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Ruowen Liu

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Contact Information

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Education

Arizona State University, Tempe AZ, USA 8/2011 - 5/2017
Doctor of Philosophy in Applied Mathematics
Thesis: Numerical Issues Arising in Simulations of Transient Water Flow in Layered Unsaturated Soils
Advisor: Prof. Bruno Welfert, Prof. Sandra Houston

Beijing Normal University, Beijing, China 9/2006 - 6/2010
Bachelor of Science in Mathematics and Applied Mathematics
Thesis: Structural Analysis of Higher Logic Complex Networks of Breast Cancer Functional Genomes
Advisors: Prof. Haiyang Huang, Prof. Dazhi Meng

Work Experience

Rider University, Lawrenceville NJ, USA
Assistant Professor I, Department of Mathematics 9/2023 - Present
Lecturer, Department of Mathematics 9/2021 - 8/2023

University of Michigan, Ann Arbor MI, USA
Assistant Professor, Department of Mathematics 9/2017 - 5/2021

Arizona State University, Tempe AZ, USA
Teaching Assistant, School of Mathematical & Statistical Sciences 1/2013 - 5/2017

Beijing No. 2 High School, Beijing, China
Intern Mathematics Teacher, 11th grade (junior year) 10/2009 - 12/2009

Teaching Experience

Rider University, Lawrenceville NJ 9/2021 - Present
MTH 102 Finite Mathematics (Fall 2021, Fall 2022, Fall 2024)
MTH 105 Algebra and Trigonometry (Fall 2023)
MTH 106 Precalculus (Spring 2024, Fall 2024)
MTH 120 Intro to Applied Statistics (Fall 2023)
MTH 210 Calculus I (Fall 2021, Spring 2022, Fall 2022)
MTH 212 Calculus III (Spring 2024)
MTH 340 Probability & Statistical Analysis I (Fall 2021, Fall 2022, Fall 2023, Fall 2024)
MTH 341 Probability & Statistical Analysis II (Spring 2022, Spring 2023, Spring 2024)

University of Michigan, Ann Arbor MI 9/2017 - 5/2021
MATH 115 Calculus I (Fall 2017, Fall 2018)
MATH 215 Calculus III – Multivariable & Vector Calculus (Fall 2020)
MATH 216 Introduction to Differential Equations (Fall 2019)
MATH 452 Advanced Calculus II – Multivariable (Winter 2019, Winter 2020, Winter 2021)

Arizona State University, Tempe AZ 1/2013 - 5/2017

MAT 170 Precalculus (Summer 2013, Fall 2016)

MAT 265 Calculus for Engineers I (Fall 2013, Fall 2014, Spring 2015, Spring 2017)

MAT 266 Calculus for Engineers II (Spring 2014, Fall 2015, Spring 2016)

MAT 267 Calculus for Engineers III (Summer 2016)

MAT 270 Calculus w/Analytic Geometry I – Recitation (Spring 2013)

Academic & Professional Experience

University of Michigan, Ann Arbor MI 09/2017 - 5/2021

Direction: *Fast Algorithm of Shape Optimization for Stokesian Flow*

- Implemented shape optimization problem of peristaltic pumpings which transport viscous fluids using fast algorithm of boundary integral equation methods;
- Optimized the shape of peristaltic pumping channels/tubes which transport passive matters;
- Optimized the shape of axisymmetric micro-swimmers in Stokes flow.

Arizona State University, Tempe AZ 2012 - 2017

Direction: *Numerical Algorithms in Simulations of Unsaturated Flow in Nonhomogeneous Soils*

- Collaborated with School of Sustainable Engineering & the Built Environment, ASU;
- Developed a mathematical model to evaluate hydraulic conductivities at interfaces of distinct soil layers and proposed the ill-posedness of the interface problem;
- Investigated different averaging methods for cell-centered hydraulic conductivities and the impact on the interface problem;
- Proposed a reduced model of unsaturated flow in 1D heterogeneous soil with spatially stochastic soil hydraulic conductivities.

Beijing Normal University, Beijing China 2009 - 2010

Direction: *Complex Gene Network Analysis*

- Collaborated with Institute of Systems Biology and BioComputing at Shandong University of Science and Technology, Shandong, China;
- Conducted data mining on polygenetic profiles of breast cancer patients, compared with the profiles of normal breast cells based on information theories, and established mutual information complex networks with logic relationships of relevant genes;
- Analyzed the statistical characteristics of gene networks related to different diseases, especially cancers, and proposed a potential diagnosis of breast cancer using the gene-interaction network.

