

Adrianna Gillman

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Computational and Applied Mathematics
Rice University
6100 Main Street M.S. 134
Houston, Texas 77005

EDUCATION

University of Colorado at Boulder

Ph.D., Applied Mathematics August 2011

Advisor: Per-Gunnar Martinsson

California State University, Northridge (CSUN)

M.S., Mathematics June 2006

Advisor: Rabia Djellouli

CSUN

B.S., Mathematics May 2003

Uppsala Universitet SWEDEN

Junior level undergraduate student 2001-2002

PROFESSIONAL EXPERIENCE

Assistant Professor

July 2014 – Present

Rice University

John Wesley Young Research Instructor in Mathematics

July 2011 – June 2014

Dartmouth College

Intern

June – August 2008

Summer Internships in Parallel Computational Science (SIParCS) program at National Center for Atmospheric Research (NCAR)

Visiting Graduate Research Assistant

January and December 2005

Laboratoire de Mathématiques Appliquées-UPPA Université de Pau FRANCE

RESEARCH INTERESTS

Generally speaking, I am interested in scientific computing, numerical methods for linear PDEs, and numerical linear algebra. My recent work has focused on the following areas:

- “Fast” algorithms such as the Fast Multipole Method and rank-structured fast linear algebraic solvers (fast direct solvers).
- Integral equation solvers for elliptic PDE.
- Integral equation formulations for the mathematical modeling of physics and other real world applications.
- High order discretization techniques for PDEs.

- Wave scattering, acoustics, variable media.
- Techniques for handling challenging geometries such as corners, edges, and periodic domains.

AWARDS

US National Academy of Sciences Kavli Fellow, 2017.

Simons Visiting Professorship, Oberwolfach, 2017.

Sloan Fellowship, 2016-2018.

GRANTS AND EXTERNAL SUPPORT

Industrial contract, \$277,945, 4/2017-4/2019.

Sloan Fellowship, \$55,000, 2016-2018.

National Science Foundation, Grant DMS-1522631, PI, award amount \$149,980.00, 08/2015 - 07/2018.

National Science Foundation, Grant DMS-1347163, CO-PI, award amount \$34,973, 2014.
Funding support for *CBMS Conference on Fast Direct Solvers for Elliptic PDEs*

AMS-Simons Travel Grant, July 2013-July 2015.

SIAM Travel Award to attend the SIAM Conference on the Computational Science and Engineering (CSE13), February 2013.

AWM-NSF Travel Grant to attend SIAM Conference on Applied Linear Algebra, June 2012.

SIAM Student Travel Award to attend the 7th International Congress on Industrial and Applied Mathematics (ICIAM 2011), July 2011.

PUBLICATIONS

An adaptive high order direct solution technique for elliptic boundary value problems (with P. Geldermans), To appear in *SIAM Journal on Scientific Computing*.

An accelerated Poisson solver based on multidomain spectral discretization (with T. Babb, S. Hao, and P.G. Martinsson), To appear in *BIT Numerical Analysis*.

A fast direct solver for boundary value problems on locally perturbed geometries (with Y. Zhang), *Journal of Computational Physics*, 356(1), pp. 356-371, 2018.

High resolution inverse scattering in two dimensions using recursive linearization (with C. Borges and L. Greengard), *SIAM Journal on Imaging Sciences*, 10(2), pp. 641-664, 2017.

An integral equation technique for scattering problems with mixed boundary conditions, *Advances in Computational Mathematics*, 43(2), pp. 351-364, 2017. doi:10.1007/s10444-016-9488-6.

A fast algorithm for simulating multiphase flows through periodic geometries of arbitrary shape (with G. Marple, A. Barnett, and S. Veerapaneni), *SIAM Journal on Scientific Computing*, 38(5), pp. B740-B772, 2016.

A spectrally accurate direct solution technique for frequency-domain scattering problems with variable media (with A. Barnett, and P.G. Martinsson), *BIT Numerical Mathematics*, 55, pp. 141–170, 2015. doi:10.1007/s10543-014-0499-8.

A high-order accelerated direct solver for non-oscillatory integral equations on curved surfaces (with J. Bremer, and P.G. Martinsson), *BIT Numerical Mathematics*, 55, pp. 367–397, 2015. doi:10.1007/s10543-014-0508-y.

