

Xinyu Cheng

Ph.D. in Mathematics | Applied & Computational PDEs

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Education

- Doctor of Philosophy in Mathematics** 2021.11
University of British Columbia
Area: Analysis, dynamics and numerics in PDEs.
PhD Thesis: Analytical and numerical results for phase field, implicit free boundary, and fluid models.
Advisers: Prof. Dong Li & Prof. Brian Wetton.
- Master of Science in Mathematics** 2017.09
University of British Columbia
Area: Analysis, dynamics and numerics in PDEs.
MSc Thesis: On the Stability of a Semi-Implicit Scheme of Cahn-Hilliard Type Equations.
Advisers: Prof. Dong Li & Prof. Brian Wetton.
- Bachelor of Science in Mathematics** 2015.11
The Chinese University of Hong Kong
Areas: Computational & Applied Mathematics; Enrichment Stream in Mathematics.

Working Experience

- Young Principal Investigator** 2023.12–present
Research Institute of Intelligent Complex Systems, Fudan University
- Postdoctoral Fellow** 2021.09–2023.11
School of Mathematical Sciences, Fudan University
Host: Prof. Zhen Lei.
- Full-time Instructor** 2018.09–2019.01
Department of Mathematics, University of British Columbia
Math 110/001: Differential Calculus 2018–2019 Winter Term 1.
- Full-time Teaching Assistant** 2015.09–2021.11
Department of Mathematics, University of British Columbia
Math 300: Complex Analysis; Math 316: Partial Differential Equations, etc.

Grants

Active

- NSFC, Young Scientists Fund (PI) **(30W)** 2025.01–
- NSFC, Original Exploration Program (Co-PI, 130W) **(participate)** 2025.01–
- Shanghai Magnolia Talent Plan – Pujiang Project (PI) **(30W)** 2024.12–
- Natural Science Foundation of Shanghai, General Project (PI) **(20W)** 2024.10–
- Fudan University “AI+” Course Funding (Sub-PI) **(20W)** 2024.09–

Completed

- China Postdoctoral Science Special Fund, In-Station (PI) **(18W)** 2022.10–2023.11
- China Postdoctoral Science Fund, General Project (PI) **(8W)** 2022.10–2023.11
- International Postdoctoral Exchange Fellowship (PI) **(40W)** 2021.09–2023.11
- Shanghai “Super Postdoc” Incentive Plan (PI) **(20W)** 2021.09–2023.11

Honors & Awards

Fudan University

- Quality Course of Education and Teaching Reform 2026
- Outstanding Postdoctoral Researcher 2025

University of British Columbia

- President's Academic Excellence Initiative PhD Award 2020, 2021
- International Doctoral Fellowship 2017–2021
- International Doctoral Fellowship Tuition Award 2017–2021
- International Tuition Award 2015–2017
- Faculty of Science Graduate Award 2015–2017

The Chinese University of Hong Kong

- First Class Graduate Honor 2015
- Morningside College Master's List 2014–2015
- Science Faculty Dean's List 2014–2015
- Morningside College Exchange Scholarship 2013
- Wei Lun Exchange Scholarships 2013
- Weishan Lake Academic Scholarship 2012, 2013

Relevant Skills

- **Software:** L^AT_EX, MATHEMATICA, MS OFFICE, VISUAL STUDIO.
- **Programming:** C++, C, MATLAB.

