Shi Chen

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EDUCATION

Department of Mathematics, University of Wisconsin- Madison, Madison, WI Jul 2018- present

- Ph.D. in Applied and Computational Mathematics, GPA: 4.0/4.0, Advisor: Prof. Qin Li
- Specializations: Scientific Computing, Inverse Problems, Multiscale Modeling and Computation

Department of Mathematical Sciences, Tsinghua University, Beijing, China Sep 2014- Jul 2018

- B.S. in Pure and Applied Mathematics (Second Degree), GPA: 93/100
- Senior Thesis: Modeling and Simulation of Dynamic Property of Metamaterials, Advisor: Prof. Zhongyi Huang
- Specializations: Applied Mathematics, Numerical Analysis, Scientific Computing

Department of Chemical Engineering, Tsinghua University, Beijing, China Aug 2013- Jul 2018

- B.Eng. in Polymer Materials and Engineering, GPA: 91/100, Ranking: 1/27
- Senior Thesis: Simulation of Movement of Microcapsules in Solution with Enzymatic Reactions, Advisor: Prof. Li-Tang Yan
- Specializations: Computational Physics and Chemistry, Engineering Sciences

SKILLS

- Programming Languages: Matlab, Python, PyTorch, Fortran, C
- Tools: LaTex, AWS Cloud Computing, Linux

RESEARCH EXPERIENCE

Department of Mathematics, University of Wisconsin- Madison Summer 2019, 2020, 2021, Spring 2022

- Research Assistant
- Work with Prof. Qin Li on inverse problems for wave-type PDEs in the high-frequency limit and efficient multiscale PDE solvers

Institute for Foundations of Data Science, University of Wisconsin- Madison Spring 2021

- Research Assistant
- Work with Prof. Stephen J. Wright and Prof. Qin Li on multiscale PDE solvers based on neural networks

SELECTED RESEARCH PROJECTS

High-Frequency Limit of Inverse Problems for the Helmholtz equation Oct 2021- present

- Proposed and investigated a new inverse scattering problem where tightly concentrated monochromatic beams was impinged in the medium and the data was extracted by Husimi transform in phase space
- Designed and implemented in Matlab a scalable solver for the new inverse scattering problem using Husimi data
- Results suggested that the new problem provided stable reconstruction asymptotically in the high-frequency regime

Efficient Multiscale Methods for Nonlinear PDEs Jan 2019- present

- Designed and implemented in PyTorch a neural network-based reduced order Schwarz method for fully nonlinear multiscale elliptic equation and achieved significant speedup over traditional methods
- Designed and implemented in Matlab a manifold learning-based versatile PDE solver that achieved significant improvements in efficacy for a semilinear elliptic equation and a nonlinear radiative transfer equation

Projection of COVID-19 Infection Using the Ensemble Kalman Filter Mar 2020- Apr 2020

- Designed and implemented in Matlab an ensemble Kalman filter method to efficiently analyze the parameters in a COVID-19 epidemic model that couples the spread in each state by making use of the infection data
- Proposed three measures to mitigate the spread and evaluated the effectiveness of each measure

SELECTED PUBLICATIONS

*Authors are listed in alphabetical order, unless marked by **

- *High-Frequency Limit of the Inverse Scattering Problem: Asymptotic Convergence from Inverse Helmholtz to Inverse Liouville*
  Shi Chen, Zhiyan Ding, Qin Li, Leonardo Zepeda-Núñez. In Preparation.
- *A Reduced Order Schwarz Method for Nonlinear Multiscale Elliptic Equations Based on Two-Layer Neural Networks*
  Shi Chen, Zhiyan Ding, Qin Li and Stephen J. Wright, submitted to *Journal of Computational Mathematics*, arXiv preprint arXiv:2111.02280 (2021).
- *Low-Rank Approximation for Multiscale PDEs*
  Ke Chen, **Shi Chen**, Qin Li, Jianfeng Lu, and Stephen J. Wright, submitted to *Notices of the American Mathematical Society*, arXiv preprint arXiv:2111.12904 (2021).
- *Manifold Learning and Nonlinear Homogenization*
  Shi Chen, Qin Li, Jianfeng Lu, and Stephen J. Wright, revision submitted to *Multiscale Modeling & Simulation*, arXiv preprint arXiv:2011.00568 (2020).
- *Semiclassical Limit of an Inverse Problem for the Schrödinger Equation*
  Shi Chen and Qin Li, *Research in the Mathematical Sciences*, 8 (3), 1-18, 2021.
- *State-Specific Projection of COVID-19 Infection in the United States and Evaluation of Three Major Control Measures*
  ***Shi Chen**, Qin Li, Song Gao, Yuhao Kang and Xun Shi, *Scientific Reports*, 10 (1), 1-9, **the Top 100 Most Highly Accessed Papers** in 2020 from *Scientific Reports*.
- *Classical Limit for the Varying-Mass Schrödinger Equation with Random Inhomogeneities*
  Shi Chen, Qin Li and Xu Yang, *Journal of Computational Mathematics*, 438, 110365, 2021.

SELECTED PRESENTATIONS

- **IMA Workshop of Mathematical Foundation and Applications of Deep Learning** Aug 2021
  Poster Talk: A Reduced Order Schwarz Method for Nonlinear Multiscale Elliptic Equations Based on Two-Layer Neural Networks
- **SIAM Conference on Computational Science and Engineering** Mar 2021
  Poster: Low-Dimensional Approximation to PDE Solution Manifold
- **Data Science Research Bazaar, University of Wisconsin-Madison** Feb 2021
  Poster: State-Specific Projection of COVID-19 Infection in the United States and Evaluation of Three Major Control Measures

HONORS AND AWARDS

- *Student Travel Award*, 2021 SIAM Annual Meeting (Virtual), USA 2021
- *Student Travel Award*, 2021 SIAM Conference on Computational Science and Engineering (Virtual), USA 2021
- *Schaerf Research Award*, University of Wisconsin-Madison, USA 2020
- *Physical Sciences Award*, University of Wisconsin-Madison, USA 2019
- *Academic Excellence Award*, Tsinghua University, China 2016
- *Evergrande Group Scholarship*, Tsinghua University, China 2015
- *China National Petroleum Scholarship*, Rank 2/110, Tsinghua University, China 2014
- *First Prize, National Undergraduate Physics Contest*, Beijing, China 2014

TEACHING EXPERIENCE

Department of Mathematics, University of Wisconsin- Madison, Madison, WI

- Teaching Assistant, MATH221, Calculus and Analytic Geometry I Fall 2018, Spring 2020, Fall 2020
- Teaching Assistant, MATH222, Calculus and Analytic Geometry II Spring 2019
- Teaching Assistant, MATH234, Calculus and Analytic Geometry III Fall 2021

LANGUAGES

English (Full professional proficiency), Chinese (Mandarin and Cantonese, Native proficiency)