

Bin Shi

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Academic Appointments

- 06/2021–
present **Associate Professor**
Academy of Mathematics and Systems Science
Chinese Academy of Sciences
- 01/2019–
05/2021 **Postdoctoral Scholar (Hosted by Michael I. Jordan)**
Department of Electrical Engineering & Computer Science
University of California, Berkeley

Education

- 2015–2018 **Ph.D in Computer Science**
Major: Theoretical Machine Learning
School of Computing and Information Sciences, Florida International University, FL
- 2013–2015 **M.S. in Physics**
Major: Theoretical Physics
Department of Physics, University of Massachusetts, Dartmouth, MA
- 2008–2011 **M.S. in Mathematics**
Major: Pure Mathematics
Thesis: Nekhoroshev Estimates for Infinite-Dimensional Reversible System with Chain Structure,
Advisor: Xiaoping Yuan
School of Mathematical Science, Fudan University, Shanghai, China
- 2002–2006 **B.S. in Mathematics**
Major: Pure and Applied Mathematics
School of Mathematical Science, Ocean University of China, Qingdao, China

Research Interests

- Optimization for Machine Learning
- Numerical Analysis and Scientific Computing
- Nonlinear and Stochastic Sciences
- Fluid Dynamics (Turbulence, Geophysical and Astrophysical)

Publications

- **Linear Convergence of Forward-Backward Accelerated Algorithms without Knowledge of the Modules of the Strong Convexity**
Bowen Li, **Bin Shi** and Ya-xiang Yuan
To appear in SIAM Journal on Optimization, 2024+.
- **The sampling method for optimal precursors of El Niño-Southern Oscillation events**
Bin Shi and Junjie Ma
Nonlinear Processes in Geophysics, 2024, 31(1):165-174.

- **On Learning Rates and Schrödinger Operators**
Bin Shi, Weijie J. Su and Michael I. Jordan
Journal of Machine Learning Research, 2023, 24(379):1-53.
- **An adjoint-free algorithm for conditional nonlinear optimal perturbations (CNOPs) via sampling**
Bin Shi and Guodong Sun
Nonlinear Processes in Geophysics, 2023, 30(3):263–276.
- **Understanding the Acceleration Phenomenon via High-Resolution Differential Equations**
Bin Shi, Simon S. Du, Michael I. Jordan, and Weijie J. Su
Mathematical Programming, Series A, 2022, 195(1):79-148.
- **Conjugate and Cut Points in Ideal Fluid Motion**
Theodore D. Drivas, Gerard Misiólek, Bin Shi and Tsuyoshi Yoneda
Annales Mathématiques du Québec, 2022, 46(1):207-225.
- **Acceleration via Symplectic Discretization of High-Resolution Differential Equations**
Bin Shi, Simon S. Du, Weijie J. Su and Michael I. Jordan
Advances in Neural Information Processing Systems, 2019, 32.

Monographs

- **Mathematical Theories of Machine Learning - Theory and Applications**
Bin Shi and Sundaraja S. Iyengar
Springer International Publishing, 2020

Workshop Papers

- **A Conservation Law Method in Optimization**
Bin Shi, Tao Li and Sundaraja S. Iyengar
The Tenth Workshop on Optimization for Machine Learning
Advances in Neural Information Processing Systems, 2017, 30

Preprints

- **On the Hyperparameters in SGD with Momentum**
Bin Shi
arXiv preprint <https://arxiv.org/abs/2108.03947>, (Accepted after Minor Revision) Journal of Machine Learning Research
- **Gradient Norm Minimization of Nesterov Acceleration: $o(1/k^3)$**
Shuo Chen, Bin Shi and Ya-xiang Yuan
arXiv preprint <https://arxiv.org/abs/2209.08862>
- **Optimal Disturbances of Blocking: A Barotropic View**
Bin Shi, Dehai Luo and Wenqi Zhang
arXiv preprint <https://arxiv.org/abs/2210.06011>, submitted
- **Proximal Subgradient Norm Minimization of ISTA and FISTA**
Bowen Li, Bin Shi and Ya-xiang Yuan
arXiv preprint <https://arxiv.org/abs/2211.01610>