A direct solver with $O(N)$ complexity for variable coefficient elliptic PDEs discretized via a high-order composite spectral collocation method (with P.G. Martinsson), *SIAM Journal on Scientific Computing*, 36, pp. A2023-A2046, 2014.

An $O(N)$ algorithm for constructing the solution operator to elliptic boundary value problems in the absence of body loads (with P.G. Martinsson), *Advances in Computational Mathematics*, 40, pp. 773-796, 2014. doi:10.1007/s10444-013-9326-z.

A fast solver for Poisson problems on infinite regular lattices (with P.G. Martinsson), *Journal of Computational and Applied Mathematics*, 258, pp. 42-56, 2014.

A simplified technique for the efficient and high-accuracy discretization of boundary integral equations in 2D on domains with corners (with S. Hao, and P.G. Martinsson), *Journal of Computational Physics*, 256, pp. 214-219, 2014.

A fast direct solver for quasi-periodic scattering problems (with A. Barnett), *Journal of Computational Physics*, 248, pp. 309-322, 2013.

A direct solver with $O(N)$ complexity for integral equations on one-dimensional domains (with P. Young, and P.G. Martinsson), *Frontiers of Mathematics in China*, 7, no. 2, pp. 217-247, 2012.

Fast and accurate numerical methods for solving elliptic difference equations defined on lattices (with P.G. Martinsson), *Journal of Computational Physics*, 229, pp. 9026-9041, 2010.

A Mixed Hybrid Formulation Based on Oscillated Polynomials for Solving Helmholtz Problems (with R. Djellouli, and M. Amara), *Journal of Computational and Applied Mathematics*, 204, pp.515-525, 2007.

BOOK CHAPTERS

Study of Discrete Scattering Operators for Some Linear Kinetic Models (with Y. Chen, Z. Chen, Y. Cheng, and F. Li), *Topics in Numerical Partial Differential Equations and Scientific Computing*, 2016. Springer New York. pp.99–136.

Numerical homogenization via approximation of the solution operator (with P. Young, and P.G. Martinsson), In B. Engquist, O. Runborg, R. Tsai, editors, *Numerical Analysis of Multi-scale Computations*, volume 82 of Lecture Notes in Computational Science and Engineering, Heidelberg, 2011. Springer Verlag. pp. 187-216.

THESES

Fast direct solvers for elliptic partial differential equations, PhD Thesis, CUB, 2011.

On the numerical performance of a mixed-hybrid type solution methodology for solving high-frequency Helmholtz problems, Masters Thesis, CSUN, 2006.

PRESENTATIONS

2018

SIAM TX-LA Sectional Meeting, October 2018.

Frontiers in Applied and Computational Mathematics, August 2018.

SIAM Applied Linear Algebra, May 2018.

Symposium of the International Association for Boundary Element Methods (IABEM 2018), June 2018.

International Conference on Spectral and High Order Methods (ICOSAHOM), July 2018.

ICERM Workshop: Fast Algorithms for Generating Static and Dynamically Changing Point Configurations, February 2018.

2017

BIRS: Complex Creeping Fluids: Numerical Methods and Theory, October 2017.

AMS Central Sectional Meeting, *Plenary*, September 2017.

Modern Advances in Computational and Applied Mathematics: A workshop in honor of the work of Charlie Epstein and Leslie Greengard, June 2017.

Numerical methods for PDEs and their applications Workshop at Institut Mittag-Leffler, May 2017.

AWM Research Symposium 2017 at UCLA, April 2017.

Rice Oil and Gas HPC Workshop, March 2017.

SIAM Conference on Computational Science and Engineering, February 27 - March 3, 2017.

2016

Purdue Workshop on Fast Direct Solvers, November 2016.

Oberwolfach Mini-Workshop on Fast Solvers for Highly Oscillatory Problems, October 30 - November 5, 2016.

INRIA TOTAL DIP : Depth Imaging Partnership at TOTAL Houston, October 2016.

SIAM Annual Conference, July 2016.

International Conference on Spectral and High Order Methods (ICOSAHOM), June 2016.

Copper Mountain Conference on Iterative Methods, March 2016.

Rice Oil and Gas HPC Workshop, March 2016.

2015

SIAM Applied Linear Algebra, October 2015.

Mathematical Foundations for Fast Multi-resolution Interactions and Large Data Analysis at Duke University, August 2015.

ICIAM, August 2015.

