Zhuolin Qu

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Research Interests

Mathematical and Computational Epidemiology, Numerical Methods for Time-Dependent PDEs, Uncertainty Quantification, Optimization Algorithms

Education

Doctor of Philosophy, Applied Mathematics — **New Orleans, LA**
Tulane University, 3.98 — *2011–2016*
Thesis: Fast Operator Splitting Methods for Nonlinear PDEs
Advisor: Professor Alexander Kurganov

Master of Science, Statistics — **New Orleans, LA**
Tulane University, 4.00 — *2012–2016*
Advisor: Professor Michelle Lacey

Bachelor of Science, Mathematics — **Heifei, China**
University of Science and Technology of China — *2007–2011*
Advisor: Professor Mengping Zhang

Experience

Postdoctoral Fellow, Tulane University — **New Orleans, LA**
Mentor: James (Mac) Hyman — *2016–present*
- Work in multi-disciplinary team (public health, mathematics, statistics) to model infectious diseases, including vector-borne diseases and sexually transmitted diseases
- Propose and analyze both equation-based models and stochastic agent-based network models to study disease dynamics and optimize the mitigation resources

Visiting Scholar, Los Alamos National Laboratory — **Los Alamos, NM**
Host: Benjamin McMahon — *summer 2017, 2018, 2019*
- Performed epidemiological analysis on invasive non-typhoidal Salmonella(iNTS) in sub-Saharan Africa
- Proposed agent-based multi-scale model describing host-pathogen interactions, risk factors for host susceptibility and family structure in disease transmission

Graduate Research Assistant, Tulane University — **New Orleans, LA**
Mentor: Alexander Kurganov — *2012–2016*
- Addressed numerical challenges for fluid dynamic systems, including hyperbolic systems of conservation laws, phase-field models and the modified Buckley-Leverett equations
- Designed highly efficient and stable numerical algorithms using finite-difference/finite-volume methods, operator splitting methods and pseudo-spectral methods

Summer Intern, Los Alamos National Laboratory — **Los Alamos, NM**
Mentor: Carl Gable, Nataliia Makedonska — *summer 2015*
- Improved algorithms for calculating geometric coefficients of large unstructured mesh
- Independently implemented the algorithms using highly efficient parallel programming (in PETSc and MPI) and object-oriented programming in Fortran
- Codes are now part of dfnWorks, the software suit of flow and transport modeling in discrete fracture networks, used by the lab

Visiting Fellow, Shanghai Jiao Tong University — **Shanghai, China**
Institute of Natural Sciences — *summer 2012, 2013*

Summer Intern, Pohang University of Science and Technology **Pohang, Korea**
Mentor: Kwang Ik Kim *summer 2010*
Worked on the Singular Perturbation Theory in Combinatorial and Computational Mathematics (Com2MaC) Research Center of POSTECH

Publications

- **Qu, Zhuolin**, Hyman, J. M. Generating a Hierarchy of Reduced Models for a System of Differential Equations Modeling the Spread of *Wolbachia* in Mosquitoes, submitted
- *with* Kurganov, A., Wu, T. Adaptive Moving Mesh Central-Upwind Schemes for Hyperbolic System of PDEs. Applications to Compressible Euler Equations and Granular Hydrodynamics, submitted
- **Qu, Zhuolin**, Xue, L., Hyman, J.M. Modeling the Transmission of *Wolbachia* in Mosquitoes for Controlling Mosquito-Borne Diseases, *SIAM Journal on Applied Mathematics*, 2018, 78(2):826–852.
- *with* Cheng, Y. Z., Kurganov, A., Tang, T. Fast and Stable Explicit Operator Splitting Methods for Phase-field Models, *Journal of Computational Physics*, 2015, 303:45-65.
- *with* Kao, C. Y., Kurganov, A., Wang, Y. A Fast Explicit Operator Splitting Method for Modified Buckley–Leverett Equations, *Journal of Scientific Computing*, 2015, 64(3):837-857.
- *with* Chertock, A., Kurganov, A., Wu, T. Three-Layer Approximation of Two-Layer Shallow Water Equations, *Mathematical Modelling and Analysis*, 2013, 18(5):675-693.

