# 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, to appear in SIAM Journal on Applied Mathematics.

○ **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.

○ *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

## 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

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|---|---|
| **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

- **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

- **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

- **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

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|---|---|
| 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

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|---|---|
| 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

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|---|---|
| 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