

John LaGrone

Curriculum Vitae

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Educational History

- 2016 **Ph.D. Computational and Applied Math**, *Southern Methodist University*, Dallas, Texas,
Dissertation: *Optimization and Application of Complete Radiation Boundary Conditions*.
Advisor: Prof. Thomas Hagstrom
- 2013 **M.S. Computational and Applied Math**, *Southern Methodist University*, Dallas, Texas.
- 2010 **B.S. Mathematics**, *Texas Christian University*, Fort Worth, Texas.

Employment History

- 2019–Present **Senior Computer Vision Engineer**, *Scandy, LLC*, New Orleans, Louisiana.
- Improving the usability and performance of *Scandy Pro*, an iPhone application for 3D scanning.
 - Implementing and improving algorithms on CPU and GPU for real time 3D scanning and volumetric video in a primarily simultaneous localization and mapping (SLAM) based system.
 - Working as part of a team and individually to develop novel solutions for client and internal projects.
 - Supervising a junior computer vision engineer.
- 2016–2019 **Postdoctoral Fellow**, *Tulane University*, New Orleans, Louisiana.
- Taught courses in Calculus I-III and Analytical Methods. Worked on adding Matlab programming assignments to the Calculus III curriculum.
 - Conducting research in low Reynolds number fluid dynamics with applications to biological systems using high performance computing.
 - Implemented algorithms on heterogeneous computer systems including OpenMP, MPI, and Intel Phi coprocessors.
 - Co-led group meetings with collaborators, department visitors, and students concerning ongoing research projects.
 - Mentoring undergraduate students in research projects involving stochastic methods to simulate microorganisms responding to a distribution of chemicals (chemotaxis). We are working on developing methods using NumPy to statistically quantify the effectiveness of our models.
 - Volunteered for events designed to introduce mathematics and science topics to middle schoolers.
- 2012–2016 **Research Assistant**, *Southern Methodist University*, Dallas, Texas.
- Formulation and implementation of complete radiation boundary conditions and double absorbing boundary layers for finite difference time domain solvers for electromagnetic simulations in high performance computing environments including OpenMP and MPI.
 - Released an open source C++ library called **rbcpack** with interfaces in C and Fortran (available at rbcpack.org). I am currently responsible for the documentation, website, and released codebase.
 - Development of a sweeping style solver and preconditioner for Helmholtz Equation.
 - Organized and ran the weekly Graduate Student Seminar. Invited speakers to give talks to graduate students.
 - Involved with the local student chapter of the Society of Applied and Industrial Mathematics.

- 2011–2012 **Teaching Assistant**, *Southern Methodist University*, Dallas, Texas.
- Administered tests, graded, and ran tutoring sessions for students.
 - Collected statistical data on the usage of the tutoring sessions that we used to optimize scheduling times and availability.

Teaching Experience

Courses Taught at Tulane University

- Fall 2019 **MATH 1220**, *Calculus II*.
Fall 2019 **MATH 4470/6470**, *Analytical Methods*.
Fall 2018 **MATH 2210**, *Calculus III*.
Spring 2018 **MATH 2210**, *Calculus III*.
Fall 2017 **MATH 1310**, *Consolidated Calculus, Combined Calculus I & II*.

Other Teaching, Mentoring Experiences, and Training

- Spring/Summer 2019 **Mentor**, *Undergraduate Research in Computational Biofluids*.
- Directed research project with an undergraduate student to add a tree code based evaluation method to biofluid models at Tulane University.
- Fall 2018 **Mentor**, *Undergraduate Research in Computational Biofluids*.
- Directed a semester research project for an undergraduate student adding stochastic and chemotactic rules to a model of sea urchin sperm at Tulane University.
- Spring 2018 **Mentor**, *Undergraduate Research in Computational Biofluids*.
- co-Directed a semester research project for three undergraduate students characterizing a model of sea urchin sperm at Tulane University.
- Summer 2017 **Mentor**, *Research Experience for Undergraduates in Computational Biofluids*.
- co-Directed a summer research project for three undergraduate students modeling microscale swimming at Tulane University.
- 2016–Present **Mentor**, *Graduate students*.
- Aid in and discuss research topics, review application materials, etc.
- Spring 2016 **The Teaching Institute for Graduate Students**, *Short course, Southern Methodist University*.

