Becca Thomases

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RESEARCH FOCUS

Data driven analysis and numerical simulations of partial differential equations, and complex fluids with applications in life sciences and engineering

EDUCATION

University of California, Santa Barbara. Ph.D. Mathematics: *Global Existence of 3D Nonlinear Incompressible Elastodynamics as a Limit of Slightly Compressible Materials*, June 2003.
Thesis advisor: Thomas Sideris.

University of California, Santa Barbara. M.A. Applied Mathematics, December 1999.

Vassar College. B.A. Mathematics, with honors, May 1997.

PROFESSIONAL EXPERIENCE

Professor. July 2022 – present.
Mathematical Sciences, Smith College.

Department Chair. July 2024 – June 2027.
Mathematical Sciences, Smith College.

Professor. July 2020 – June 2023.
Mathematics Department, University of California, Davis.

Vice Chair for Graduate Matters. July 2020 – June 2022.
Mathematics Department, University of California, Davis.

Visiting Associate Professor. July 2017 - July 2018.
School of Engineering and Applied Sciences, Harvard University.

Associate Professor. July 2012 – June 2020.
Mathematics Department, University of California, Davis.

Assistant Professor. July 2007 – June 2012.
Mathematics Department, University of California, Davis.

Assistant Professor. September 2006 – June 2007.
Courant Institute of Mathematical Sciences, New York University.

Courant Instructor / Assistant Professor. September 2003 – August 2006.
Courant Institute of Mathematical Sciences, New York University.

GRANTS, FELLOWSHIPS, and AWARDS

Richard Lounsbery Foundation grant: "Providing Pathways for Women to Advanced Summer Internships in Computational and Applied Mathematics," 2024–2026. (Principal Investigator) Grant to establish the *Computational and Applied Math Practicum*, a research-preparation experience for Smith College undergraduate students. The inaugural program served 5 students in Summer 2025; an expanded January 2026 program served 15 students.

NSF Research Grant: FRG: Collaborative Research: Computational Methods for Complex Fluids: Adaptivity, Fluid-Structure Interaction, and Applications in Biology, DMS 1664679/1664645, 2017-2021. (co-Principal Investigator)

NSF Conference Grant: Workshop: Mathematical Fluids, Materials, and Biology, DMS 1903035, 2019. (co-Principal Investigator)

Provost's Fellowship for Innovation of Teaching Award: with T. Lewis, and S. Walcott, 2015-2016.

Hellman Fellowship: University of California, Davis, 2010-2011.

NSF Research Grant: Viscoelastic Fluid Flow, DMS-0600668/0757813, 2006-2009. (Principal Investigator)

PUBLICATIONS

"Corkscrew motion of *Trypanosoma brucei* is driven by helical beating of the flagellum and facilitated by its bent shape", (with S. Cheng, D. Das, M. Barchuk, R. Armstrong, M. M. Klingbeil, and S. Zhou) Proceedings of the National Academy of Sciences, 123 (27), e2536746123, 2026

"Emergence of Purely Elasto-Plastic Turbulence in Shear Flows", (with M. Abdullah, S. Pradeep, D. J. Jerolmack, and P. E. Arratia) Accepted for publication, Physical Review Letters, September 2026

"Quantification of Flagellar Gait Changes with Combined Shape Mode Analysis and Swimming Simulations" (with K. E. Gutierrez, P. E. Arratia, R. D. Guy) Philosophical Transactions A 383.2304, 2025

"A period-doubling route to chaos in viscoelastic Kolmogorov flow", (with J. Nichols, and R. D. Guy) Phys. Rev. Fluids, 10 (4), L041301, 2025

"Effect of fluid elasticity on the emergence of oscillations in an active elastic filament", (with K. Link, P. A. Arratia, and R. D. Guy) Journal of The Royal Society Interface, 21.214: 2024.0046, 2024

"A mathematician's perspective on the Oldroyd B model: Progress and future challenges", (with M. Renardy) J. Non-Newtonian Fluid Mech., 293, 104573, 2021

"Three dimensional viscoelastic instabilities in a four-roll mill geometry at the Stokes limit", (with P. Gutierrez-Castillo, and A. Kagel) Phys. Fluids, 32, no. 2, 023102, 2020

