

BRYAN QUAIFE

bquaife@fsu.edu · (512) 436-1148
400 Dirac Science Library · Tallahassee, Florida, 32306
<http://people.sc.fsu.edu/~bquaife>

EMPLOYMENT

Florida State University *August 2015–*
Assistant Professor of Scientific Computing
Associate of Geophysical Fluid Dynamics Institute

University of Texas *September 2011–July 2015*
Postdoctoral Fellow/Research Associate

EDUCATION

Simon Fraser University *September 2006–July 2011*
Ph.D. in Applied and Computational Mathematics
Advisor: Mary-Catherine Kropinski

University of Calgary *September 2004–August 2006*
M.Sc. in Applied Mathematics
Advisor: Antony Ware

University of Calgary and Red Deer College *September 2000–April 2004*
B.Sc. in Pure and Applied Mathematics

PUBLICATIONS, CONFERENCE PROCEEDINGS, PREPRINTS, THESES

- [1] Yana Bebieva, Julia Oliveto, Bryan Quaife, Nick Skowronski, Warren E. Heilman, and Kevin Speer. Role of horizontal eddy diffusivity within the canopy on fire spread. *Atmosphere*, 2020. Under review.
- [2] Shang-Huan Chiu, M. N. J. Moore, and Bryan Quaife. Viscous Transport in Eroding Porous Media. *Journal of Fluid Mechanics*, 893, 2020. **Cover Image.**
- [3] Madhuparna Roy, Phong Tran, Tarik Dickens, and Bryan D. Quaife. Effects of geometry constraints and fiber orientation in field assisted extrusion-based processing. *Additive Manufacturing*, 32:101022, 2020.
- [4] Lukas Bystricky, Sachin Shanbhag, and Bryan D. Quaife. Stable and contact-free time stepping for dense rigid particle suspensions. *International Journal for Numerical Methods in Fluids*, 92:94–113, 2020.
- [5] Bryan Quaife, Shravan Veerapaneni, and Y.-N. Young. Hydrodynamics and rheology of a vesicle doublet suspension. *Physics of Fluids*, 4:103601, 2019. **Editor’s Suggestion.**
- [6] Bryan D. Quaife and M. Nicholas J. Moore. A boundary-integral framework to simulate viscous erosion of a porous medium. *Journal of Computational Physics*, 375:1–21, 2018.

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- [7] Miles Currie, Kevin Speer, Kevin Hiers, Joseph O'Brien, Scott Goodrick, and Bryan Quaife. Pixel-Level Statistical Analyses of Prescribed Fire Spread. *Canadian Journal of Forest Research*, 49(1):18–26, 2018.
- [8] Alan E. Lindsay, Bryan Quaife, and Laura Wendelberger. A boundary integral equation method for mode elimination and vibration confinement in thin plates with clamped points. *Advances in Computational Mathematics*, 44(4):1249–1273, 2018.
- [9] Gokberk Kabacaoğlu, Bryan Quaife, and George Biros. Low-resolution simulations of vesicle suspensions in 2D. *Journal of Computational Physics*, 357:43–77, 2018.
- [10] Bryan Quaife, Pieter Coulier, and Eric Darve. An efficient preconditioner for the fast simulation of a 2D Stokes flow in porous media. *International Journal for Numerical Methods in Engineering*, 113(4):561–580, 2018.
- [11] Pietro de Anna, Bryan Quaife, George Biros, and Ruben Juanes. Prediction of velocity distribution from pore structure in simple porous media. *Physical Review Fluids*, 2(12):124103, 2017.
- [12] Zhicheng Long, Bryan Quaife, Hanna Salman, and Zoltán N. Oltvai. Cell-cell communication enhances bacterial chemotaxis toward external attractants. *Scientific Reports*, 7(1):12855, 2017.
- [13] Benjamin W. Ong, Andrew J. Christlieb, and Bryan D. Quaife. A New Family of Regularized Kernels for the Harmonic Oscillator. *Journal of Scientific Computing*, 71(3):1212–1237, 2017.
- [14] Gokberk Kabacaoğlu, Bryan Quaife, and George Biros. Quantification of mixing in vesicle suspensions using numerical simulations in two dimensions. *Physics of Fluids*, 27:021901, 2017.
- [15] Bryan Quaife and George Biros. Adaptive time stepping for vesicle simulations. *Journal of Computational Physics*, 306:478–499, 2016.
- [16] M.C. Kropinski, N. Nigam, and B. Quaife. Integral Equation Methods for the Yukawa-Beltrami Equation on the sphere. *Advances in Computational Mathematics*, 42(2):469–488, 2016.
- [17] Bryan Quaife and George Biros. High-order adaptive time stepping for vesicle suspensions with viscosity contrast. *Procedia IUTAM*, 16:89–98, 2015.
- [18] Bryan Quaife and George Biros. High-volume fraction simulations of two-dimensional vesicle suspensions. *Journal of Computational Physics*, 274:245–267, 2014.
- [19] Bryan Quaife and George Biros. On preconditioners for the Laplace double-layer potential in 2D. *Numerical Linear Algebra with Applications*, 22:101–122, 2015.
- [20] Shidong Jiang, Mary-Catherine A. Kropinski, and Bryan D. Quaife. Second kind integral equation formulations for the modified biharmonic equation and its applications. *Journal of Computational Physics*, 249:113–126, 2013.
- [21] Bryan D. Quaife and Mary-Catherine A. Kropinski. Fast Integral Equation Methods for the Modified Helmholtz Equation. In *Waves Conference Proceedings*, 2011.