Publications

Journal Articles

- 1 B. Chakrabarti, Y. Liu, J. LaGrone, R. Cortez, L. Fauci, O. Du Roure, D. Saintillan, and A. Lindner. *Flexible filaments buckle into helicoidal shapes in strong compressional flows*. *Nature Physics*. 16, 689-694. March 2020
- 2 J. LaGrone, R. Cortez, W. Yan, and L. Fauci. *Complex dynamics of long, flexible fibers in shear*. *Journal of Non-Newtonian Fluid Mechanics*. 269. July 2019
- 3 J. LaGrone, R. Cortez, and L. Fauci. *Elastohydrodynamics of swimming helices: effects of flexibility and confinement*. *Physical Review Fluids*. 4, 033102. March 2019

- 4 J. LaGrone and T. Hagstrom. *Double Absorbing Boundaries for Finite Difference Time Domain Electromagnetics*. Journal of Computational Physics 326 (2016): 650-665.

Software

- 5 J. LaGrone and T. Hagstrom. RBCPack: The Radiation Boundary Condition Package. rbcpack.org. *In collaboration with HyPerComp, Inc. to provide an easy-to-use interfaces to Complete Radiation Boundary Conditions and Double Absorbing Boundary Layers for a variety of numerical wave propagation solvers*. Initial Release, October 2015.

In Preparation

- IP6 J. Bielak, D. Givoli, T. Hagstrom and J. LaGrone. *Complete Radiation Boundary Conditions in an Elastic Half-Space*.
- IP7 J. LaGrone, S. Khatri, and R. Cortez. *Performance of stochastic chemotaxis processes in a Stokesian fluid coupled with advection-diffusion-reaction equations*.
- IP8 J. LaGrone, R. Cortez, and L. Fauci. *Effects of viscoelastic networks on flagellated swimmers*.
- IP9 J. LaGrone, A. Burns, T. Glaeser, C. Reasonover, R. Cortez, and L. Fauci. *A computational model of chemotactic swimming for sea urchin sperm*.

Refereed Conference Proceedings and Extended Abstracts

- P10 J. LaGrone, A. Burns, T. Glaeser, C. Reasonover, and R. Cortez. *Chemotaxis Modeling for Sperm Motility*, Abstract, SMB Annual Meeting 2018.
- P11 J. LaGrone, L. Fauci and R. Cortez. *Simulating Bacterial Motility in Confined Environments*, Extended Abstract, IUTAM Symposium on Motile Cells in Complex Environments May 2018.
- P12 J. LaGrone, L. Fauci and R. Cortez. *Influence of Driving Mechanisms on Bacterial Motility*, Abstract, SMB Annual Meeting 2017.
- P13 J. LaGrone and T. Hagstrom. *High Order Radiation Boundary Conditions For Elastic Waves*, Abstract, ICOSAHOM 2016.
- P14 T. Hagstrom, J. LaGrone and D. Appelö. *Optimal Radiation Boundary Conditions and Absorbing Layers for Elastic Waves*, Abstract, ECCOMAS Congress 2016.
- P15 J. LaGrone and T. Hagstrom. *Double Absorbing Boundaries for Finite Difference Time Domain Electromagnetics*, Extended Abstract, Waves 2015, July 2015.

Service

Departmental Service

- 2016 – 2019 **Workshop Leader**, *BATS (Boys at Tulane in STEM) and GIST (Girls In STEM at Tulane)*, BATS and GIST are programs to provide fifth through seventh graders with the opportunity to meet and work with role models in STEM fields.
- 2012 – 2014 **Organized Graduate Student Seminar**, *Southern Methodist University*.

Presentations

Invited Talks

- May 2019 **Numerical methods for (a) Absorbing boundaries in wave propagation and (b) Elasto-hydrodynamics in flagellar swimming**, *Sandia National Laboratory*.

