

Zhongjian Wang

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EMPLOYMENT

- **Nanyang Technological University, Division of Mathematical Sciences, SPMS** Singapore
Assistant Professor 2023-present
- **The University of Chicago, Department of Statistics and CCAM** Chicago
William H. Kruskal Instructor, Mentor: Prof. Guillaume Bal 2020-2023

EDUCATION

- **The University of Hong Kong, Department of Mathematics** Hong Kong
Doctor of Philosophy, Supervisor: Prof. Zhang Zhiwen 2016-2020
- **Tsinghua University, Department of Mathematical Sciences** Beijing
Bachelor of Science, member of XueTang project 2012-2016

RESEARCH INTERESTS

Applied analysis and computational methods for physics and engineering problems, including but not limited to,

- **structure preserving schemes:** Lagrangian approach for effective diffusivities, KPP front wave speed; scattering in topological insulators;
- **neuron net models:** transport maps, multiscale physic problems, scattering matrices;
- **data-driven model reduction:** conditional density function in filtering, uniform accuracy schemes in time integration, inverse problems.

AWARDS AND SCHOLARSHIPS

- **Best PhD thesis Award** Hong Kong Mathematical Society 2021
- **Student Travel Award for UQ20** Society for Industrial and Applied Mathematics 2019
- **Student Travel Award for CSE19** Society for Industrial and Applied Mathematics 2019
- **Pilot Scheme on International Experience** Faculty of Science, HKU 2017
- **IPAM Student Travel Support** Institute for Pure & Applied Mathematics, UCLA 2017
- **Hong Kong Ph.D. Fellowship** Research Grants Council of HK 2016
- **Scholarship for Academic Excellence** Tsinghua University 2013
- **Gold Medalist** China Mathematics Olympiad 2012

PUBLICATIONS

- **Published and Accepted**

1. Bal, G., Hoskins, J.G., Wang Z., Asymmetric transport computations in Dirac models of topological insulators (*JCP, to appear*)
2. Wang, Z., Zhang W., Zhang Z., A data-driven model reduction method for parabolic inverse source problems and its convergence analysis (*JCP, to appear*)
3. Cui, T., Wang, Z., Zhang, Z., A variational neural network approach for glacier modelling with nonlinear rheology (*CiCP, to appear*)
4. Li, S., Wang, Z., Yau, S. S. T., Zhang, Z., Solving high-dimensional nonlinear filtering problems using a tensor train decomposition method (*IEEE TAC, to appear*)
5. Wang, Z., Xin, J., Zhang, Z., DeepParticle: Learning invariant measure by a deep neural network minimizing Wasserstein distance on data generated from an interacting particle method, *Journal of Computational Physics* (2022): 111309.
6. Wang, Z., Xin, J., Zhang, Z., Computing effective diffusivities in 3D time-dependent chaotic flows with a convergent Lagrangian numerical method, *ESAIM: M2AN* 56 (2022) 15211544
7. Lyu, J., Wang, Z., Xin, J., Zhang, Z., A convergent interacting particle method and computation of KPP front speeds in chaotic flows, *SIAM Journal on Numerical Analysis*, 2022, 60(3): 1136-1167
8. Wang, Z., Xin, J., Zhang, Z., Sharp error estimates on a stochastic structure-preserving scheme in computing effective diffusivity of 3D chaotic flows, *Multiscale Model and Simulation*, 19 (2021), no. 3, 11671189
9. Lyu, J., Wang, Z., Xin, J., Zhang, Z., Convergence analysis of stochastic structure-preserving schemes for computing effective diffusivity in random flows, *SIAM Journal on Numerical Analysis*, 58 (2020), no. 5, 30403067.
10. Wang, Z., Zhang, Z., A mesh-free method for interface problems using the deep learning approach, *Journal of Computational Physics* (2020): 108963.

11. Wang, Z. Luo, X., Yau, S. S. T., Zhang, Z., Proper orthogonal decomposition method to nonlinear filtering problems in medium-high dimension, *IEEE Transactions on Automatic Control*, 65 (2020), no. 4, 16131624.
12. Wang, Z., Xin, J., Zhang, Z., Computing effective diffusivity of chaotic and stochastic flows using structure-preserving schemes, *SIAM Journal on Numerical Analysis*, 56(4), 2322-2344.

- **Preprints and Under-preparation**

1. Lu, Y., Wang, Z., Bal, G., Understanding the diffusion models by conditional expectations. *arXiv:2301.07882*
2. T. Hou, Wang, Z., Zhang, Z. A class of robust numerical methods for solving dynamical systems with multiple time scales (*arXiv:1909.04289*)
3. Wang, Z., Xin, J., Zhang Z., A DeepParticle method for learning and generating aggregation patterns in multi-dimensional Keller-Segel chemotaxis systems (*arXiv:2209.00109*)
4. Bal, G., Chen, B., Wang, Z. Long time asymptotics of mixed-type Kimura diffusions (*arXiv:2210.10037*)
5. Xie, Y., Wang, Z., Zhang, Z., Random block coordinate descent methods for computing optimal transport and convergence analysis (*arXiv:2212.07046*)
6. Wang, Z., Zhang W., Zhang Z., Stochastic convergence of regularized solutions for backward heat conduction problems
7. Non-convergence tests for trajectory averages of ergodic Markov chains and diffusions

- **Dissertations**

1. Robust Lagrangian Numerical Schemes in Computing Effective Diffusivities for Chaotic and Random Flows, *Ph.D. Thesis, advisor: Prof. Zhiwen Zhang at HKU*
2. Convergence analysis of strong approximation to stochastic differential equation, *Bachelor Thesis, advisor: Prof. Espen Robstad Jakobsen at ENS*

Names in Math papers are arranged in alphabetical order. For the most recent updates, please refer to the Google Scholar or ORCID: 0000-0002-5954-2483.

