Curriculum Vitae

Shuang Liu

CONTACT INFORMATION

Department of Mathematics
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EMPLOYMENT

University of Califonia, San Diego — La Jolla, CA USA
Stefan E. Warschawski Assistant Professor — Jan. 2021–Jun. 2023
Mentor: Li-Tien Cheng and Bo Li

Los Alamos National Laboratory — Los Alamos, NM USA
Postdoc Research Associate — Jan. 2020–Jan. 2021
Mentor: Xianzhu Tang

EDUCATION

University of South Carolina — Columbia, SC USA
Ph.D. in Applied and Computational Mathematics — Aug. 2015–Dec. 2019

- Thesis: Numerical methods for a class of reaction-diffusion equations with free boundaries.
- Advisor: Xinfeng Liu

Henan Normal University — Xinxiang, Henan, China
M.S., College of Mathematics and Information Science — Sept. 2012–Jul. 2015

- Thesis: A Liouville type theorem for higher order Hardy–Hénon equation in R^n.
- Advisor: Zongming Guo

Henan Normal University — Xinxiang, Henan, China
B.S., College of Mathematics and Information Science. — Sept. 2008–Jul. 2012

- Major in Applied Mathematics

RESEARCH INTERESTS

1. Numerical Methods for Partial Differential Equations and Moving Boundary Problems, Scientific Computing
   - Integration factor methods and ETD/ETDRK schemes
   - Embedded boundary method
   - Front tracking methods and front fixing methods
   - Fast local level set method
   - Binary level set method
   - Scientific computing: fast algorithms and parallel computing
2. Computational and Mathematical Biology/Physics
   - Moving boundary problems for invasive behavior under competition between two/three species
   - Cell polarization and cell movement
   - Biomolecular modeling and Monte Carlo simulations
   - Free boundary Grad-Shafranov problem

COMPUTER SKILLS

- Programming Languages: C/C++, PETSc, Julia, Matlab, R, Maple.
- CPU/Integrated GPU Parallel Computing

COMPUTATIONAL PACKAGE

- *Free-boundary GS solver:* A parallel PETSc–based cut cell free–boundary MHD equilibrium solver (primary developer)
- *AMG Accelerated Cut Cell Algorithm:* A universal AMG accelerated cut cell solver (primary developer)

PUBLISHED

1. **Shuang Liu**, Zirui Zhang, Li-Tien Cheng, and Bo Li. Explicit-Solute Implicit-Solvent molecular simulation with binary level-set, adaptive–mobility, and GPU. Journal of Computational Physics, 2022 (accepted). arXiv.2208.05524
2. **Shuang Liu**, Qi Tang, and Xian-Zhu Tang. A parallel cut-cell algorithm for the free-boundary Grad–Shafranov problem. SIAM Journal on Scientific Computing 43, no. 6 (2021): B1198-B1225.
3. Kamruzzaman Khan, **Shuang Liu**, Timothy M. Schaerf, and Yihong Du. Invasive behaviour under competition via a free boundary model: a numerical approach. Journal of Mathematical Biology 83, no. 3 (2021): 1–43.
4. **Shuang Liu** and Xinfeng Liu. Krylov implicit integration factor method for a class of stiff reaction-diffusion systems with moving boundaries. Discrete & Continuous Dynamical Systems-B 25, no. 1 (2020): 141–159.
5. **Shuang Liu** and Xinfeng Liu. Numerical methods for a two-species competition–diffusion model with free boundaries. Mathematics 2018, 6, 72.
6. **Shuang Liu**, Yihong Du, and Xinfeng Liu. Numerical methods for a class of reaction–diffusion equations with free boundaries. International Journal of Computer Mathematics 97, no. 5 (2020): 959–979.
7. Tingzhi Cheng and **Shuang Liu**. A Liouville type theorem for higher order Hardy–Hénon equation in R^n. Journal of Mathematical Analysis and Applications 444, no. 1 (2016): 370–389.

