Junyan Zhang

CONTACT INFORMATION

Email: zhangjy9610@gmail.com, zhangjy@nus.edu.sg
Address: 10 Lower Kent Ridge Road, Block S17 #05-04,
National University of Singapore, Singapore 119076.
Personal webpage: https://www.zhangjy9610.me

EMPLOYMENT

National University of Singapore (NUS)

Peng Tsu Ann Assistant Professor (Postdoc), August 1, 2022 $\sim$ July 31, 2025.

- Mentor: Professor Yao Yao.

EDUCATION

Johns Hopkins University (JHU)

Ph.D. in Mathematics, August 27, 2017$\sim$May 22, 2022.

- Dissertation: The Free-Boundary Problems in Inviscid Magnetohydrodynamics with or without Surface Tension.
- Advisor: Professor Hans Lindblad.

University of Science and Technology of China (USTC)

B.Sc. in Mathematics, August 14, 2013$\sim$June 21, 2017.

- Thesis: Inviscid dampimg and Asymptotic Stability of PDEs in fluids.
- Advisor: Professor Lifeng Zhao.

RESEARCH INTERESTS

I study fluid PDEs, especially the free-boundary problems of inviscid fluids, such as water waves with vorticity, MHD, elastodynamics, relativistic fluids, liquid crystals, etc.

- Nonlinear stability of compressible vortex sheets and contact discontinuities in various kinds of fluids with or without surface tension.
- Singular limits of various types of compressible flows, including the low Mach number limit for "ill-prepared data"(especially the free-boundary problems), multi-parameter singular limits (e.g., low Mach number and small Alfven number limits for MHD).
- Singularity or long-time evolution of free-surface inviscid fluids.

PUBLICATIONS & PREPRINTS

15. Qiangchang Ju, Jiawei Wang, Junyan Zhang. *Uniform Anisotropic Regularity and Low Mach Number Limit of Non-isentropic Ideal MHD Equations with a Perfectly Conducting Boundary.* arxiv:2412.09943, preprint.
14. Jiawei Wang, Junyan Zhang. *Low Mach Number Limit of Non-isentropic Inviscid Elastodynamics with General Initial Data.* arxiv:2412.09941, preprint.
13. Junyan Zhang. *On the Incompressible Limit of Current-Vortex Sheets with or without Surface Tension.* arxiv:2405.00421, preprint.
12. Junyan Zhang. *Well-posedness and Incompressible Limit of Current-Vortex Sheets with Surface Tension in Ideal Compressible MHD.* arxiv:2312.11254v3, preprint.
11. Jiawei Wang, Junyan Zhang. *Incompressible Limit of Compressible Ideal MHD Flows inside a Perfectly Conducting Wall.* arxiv:2308.01142, preprint.
10. Chenyun Luo, Junyan Zhang. *Compressible Gravity-Capillary Water Waves with Vorticity: Local Well-posedness, Incompressible and Zero-Surface-Tension Limits.* arxiv:2211.03600, preprint.
9. Xumin Gu, Chenyun Luo, Junyan Zhang. *Zero Surface Tension Limit of the Free-Boundary Problem in Incompressible Magnetodynamics.* **Nonlinearity**, 35(12), 6349-6398 (2022).