"Polymer stress growth in viscoelastic fluids in oscillating extensional flows with applications to microorganism locomotion", (with R. D. Guy) J. Non-Newtonian Fluid Mech., 269, pp. 47-56, 2019

"Convergent solutions of Stokes Oldroyd-B boundary value problems using the Immersed Boundary Smooth Extension (IBSE) method", (with D.B. Stein, and R.D. Guy) J. Non-Newtonian Fluid Mech., 268, pp. 56-65, 2019

"Orientation dependent elastic stress concentration at tips of slender objects translating in viscoelastic fluids", (with C. Li, and R.D. Guy) Phys. Rev. Fluids 4, 031301(R), 2019

"Proper Orthogonal Decomposition (POD) of the flow dynamics for a viscoelastic fluid in a four-roll mill geometry at the Stokes limit", (with P. Gutierrez-Castillo) J. Non-Newtonian Fluid Mech., 264, pp. 48-61, 2019

"Flagellar swimming in viscoelastic fluids: role of fluid elastic stress revealed by simulations based on experimental data", (with C. Li, B. Qin, A. Gopinath, P. Arratia, and R.D. Guy) Journal of The Royal Society Interface, 14.135: 20170289, 2017

"The role of body flexibility in stroke enhancements for finite-length undulatory swimmers in viscoelastic fluids", (with R.D. Guy) Journal of Fluid Mechanics, 825, pp. 109-132, 2017

"Immersed Boundary Smooth Extension (IBSE): A high-order method for solving incompressible flows in arbitrary smooth domains", (with D.B. Stein, and R.D. Guy) Journal of Computational Physics, 335, 155-178, 2017

"Equilibrium circulation and stress distribution in viscoelastic creeping flow", (with J. A. Biello) J. Non-Newtonian Fluid Mech., 229, pp. 101-111, 2016

"Immersed boundary smooth extension: A high-order method for solving PDE on arbitrary smooth domains using Fourier spectral methods," (with D.B. Stein, and R.D. Guy) Journal of Computational Physics, 304, 252 - 274, 2016

"Computational challenges for simulating strongly elastic flows in biology", (with R.D. Guy) In Complex Fluids in Biological Systems. 359-397 2015

"Mechanisms of elastic enhancement and hindrance for finite length undulatory swimmers in viscoelastic

fluids" (with R.D. Guy) Physical Review Letters, 113, 098102 2014

"An Analysis of the Effect of Stress Diffusion on the Dynamics of Creeping Viscoelastic Flow" J. Non-Newtonian Fluid Mech. 166, 1221-1228, 2011

"A Stokesian Viscoelastic Flow: Transition to Oscillations and Mixing" (with M. Shelley and J.-L. Thiffeault) Phys. D. 240 1602-1614, 2011

"Symmetric Factorization of the Conformation Tensor in Viscoelastic Fluid Models" (with N. Balci, M. Renardy, and C. Doering) J. Non-Newtonian Fluid Mech. 166, pp. 546-553, 2011

"Transition to Mixing and Oscillations in a Stokesian Viscoelastic Flow" (with M. Shelley) Physical Review Letters,103, 094501, 2009

"Emergence of Singular Structures in Oldroyd-B Fluids" (with M. Shelley) Phys. Fluids 19, no. 10, 2007

"Global Existence for 3D Incompressible Isotropic Elastodynamics." (with T. Sideris) Comm. Pure Appl. Math. 60, no. 12, 1707 – 1730, 2007

"Elastic waves in exterior domains, Part II: Global existence with a null structure." (with J. Metcalfe) Int. Math. Res. Not., pp 34-43, 2007

"Local Energy Decay For Solutions of Multi-Dimensional Isotropic Symmetric Hyperbolic Systems" (with T. Sideris) J. Hyperbolic Differ. Equ., no. 4, 673-690 2006

"A Decay Theorem For Some Symmetric Hyperbolic Systems" (with C. Morawetz) J. Hyperbolic Differ. Equ., no. 3, 475–480, 2006

"Global Existence For 3D Incompressible Isotropic Elastodynamics Via the Incompressible Limit" (with T. Sideris) Comm. Pure Appl. Math. 58, no. 6, 750 – 788, 2005