Papers in Preparation

- Thongsripong, P., **Qu, Zhuolin**, Yukich, J., Hyman, J. M., Wesson, D. Quantification of Human-mosquito Contact Rate Using Surveys and its Application in Determining Dengue Viral Transmission Risk
- **Qu, Zhuolin**, Hyman, J. M., Azizi, A., Schmidt, N., Kissinger, P., Modeling Impact of Community-based male-screeing on the Ct prevalence of Women
- **Qu, Zhuolin**, Gulbudak, H., Hyman, J. M., Milner, F., Sensitivity Analysis in a Vector-Host Immuno-Epidemiological Model with Application to Rift Valley Fever

Honors and Awards

Postdoctoral Fellow Travel Fund, Tulane University 2017–2019
Health Sciences Research Days Award for Excellence in Research and Presentation by a Postdoctoral Fellow, Tulane University 2017
SAMSI Workshop Travel Award, SAMSI 2016
KI-Net Conference Travel Award, KI-Net 2015
Graduate Studies Student Association Travel Award, Tulane University 2015
Tulane Science and Engineering Dean's Office Travel Award, Tulane University 2015
Summer Research Fellowship, Tulane University 2012–2015
Outstanding Students Fellowship, University of Science and Technology of China 2008–2010
Special Freshmen Fellowship, University of Science and Technology of China 2007

Conference and Talks

2019

- **The Fifth International Conference on Computational and Mathematical Population Dynamics (CMPD5)**, invited talk, Fort Lauderdale, May
- **Workshop on Modeling the Spread of Infectious Diseases**, Tulane University, February
- **Scientific Computing around Louisiana**, contributed talk, Tulane University, February
- **NIMBioS tutorial: Network Modeling**, workshop, University of Tennessee, February

2018

- **University of Louisiana at Lafayette**, Mathematics Department Colloquium, October
- **Biomathematics and Ecology: Education and Research** (BEER) conference, contributed talk, Arizona State University, October
- **SAMSI workshop**, Model Uncertainty: Mathematical and Statistical, poster presentation, Duke University, August
- **SIAM Annual Meeting 2018**, contributed talk, July
- **Los Alamos National Laboratory**, Brown bag meeting on disease transmission modeling and surveillance, seminar talk, July
- **Joint Research Conference on Statistics in Quality, Industry, and Technology**, participation, Santa Fe, June
- **MBI Emphasis Workshop on Multiscale Dynamics of Infections**, poster presentation, Ohio State University, April
- **NIH-MIDAS Network Meeting**, poster presentation, April
- **42nd SIAM SEAS Sectional Conference**, invited talk, UNC Chapel Hill, March
- **29th Annual Health Sciences Research Days**, poster presentation, Tulane University, February
- **Scientific Computing around Louisiana (SCALA)**, contributed talk, Louisiana State University, February

2017

- **Mathematical Biology Center**, Guangzhou University, invited talk, November
- **Mathematics and Science College**, Shanghai Normal University, invited talk, November
- **Tropical Medicine Seminar**, School of Public Health and Tropical Medicine, Tulane, seminar talk, September
- **Los Alamos National Laboratory**, Center for Nonlinear Studies, seminar talk, August
- **9th Annual Summer Institute in Statistics and Modeling in Infectious Diseases**, workshop, University of Washington, July
- **SMB Annual Meeting 2017**, poster presentation, July
- **SIAM Annual Meeting 2017**, contributed talk, July
- **NIMBioS Tutorial: Uncertainty Quantification for Biological Models**, workshop, June
- **NIH-MIDAS Network Meeting**, poster presentation, May
- **How Mathematical Models are helping Guide Mitigation Efforts to Control Epidemics**, guest lecture, Georgia State University, May
- **Scientific Computing around Louisiana (SCALA)**, contributed talk, Tulane University, March
- **SIAM Conference on Computational Science and Engineering**, poster presentation, March

- **28th Annual Health Sciences Research Days**, poster presentation, Tulane University, February

