

CURRICULUM VITAE

SHIBIN DAI

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Education

Ph.D. in Applied Mathematics, University of Maryland, 2005 (Advisor: Robert Pego)

M.S. in Mathematics, Chinese Academy of Sciences, 2000 (Advisor: Zhiming Chen)

B.S. in Mathematics, Peking University, 1997

Employment

2017– Associate Professor, The University of Alabama

2013–2017 Assistant Professor, New Mexico State University

2011–2013 Visiting Assistant Professor, Michigan State University

2008–2011 Visiting Assistant Professor, Worcester Polytechnic Institute

2005–2008 CAM Assistant Professor, UCLA

Research Interests

Nonlinear partial differential equations, applied analysis, and numerical analysis, with applications in physical, biological, and materials sciences. Specific areas include

- Network formation in amphiphilic mixtures with applications to lipid bilayer evolution, biomaterials, and morphology in polymer electrolyte materials
- Domain coarsening and self-similarity in materials science, phase transitions and thin films
- Free boundary problems

Funding

MAA Dolciani Mathematics Enrichment Grant: *Northridge Middle School Math Club*, 2020-2021, \$5,000 (PI).

NSF DMS-1815746: *Complex Amphiphilic Structures and Functionality of Biomaterials*, 2018-2021, \$217,087 (PI).

NSF DMS-1802863: *Degenerate diffusion in complex amphiphilic network structures*, 2017-2020, \$86,170 (PI, this is a portion of DMS-1411438 that was transferred to The University of Alabama).

NSF DMS-1411438 (2014-2018): *Degenerate diffusion in complex amphiphilic network structures*, \$186,486 (PI).

Publications and Preprints

Preprints

1. Shibin Dai and Toai Luong, Geometric evolution of bilayers under the degenerate functionalized Cahn-Hilliard equation, *preprint*.
2. Shibin Dai, Qiang Liu, Toai Luong, and Keith Promislow, On nonnegative solutions for the Functionalized Cahn-Hilliard equation with degenerate mobility, *submitted*.

3. Shibin Dai and Keith Promislow, Codimension one minimizers of highly amphiphilic mixtures, *submitted*.

Publication

1. Shibin Dai, Bo Li, and Toai Luong, Minimizers for the Cahn-Hilliard energy functional under strong anchoring conditions, *SIAM J. Appl. Math.*, to appear.
2. Shibin Dai, Rigorous derivation of a mean field model for the Ostwald ripening of thin films, *Communications in Mathematical Sciences*, Vol. 18, No. 2 (2020), 293–320.
3. Shibin Dai, Qiang Liu, and Keith Promislow, Weak Solutions for the Functionalized Cahn-Hilliard Equation with Degenerate Mobility, *Applicable Analysis*, published online 04 March 2019, DOI:10.1080/00036811.2019.1585536.
4. Shibin Dai, Bo Li, and Jianfeng Lu, Convergence of phase-field free energy and boundary force for molecular solvation, *Archive for Rational Mechanics and Analysis*, Volume 227, Issue 1 (2018), 105–147.
5. Shibin Dai and Qiang Du, Computational studies of coarsening rates for the Cahn-Hilliard equation with phase-dependent diffusion mobility, *Journal of Computational Physics*, 310 (2016), 85–108.
6. Shibin Dai and Qiang Du, Weak solutions for the Cahn-Hilliard equation with degenerate mobility, *Archive for Rational Mechanics and Analysis*, Vol. 219, Issue 3 (2016), 1161–1184.
7. Shibin Dai and Keith Promislow, Competitive geometric evolution of amphiphilic interfaces, *SIAM J. Math. Anal.* Vol. 47, No. 1 (2015), 347–380.
8. Shibin Dai and Qiang Du, Coarsening mechanism for systems governed by the Cahn-Hilliard equation with degenerate diffusion mobility, *Multiscale Modeling and Simulation*, Vol. 12, No. 4 (2014), 1870–1889.
9. Shibin Dai and Keith Promislow, Geometric evolution of bilayers under the functionalized Cahn-Hilliard equation, *Proc. Royal Soc. A*, (2013) 469: 20120505.
10. Shibin Dai and Qiang Du, Motion of interfaces governed by the Cahn-Hilliard equation with highly disparate diffusion mobility, *SIAM J. Appl. Math.*, Vol. 72, No. 6 (2012), 1818–1841.
11. Shibin Dai, On the Ostwald ripening of thin liquid films, *Comm. Math. Sci.*, Vol. 9, Issue 1 (2011), 143–160.
12. Shibin Dai, On a mean field model for 1D thin film droplet coarsening, *Nonlinearity*, 23 (2010), 325–340.
13. Shibin Dai, Barbara Niethammer, and Robert L. Pego, Crossover in coarsening rates for the monopole approximation of the Mullins-Sekerka model with kinetic drag, *Proc. Royal Soc. Edinburgh*, Vol. 140, Issue 03 (2010), 553–571.
14. Shibin Dai, On the shortening rate of collections of plane convex curves by the area-preserving mean curvature flow, *SIAM J. Math. Anal.* Vol. 42, No. 1 (2010), 323–333.
15. Shibin Dai and Robert L. Pego, Universal bounds on coarsening rates for mean field models of phase transitions, *SIAM J. Math. Anal.* Vol. 37, No. 2 (2005), 347–371.
16. Shibin Dai and Robert L. Pego, An upper bound on the coarsening rate for mushy zones in a phase field model, *Interfaces and Free Boundaries*, 7 (2005), 187–197.
17. Zhiming Chen and Shibin Dai, On the efficiency of adaptive finite element methods for elliptic problems with discontinuous coefficients, *SIAM J. Sci. Comput.* Vol. 24, No. 2 (2002), 443–462.
18. Zhiming Chen and Shibin Dai, Adaptive Galerkin methods with error control for a dynamical Ginzburg-Landau model in superconductivity, *SIAM J. Numer. Anal.* Vol. 38, No. 6 (2001), 1961–1985.

