

# Bin Shi

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## Academic Appointments

- 06/2021–  
present **Associate Professor.**  
State Key Laboratory of Scientific and Engineering Computing  
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

- Nonlinear and Stochastic Sciences (Major in differential equations and optimization)
- Geophysical and Astrophysical Fluid Dynamics
- Machine Learning

## Publications

- **An Adjoint-Free Algorithms for CNOP via Sampling.**  
**Bin Shi** and Guodong Sun  
Nonlinear Processes in Geophysics, 2023+, Forthcoming,  
arXiv preprint <https://arxiv.org/abs/2208.00956>
- **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 Misiołek, **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.
- **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

## Monograph

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

## Preprints

- **On Learning Rates and Schrödinger Operators.**  
**Bin Shi**, Weijie J. Su and Michael I. Jordan  
arXiv preprint <https://arxiv.org/abs/2004.06977>, under review of Journal of Machine Learning Research
- **On the Hyperparameters in SGD with Momentum.**  
**Bin Shi**  
arXiv preprint <https://arxiv.org/abs/2108.03947>, submitted
- **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 Initial Disturbance of Atmospheric 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

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## 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

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## Professional Experience

Journal Review   **Mathematical Reviews/MathSciNet**  
                          **Mathematical Programming (MP)**  
                          **Journal of Machine Learning Research (JMLR)**  
                          **Mathematics of Computation (MCOM)**  
                          **SIAM Journal on Optimization (SIOPT)**  
                          **Computational Optimization and Applications (CoA)**  
                          **IEEE Access**

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

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## 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

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## Work Experience

2021-Autumn   Convex 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

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## References: Machine Learning and Applied Mathematics

Michael I. Jordan  
Pehong Chen Distinguished Professor  
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## References: Atmospheric Science and Oceanography

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