Low-rank approximations for high performance sparse solvers at ENSEEIHT, Toulouse, June 2015.

Troisième Workshop de l'action stratégique INRIA TOTAL DIP : Depth Imaging Partnership at Université de Pau et des Pays de l'Adour, June 2015.

SIAM Conference on Computational Science and Engineering, March 2015.

2014

SIAM Annual Conference, July 2014.

(Guest Lecture) CBMS Conference at Dartmouth College, June 2015.

SHAXC-2 Workshop at KAUST, May 2014.

2013

Workshop on Integral Equations Methods: Fast Algorithms and Applications, BIRS, December 2013.

SIAM Annual Conference, July 2013.

SIAM Conference on Computational Science and Engineering, February 2013.

2012

SIAM Conference on Applied Linear Algebra, June 2012.

2012 New England Numerical Analysis Day, April 2012.

2011

ICIAM, July 2011.

COLLOQUIUM AND SEMINAR PRESENTATIONS

2018

Algorithms Seminar, Flatiron Institute, January 2018.

Seminar, Colorado School of Mines, January 2018.

2017

Scientific Computing Seminar, Southern Methodist University, November 2017.

Colloquium, Colorado School of Mines, November 2017.

Numerical Analysis Seminar, Oxford University, May 2017.

2016

Colloquium, University of Maryland, Baltimore, February 2016.

2015

ICES Seminar, September 2015.

Scientific Computing Seminar, University of Houston, April 2015.

Applied Mathematics Seminar, Michigan State University, April 2015.

2014

Computational Science Seminar, University of Texas, Dallas, November 2014.

Simon Fraser University, March 2014.

Rice University, February 2014.

New Jersey Institute of Technology, February 2014.

University of North Carolina, Chapel Hill, January 2014.

University of California, Merced, January 2014.

University of Wisconsin, Madison, January 2014.

North Carolina State University, January 2014.

2013

Computational Science Seminar at University of Massachusetts Dartmouth, April 2013.

2012

Mathematics Colloquium, Tufts University, December 2012.

Numerical Analysis and Scientific Computing Seminar, Courant Institute of Mathematical Sciences, November 2012.

ACADEMIC EXPERIENCES

National Academy of Sciences' Korean-American Kavli Frontiers of Science, June 2017.

Oberwolfach Workshop on Computational Inverse Problems for Partial Differential Equations, May 2017.

IMA Workshop on Mathematical and Numerical Modeling in Optics, December 2016.

Mathematical Foundations for Fast Multi-resolution Interactions and Large Data Analysis, August 2015.

IMA-WhAM! A Research Collaboration Workshop for Women in Applied Mathematics: Numerical Partial Differential Equations and Scientific Computing, August 2014.

IMA Hot Topics Workshops: Integral Equation Methods, Fast Algorithms and Applications, August 2010.

PROFESSIONAL ACTIVITIES

Member of the organizing Committee for the 18th Chinese-American Kavli Frontiers of Science (KFoS) symposium, sponsored by the Chinese Academy of Sciences and the U.S. National Academy of Sciences to take place in October 2018.

Scientific Committee member for Symposium of the International Association for Boundary Element Methods (IABEM 2018), June 2018.

Co-organizer for a workshop at ICERM in February 2018.

Co-organizer for a 2 session minisymposium at SIAM Annual Conference in July 2016.

Co-organizer for a 2 session minisymposium at SIAM Computational Science and Engineering Conference in July 2014.

Co-organizer for a 4 session minisymposium at SIAM Annual Conference in July 2014.

Co-organizer for a minisymposium at SIAM Annual Conference in July 2013.

Co-organize the Applied and Computational Mathematics Seminar at Dartmouth College, 2011-2014.

SIAM member, Association for Women in Mathematics (AWM) member

Referee for SIAM Journal on Scientific Computing (SISC), SIAM Journal on Matrix Analysis and Applications (SIMAX), and the Journal of Computational Physics (JCP), Computers and Mathematics with Applications (CAMWA), Applied Numerical Mathematics (APNUM), Applied and Computational Harmonic Analysis (ACHA) and Super Computing 2016 (SC16).

DEPARTMENT SERVICE ACTIVITIES

Faculty sponsor for CAAM Senior Design Team: 2016-2017.

Students: Hannah Park, Luke Hall, Jeremy Vollen.

Undergraduate Fair, August 2016.