Ph.D. Dissertation

Universal bounds on coarsening rates for some models of phase transitions, University of Maryland, 2005

Teaching Experience

at University of Alabama:

Math 125: Calculus I (class size 20) (Summer 2018)
Math 238: Applied Differential Equations I (class size 40–60) (Fall 2017, Spring 2018, Spring 2019, Spring 2020)
Math 247: Honors Calculus III (class size 17) (Fall 2018)
Math 301: Discrete Mathematics (class size 30) (Spring 2018)
Math 343: Applied Differential Equations II (class size about 30) (Fall 2020)
Math 441/541: Boundary Value Problems (undergraduate/graduate course, 16 students) (Fall 2017)
Math 541: Boundary Value Problems (graduate course, 12 students) (Fall 2019)
Math 588: Theory of Differential Equations (graduate course, 4 students) (Spring 2020)
Math 642: Partial Differential Equations (graduate course, 8 students)(Spring 2019)
Math 688: Seminar: Topics in Analysis (Modern Theory of PDE) (class size 8)(Fall 2018)

at NMSU:

Math 192G: Calculus and Analytic Geometry II (class sizes around 40)(Fall 2013, Fall 2014, Fall 2016, Spring 2017)
Math 280: Introduction to Linear Algebra (class size around 40)(Fall 2014)
Math 332: Introduction to Analysis (class size 10)(Spring 2014)
Math 392: Introduction to Ordinary Differential Equations (class size around 40)(Fall 2015, Spring 2016)
Math 491/527: Introduction to Real Analysis I (undergraduate/graduate course, 12 students)(Fall 2015)
Math 492/528: Introduction to Real Analysis II (undergraduate/graduate course, 11 students)(Spring 2016)
Math 532: Partial Differential Equations (graduate course, 9 students)(Spring 2015)
Math 593: Measure and Integration (graduate course, 12 students)(Fall 2016)
Math 594: Real Analysis (graduate course, 7 students)(Spring 2017)

at WPI:

Math 1021: Calculus I (class sizes around 30)(Fall 2008 Term A, Fall 2009 Term A)
Math 1022: Calculus II (class sizes around 30)(Fall 2008 Term B)
Math 1023: Calculus III (each section had around 30 students, some classes had two sections)(Fall 2010 Terms A & B, Spring 2011 Term C)
Math 1024: Calculus IV (each section had around 30 students, some classes had two sections)(Spring 2009 Term D, Fall 2009 Term A, Fall 2010 Term A)
Math 1033: Introduction to Analysis III (5 students)(Spring 2010, Term C)
Math 1034: Introduction to Analysis IV (7 students)(Spring 2010, Term D)
Math 2073: Matrices and Linear Algebra II (35 students)(Spring 2011, Term C)
Math 2251: Vector and Tensor Calculus (46 students)(Spring 2010, Term C)

at UCLA:

Math 3B: Calculus for Life Sciences Students B (big class of 100+ students)(Fall 2007)
Math 134: Linear and Nonlinear Systems of Differential Equations (Winter 2008)
Math 151A: Applied Numerical Methods A (Spring 2006, Fall 2006)

Math 151B: Applied Numerical Methods B (Winter 2006, Winter 2007)

Talks

- CAM Seminar, University of Tennessee, Knoxville, TN, October 22, 2019.
- CCAM Seminar, Purdue University, West Lafayette, IN, September 16, 2019.
- Colloquium, Beijing Normal University, Beijing, China, June 21, 2019.
- Seminar, Institute of Computational Mathematics and Scientific/Engineering Computing, Chinese Academy of Sciences, Beijing, China, June 3, 2019.
- SIAM Conference on Applications of Dynamical Systems (DS19), Snowbird, Utah, May 19-23, 2019.
- NSF-CBMS Conference: Mathematical Molecular Biosciences and Biophysics, University of Alabama, Tuscaloosa, AL, May 13-17, 2019.
- AMS Southeastern Sectional Meeting, Auburn University, Auburn, AL, March 16, 2019.
- CAM Seminar, Mississippi State University, Mississippi State, MS, November 29, 2018.
- The 4th Annual Meeting of SIAM Central States Section, University of Oklahoma, Norman, Oklahoma, October 5-7, 2018.
- SIAM Conference on Mathematical Aspects of Materials Science (MS18), Portland, Oregon, July 9-13, 2018.
- SIAM Conference on Nonlinear Waves and Coherent Structures (NWCS18), Orange, CA, June 11-14, 2018.
- Seminar on Mathematics for Complex Biological Systems, University of California San Diego, San Diego, CA, May 17, 2018.
- SIAM Conference on Analysis of Partial Differential Equations, Baltimore, MD, December 9-12, 2017.
- 30th Annual UA System Applied Mathematics Meeting, The University of Alabama at Birmingham, AL, November 4, 2017.
- The 3rd Annual Meeting of SIAM Central States Section, Colorado State University, Fort Collins, CO, September 29–October 1, 2017.
- 14th U.S. National Congress on Computational Mechanics (USNCCM14), Montreal, QC, Canada, July 17–20, 2017.
- Analysis and Applications Seminar, University of Arizona, Tucson, AZ, March 07, 2017.
- Colloquium, University of Alabama, Tuscaloosa, AL, February 27, 2017.
- Colloquium, Kent State University, Kent, OH, February 21, 2017.
- Colloquium, University of Louisiana at Lafayette, Lafayette, LA, February 14, 2017.
- Colloquium, Kansas State University, Manhattan, KS, January 24, 2017.
- The 2nd Annual Meeting of SIAM Central States Section, University of Arkansas at Little Rock, Little Rock, AR, September 30–October 2, 2016.
- SIAM Conference on the Life Sciences, Boston, MA, July 11–14, 2016.
- Seminar, Institute of Computational Mathematics and Scientific/Engineering Computing, Chinese Academy of Sciences, Beijing, China, June 27, 2016.
- Colloquium, Department of Mathematics, Tsinghua University, Beijing, China, June 22, 2016.
- SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA, May 8–12, 2016.
- 2016 MRS (Materials Research Society) Spring Meeting & Exhibit, Phoenix, AZ, March 28–April 1, 2016.
- SIAM Conference on Analysis of Partial Differential Equations, Scottsdale, AZ, December 7–10, 2015.