Publications

Published / Accepted

1. *On the Spectral Gap of a Square Distance Matrix*, joint with D. Li, D. Shirokoff and B. Wetton, *J. Stat. Phys.*, 2017, 166(3-4), 1029–1035.
2. *Asymptotic Behaviour of Time Stepping Methods for Phase Field Models*, joint with D. Li, K. Promislow and B. Wetton, *J. Sci. Comput.*, 2021, 86(3), 1–34.
3. *On a parabolic Sine-Gordon model*, joint with D. Li, C. Quan and W. Yang, *Numer. Math. Theory Methods Appl.*, 2021, 14(4), 1068–1084.
4. *Non-uniqueness of stationary weak solutions to the surface quasi-geostrophic equations*, joint with H. Kwon and D. Li, *Commun. Math. Phys.*, 2021, 388, 1281–1295.
5. *Global wellposedness for 2D quasilinear wave without Lorentz*, joint with D. Li, J. Xu and D. Zha, *Dyn. Partial Differ. Equ.*, 2022, 19(2), 123–140.
6. *On the equivalence of classical Helmholtz equation and fractional Helmholtz equation with arbitrary order*, joint with D. Li and W. Yang, to appear in *Commun. Contemp. Math.*
7. *Equivalent formulations of the oxygen diffusion problem and other implicit free boundary value problems and implications for numerical approximation*, joint with Z. Fu and B. Wetton, *SIAM J. Appl. Math.*, 2023, 83(1), 52–78.
8. *On the global well-posedness and scattering of the 3D Klein-Gordon-Zakharov system*, joint with J. Xu, *Calc. Var. Partial Differential Equations*, 63(17), 2024.
9. *Localization for general Helmholtz*, joint with D. Li and W. Yang, *J. Differential Equations*, 393, 139–154, 2024.
10. *Energy stable semi-implicit schemes for the 2D Allen-Cahn and fractional Cahn-Hilliard equations*, *IMA J. Numer. Anal.*, 46(2), 758–794, 2026.
11. *Second order energy stable semi-implicit schemes for the 2D Allen-Cahn equation*, *BIT Numer. Math.*, 65(26), 2025.
12. *Stability and convergence of an iterative low-regularity method for the Cahn-Hilliard equation*, joint with Z. Luo and S. Wang, to appear in *J. Differential Equations*.

Preprints

1. *Unconditionally stable exponential integrator schemes for the 2D Cahn-Hilliard equation*, submitted.
2. *On a Sinc-type MBE model*, joint with D. Li, C. Quan and W. Yang, submitted. ArXiv:2106.16193.

3. *Uniform boundedness of the highest norm for 2D quasilinear wave*, joint with D. Li and J. Xu, submitted. ArXiv:2104.10019.
4. *Energy stability and convergence of Strang splitting method for Cahn-Hilliard equation*, joint with D. Li, in preparation.
5. *Global well-posedness for 2D quasilinear wave equations with non-compactly supported initial data*, joint with D. Li and J. Xu, preprint.
6. *Global well-posedness of a two dimensional wave-Klein-Gordon system with small non-compactly supported data*, submitted. ArXiv:2312.00821.
7. *On semi-implicit schemes for the incompressible Euler equations via the vanishing viscosity limit*, joint with Z. Luo and S. Wang, submitted. ArXiv:2406.12320.
8. *Global well-posedness and uniform-in-time vanishing damping limit for the inviscid Oldroyd-B model*, joint with Z. Luo, Z. Yang and C. Yuan, ArXiv:2410.09340.
9. *A Besov-based integration-by-parts method for the incompressible Navier-Stokes equations*, joint with Z. Luo and S. Wang, ArXiv:2509.23192.
10. *A sharp low regularity method for the surface quasi-geostrophic equations: a Besov framework*, joint with Z. Luo and S. Wang, submitted.

Academic Service

I have refereed articles for the following journals:

- **Numerical Analysis, Scientific Computing & Applied Mathematics:**
Mathematics of Computation; IMA Journal of Numerical Analysis; Advances in Computational Mathematics; Applied Mathematics Letters.
- **PDE and Analysis:**
Acta Mathematica Scientia; Advances in Differential Equations; Zeitschrift für Angewandte Mathematik und Mechanik; Communications in Analysis and Mechanics; Fractional Calculus and Applied Analysis; Dynamics of Partial Differential Equations.
- **Mathematical Physics:**
Classical and Quantum Gravity; Physica Scripta.

Mentoring

Ph.D. students

- Haoran Wu (since Fall 2024).
- Weiran Xiong (since Fall 2026).

Undergraduate students

- Xuewen Lai (since Fall 2025).

