SHUMO CUI

EDUCATION

Ph.D. in Mathematics *August 2010 – May 2015*
Tulane University, New Orleans, LA
Advisor: Professor Alexander Kurganov

B.S. in Applied Mathematics *August 2006 – June 2010*
Tongji University, Shanghai, China

WORK EXPERIENCE

Research Assistant Professor *February 2023 – present*
Shenzhen International Center for Mathematics, Southern University of Science and Technology

Visiting Assistant Professor *September 2019 – February 2023*
Department of Mathematics, Southern University of Science and Technology

Senior Quantitative Analyst *January 2017 – August 2019*
Arowana Asset Management Limited

Postdoctoral Researcher *July 2015 – December 2016*
Department of Mathematics, Temple University

Visiting Researcher *August 2015 – December 2015*
Institute for Pure and Applied Mathematics (IPAM), University of California Los Angeles (UCLA)

RESEARCH INTEREST

Numerical Methods for Hyperbolic Partial Differential Equations, Structure-Preserving Schemes, Traffic Modeling and Simulation on Networks, Computational Finance

RESEARCH FUNDS

PI, National Natural Science Foundation of China, General Program (国自然, 面上项目) *2025 – 2027*
  ■ *Success on the first attempt* ■ *Highly competitive: low success rate of 11.66%*

PI, Guangdong Natural Science Foundation, General Program (广东省, 面上项目) *2024 – 2026*

PI, Shenzhen Natural Science Foundation, General Program (深圳市, 面上项目) *2025 – 2028*

Participant, NSFC, Major Research Plan (国自然, 重大研究计划) *2024 – 2026*

Participant, Shenzhen Outstanding Youth Science Fund (深圳市, 杰青项目) *2023 – 2028*

Participant, NSFC, General Program (国自然, 面上项目) *2022 – 2025*

Participant, NSFC, International Cooperation Programs (国自然, 国际合作与交流项目) *2021 – 2022*

STUDENT ADVISING

Wei Chen *April 2024 – May 2024*
Visiting student, PhD student at Xiamen University

Baoyue Yu *December 2020 – May 2023*
Master student at SUSTech, co-supervised with Prof. Alexander Kurganov

PUBLISHED PAPERS

14. W. Chen, **S. Cui**, K. Wu, T. Xiong. *Bound-preserving OEDG method for Aw-Rascle-Zhang traffic models on networks*, **Journal of Computational Physics**, 520(**2025**), 113507. JCR Q1, a top journal in mathematical physics and interdisciplinary applications.

13. **S. Cui**, A. Kurganov, K. Wu. *Bound-Preserving Framework for Central-Upwind Schemes for General Hyperbolic Conservation Laws*, **SIAM Journal on Scientific Computing** 46(**2024**), A2899-A2924. JCR Q1, a top journal in computational mathematics.

12. **S. Cui**, S. Ding, K. Wu. *On Optimal Cell Average Decomposition for High-Order Bound-Preserving Schemes of Hyperbolic Conservation Laws.* **SIAM Journal on Numerical Analysis**, 62(**2024**), 775–810. JCR Q1, a top journal in computational mathematics.

11. C. Wang, A. Chertock, **S. Cui**, A. Kurganov, Z. Zhang. *A Diffuse-Domain Based Numerical Method for a Chemotaxis-Fluid Model*, **Mathematical Models and Methods in Applied Sciences**, 33(**2023**), 341–375. JCR Q1, a top journal in applied mathematics.

10. **S. Cui**, S. Ding, K. Wu. *Is the Classic Convex Decomposition Optimal for Bound-Preserving Schemes in Multiple Dimensions?* **Journal of Computational Physics**, 476(**2023**), 111882. JCR Q1, a top journal in mathematical physics and interdisciplinary applications.

9. F. Wu, R. E. Stern, **S. Cui**, M. L. Delle Monache, R. Bhadani, M. Bunting, M. Churchill, N. Hamilton, R. Haulcy, B. Piccoli, B. Seibold, J. Sprinkle, D. B. Work, *Tracking Vehicle Trajectories and Fuel Rates in Phantom Traffic Jams: Methodology and Data*, Transportation Research Part C: Emerging Technologies, 99 (2019), pp. 82–109. Five Year IF = 9.6, JCR Q1, a top journal in transportation science and technology.

8. R. Bhadani, M. Bunting, B. Seibold, R. Stern, **S. Cui**, J. Sprinkle, B. Piccoli, D. B. Work, *Real-Time Distance Estimation and Filtering of Vehicle Headways for Smoothing of Traffic Waves*, ICCPS 2019. New York, (2019), pp. 280–-290.

7. A. Chertock, **S. Cui**, A. Kurganov, Ş. N. Özcan and E. Tadmor, *Well-Balanced Schemes for the Euler Equations with Gravitation: Conservative Formulation Using Global Fluxes*, **Journal of Computational Physics**, 358 (2018), pp. 36–52. JCR Q1, a top journal in mathematical physics and interdisciplinary applications. Citation: **87** on Google Scholar, **58** on Web of Science.