TEACHING EXPERIENCES

- **The University of Chicago**

- *Lecturer of undergraduate and graduate courses* *2020-2023*
 - **STAT31120 Numerical Methods for Stochastic Differential Equations**
20/21 Spring, 21/22 Winter, 21/22 Autumn
 - **STAT251 Introduction to Probabilities**
20/21 Autumn, 21/22 Spring, 22/23 Spring
 - **STAT24300 Numerical Linear Algebra**
22/23 Winter
 - **MATH185 Mathematical Methods in the Physical Sciences (III, ODE)**
21/22 Winter

- **The University of Hong Kong**

- *Tutor of undergraduate courses* *2016-2020*
 - **Certificate** I was awarded the Certificate of Teaching and Learning in Higher Education from HKU Center of the Enhancement of Teaching and Learning in 2016.
 - **MATH3601 Numrical analysis:** 18/19 Fall, 19/20 Fall
 - **MATH4602 Scientific computing:** 17/18 Spring, 18/19 Spring
 - **MATH2014 Multivariable calculus and linear algebra:** 17/18 Fall
 - **MATH1009 Basic mathematics for business and economics:** 16/17 Fall, 17/18 Fall

- **Co-Supervising Students**

- **Boyi Hu** with Zhiwen Zhang
- **Raphaël Terrine** with Guillaume Bal
- **Tan Zhang** with Zhiwen Zhang
- **Binglu Chen** with Guillaume Bal

VISITING EXPERIENCES

- **Tsinghua University** Beijing
Visiting Ph.D. Student, hosted by Professor Steven Shing Tung Yau *2018.11-19.1*
- **California Institute of Technology** Pasadena
Visiting Ph.D. Student, hosted by Professor Thomas Hou *2018.4-5*
- **Ecole Normale Superieure** Paris
For Bachelor Thesis, supervised by Professor Espen Robstad Jakobsen *2016.1-6*
- **University of Oxford** Oxford
Tsinghua University Distinguished Newcomer Student Leadership Program *2013. 7*

RESEARCH PRESENTATIONS

- **DeepParticle: learning measure by a deep neural network minimizing Wasserstein distance on data generated from interacting particle methods**
 - Math Colloquium, CMU *Pittsburgh, 2023. 1*
 - Math Colloquium, LSU *Baton Rouge, 2023. 1*
 - Applied Math Colloquium, FSU *Tallahassee, 2023. 1*
 - Math Colloquium, SIT *Hoboken, 2022.12*
 - Applied Math Colloquium, CUHK *Remote, 2022.12*
 - Math Seminar, HKUST *Remote, 2022.12*
 - Research Seminar, NTU *Singapore, 2022.12*
 - Young Mathematician Workshop on Computational and Applied Mathematics, BiCMR *Remote, 2022.11*
 - CAM Research Seminar, YMSC *Remote, 2022.11*
 - Applied Mathematics Seminar, IIT *Chicago, 2022. 7*
 - Applied Mathematics Seminar, SusTech *Remote, 2022. 7*
- **Tensor train method for high-dimensional nonlinear filtering problems**
 - SIAM Conference on Uncertainty Quantification (UQ22) *Atlanta, 2022. 4*
- **A convergent interacting particle method and computation of KPP front speeds**
 - CCAM Seminar, Purdue University *IN, 2021.11*
 - Applied Math Seminar, BUAA *Beijing, 2021.11*
- **A Robust Lagrangian Scheme in Computing Effective Diffusivities**
 - Applied Mathematics Seminar, IIT *Chicago, 2020.12*
 - CAM Colloquium, UChicago *Chicago, 2020.10*
 - Applied Mathematics Seminar, Cermics ENPC *Paris, 2020. 3*
 - Special Applied Mathematics Colloquium, Columbia University *New York, 2020. 1*
 - posters: International Congress on Industrial and Applied Mathematics (ICIAM 2019), Valencia, 2019. 7; SIAM Conference on Computational Science and Engineering (CSE19), Spokane, 2019.2; The 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Taipei, 2018.7; IPAM Workshop IV of Complex High-Dimensional Energy Landscape, Los Angeles, 2017.11
- **POD method to nonlinear filtering problems in medium-high dimension**
 - The 8th International Congress of Chinese Mathematicians (ICCM 2019) *Beijing, 2019. 6*
- **A new mesh-free method for PDE with discontinuous coefficients using the deep learning approach**
 - poster: Big Data Challenges for Predictive Modeling of Complex Systems, Hong Kong, 2018.11

PROFESSIONAL SERVICE

- **Faculty Sponsor** CAM Grad Student Seminar *Chicago, 2021.1-3*
- **Co-organizer** Big Data Challenges for Predictive Modeling of Complex Systems *HK, 2018.11*
- **Journal Referee**
Computers and Mathematics with Applications, Journal of Computational Physics, IEEE Conference on Decision and Control
- **Memberships** IEEE, SIAM