Academic Visits and Events

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|---------|---|
| 2026.07 | Organiser, 11th Shanghai Int. Workshop on Nonlinear Science and Applications
<i>Shanghai Society for Nonlinear Science; Guangxi Normal University</i> |
| 2026.04 | Speaker, 2026 Lanzhou University Forum on Frontiers of Computational Mathematics
<i>Lanzhou University</i>
Title: Parameter-stable low-regularity method in fluid models. |
| 2026.03 | Speaker, SYSU 5th Anniversary Conf. on PDEs, Dynamical Systems and Computational Mathematics
<i>School of Science, Sun Yat-sen University</i>
Title: Parameter-stable low-regularity method in fluid models. |
| 2025.11 | Speaker, 2025 HKU Workshop on PDEs and Analysis
<i>University of Hong Kong</i>
Title: Parameter-stable low-regularity method in fluid models. |
| 2025.10 | Speaker, 23rd Annual Conference of CSIAM 2025
<i>CSIAM; Xiangtan University; Central South University</i>
Title: Parameter-stable low-regularity method in fluid models. |

- 2025.07 **Speaker, 30th Int. Conf. on Difference Equations and Applications (ICDEA 2025)**
Int. Soc. Difference Equations; Guangzhou University
Title: Analytic and numerical results of PDE models in material sciences and biology.
- 2025.07 **Co-organiser, 2nd Future-oriented Complex Systems Science (FOCSS) Workshop**
IICS, Fudan University
- 2025.06 **Participant, Advances in Mathematical Fluid Dynamics**
Peking University
- 2025.06 **Speaker, Workshop on Differential Equations and Dynamical Systems**
SUSTech
Title: Parameter stability in fluid and related models.
- 2025.05 **Speaker, Workshop on Theory, Scientific Computing and Optimization of PDEs**
Chongqing Normal University
Title: Parameter stability in fluid and related models.
- 2024.12 **Co-organiser, 1st Workshop on Differential Equations and Nonlinear Analysis**
Fudan University
- 2024.06 **Speaker, 4th Int. Symposium on Modelling, Analysis and Applications in Biomathematics**
Harbin Engineering University
Title: Analytical and numerical results of PDE models from material sciences and biology.
- 2024.06 **Speaker, Workshop on Nonlinear Analysis**
Wuhan University of Technology
Title: Analytical and numerical results of PDE models from material sciences and biology.
- 2024.01 **Participant, Sanya Bo International Frontier Forum**
Tsinghua Sanya International Mathematics Forum
- 2023.11 **Co-organiser and Speaker, 1st FOCCS Workshop**
IICS, Fudan University
- 2023.11 **Speaker, Seminar Talk**
Institute of Mathematical Sciences, ShanghaiTech University
Title: Analytical and numerical results of some phase field and free boundary models.
- 2023.07–2023.08 **Academic Visitor**
South China University of Technology
- 2022.12 **Speaker, Online Workshop on Analysis and Computation of PDEs**
SUSTech & Beijing Normal University (Zhuhai)
Title: Trigonometric type models in the recent study of phase field problems.
- 2021.02–2021.04 **Academic Visitor**
SUSTech International Center for Applied Mathematics
- 2019.08 **Speaker, Workshop on Analysis and PDE**
Tianjin Center for Applied Mathematics (TCAM)
Title: Fully implicit time stepping for Allen-Cahn dynamics.
- 2019.06–2019.08 **Academic Visitor**
Tianjin University
Invited by Prof. Yifei Wu.
- 2019.05 **Speaker, SIAM Conf. on Applications of Dynamical Systems (Minisymposium)**
SIAM, Snowbird, UT, USA
Title: Fully implicit time stepping for Allen-Cahn dynamics.
- 2018.04 **Academic Visitor**
Michigan State University
Invited by Prof. Keith Promislow.
- 2016.08 **Participant, PIMS Graduate Mathematical Modelling in Industry Workshop**
Pacific Institute for the Mathematical Sciences, Vancouver, BC, Canada