

Yukuan Hu

PH.D. IN COMPUTATIONAL MATHEMATICS

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Education

Academy of Mathematics and Systems Science (AMSS), Chinese Academy of Sciences (CAS)

Beijing, China

Ph.D. in Computational Mathematics

09/2019 - 06/2024

Supervisor: Prof. Xin Liu

School of Mathematical Sciences, Tongji University

Shanghai, China

B.Sc. in Mathematics and Applied Mathematics

09/2015 - 06/2019

Thesis advisor: Prof. Junfeng Yin

Academic Experience

CERMICS, École nationale des ponts et chaussées, Institut Polytechnique de Paris

Champs-sur-Marne, France

Postdoctoral Fellow

09/2024 - Present

Advisor: Prof. Éric Cancès

Department of Applied Mathematics, The Hong Kong Polytechnic University

Hong Kong, China

Research Associate

07/2024 - 08/2024

Host: Prof. Zaikun Zhang

Research Interests

- Numerical optimization
- Computational materials science
- Machine learning

My interests focus on developing numerical optimization methods for scientific and engineering applications. Recently, I have been working on the topics in computational materials science, including strongly correlated electrons systems and structure relaxation with physical constraints, as well as machine learning-based approaches. Motivated by the ubiquitous large-scale applications, I also pay attention to the development and analysis of first-order optimization methods.

Publications & Preprints

1. **Sampling-based approaches for multi-block optimization problems over transport polytopes**
Mathematics of Computation, 2025, 94(353): 1281–1322 ([doi](#), [preprint](#))
Yukuan Hu, Mengyu Li, Xin Liu, Cheng Meng
2. **Complexity of tensor product functions in representing antisymmetry**
arXiv preprint arXiv:2501.05958, 2025 ([preprint](#))
Yuyang Wang, **Yukuan Hu**, Xin Liu
3. **The exactness of the ℓ_1 penalty function for a class of mathematical programs with generalized complementarity constraints**
Fundamental Research, 2024, 4(6): 1459–1464 ([doi](#), [preprint](#))
Yukuan Hu, Xin Liu
4. **Projected gradient descent algorithm for *ab initio* crystal structure relaxation under a fixed unit cell volume**
Physical Review B, 2024, 109(22): 224109 (14 pages) ([doi](#), [preprint](#))
Yukuan Hu, Junlei Yin, Xingyu Gao, Xin Liu, Haifeng Song
5. **The convergence properties of infeasible inexact proximal alternating linearized minimization**
Science China Mathematics, 2023, 66(10): 2385–2410 ([doi](#), [preprint](#))
Yukuan Hu, Xin Liu

6. A global optimization approach for multimarginal optimal transport problems with Coulomb cost
SIAM Journal on Scientific Computing, 2023, 45(3): A1214–A1238 ([doi](#), [preprint](#))
Yukuan Hu, Huajie Chen, Xin Liu
7. Force-based gradient descent method for *ab initio* atomic structure relaxation
Physical Review B, 2022, 106(10): 104101 (10 pages) ([doi](#), [preprint](#))
Yukuan Hu, Xingyu Gao, Yafan Zhao, Xin Liu, Haifeng Song

Patents & Copyrights

1. 晶体结构弛豫软件包 ProME-SuRe
Description: **A suite for crystal structure relaxation**; static-link library files are available upon request
CN Software Copyright, 2023, 2023SR1558824
Xingyu Gao, Xin Liu, **Yukuan Hu**, Haifeng Song, Xin Chen, Yuechao Wang, Lifang Wang
2. 固定晶格体积晶体结构弛豫的计算方法及装置
Description: **Computational methods and apparatus for crystal structure relaxation with a fixed unit cell volume**
CN Patent, 2023, ZL 202211210741.3
Xingyu Gao, Xin Liu, Haifeng Song, **Yukuan Hu**, Xin Chen, Yuechao Wang, Jun Fang, Lifang Wang, Le Zhang
3. 原子结构弛豫的非单调线搜索方法及装置
Description: **Computational methods and apparatus for atomic structure relaxation**
CN Patent, 2022, ZL 202111534901.5
Xingyu Gao, Xin Liu, Haifeng Song, **Yukuan Hu**, Jun Fang, Zhen Yang, Yafan Zhao, Lifang Wang, Haifeng Liu

Selected Presentations

07/2024	The First Forum for Ph.D. Students in Computational Mathematics	<i>Beijing, China</i>
10/2023	The 21st Annual Meeting of China Society for Industrial and Applied Mathematics	<i>Kunming, China</i>
08/2023	The 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023)	<i>Tokyo, Japan</i>
08/2023	The 14th International Conference on Numerical Optimization and Numerical Linear Algebra	<i>Taiyuan, China</i>
06/2023	Applied Math Ph.D. Seminar at Fudan University	<i>Shanghai, China</i>

Selected Honors & Awards

11/2024	CAS President's Special Award (10,000 CNY)	<i>CAS</i>
11/2023	Beijing Mathematical Society (BMS) Excellent Youth Paper (the only Ph.D. candidate selected)	<i>BMS</i>
11/2023	Zhu Li Yuehua Outstanding Doctoral Student Award (5,000 CNY)	<i>University of CAS</i>
09/2023	AMSS President's Special Award (32,000 CNY)	<i>AMSS</i>
04/2023	Financial Support Program	<i>ICIAM 2023</i>
09/2022	Loo-Keng Hua Scholarship (100,000 CNY)	<i>AMSS</i>
09/2021	Loo-Keng Hua Scholarship (100,000 CNY)	<i>AMSS</i>

Skills

Languages	Chinese (mother tongue), English (professional fluency)
Programming	Fortran, C, MATLAB, Shell, Python, \LaTeX
Parallel Computing	MPI, OpenMP

Professional Activities

Referee for Journals

- IEEE Transactions on Signal Processing
- The Innovation