- Colloquium, Department of Mathematics, Tsinghua University, Beijing, China, June 11, 2015.
- SIAM Conference on the Life Sciences, Charlotte, NC, August 4-7, 2014.
- Seminar, Institute of Computational Mathematics and Scientific/Engineering Computing, Chinese Academy of Sciences, Beijing, China, June 19, 2014.
- Colloquium, Department of Mathematics, Tsinghua University, Beijing, China, June 18, 2014.
- AMS 2014 Western Spring Sectional Meeting, University of New Mexico, April 5–6, 2014.
- SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA, June 9–12, 2013.
- The Eighth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia, March 25–28, 2013.
- AMS 2012 Fall Central Sectional Meeting, University of Akron, October 20–21, 2012.
- The 9th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida, July 1–5, 2012.
- FACM 2012: Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology, May 18–20, 2012.
- AMS 2012 Spring Central Section Meeting, University of Kansas, March 30–April 1, 2012.
- SIAM Conference on Mathematical Aspects of Materials Science, Philadelphia, PA, May 23–26, 2010.
- SIAM Conference on Analysis of Partial Differential Equations, Miami, FL, December 7–10, 2009.
- Colloquium, Department of Mathematical Sciences, WPI, October 31, 2008.
- Seminar, Institute of Computational Mathematics and Scientific/Engineering Computing, Chinese Academy of Sciences, August 22, 2007.
- SIAM Conference on Analysis of Partial Differential Equations, Houston, TX, December 6–8, 2004.

Conference and Workshop Participation

- The 24th Annual PCMI Summer Session, Mathematics and Materials, Park City, UT, June 29–July 19, 2014.
- 2013 CNA Summer School: Topics in Nonlinear PDEs and Calculus of Variations, and Applications in Materials Science, Carnegie Mellon University, May 30–June 7, 2013.
- CNA Conference on “Incompressible fluids, turbulence and mixing, in honor of Peter Constantin’s 60th birthday”, Carnegie Mellon University, October 13–16, 2011.
- IMA Hot Topics Workshop: Higher Order Geometric Evolution Equations: Theory and Applications from Microfluidics to Image Understanding, University of Minnesota, March 23–26, 2009.
- IPAM Program: Optimal Transport, UCLA, March 10–June 13, 2008.
- 2004 CNA Summer School: Advances in Nonlinear Analysis, Carnegie Mellon University, May 27–June 5, 2004.
- Analytical and Computational Challenges of Incompressible Flows at High Reynolds Number, University of Maryland, May 17–21, 2004.
- Nonequilibrium Interface Dynamics: Theory and Simulation from Atomistic to Continuum Scales, University of Maryland, October 13–31, 2003.
- US/EU Meeting on Phase Transitions in Crystals and TMR Annual Meeting, University of Minnesota, April 11–12, 2003.

Invited Visits

- Tsinghua University, June 8–July 2, 2016.
- Beijing Computational Science Research Center, May 26–June 27, 2014; May 19–July 3, 2015.

Professional Services

- Proposal Review Panelist: NSF
- Journal Referee Services

Applied Mathematics and Computation, Applied Mathematics Letters, Communications in Computational Physics, Communications in Mathematical Sciences, Communications in Nonlinear Science and Numerical Simulation, Computational Materials Science, Computers and Mathematics with Applications Discrete and Continuous Dynamic Systems–Series B, European Journal of Applied Mathematics, 19th International Meshing Roundtable special journal issue of Engineering with Computers, Journal of Advanced Mathematics and Applications, Journal of Computational Physics, Journal of Hyperbolic Differential Equations, Journal of Mathematical Analysis and Applications, Mathematical Methods in the Applied Sciences, Mathematische Nachrichten, Methods and Applications of Analysis, Molecular Based Mathematical Biology, Multiscale Modeling and Simulation: A SIAM Interdisciplinary Journal, Nonlinearity, Numerical Methods for Partial Differential Equations, Physica D, Results in Applied Mathematics, SIAM Journal on Applied Mathematics, SIAM Journal on Mathematical Analysis, SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing

Undergraduate Students and Research Projects Supervised

- Anahi Reyna Cruz, summer 2015
- UCLA IPAM summer programs: Research in Industrial Projects for Students (RIPS) 2007 (collaborated with Microsoft Research Asia)

Departmental Services

at University of Alabama:

Graduate Program Committee (2017–present)

Applied Mathematics Seminar Coordinator (Spring 2020–present)

at NMSU:

Graduate Studies Committee (2016–2017)

Graduate Recruiting Subcommittee (2014–2016)

Hiring/Planning Committee (2015–2016)

Undergraduate Curriculum/Undergraduate Teaching Committee (2013–2016)

Memberships

American Mathematical Society, Society for Industrial and Applied Mathematics