- [22] Bryan Quaife. *Fast Integral Equation Methods for the Modified Helmholtz Equation*. PhD thesis, Simon Fraser University, 2011.
- [23] M.C. Kropinski and B.D. Quaife. Fast integral equation methods for the modified Helmholtz equation. *Journal of Computational Physics*, 230:425–434, 2011.
- [24] M.C. Kropinski and B.D. Quaife. Fast integral equation methods for Rothe’s method applied to the isotropic heat equation. *Computers and Mathematics with Applications*, 61(9):2436–2446, 2010.
- [25] Bryan Quaife. An Adaptive Local Scaling Function Representation. Master’s thesis, University of Calgary, 2006.

AWARDED FUNDING

From Fire to Plume: The Role of Vorticity and Fuel Moisture on the Near-Field Plume and Ember Dynamics *Strategic Environmental Research and Development Program*, \$2,235,917, 2020–2024 (co-PI).

Augmented Reality Simulations of Fire Dynamics with Topography, *FSU Committee on Faculty Research Support Award*, \$14,000, 2019.

Multiscale Simulation of Wildfire Propagation in the Urban Interface, *FSU CRC Multidisciplinary Support Award*, \$25,000, 2017 (co-PI).

Computational Methods for Complex Stokesian Fluids, *Simons Foundation*, \$42,000, 2017.

Integral equation methods for flow in porous media, *FSU CRC FYAP*, \$20,000, 2015.

PENDING FUNDING

Erosion, Transport, and Dispersion in Granular and Porous Media *NSF Division of Mathematical Sciences*, 2020–2023, \$439,824 (co-PI).

REJECTED FUNDING

Time Stepping Methods for Interfacial Dynamics, *NSF Division of Mathematical Sciences*, 2018, \$425,055.

Simulating and Assessing Fire Dynamics and Ember Propagation in Wildlands, Urban Areas, and Their Interfaces, *NSF Prediction of and Resilience against Extreme Events*, 2018, \$596,676 (co-PI).

CAREER: High-Fidelity Numerical Methods for Flow in Complex Domains, *NSF Division of Mathematical Sciences*, 2018, \$565,004.

How Ignition Patterns, Boundary Layer Turbulence, and Fuel/WUI Structure Control Plume Dynamics, *Strategic Environmental Research and Development Program*, 2018, \$1,987,237 (co-PI).