6. R. E. Stern, **S. Cui**, M. L. Delle Monache, R. Bhadani, M. Bunting, M. Churchill, N. Hamilton, R. Haulcy, H. Pohlmann, F. Wu, B. Piccoli, B. Seibold, J. Sprinkle, D. B. Work, *Dissipation of Stop-and-Go Waves via Control of Autonomous Vehicles: Field Experiments*, Transportation Research Part C: Emerging Technologies, 89 (2018), pp. 205–221. Five Year IF = 9.6, JCR Q1, a top journal in transportation science and technology. 🏆 **Highly Cited Paper (Top 1%)**: **810** on Google Scholar, **460** on Web of Science.

5. A. Chertock, **S. Cui**, A. Kurganov, *Hybrid Finite-Volume-Particle Method for Dusty Gas Flows*, SMAI Journal of Computational Mathematics, 3 (2017), pp. 139–180.

4. **S. Cui**, B. Seibold, R. E. Stern, D. B. Work, *Stabilizing Traffic Flow via a Single Autonomous Vehicle: Possibilities and Limitations*, IV Symposium, 2017. Citation: **208** Google Scholar, **127** Web of Science.

3. A. Chertock, **S. Cui**, A. Kurganov, T. Wu, *Steady State and Sign Preserving Semi-Implicit Runge-Kutta Methods for ODEs with Stiff Damping Term*, **SIAM Journal on Numerical Analysis**, 53 (2015), pp. 2008–2029. JCR Q1, a top journal in computational mathematics.

2. A. Chertock, **S. Cui**, A. Kurganov, T. Wu, *Well-Balanced Positivity Preserving Central-Upwind Scheme for the Shallow Water System with Friction Terms*, International Journal for Numerical Methods in Fluids, 78 (2015) pp. 355–383. Citation: **76** on Web of Science, **123** on Google Scholar.

1. **S. Cui**, A. Kurganov, A. Medovikov, *Particle Methods for PDEs Arising in Financial Modeling*, Applied Numerical Mathematics, 93 (2015), pp. 123–139. a JCR Q1 journal in applied mathematics.

SUBMITTED PAPERS AND PREPRINTS

15. A. Chertock, **S. Cui**, A. Kurganov, C. Wang. *A Hybrid Finite-Difference-Particle Method for Chemotaxis Models*, submitted to **Journal of Scientific Computing**.

16. S. Ding, **S. Cui**, K. Wu. *Robust DG Schemes on Unstructured Triangular Meshes: Oscillation-Damping Filter and Bound Preservation via Optimal Convex Decomposition*, submitted to **Journal of Computational Physics**.

17. **S. Cui**, Y. Gu, A. Kurganov, K. Wu, R. Xin. *Positivity-Preserving New Low-Dissipation Central-Upwind Schemes for Compressible Euler Equations*, submitted to **Journal of Computational Physics**.

18. **S. Cui**, K. Wu, L. Xu. *On local minimum entropy principle of high-order schemes for relativistic Euler equations*, ready to be submitted to Numerische Mathematik.

19. **S. Cui**, S. Ding, K. Wu. *Positive Linear Functional Approach for Bound-Preserving High-Order Schemes: Foundation and Framework on General Meshes*, preprint.

20. W. Chen, **S. Cui**, K. Wu, T. Xiong, B. Yu. *High-Order Moving Mesh Methods Preserving Non-Convex Invariant Domain of Hyperbolic Systems* , preprint.

HONORS AND AWARDS

Excellence in Mathematics (two graduate students awarded every year, 300 USD)   *2013 – 2014*
Department of Mathematics, Tulane University

IBM Research Fellowship in Computational Science (1,500 USD)   *2013 – 2014*
Center of Computational Science, Tulane University

Excellence in Mathematics (two graduate students awarded every year, 300 USD)   *2012 – 2013*
Department of Mathematics, Tulane University

CONFERENCES ORGANIZED OR CO-ORGANIZED

Mini-Workshop on Advances in Computational and Applied Mathematics (WACAM)
SUSTech International Center for Mathematics, Shenzhen   *July 12 – July 14, 2024*

Workshop III: Numerical Methods for Shallow Water Models
Shenzhen International Center for Mathematics, Shenzhen   *May 11 – May 15, 2024*

Spring School: Numerical Methods for Shallow Water Models
Shenzhen International Center for Mathematics, Shenzhen   *May 6 – May 10, 2024*

Workshop II: Development of High-Order Methods for Hyperbolic PDEs
Shenzhen International Center for Mathematics, Shenzhen   *March 15 – March 19, 2024*

Opening Workshop: Advances in Numerical Methods for Hyperbolic Conservation Laws
Shenzhen International Center for Mathematics, Shenzhen   *December 9 – December 15, 2023*