CAAM Graduate Curriculum Committee, 2016-present.

CAAM Graduate Committee member, 2015-2017.

Hiring Committee 2015-present.

Faculty sponsor for CAAM Senior Design Team: 2014-2015.

Students: Fortino Garcia, Sarah Schwettmann, Shurui Chen, Alexander Balkum

CAAM Colloquium Chair 2014-2015 academic year.

RICE SERVICE ACTIVITIES

SIAM Student Chapter Advisor 2015-present.

Graduate Marshal, Commencement 2015, 2016.

Vision Dinner: Welcoming prospective students from underrepresented minority groups in STEM to Rice. February 2016.

Grace Murray Hopper Conference, October 14-16, 2015.

Outreach talk for the CAAM Summer Math Days program, 2015.

Mentor in ELA-Rice Faculty Mentoring Program 2014-2015 academic year.

PH.D. AND M.A. DEFENSE COMMITTEE MEMBER

Thomas Klotz, M.A. CAAM, *Accurate Evaluation of Ellipsoidal Harmonics using Tanh-Sinh Quadrature with Applications to Solvation*, Advisor: Knepley, Dec. 2016.

Rujeko Chinomona, MA CAAM, *Black oil simulation utilizing a central finite volume scheme*, Advisor: Riverie, April 2016.

Brianna Lynn, M.A. CAAM, *Optimal Control of Flow and Transport Equations Using Discontinuous Galerkin Methods*, Advisor: Riverie, Dec. 2015.

Jonathan Baker, M.A. CAAM, *Nonnormality in Lyapunov Equations*, Advisor: Sorensen, Dec. 2015.

Qionglng Li Ph.D. Math, *Hitchin Components, Riemannian Metrics and Asymptotics*, Advisor: Wolf, Nov. 2014.

Timur Takhtaganov, Ph.D., Computational and Applied Mathematics, Advisor: Matthias Heinkenschloss.

Mihaela Nistor, Ph.D., Civil and Environmental Engineering, Advisor: Stanciulescu.

PH.D. THESIS PROPOSAL COMMITTEE MEMBER

Timur Takhtaganov, Ph.D., Computational and Applied Mathematics, Advisor: Matthias Heinkenschloss.

Mihaela Nistor, Ph.D., Civil and Environmental Engineering, Advisor: Stanciulescu.

STUDENTS

Yabin Zhang, 2015–Present. (M.A. August 2017)

Peter Geldermans, 2015–Present. (To defend Ph.D. in April 2019)

Peter Geldermans, 2015–2017 (Co-advised with Matthias Heinkenschloss) (M.A. December 2017).

Arturo Vargas, 2015-2017 (Co-advised with Tim Warburton), Currently at Lincoln Livermore National Laboratory.

Zheng Wang, 2015-2017 (Co-advised with Tim Warburton), Currently at Google.

TEACHING EXPERIENCE

Instructor Rice University

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|---|-------------------------------|
| CAAM 551 <i>Numerical linear Algebra</i> | August-December 2018 |
| CAAM 536 <i>Numerical methods for PDEs</i> | January-May 2017 |
| CAAM 336 <i>Differential Equations in Science and Engineering</i> | August-December 2016, 2017 |
| CAAM 536 <i>Numerical methods for PDEs</i> | January-May 2016 |
| CAAM 553 <i>Advanced Numerical Analysis I</i> | August-December 2015 |
| CAAM 652 <i>Topics in numerical differential equations</i> | January-May 2015 |
| CAAM 553 <i>Advanced Numerical Analysis I</i> | August-December 2014 |

Instructor Dartmouth College

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|---|--|
| Math 53 <i>Chaos! (Dynamical Systems)</i> | September -November 2013 |
| Math 46 <i>Introduction to Applied Mathematics</i> | March -May 2013 |
| Math 126 <i>Topics in Applied Mathematics: PDEs</i> | January-March 2013 |
| Math 23 <i>Differential Equations</i> | January- June 2012 |
| Math 8 <i>Calculus II</i> | September- December 2011, January-March 2013 |

NON-ACADEMIC SERVICE (SELECT)

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| Ride Leader, Urban Bicycle Gallery | 2015-Present |
| Board member for the CYCLE Houston Young Professionals Group | 2016-2017 |
| Rodeo Volunteer | 2015-2017 |
| Foster parent for SAV-A-Pet and Houston Pets Alive | |