"Long Time Behavior of Solutions to the 3D Compressible Euler Equations with Damping" (with T. Sideris and D. Wang), Comm. PDE. 28, no. 3-4, 795–816, 2003

TALKS

Invited Talks and Workshops (previous 5 years)

Williams College Association for Women in Mathematics Regional Symposium, *Plenary Speaker*, Williams College, Williamstown, MA, March 2026

Mathematical Modeling, Computational Methods, and Biological Fluid Dynamics: Research and Training Workshop, *Invited Speaker*, National Institute for Theory and Mathematics in Biology, Chicago, IL, July 2025

Chaotic Flows in Polymer Solutions, Workshop, *Invited Speaker*, International Centre for Mathematical Sciences, Bayes Centre, Edinburgh, Scotland, January 2025

Runnals Dinner for Women in Mathematics, *Keynote Speaker*, Department of Mathematics, Colby College, October 2024

Congress on Theoretical and Applied Mechanics, *Symposium speaker*, Microswimming in Newtonian and Complex Fluid Environments, Austin, TX, June 2022.

Mechanics of Life Workshop, *Invited Speaker*, Center for Computational Biology, Flatiron Institute, May 2022.

"LGBTQ+Math Day", *Keynote Speaker*, The Fields Institute for Research in Mathematical Sciences, *virtual*, November 2021.

"Spectra LGBTQ+ in Mathematics Conference", *Plenary Speaker*, The Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University *virtual*, August 2021.

"XX International Workshop on Numerical Methods for Non-Newtonian Flows", Banff International Research Station, *virtual*, June 2021.

Annual Meeting of the American Physical Society, *Invited speaker*, Session: Swimming, motility and locomotion, *virtual*, March 2021.

Seminar and Colloquium Talks (previous 5 years)

University of New Hampshire, Applied Mathematics Seminar, October 2025.

Vassar College, Mathematics Colloquium, April 2025.

Worcester Polytechnic Institute, Mathematics Colloquium, November 2024.

University of Massachusetts, Applied Mathematics Seminar, October 2024.

Liberal Arts Luncheon Speaker, Smith College, September 2024.

University of Pennsylvania, Penn Institute for Computational Science Colloquium, November 2023.

Wellesley College, Mathematics Colloquium, April 2023.

Smith College, Sigma Xi, February 2023.

University of New Mexico, Applied Mathematics Seminar, *virtual* January 2022.

Journal of non-Newtonian Fluid Mechanics Seminar Series, *virtual* June 2021.

BioActive Fluids Seminar, *virtual* May 2021.

SERVICE ACTIVITIES

College Service:
· Campus Planning Committee (CPC), (2023 - 2027).
· Committee on Athletics, (2024 - 2025).
· Strategic Planning Working Group, (2025). · Faculty Board of Counselors, Member and Faculty Mentor to Nikko Stevens, 2025–2027.
· Outdoor Signage Policy Working Group, Campus Planning Committee, 2025 – 2026.
· Panelist, STEM Lunchbag discussion on undergraduate research for pre-health students, October 2025.

Departmental Service:
· Led the Mathematical Sciences Department decennial review, including preparation of the self-study and coordination of the external review, 2025–2026.
· Visiting Assistant Professor Search Committee, Member, (2024-2026).
· Tenure Track Search Committee, Member, (2023-2024).
· Postdoctoral Scholar Search Committee, Chair, (2023-2024).
· Science Planning Committee, Departmental Representative (Spring 2024 - present).
· Curriculum Committee, (2022 - 2024).
· Introductory Courses Committee (2022 - 2024).
· Calculus Training Groups (CTG) coordinator, Fall 2023.
· Postbaccalaureate Admissions Committee, 2025-2026.