SUBMITTED

1. **Shuang Liu**, Li-Tien Cheng, and Bo Li. Cell polarity and movement with reaction-diffusion and moving boundary: rigorous modeling and robust simulations. Submitted to SIAM Journal on Applied Mathematics. arXiv.2208.05536
2. Zhichao Peng, Daniel Appelö, and **Shuang Liu**. Universal AMG accelerated embedded boundary method without small cell stiffness. Submitted to Journal of Scientific Computing. arXiv.2204.06083
3. **Shuang Liu** and Xinfeng Liu. Integration factor combined with level set method for reaction–diffusion systems with free boundary in high spatial dimensions. Submitted to Communications on Applied Mathematics and Computation. arXiv.2209.15095

HORNORS AND AWARDS

- 07/2021-06/2023 AMS Simons Travel Grant, AMS $5,000
- Research fund of Department of Mathematics, UCSD $4,000
- 5th Annual STEM Faculty Launch Program at WPI 10/2019
- 2019 National Science Foundation (NSF)–Mathematical Sciences Graduate Internship at Los Alamos National Laboratory 06/10/2019–08/16/2019
- The 2019 George W. Johnson Graduate Fellowship, UofSC $3000
- Visiting student scholarship (University of New England, Australia) 07/2018
- SAMSI 2017 IMSM Workshop (North Carolina State University) 07/2017
- The Outstanding First Year Graduate ACM Student Award, UofSC 04/2016
- Travel Award by Graduate School of University of South Carolina $500*2
- Travel Award by AMS or SIAM $250+$400+$500

TEACHING EXPERIENCE

Instructor (01/04/2021–now) University of California at San Diego

- Math 3C: Pre-calculus, Spring & Fall 2021
- Math 20B: Calculus For Science & Engineering, Winter & Fall 2021, Spring 2022
- Math 142A: Introduction to Analysis I, Winter 2022
- Math 170A: Introduction to Numerical Analysis: Linear Algebra, Fall 2022
- Math 170C: Introduction to Numerical Analysis: Ordinary Differential Equations, Spring 2023 (planned course offering)

Instructor (08/20/2015–12/16/2019) University of South Carolina

- Math 122: Calculus for Business Administration and Social Sciences, Spring 2018
- Math 111: Basic College Mathematics, Fall 2017

Teaching Assistant (08/20/2015–12/16/2019) University of South Carolina

- Math 141: Conducted recitation sessions for Calculus I
- Math 142: Conducted recitation sessions for Calculus II
- Maple Labs: Demonstrated how to use Maple to solve mathematical problems for undergraduate.
- Math Tutor for undergraduate students in Math Tutoring Center

SELECTED ACADEMIC TALKS

- AMS Western Sectional special session on Mathematical Modeling of Biological and Social Systems Oct. 2022
- Southern California Applied Mathematics Symposium (SOCAMS) May 2022
- Applied Mathematics Seminar at University of Georgia Sept. 2021
- Center For Computational Mathematics Seminar at UCSD May 2021
- Applied and Computational Mathematics (ACM) Seminar at University of South Carolina Mar. 2021
- Postdoc Seminar at University of California, San Diego Apr. 2021 & Apr. 2022
- Talk at Daniel Appelö's research group at Michigan State University Mar. 2021
- Seminars on Mathematics for Complex Biological Systems at University of California, San Diego Dec. 2020
- Principal Talk at SIAM Northern State Section Student Chapters Conference at Utah State University Oct. 2020
- Talk in TDS SciDAC Webinar in Applied Mathematics and Plasma Physics Group at Los Alamos National Laboratory (LANL) Aug. 2019
- Job Talking Presentation at Worcester Polytechnic Institute Oct. 2019
- Talk in Earth and Environmental Science Group at LANL Aug. 2019
- Nonlinear Evolution Equations & Wave Phenomena at U of Georgia Apr. 2019
- Applied and Computational Mathematics Seminar (ACM) at University of South Carolina Feb. 2019
- 1st Annual Symposium on Multi-scale Cell Fate at UC, Irvine Oct. 2018
- 42nd SIAM Conference on Applied Mathematics at University of North Carolina at Chapel Hill Mar. 2018
- 9th Annual Graduate Student Mini–conference in Computational Mathematics at University of South Carolina Feb. 2018