Time Stepping Methods for Interfacial Dynamics, *NSF Division of Mathematical Sciences*, 2017, \$139,595.

CAREER: Integral Equations Applied to Complex Porous Media Flow, *NSF Division of Mathematical Sciences*, 2017, \$505,999.

Integral equation methods for spherical Beltrami Equations, *NSF Division of Mathematical Sciences*, 2016, \$135,776.

Efficient integral equation methods for surface PDEs, *NSF Division of Mathematical Sciences*, 2015, \$139,846.

Efficient Time Stepping for Interfacial Dynamics, *NSF Division of Advanced Cyberinfrastructure*, 2015, \$174,867.

TEACHING

Computational Methods for Continuous Problems	Fall 2019
Discrete Algorithms for Science Applications	Fall 2019
Iterative and Direct Solvers for Linear Systems	Spring 2019
Computational Methods for Continuous Problems	Fall 2018
Applied Computational Science II	Spring 2018
Integral Equation Methods	Fall 2017
Applied Computational Science II	Spring 2017
Computational Methods for Continuous Problems	Fall 2016
Integral Equation Methods	Spring 2016
Vector Calculus and Complex Variables for Engineers	Summer 2009

INVITED PRESENTATIONS

Semipermeable Vesicle Suspensions, *BIRS workshop on Biological Active Porous Materials: Modeling, Simulation and Experimentation*, October 2020.

Semipermeable Vesicle Suspensions, *SIAM/CAIMS Annual Meeting*, July 2020 (postponed).

Viscous Transport in Eroding Porous Media, *SIAM Conference on Mathematics of Planet Earth*, June 2020 (postponed).

Viscous Transport in Eroding Porous Media, *Boise State University*, April 2020 (postponed).

Coupling Between Flow and Porous Structures, *New Jersey Institute of Technology*, February 2020.

Semi-Permeable Vesicles with Adhesion, *Flatiron Institute*, February 2020.

High-Order Methods for Viscous Erosion, *CAIMS Annual Meeting*, July 2019.

Transport in Viscous Erosion, *SIAM Conference on Computational Science and Engineering*, March 2019.

Viscous Fluid, Meet Complex Geometry: High-Fidelity Simulations, *Department of Chemical Engineering, Florida State University*, October 2018.

The Role of Adhesion in Vesicle Suspensions, *AMS Fall Eastern Sectional Meeting*, September 2018.

The Role of Adhesion in Vesicle Suspensions, *SIAM Conference on Life Sciences*, August 2018.

IFMM-Preconditioning for 2D Stokes Flow in Porous Media, *World Congress on Computational Mechanics*, July 2018.

A Boundary Integral Equation for the Clamped Bi-Laplacian Eigenvalue Problem, *Symposium of the International Association for Boundary Element Methods*, June 2018.

Resolving the Small Scales in Porous Media Flow, *Department of Applied and Computational Mathematics, University of Notre Dame*, April 2018.

High-Order Adaptive Time Stepping of Vesicle Suspensions, *IMA workshop: Electrohydrodynamics and Electrodifffusion in Material Sciences and Biology*, March 2018.

Integral Equation Methods for Complex Dynamics, *Department of Mechanical Engineering, Florida State University*, October 2017.

Pores, Fibers, and Clamped Points: Forming High Resolution Solutions of Small Structures in Fluids, *Florida State University*, October 2017.

Eroding Bodies in a Stokesian Fluid, *CAIMS Annual Meeting*, July 2017.

Pores, Capsules, and Wildfires: Efficient Numerical Methods, *GFDI 50th Anniversary Workshop*, May 2017.

Erosion in Stokesian Porous Media, *SIAM Southeastern Atlantic Section Conference*, March 2017.

Erosion in Stokesian Porous Media, *AMS Spring Southeastern Sectional Meeting*, March 2017.

High-order adaptive time stepping in vesicle suspensions, *SIAM Conference on Computational Science and Engineering*, March 2017.