Advising and Mentoring:
· Thesis and Reading Course Advisor: Sarah Qin (reading course, Fall 2025; thesis, Spring 2026).
· MTH 301 Research Project Supervisor: Melody Song (Fall 2025, flagellar and sperm data analysis); Lily Garner, Kyla Biscocho, Charlotte Saunders, and Tentiana Perehinets (Spring 2026, reinforcement learning and cilia).
· Independent Study Supervisor: Lily Smetzer and Melody Song (partial differential equations, Spring 2026).
· STRIDE Research Supervisor: Ruth Norton (Fall 2025, partial differential equations and MATLAB).
· Undergraduate Research Assistant Supervisor: Quinn He (Spring 2026, Dedalus code development).
· External Student Research Mentor and Collaborator: Muhammad Abdullah (Summer 2024–present, with P. E. Arratia); Daniel Twohig (2025–2026, UMass Amherst undergraduate, with S. Zhou); Sizhe Cheng (Spring 2026, UMass Amherst graduate student, with S. Zhou).
· Computational and Applied Math Practicum (CAMP), January 2026: Directed an intensive two-week research-preparation program for 15 Smith College students: Hodan Ali, Fida Bijin, Tanya Chen, Nelle Feliciano, Reagan Gonzales, Clare Harned, Lucia Kim, Lynn Kimathi, Anjia Lu, Libby Newton, Isabella Purnell-Amáez, Beijia Shen, Amy Tang, Beatrice Tauer, and S. Whitin.
· Smith College SURF Research Supervisor, Summer 2025, four-week project: Chelsea Harmon and Melody Song.

· Computational and Applied Math Practicum (CAMP), Summer 2025, two-week research-preparation program: Chelsea Harmon, Melody Song, Katrina Wang, Maylynn Rodriguez, and Sabzara Ali.
· Smith College SURF Research Supervisor, Summer 2023, ten-week project: Juniper Huang, Mehreen Mirza, and Tentiana Perehinets.
· MTH 301 Research Project Supervisor: Malaika Kironde (Fall 2022), Keren WuRohe (Fall 2022–Spring 2023), Kira Seshaiah (2023–2025), Aiden Van Horn (Fall 2024), and Caroline Zouloumian (Spring 2025).
· STRIDE Research Supervisor: Karen Zhao (Fall 2024).
· Ph.D. Committee Member: Kelli E. Gutierrez (Ph.D. completed 2026).
· Ph.D. Advisor: Jeffery Nichols (Ph.D. 2025, Seattle Central College); Chuanbin Li (Ph.D. 2017, Google); David Stein (Ph.D. 2016, Research Scientist, Flatiron Institute).
· Postdoctoral Mentor: Elaine Gorom (2024–2026, including development of a new numerical analysis course); Kathryn Link (2020–2022); Paloma Gutierrez (2017–2019, currently Assistant Professor, Department of Mechanical, Thermal and Fluid Engineering, University of Malaga).

Conference/Symposium Organization:
· Queer in Computational and Applied Mathematics (QCAM) *Co-organizer*
Active August 2022 - June 2024. Conference hosted at ICERM, The Institute for Computational and Experimental Research in Mathematics, Brown University, Jun 24 - 28, 2024.
· Workshop on Recent Advances in Hyperbolic PDEs and Applications, *Co-organizer*
Active August 2023-April 2024. Mathematics Research Center (MRC) of the Department of Mathematics, University of Pittsburgh. April 6-7, 2024.
· Microswimming in Newtonian and Complex Fluid Environments, *Session Co-chair*, 2022 US National Congress on Theoretical and Applied Mechanics, Austin, TX, June 2022.

Editorial Work:
· Editorial Board, Proceedings of the Royal Society A: Mathematical, Physical & Engineering Sciences, 2025 - present.
· Editorial Board, Applied Mathematics for Modern Challenges (AMMC), American Institute of Mathematical Sciences, 2022- present.
· Editorial Advisory Board, Journal of Non-Newtonian Fluid Mechanics, 2021 - present.
· Referee (previous 5 years): Applied Mechanics Reviews, Archive for Rational Mechanics and Analysis, International Mathematics Research Notices, Annals of Mathematics, Journal of Fluid Mechanics, Journal of non-Newtonian Fluid Mechanics, Kinetic and Related Models, Physical Review Letters,
Physical Review E, Physical Review Fluids, Physical Review X, SIAM Journal on Applied Mathematics

Additional Service:
· NSF Panelist, Division of Mathematical Sciences, 2014, 2019, 2023.
· Prize Committee, Member, Society for Industrial and Applied Mathematics (SIAM), 2020.
· Secretary, SIAM Analysis of PDE, January 2015-December 2016.

PROFESSIONAL MEMBERSHIPS

American Physical Society, Division of Fluid Dynamics
Association for Women in Mathematics
Society for Industrial and Applied Mathematics
Society of Rheology