as Graduate Student Instructor)

Math 371: Probability Theory	Summer 2011
Math 215: Applied Calculus I	Summer 2009
Math 100: Mathematical Reasoning	Summer 2010

Talks

Computing Difference Term Operations in Polynomial Time — Denver, CO 2018
BLAST Conference, University of Denver

Why Universal Algebra Needs Inductive, Dependent Types — Eugene, OR 2018
Oregon Programming Languages Summer School

A Tutorial Introduction to the Lean Prover — Boulder, CO 2018
University of Colorado Logic Seminar

The Lambda Calculus and Dependent Type Theory — Boulder, CO 2018
University of Colorado Logic Seminar

Representing Finite Lattices as Congruence Lattices (slides) — Fort Collins, CO 2017
Colorado State University Algebra Seminar

Algebraic Approach to Complexity of Constraint Satisfaction Problems (slides) — Honolulu, HI 2016
University of Hawaii Logic and Analysis Seminar

Universal Algebraic Methods for Constraint Satisfaction Problems — Denver, CO 2016
AMS Fall Western Sectional Meeting: Special Session in Algebraic Logic

The Rectangularity Theorem of Barto and Kozik (slides) — Boulder, CO 2016
Algebras and Algorithms: Structure and Complexity Theory

Constraint Satisfaction Problems and Universal Algebra (slides) — Birmingham, GBR 2016
Midlands Graduate School in the Foundation of Computing Science

Permutability in Diamonds — Ames, IA 2016
Iowa State Algebra and Combinatorics Seminar

Which Commutative Idempotent Binars are Tractable? (slides) — Nashville, TN 2015
Vanderbilt Shanks workshop: Open Problems in Universal Algebra

Some Small Finite Algebras Yielding Tractable CSP Templates — Ames, IA 2015
Iowa State Algebra and Combinatorics Seminar

Algebraic CSP and Tractability of Commutative Idempotent Binars (slides) — Denton, TX 2015
BLAST Conference, University of North Texas

Isotopic Algebras — Ames, IA 2015
Iowa State Algebra and Combinatorics Seminar

Talks (continued)

What Does a Nonabelian Group Sound Like? (slides) — Baltimore, MD 2014
MAA Special Session: At the Intersection of Mathematics and the Arts

Interval Enforceable Properties of Finite Groups (slides) — Louisville, KY 2013
AMS Special Session on Finite Universal Algebra

Tutorial: UACalc at the command line and in the cloud — Louisville, KY 2013
Workshop on Computational Universal Algebra

Approximating Eigenvalues of Large Stochastic Matrices — Columbia, SC 2013
University of South Carolina Combinatorics Seminar

Congruence Lattices of Finite Algebras (plenary lecture) (slides) — Orange, CA 2013
BLAST Conference, Chapman University

Transposition Principles for Subgroups and Equivalence Relations (slides) — Asheville, NC 2013
Zassenhaus Group Theory Conference

Isotopic Algebras with Nonisomorphic Congruence Lattices (slides) — Boulder, CO 2013
AMS Special Session on Algebras, Lattices, and Varieties

Synchronizing Automata and the Černý Conjecture (slides) — Boulder, CO 2013
Graduate Algebra Seminar, University of Colorado

The Finite Lattice Representation Problem in Four Parts — Columbia, SC 2012
University of South Carolina Algebra and Logic Seminar

Interval Sublattice Enforceable Properties of Finite Groups (slides) — Columbus, OH 2012
The 31st Ohio State-Denison Mathematics Conference

Expansions of Finite Algebras and their Congruence Lattices (slides) — Honolulu, HI 2012
American Mathematical Society sectional meeting

Intervals in Subgroup Lattices and Permutation Representations — Cullowhee, NC 2012
Western Carolina University Group Theory Seminar

Recent Progress on the Finite Lattice Representation Problem — Honolulu, HI 2011
Achievement Rewards for College Scientists: Scholar Presentations

The Finite Lattice Representation Problem — Seoul, KOR 2009
First Joint Meeting of the Korean and American Mathematical Societies

References

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† teaching reference