Integral Equation Methods for Complex Fluids, *Geophysical Fluid Dynamics Institute*, October 2016.

Stable and low resolution simulations in interfacial dynamics, *SIAM Conference on Nonlinear Waves and Coherent Structures*, August 2016.

Method of lines transpose applied to regularized kernels, *SIAM Annual Meeting*, July 2016.

Integral Equation Methods for Complex Fluids: Numerical Analysis and Applications, *Florida State University*, April 2016.

An integral equation method for Stokes flow in porous media, *SIAM Southeastern Atlantic Section Conference*, March 2016.

Time Stepping in Fluid Dynamics and Other Applications, *Florida State University*, February 2016.

High-order adaptive time stepping for deformable capsules, *Mathematical Foundations for Fast Multi-resolution Interactions & Large Data Analysis*, August 2015.

Black-box Simulations for Vesicle Transport, *AMMCS Meeting*, June 2015.

An Integral Equation Method for Flow in Porous Media, *CAIMS Annual Meeting*, June 2015.

An Adaptive Spectral Deferred Time Integrator for Vesicle Suspensions, *SIAM Conference on Computational Science and Engineering*, March 2015.

Integral Equation Methods for Complex Fluids: Numerical Analysis and Applications, *Florida State University*, February 2015.

Integral Equation Methods for Complex Fluids: Numerical Analysis and Applications, *Old Dominion University*, February 2015.

Integral Equation Methods for Complex Fluids: Numerical Analysis and Applications, *New Jersey Institute of Technology*, February 2015.

Integral Equation Methods for Complex Fluids: Numerical Analysis and Applications, *University of Houston*, January 2015.

Adaptive Time Stepping for High Concentration Vesicle Suspensions, *Michigan State University*, June 2014.

Adaptive Time Stepping for Vesicle Suspensions, *University of Texas at Austin*, April 2014.

FMM-based Preconditioners for Second Kind Integral Equations, *BIRS workshop on Integral Equations Methods: Fast Algorithms and Applications*, December 2013.

High Volume Fraction Simulations of Two-Dimensional Vesicle Suspensions, *Dartmouth College*, February 2013.

Fast Integral Equation Methods for the Two-Dimensional Heat Equation and Stokes Flow, *Texas A&M University*, October 2012.

Solving the Modified Helmholtz Equation with Integral Equations, *Simon Fraser University*, December 2010.

Integral Equation Methods for the Navier-Stokes Equations, *Advances in Boundary Integral Equations and Related Topics, University of Delaware*, August 2009.

OTHER PRESENTATIONS

Semi-Permeable Vesicles with Adhesion, *APS Annual Meeting of Fluid Dynamics*, November 2019.

Viscous Erosion of Porous Media, *APS Annual Meeting of Fluid Dynamics*, November 2018.

Preconditioning Stokes Equation in Porous Media with the IFMM, *Workshop on Fast Direct Solvers*, November 2016.

High-Order Adaptive Time Stepping for Vesicle Suspensions, *4th Workshop on Sparse Grid and Applications*, October 2016.

Predicting anomalous diffusion rates of Stokes flow in porous media (poster presentation), *APS Annual Meeting of Fluid Dynamics*, November 2015.

The effect of low accurate vesicle suspensions on observables, *APS Annual Meeting of Fluid Dynamics*, November 2015.

Spectral Deferred Correction Methods for Vesicle Suspensions, *SIAM Annual Meeting*, July 2014.

Adaptive Time Stepping for Vesicle Suspensions, *Copper Mountain Conference on Iterative Methods*, April 2014.

High Concentration Vesicle Suspensions, *Applied Mathematics, Modeling, and Computer Science*, August 2013.

Time Step Control for Two-Dimensional Moving Interface Problems, *SIAM Annual Meeting*, July 2013.

Multigrid Applied to Stokes Double Layer Potential, *Copper Mountain Conference on Multigrid Methods*, March 2013.