TEACHING EXPERIENCE

Total **14** courses taught as a lecturer (10 in SUSTech, 2 in Temple University, 2 in Tulane University)

Year	Semester	University	Course Name	Role
2024	Spring	SUSTech	Life Insurance Actuarial Science	Lecturer
2023	Spring	SUSTech	Life Insurance Actuarial Science	Lecturer
2023	Spring	SUSTech	Introduction to MATLAB	Lecturer
2022	Fall	SUSTech	Introduction to MATLAB	Lecturer
2022	Spring	SUSTech	Numerical Analysis, graduate course	Lecturer
2021	Fall	SUSTech	Numerical Analysis, graduate course	Lecturer
2020	Fall	SUSTech	Partial Differential Equations (H)	Lecturer
2020	Fall	SUSTech	Chartered Financial Analyst Course: Level I	Lecturer
2020	Spring	SUSTech	MATLAB Programming and Application	Lecturer
2019	Fall	SUSTech	Partial Differential Equations	Lecturer
2016	Fall	Temple	Calculus II	Lecturer
2016	Spring	Temple	Calculus I	Lecturer
2014	Fall	Tulane	Calculus I	Lecturer
2012	Spring	Tulane	Calculus III	Lecturer
2014	Fall	Tulane	Engineering Mechanics	Teaching Assistant
2013	Fall	Tulane	Engineering Mechanics	Teaching Assistant
2012	Fall	Tulane	Engineering Mechanics	Teaching Assistant
2011	Fall	Tulane	Real Analysis	Teaching Assistant
2011	Fall	Tulane	Linear Algebra	Teaching Assistant
2011	Fall	Tulane	Engineering Mechanics	Teaching Assistant
2011	Spring	Tulane	Calculus II	Teaching Assistant
2010	Fall	Tulane	Statistics for Business	Teaching Assistant

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TALKS

Optimal Cell Average Decomposition for High-Order Bound-Preserving Schemes of Hyperbolic Conservation Laws, Mini-Workshop on Advances in Computational and Applied Mathematics, Shenzhen International Center for Mathematics, Shenzhen, China. (July 2024)

Bound-preserving high-order oscillation-eliminating discontinuous Galerkin scheme for adapted pressure Aw-Rascle-Zhang traffic model on networks, Workshop on Numerical Methods for Shallow Water Models, Shenzhen International Center for Mathematics, Shenzhen, China. (May 2024)

Optimal Cell Average Decomposition for High-Order Bound-Preserving Schemes of Hyperbolic Conservation Laws, The Chinese University of Hong Kong (Shenzhen), China. (December 2023)

Optimal Cell Average Decomposition for High-Order Bound-Preserving Schemes of Hyperbolic Conservation Laws, CSIAM Annual Meeting, Kunming, China. (October 2023).

Optimal Cell Average Decomposition for High-Order Bound-Preserving Schemes of Hyperbolic Conservation Laws, Computational and Applied Math Seminar, SUSTech. (November 2022)

Well-balanced schemes and semi-implicit Runge-Kutta method, Structure Preserving Numerical Methods for Hyperbolic PDEs, SUSTech, Shenzhen. (November 2019)

Not All Jamitons Are Stable, Long program: New Directions in Mathematical Approaches for Traffic Flow Management – Reunion II, IPAM, UCLA. (May 2018)

The Paradoxical Stability of Traffic Flow, Applied Mathematics and Scientific Computing Seminar, Temple University. (November 2016)

Steady state and sign preserving semi-implicit Runge-Kutta methods, Applied Mathematics and Scientific Computing Seminar, Temple University. (January 2016)

Jamiton Solutions in Second Order Models: A Numerical Investigation, Long program: New Directions in Mathematical Approaches for Traffic Flow Management, IPAM, UCLA. (December 2015)

Well-Balanced Central-Upwind Scheme for the Shallow Water System with Stiff Friction Terms, The 5th International Conference on Scientific Computing and Partial Differential Equations, Hong Kong Baptist University, Hong Kong, China. (December 2014)

Well-Balanced Central-Upwind Scheme for the Shallow Water System with Stiff Friction Terms, Hong Kong University of Science and Technology. (December 2014)

Pressureless Gas Dynamics and Sticky Particle Methods, Graduate Colloquium, Tulane University. (October 2014)

Well-Balanced Positivity Preserving Central-Upwind Scheme for the Shallow Water System with Friction Terms, Applied and Computational Mathematics Research Seminars, Tulane University. (April 2014)

Well-Balanced Positivity Preserving Central-Upwind Scheme for the Shallow Water System with Friction Terms, 2014 SIAM Annual Meeting, Chicago. (July 2014)

Application of Deterministic Particle Methods to PDEs Arising in Financial Modeling, KI-Net Young Researchers Workshop, University of Wisconsin Madison. (October 2012)

CONTACT

| Phone (China Mainland): | +86 15002070244 | | E-mail: | shumocui@hotmail.com |
| Phone (Hong Kong): | +852 52288692 | | | |