Publications

Note: In publications [5] and [8], authors are listed alphabetically, which is common in mathematics, as the authors contributed equally to these works.

[10] **Ruowen Liu**, Hai Zhu, Hanliang Guo, Marc Bonnet and Shravan Veerapaneni. (2024) Shape Optimization of Slip-Driven Axisymmetric Microswimmers. *(accepted by SIAM Journal on Scientific Computing)*

arXiv:2405.00656v1

[9] Zhengping Jay Luo, **Ruowen Liu**, Aarav Mehta and Md Liakat Ali. (2024) Demystifying the RSA Algorithm: An Intuitive Introduction for Novices in Cybersecurity. *The CCSC Eastern's 40th Annual Regional Conference, in The Journal of Computing Sciences in Colleges.* arXiv:2308.02785

[8] Marc Bonnet, **Ruowen Liu**, Shravan Veerapaneni, and Hai Zhu. (2023) Shape Optimization of Peristaltic Pumps Transporting Rigid Particles in Stokes Flow. *SIAM Journal on Scientific Computing*, 45(1), B78-B106.

DOI: 10.1137/21M144863X, arXiv:2110.00702

[7] Hanliang Guo, Hai Zhu, **Ruowen Liu**, Marc Bonnet, Shravan Veerapaneni. (2021) Optimal Ciliary Locomotion of Axisymmetric Microswimmers. *Journal of Fluid Mechanics*, 927.

DOI: 10.1017/jfm.2021.744, arXiv: 2103.15642

[6] Hanliang Guo, Hai Zhu, **Ruowen Liu**, Marc Bonnet, Shravan Veerapaneni. (2021) Optimal Slip Velocities of Micro-Swimmers with Arbitrary Axisymmetric Shapes. *Journal of Fluid Mechanics*, 910.

DOI: 10.1017/jfm.2020.969, arXiv: 2007.09567

[5] Marc Bonnet, **Ruowen Liu**, and Shravan Veerapaneni. (2020) Shape Optimization of Stokesian Peristaltic Pumps Using Boundary Integral Methods. *Advances in Computational Mathematics* 46(2), 1-24.

DOI: 10.1007/s10444-020-09761-7, arXiv:1903.03634.

[4] **Ruowen Liu**, Bruno Welfert. (2020) Reduced Model of One-Dimensional Unsaturated Flow in Heterogeneous Soils with Spatially Stochastic Soil Hydraulic Conductivities. *International Journal of Geomechanics*, 20(3).

DOI: 10.1061/(ASCE)GM.1943-5622.0001563.

[3] **Ruowen Liu**, Bruno Welfert, and Sandra Houston. (2017) Numerical Issues Arising in Determination of Interlayer Conductivities in Layered Unsaturated Soils. *International Journal of Geomechanics*, 04016078.

DOI: 10.1061/(ASCE)GM.1943-5622.0000749.

[2] **Ruowen Liu**, Bruno Welfert, and Sandra Houston. (2017) Comparison of Averaging Methods for Interface Conductivities in One-Dimensional Unsaturated Flow in Layered Unsaturated Soils. *Geotechnical Frontier*, Orlando, FL.

DOI: 10.1061/9780784480472.078

[1] **Ruowen Liu**, Bruno Welfert, and Sandra Houston. (2016) Comparison of Averaging Methods for Interface Conductivities in One-dimensional Unsaturated Flow in Layered Soils. *International Symposium on Stratified Flows*, 1(1), San Diego, CA.

Journal Access (PDF)

Selected Presentations & Posters

[14] *2024 SIAM New York-New Jersey-Pennsylvania Section Conference* 11/2024
Fast Solvers for Shape Optimization of Slip-Driven Axisymmetric Microswimmers in Stokes Flow (talk)

[13] *2021 SIAM Annual Meeting (AN21)* 7/2021
Shape Optimization of Peristaltic Pumps for Stokesian Flow using Boundary Integral Method (talk)

[12] *Mathematical Fluids, Materials and Biology - A conference in honor of the 60th Birthday of Michael J. Shelley, University of Michigan* 6/2019
Shape Optimization of Stokesian Peristaltic Pumps (poster)

[11] *SIAM Great Lakes Section Meeting, University of Michigan* 4/2019
Shape Optimization of Stokesian Peristaltic Pumps Using Boundary Integral Methods (talk)

