# 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
- Data Assimilation
- Nonlinear Sciences and Stochastic Sciences
- Fluid Dynamics (Turbulence, Geophysical and Astrophysical)

## Journal Publications

- **On the Hyperparameters in SGD with Momentum**
  **Bin Shi**
  To appear in Journal of Machine Learning Research, 2024.

- **Linear convergence of Forward-Backward Accelerated Algorithms without Knowledge of the Modules of the Strong Convexity**
  Bowen Li, **Bin Shi** and Ya-Xiang Yuan
  SIAM Journal on Optimization, 34(2):2150-2168, 2024.

- **The Sampling Method for Optimal Precursors of ENSO Events**
  **Bin Shi** and Junjie Ma
  Nonlinear Processes in Geophysics, 31(1):165-174, 2024.

- **On Learning Rates and Schrödinger Operators**
  **Bin Shi**, Weijie J. Su and Michael I. Jordan
  Journal of Machine Learning Research, 24(379):1-53, 2023.

- **An adjoint-free algorithm for conditional nonlinear optimal perturbations (CNOPs) via sampling**
  **Bin Shi** and Guodong Sun
  Nonlinear Processes in Geophysics, 30(3):263–276, 2023.

- **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, 195(1):79-148, 2022.

- **Conjugate and Cut Points in Ideal Fluid Motion**
  Theodore D. Drivas, Gerard Misiołek, **Bin Shi** and Tsuyoshi Yoneda
  Annales Mathématiques du Québec, 46(1):207-225, 2022.

## Conference and Workshop Papers

- **Acceleration via Symplectic Discretization of High-Resolution Differential Equations**
  **Bin Shi**, Simon S. Du, Weijie J. Su and Michael I. Jordan
  Proceedings of the 33rd International Conference on Neural Information Processing Systems, (NeurIPS 2019).

- **A Conservation Law Method in Optimization**
  **Bin Shi**, Tao Li and Sundaraja S. Iyengar
  The Tenth Workshop on Optimization for Machine Learning
  The Thirty-first Annual Conference on Neural Information Processing Systems, (NeurIPS 2017).

## Monographs

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

## Preprints

- **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, submitted

- **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, submitted

- **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, submitted

- **Linear Convergence of ISTA and FISTA**
  Bowen Li, **Bin Shi** and Ya-Xiang Yuan
  arXiv preprint https://arxiv.org/abs/2212.06319, submitted

- **On Underdamped Nesterov Acceleration**
  Shuo Chen, **Bin Shi** and Ya-Xiang Yuan
  arXiv preprint https://arxiv.org/abs/2304.14642, submitted

- **Understanding the ADMM Algorithm via High-Resolution Differential Equations**
  Bowen Li, **Bin Shi**
  arXiv preprint https://arxiv.org/abs/2401.07096, submitted

- **Understanding the PDHG Algorithm via High-Resolution Differential Equations**
  Shuo Chen, **Bin Shi**
  arXiv preprint https://arxiv.org/abs/2403.11139, submitted

- **A Lyapunov Analysis of Accelerated PDHG Algorithms**
  Xueying Zeng, **Bin Shi**
  arXiv preprint https://arxiv.org/abs/2407.18681, submitted

## 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

Journal Review **Mathematical Reviews/MathSciNet**
**Mathematical Programming (MP)**
**SIAM Journal on Optimization (SIOPT)**
**SIAM Journal on Control and Optimization (SICON)**
**SIAM Journal on Mathematical Analysis (SIMA)**
**SIAM Journal on Numerical Analysis (SINA)**
**Numerische Mathematik (NM)**
**Mathematics of Computation (MCOM)**
**Communications in Mathematical Sciences (CMS)**
**Journal of Machine Learning Research (JMLR)**
**Transactions on Machine Learning Research (TMLR)**
**Journal of Computational Mathematics (JCM)**
**Computational Optimization and Applications (CoA)**
**Numerical Algorithms (NA)**
**Journal of Global Optimization (JOGO)**
**Journal of Optimization Theory and Applications (JOTA)**
**Journal of Mathematical Fluid Mechanics (JMFM)**
**IEEE Access**

Conf. Review **ICML**, **NeurIPS**, **ICLR**

## References: Machine Learning and Applied Mathematics


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## References: Atmospheric Science and Oceanography


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