- April 2019 **Numerical Simulation of Viscoelastic Fibers**,
Math Colloquium, University of New Orleans.
- March 2019 **Helical Buckling of Elastic Fibers in Straining Flows**,
GFS follow on: Mathematics of form in active and inactive media, Isaac Newton Institute for Mathematical Sciences, Cambridge.
- February 2019 **Numerical Simulation of Viscoelastic Fibers**,
Oakridge National Laboratory.
- October 2018 **Microdynamics in Regularized Brinkman Flow**,
SIAM Texas-Louisiana Section Meeting, Louisiana State University.
- July 2018 **Chemotaxis Modeling for Sperm Motility**,
Society for Mathematical Biology Annual Meeting, University of Sydney.
- February 2018 **Simulating Bacterial Motility in Confined Environments**,
SIAM Southeastern Atlantic Sectional Conference, University of North Carolina, Chappel Hill.
- March 2017 **Applications of Complete Radiation Boundary Conditions to Electromagnetic and Elastic Problems**,
Undergraduate Math Seminar, Xavier University of Louisiana.
- June 2016 **High Order Radiation Boundary Conditions For Elastic Waves**,
International Conference on Spectral and High Order Methods 2016, Rio de Janeiro, Brazil.
- January 2016 **Applications of Complete Radiation Boundary Conditions**,
RTG Seminar, Rensselaer Polytechnic Institute.
- November 2015 **Double Absorbing Boundaries for Finite-Difference Time-Domain Electromagnetics**,
Applied Math Seminar, University of New Mexico.
- July 2015 **Double Absorbing Boundaries for Finite-Difference Time-Domain Electromagnetics**,
Waves 2015, Karlsruhe, Germany.

Contributed Talks

- May 2018 **Simulating Bacterial Motility in Confined Environments**,
IUTAM Symposium on Motile Cells in Complex Environments, Università degli Studi di Udine, Udine, Italy.
- February 2018 **Simulating Bacterial Motility in Confined Environments**,
Scientific Computing Across Louisiana, Louisiana State Unniversity, Baton Rouge.
- September 2017 **Simulating Bacterial Motility in Confined Environments**,
Texas Applied Mathematics and Engineering Symposium, University of Texas, Austin.
- July 2017 **Influence of Driving Mechanisms on Bacterial Motility**,
Society for Mathematical Biology Annual Meeting, University of Utah, Salt Lake City.
- March 2017 **Bacterial Motility in Confined Environments**,
Scientific Computing Across Louisiana, Tulane University, New Orleans.
- February 2015 **Double Absorbing Boundaries for Finite-Difference Time-Domain Electromagnetics**,
Finite Element Rodeo, Southern Methodist University, Dallas.

Posters

- January 2017 **Bacterial Motility in Confined Environments**,
Sixth Annual Winter Workshop on Neuromechanics and Dynamics of Locomotion, Tulane University, New Orleans.
- July 2014 **Stable Implementation of Complete Radiation Boundary Conditions in Finite Difference Time Domain Solvers for Maxwell's Equations**,
SIAM Annual Meeting, Chicago.

Travel Awards

- 2018 SMB Landahl Travel Grant.
- 2018 Tulane Postdoctoral Fellow Summer Travel Award.
- 2014 NSF-CBMS Conference on Fast Direct Solvers Travel Award.
- 2013 Gene Golub SIAM Summer School Travel Support.

Skills

- Programming Languages: C/C++, Fortran, Python (particularly NumPy, Numba), Jupyter Notebooks, L^AT_EX
- High Performance Computing: MPI, OpenMP, OpenCL, Metal, CUDA (some experience)
- Web Development: HTML, CSS, PHP
- Applications: MATLAB, Maple, Visit, Paraview, Meshlab, Blender (some experience) MS Office, OpenOffice
- Documentation Systems: Sphinx, Doxygen
- Version Control: Git, Mercurial
- Libraries: Boost, deal.II, Eigen, HDF5, OpenCV, Open3D, PETSc, PVFMM, Trilinos, VTK
- Operating Systems: Linux, Windows, macOS
- Databases (some experience): MySQL, SQL