

# Bin Shi

No.55 Zhongguancun East Road  
Beijing 100190, China  
☎ +86-(010)8254-1583  
☎ +86-(135)2171-2408  
✉ shibin@lsec.cc.ac.cn

## 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 Science & Stochastic Sciences
- Fluid Dynamics (Turbulence, Geophysical and Astrophysical)

## Journal Publications

- **Linear Convergence of ISTA and FISTA**  
Bowen Li, **Bin Shi** and Ya-Xiang Yuan  
To appear in Journal of the Operations Research Society of China, 2024+.
- **On the Hyperparameters in SGD with Momentum**  
**Bin Shi**  
Journal of Machine Learning Research, 25(236):1-40, 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 El Niño-Southern Oscillation 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 Misiólek, **Bin Shi** and Tsuyoshi Yoneda  
Annales Mathématiques du Québec, 46(1):207-225, 2022.

## Conference and Workshop Proceedings

- **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

- **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 and **Bin Shi**

arXiv preprint <https://arxiv.org/abs/2401.07096>, submitted

- **Understanding the PDHG Algorithm via High-Resolution Differential Equations**

Bowen Li and **Bin Shi**

arXiv preprint <https://arxiv.org/abs/2403.11139>, submitted

- **A Lyapunov Analysis of Accelerated PDHG Algorithms**

Bowen Li and **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)**

**Mathematics of Computation (MCOM)**

**Numerische Mathematik (NM)**

**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)**

**Annals of Operations Research (ANOR)**

**IEEE Access**

Conf. Review

**ICML, NeurIPS, ICLR**

---

## References: Machine Learning and Applied Mathematics

Michael I. Jordan  
Pehong Chen Distinguished Professor  
Department of EECS  
Department of Statistics  
University of California  
Berkeley, CA, 94720-1776  
☎ +1(510)642-9575  
✉ jordan@cs.berkeley.edu

Yurii Nesterov  
Professor  
Louvain School of Engineering  
ICTEAM and LIDAM  
Université catholique de Louvain  
Louvain-la-Neuve, Belgium, 1348  
☎ +32-10-47-43-48  
✉ yurii.nesterov@uclouvain.be

Antonin Chambolle  
Professor  
CEREMADE  
Université Paris-Dauphine-PSL  
75775 Paris Cedex 16, France  
☎ +33 (0) 144054601  
✉ antonin.chambolle@ceremade.dauphine.fr

---

## References: Atmospheric Science and Oceanography

Mu Mu  
Professor (Members of CAS)  
Department of AOS  
Fudan University  
Shanghai, China, 200438  
☎ +86(21)3124-8899  
✉ mumu@fudan.edu.cn

Stéphane Vannitsem  
Professor  
Dyna. Meteo. and Climato. Unit  
Royal Meteo. Inst. of Belgium  
BB-1180 Brussels, Belgium  
☎ BE 0349.294.822  
✉ Stephane.Vannitsem@meteo.be