- **Revisiting the Acceleration Phenomenon via High-Resolution Differential Equations**
Shuo Chen, **Bin Shi** and Ya-Xiang Yuan
arXiv preprint <https://arxiv.org/abs/2212.05700>
- **Linear Convergence of ISTA and FISTA**
Bowen Li, **Bin Shi** and Ya-Xiang Yuan
arXiv preprint <https://arxiv.org/abs/2212.06319>
- **On Underdamped Nesterov Acceleration**
Shuo Chen, **Bin Shi** and Ya-Xiang Yuan
arXiv preprint <https://arxiv.org/abs/2304.14642>
- **Understanding the ADMM Algorithm via High-Resolution Differential Equations**
Bowen Li and **Bin Shi**
arXiv preprint <https://arxiv.org/abs/2401.07096>
- **Understanding the PDHG Algorithm via High-Resolution Differential Equations**
Bowen Li and **Bin Shi**
arXiv preprint <https://arxiv.org/abs/2403.11139>

Grants and Funding

- **Co-PI: National Science Foundation of China, #12241105**
Developing 4D-Var Strongly Coupled Assimilation System of Climate System Models Based on Statistical Machine Learning
- **Co-PI: CAS Project for Young Scientists in Basic Research, #YSBR-034**
Mathematical Principles of Deep Learning

Professional Experience

PC Memeber	JCC 2024, IVP AI 2024
Journal Review	Mathematical Reviews/MathSciNet Mathematical Programming (MP) SIAM Journal on Optimization (SIOPT) Mathematics of Computation (MCOM) Communications in Mathematical Sciences (CMS) Journal of Machine Learning Research (JMLR) Computational Optimization and Applications (CoA) Numerical Algorithms (NA) Journal of Global Optimization (JOGO) IEEE Access
Conf. Review	ICML, NeurIPS, ICLR

Invited Talks

- 2021.09 School of Mathematics, Shandong University, Jinan, China (Virtual)
- 2021.10 2021 Tsinghua Symposium on Statistics And Data Science for Young Scholars, Beijing, China
- 2021.11 2021 CAS Frontier Innovation Forum on Mathematics and its Intersections, Beijing, China
- 2022.02 Department of Computer Science and Technology, Tsinghua University, Beijing, China
- 2022.11 School of Mathematical Sciences, Peking University, Beijing, China
- 2022.11 International Forum of Climate and Environmental Changes Sustainable Development (IYBSSD)
- 2023.06 2023 SIAM Conference on Optimization (OP23), Seattle, USA
- 2023.06 School of Mathematical Sciences, Ocean University of China, Qingdao, China

- 2023.06 Jordan Symposium, France
2023.06 Bernoulli Institute, University of Groningen, Netherlands
2023.07 Tianyuan Mathematical Research Center, Kunming, China
2023.07 School of Mathematics and Statistics, Yunnan University, Kunming, China
2023.08 HKSIAM Biennial Conference, Hong Kong, China

Work Experience

- 2022-Fall Partial Differential Equations
2021-Fall Numerical Optimization
2015-2018 Teaching Assistant in Florida International University
- Computer Programming I (COP-2210)
 - Computer Programming II (COP-3337)
 - Introduction to Algorithms (COT-5407)
 - Theory of Computation (COT-5310)
- 2013-2015 Research Assistant in University of Massachusetts, Dartmouth
2013 Temporary Research Staff in Institute of Oceanology, Chinese Academy of Sciences, China
2008-2011 Teaching Assistant in Fudan University
- Mathematical Analysis
 - Riemannian Geometry
 - Partial Differential Equations
 - Mathematical Method of Classical Mechanics

References: Machine Learning and Applied Mathematics

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References: Atmospheric Science and Oceanography

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