High Volume Fraction Simulations of Two-Dimensional Vesicle Suspensions, *SIAM Conference on Computational Science and Engineering*, February 2013.

High Volume Fraction Simulations of Two-Dimensional Vesicle Suspensions, *SIAM Annual Meeting*, July 2012.

Boundary Integral Methods for Inextensible Vesicle Dynamics in 2D, *CAIMS Annual Meeting*, July 2012.

Fast Integral Equation Methods for the Modified Helmholtz Equation, *ICIAM and WAVES*, July 2011.

Integral Equation Methods for the Modified Biharmonic Equation, *Foundations in Applied and Computational Mathematics*, June 2011.

An Integral Equation Method for the Modified Biharmonic Equation, *SIAM Conference on Computational Science and Engineering*, March 2011.

Fast Integral Equations Methods for the Modified Helmholtz Equation (poster presentation), *CMS Winter Meeting*, December 2010.

Fast Integral Equations Methods for the Modified Helmholtz Equation (poster presentation), *Computational Math Day, Simon Fraser University*, August 2010.

Fast Integral Equation Methods for the Modified Helmholtz Equation (poster presentation), *IMA Hot Topics Workshop: Integral Equation Methods, Fast Algorithms and Applications*, August 2010.

Fast Integral Equation Methods for the Navier-Stokes Equations (poster presentation), *SIAM Annual Meeting*, July 2009.

Fast Integral Equation Methods for the Navier-Stokes Equations (poster presentation), *SIAM Conference on Computational Science and Engineering*, March 2009.

Integral Equation Methods for Incompressible Fluid Dynamics, *SIAM Annual Meeting*, July 2008.

SERVICE

XSEDE Reviewer	2017–
Co-organizer of the BIRS workshop on Complex Creeping Fluids: Numerical Methods and Theory	October 2017
Co-organizer of the SIAM Southeastern Atlantic Section Conference	March 2017
Young Scholars Program mentor for two high school students	June–July 2016
SIAM minisymposium organizer	2012–2020
Co-organizer of the Applied Math Graduate Student Conference	2007–2009

Referee for the Advances in Computational Mathematics, Applied Mathematical Modelling, Applied Numerical Mathematics, Computational Geosciences, Engineering Analysis with Boundary Elements, International Journal for Numerical Methods in Fluids, International Journal of Mechanical Sciences, Journal of Computational Physics, Journal of Engineering Mathematics, Journal of Fluid Mechanics, Journal of Scientific Computing, Numerical Algorithms, Procedia IUTAM, Quarterly Journal of Mechanics and Applied Mathematics, Quarterly on Numerical Analysis and Theory of Computation, Research in the Mathematical Sciences, SIAM Journal on Scientific Computing.

CURRENT POSTDOC AND STUDENT SUPERVISION

David Robinson, PhD (joint with Rod Linn)	2016–
Ashley Gannon, PhD	2017–
Siddhartha Bishnu, PhD (joint with Mark Peterson)	2017–
Jake Cherry, PhD	2019–
Daryn Sagel, MS	2019–
Marcelina Nagles, MS	2019–

PAST SUPERVISION

Postdoctoral Fellows:

Dr. Shang-Huan Chiu, postdoc 2018–2019

Graduate Students:

Lukas Bystricky (joint with Sachin Shanbhag) 2016–2018

Contact-Free Simulations of Rigid Particle Suspensions Using Boundary Integral Equations

Undergraduate Students: David Miller, Dalton Drummond, Miles Currie, Leah Rumancik

High School Students: Mahima Chander, William Harrington, Julia Hernandez

GRADUATE COMMITTEES

Ph.D.: Roger Castro, Evan Cresswell-Clay, Brandon Gusto, Eitan Lees, Isaac Lyngaas, Kyle Shaw, Zlatko Sokolij, Kenneth Sockwell, Wenju Zhao

MS: Cody Estbee, Cody Ficarra, Albert Iglesias, Jonathon Nosowitz, Daniel Rosales

Undergraduate: Jacoub Spainhour