2016

- **SAMSI Optimization Program Summer School**, workshop, August

2015

- **KI-Net: Collective Dynamics in Biological and Social Systems**, poster presentation, November
- **Tulane Mathematics Department**, Graduate Student Colloquium, invited talk, September
- **Los Alamos National Laboratory**, SFT Brown Bag Seminar, invited talk, August
- **Student Symposium**: "Championing Scientific Careers", poster presentation, Los Alamos National Laboratory, August
- **The Ninth IMACS International Conference** on Nonlinear Evolution Equations and Wave Phenomena, invited talk, April
- **Scientific Computing Around Louisiana** (SCALA), poster presentation, March

2014

- **Tulane Mathematics Department**, applied mathematics seminar, invited talk, April
- **KI-Net Conference** on Modern Perspectives in Applied Mathematics: Theory and Numerics of PDEs, participation, April

before

- **Clifford Lectures Conference** on Numerical Methods for Convection Dominated Partial Differential Equations, participation, March 2013
- **American Mathematical Society Sectional Meeting**, participation, October 2012

Service

Journal Referee

- Journal of Biological Dynamics
- Journal of Theoretical Biology
- Letters in Biomathematics
- PLoS ONE
- Mathematical Biosciences
- Journal of Biological Systems

Graduate Committee

- Li Guan, Department of Mathematics, Tulane University, Spring 2018

Conference & Workshop

- Organizer, New Orleans workshop on Modeling the Spread of Infectious Diseases, Tulane University, Spring 2019
- Co-organizer, Clifford Lectures Conference 2017, Tulane University, 2017

Media Coverage

- **Forbes Magazine**, Innovation-Science, "Math-Based Mosquito Control To Prevent Human Diseases", January 14th, 2019
- **Los Alamos Monitor**, "Solving epidemics with math", October 10th, 2018
- **The Times-Picayune**, "Tulane researchers use math to contain the spread of mosquito-borne illnesses", August 30th, 2018
- **SIAM News**, Research Nugget on "Sustained bacterial outbreak in mosquitoes limits spread of life-threatening diseases", March 20th, 2018

Poster Judge, School of Science and Engineering Research Day, Tulane University 2018, 2019
Newcomb Fellow, Newcomb College Institute, Tulane University 2016–present

Teaching Experience

Instructor

Scientific Computation III (graduate course) Spring 2019
Scientific Computation III (graduate course) Spring 2018
Calculus III Fall 2016
Long Calculus II Spring 2014
Calculus II Fall 2013

Teaching Assistant

Calculus II Spring 2016
Calculus I Fall 2015
Introduction to Applied Mathematics Spring 2015
Consolidated Calculus Fall 2014
Linear Algebra Spring 2013
Linear Algebra Fall 2012
Introduction to Applied Mathematics Fall 2012
Introduction to Applied Mathematics Spring 2012
Calculus III Spring 2012
Calculus I Fall 2011

Guest Teaching Lectures

Optimization (graduate course) Fall 2018
Applied Mathematics II (graduate course) Spring 2017
Ordinary Differential Equation Fall 2016

Mentoring Experience

- Assist in mentoring doctoral dissertation, Public Health student, on quantifying human-mosquito contact rate, manuscript submitted. (Tulane, 2017-2018)
- Assist in mentoring doctoral dissertation, Mathematics student, on modeling epidemics with distribution parameters, committee member for Dissertation defense (Tulane, 2017-2019)
- Assist in mentoring master thesis project, Computational Science student, on modeling chikungunya disease and quantifying model uncertainty (Tulane, 2018-2019)
- Assist in mentoring undergraduate honor thesis, Neuroscience student, on modeling Tuberculosis progression with treatment, Senior Scholar Award for undergraduate (Tulane, 2018-2019)
- Assist in mentoring doctoral dissertation, Biostatistics student, on characterizing the spread of epidemics over networks (Tulane, 2018-2019)

- Mentoring committee member for Society of Mathematical Biology mentoring program at the annual meeting 2017

Computer Skills

Script: Matlab, Octave, Fortran, Mathematica, C, R, Python, Maple, MySQL, NetLogo

Software: Latex, Git, Vim, Inkscape, ParaView, Adobe Illustrator, Origin

Other: MPI, PETSc, LaGriT, PFLOTRAN