[10] *2019 Midwest Numerical Analysis Day, Illinois Institute of Technology* 4/2019
Reduced Model of One-Dimensional Unsaturated Flow in Heterogeneous Soils (talk)

[9] *The Michigan Institute for Computational Discovery and Engineering Annual Symposium, Ann Arbor, MI* 4/2019
Shape Optimization of Stokesian Peristaltic Pumps (poster)

[8] *ASU SoMSS Applied & Computational Math Seminar* 2/2018
Fast Algorithms for Shape Optimization Problems in Stokes Flow (talk)

[7] *Capsule Research Talks, Department of Mathematics, University of Michigan* 8/2017
On Mathematical Modeling of Water Flow in Heterogeneous Unsaturated Soils (talk)

[6] *Geotechnical Frontier Conference, Orlando, FL* 3/2017
Impact of Hydraulic Conductivity Averaging Scheme on Numerical Issues for 1D Unsaturated Flow through Layered Soils (talk, with travel grant)

[5] *31st Annual Mathematical Problems in Industry Workshop, University of Delaware* 6/2015
Flooding in Porous Media (collaboration with W.L. Gore and Associates, Inc.) (report, with travel grant)

[4] *Graduate Student Mathematical Modeling Camp, Rensselaer Polytechnic Institute* 6/2015
Changes in Filter Properties due to Folding (group presentation, with travel grant)

[3] *4th Annul Graduate Student Research Symposium, ASU* 3/2014
Numerical Instability in Simulations of Unsaturated Flow in Layered Soils (poster)

[2] *Graduate Career/Research Fair, School of Mathematical & Statistical Sciences, ASU* 10/2012
Water Flow in Layered and Fractured Unsaturated Soils (poster)

[1] *International Conference for the Integration of Science and Technology into Society KAIST (ICISTS-KAIST), South Korea* 8/2009
Group Project on Nano Clinic (second prize) (group presentation)

Service & Mentoring

Service

- Reviewer for Journal of Mathematical Analysis and Applications (2024)
- President's Council on Inclusion, Rider University (2023 - 2025)
- President's Faculty Advisory Council, Rider University (2023 - 2024 and 2024 - 2025)
- Faculty Advisor to Actuarial Science Club, Rider University (Fall 2024 - Present)
- Faculty Advisor to Math Club, Rider University (Fall 2021 - Spring 2024)
- Actuarial Science and/or Math Major Academic Advisor, Rider University (9/2021 - Present)
- Trustee Interview Day (1/27/2024)
- Open House, Rider University (9/25/2021, 4/24/2022, 10/22/2022, 9/30/2023, 11/8/2024)
- Admitted Student Day, Rider University (3/5/2022, 2/11/2023, 4/6/2024)
- Bronc for a Day (11/3/2021, 3/25/2022, 3/8/2023)
- Referee for Graduate Admission, Department of Mathematics, University of Michigan (2018)
- Reviewer for Journal of Zhejiang University-SCIENCE A (2020)

Mentoring

- Collaborated with Dr. Zhengping Jay Luo (Computer Science) to mentor an undergraduate student, Aarav Mehta, at Rider University, resulting in the publication of "Demystifying the RSA Algorithm: An Intuitive Introduction for Novices in Cybersecurity." (2023 - 2024)
- Mentor an undergraduate student, Tenzan Araki, at University of Michigan (9/2018 - 7/2020)
- Mentor an undergraduate student, Shuyang Wang, at University of Michigan (Summer 2019)

Selected Honors & Awards

Honored Instructor 2018
Recognized by students as an instructor that has made a positive impact on them
University of Michigan, Ann Arbor MI

CLAS Teaching Excellence Award Nominee (being a finalist) 2017
Arizona State University, Tempe AZ

CLAS Graduate Excellence Award (with stipend) school year 2016 - 2017
Arizona State University, Tempe AZ

3MT®(Three Minute Thesis) Competition, Second Prize 2014
School of Mathematical & Statistical Sciences, Arizona State University, Tempe AZ

Block Grant Research Award (with stipend) 2012
School of Mathematical & Statistical Sciences, Arizona State University, Tempe AZ

Outstanding Undergraduate Research Fund Project 2010
Beijing Normal University, Beijing China

Professional Scholarships (with stipend) school year 2008 - 2009
Beijing Normal University, Beijing China

Professional Scholarships (with stipend) school year 2007 - 2008
Beijing Normal University, Beijing China

Professional Membership

Member of Society for Industrial and Applied Mathematics (SIAM)