8. Hans Lindblad, Junyan Zhang. *Anisotropic Regularity of the Free-Boundary Problem in Compressible Ideal Magnetohydrodynamics.* **Arch. Rational Mech. Anal.**, 247(5), no. 89: 1-94 (2023).
7. Xumin Gu, Chenyun Luo, Junyan Zhang. *Local Well-posedness of the Free-Boundary Incompressible Magnetohydrodynamics with Surface Tension.* **J. Math. Pures Appl.**, Vol. 182, 31-115, (2024).
6. Junyan Zhang. *Local Well-posedness and Incompressible Limit of the Free-Boundary Problem in Compressible Elastodynamics.* **Arch. Rational Mech. Anal.**, 244(3), 599-697 (2022).
5. Junyan Zhang. *Local Well-posedness of the Free-Boundary Problem in Compressible Resistive Magnetohydrodynamics.* **Calc. Var. Partial Differ. Equ.**, 62(4), no.124: 1-60 (2023).
4. Chenyun Luo, Junyan Zhang. *Local Well-posedness for the Motion of a Compressible Gravity Water Wave with Vorticity.* **J. Differ. Eq.**, Vol. 332, 333-403 (2022).
3. Junyan Zhang. *A priori Estimates for the Free-Boundary Problem of Compressible Resistive MHD Equations and Incompressible Limit.* arxiv: 1911.04928 preprint.
2. Chenyun Luo, Junyan Zhang. *A priori Estimates for the Incompressible Free-Boundary Magnetohydrodynamics Equations with Surface Tension.* **SIAM J. Math. Anal.**, 53(2), 2595-2630 (2021).
1. Chenyun Luo, Junyan Zhang. *A Regularity Result for the Incompressible Magnetohydrodynamics Equations with Free Surface Boundary.* **Nonlinearity**, 33(4), 1499-1527 (2020).

Referee Services

So far I have been a reviewer for the following journals.

- Arch. Rational Mech. Anal.(2), SIAM J. Math. Anal.(1), Nonlinearity(2), J. Differ. Equ.(1), J. Math. Phys(1).

Invited Talks and Mini-Courses

- *Incompressible limit of non-isentropic ideal MHD with a perfectly conducting boundary*:
  Institute of Applied Mathematics, AMSS, Chinese Academy of Sciences, July 15 2024, Dec 02 2024;
  1st Asian-Pacific International Conference on Dispersive Equations (APICDE), Jimei University, Oct 30 2024;
  School of Mathematical Sciences, Peking University, Dec 02 2024;
  Workshop on "Old and New Challenges in Fluid Equations", National University of Singapore, Dec 19 2024.
- *Well-posedness and incompressible limit of current-vortex sheets in ideal compressible MHD*:
  National University of Singapore, Nov 1 2023;
  University of Science and Technology of China, Dec 5 2023;
  Institute of Applied Physics and Computational Mathematics (Beijing), Dec 19 2023;
  Morningside Center of Mathematics, Chinese Academy of Sciences, Dec 20 2023;
  Institute of Mathematical Sciences, The Chinese University of Hong Kong, May 22 2024;
  The 19-th international conference of "Hyperbolic problems: theory, numerics and applications", Shanghai Jiao Tong University, July 2 2024.
- *The Free-boundary Problems in Inviscid Compressible Fluids (Mini-Course)*:
  University of Science and Technology of China, June 28–29 2023;
  Nanchang University, June 4–6 2024.
- *On the motion of compressible gravity-capillary water waves with vorticity*:
  PDE & Scientific computing seminar, National University of Singapore, Aug 26 2022;
  Institute of Mathematical Sciences, The Chinese University of Hong Kong, May 19 2023;
  Institute of Applied Physics and Computational Mathematics (Beijing), Apr 12 2024.
- *Local well-posedness of incompressible ideal MHD with surface tension*. PDE seminar organised by Looi Shi-Zhuo, March 23 2022.

- *Anisotropic regularity of free-boundary compressible ideal MHD*:
  Institute of Mathematical Sciences, The Chinese University of Hong Kong, Oct 14 2021;
  Analysis & PDE Seminar, UC Berkeley, Oct 25 2021;
  PDE Seminar, Vanderbilt University, Nov 5 2021;
  Analysis of Fluids Seminar, Princeton University, Feb 17 2021.
- *Local well-posedness and incompressible limit of free-boundary compressible elastodynamics*, Webinar on APDE, June 5 2021.
- *Local well-posedness and incompressible limit of the free-boundary compressible resistive MHD equations*, Wuhan University, Jan 10 2021.
- *Local well-posedness for the motion of compressible gravity water wave*, University of Science and Technology of China, Nov 6 2020.
- *On the free-boundary problem of MHD equations with or without surface tension*, University of Science and Technology of China, Dec 23 2019.
- *On the Incompressible MHD with or without Surface Tension*, Institute of Mathematics, Chinese Academy of Sciences, May 23 2019.

ACADEMIC VISITING

- The Chinese University of Hong Kong. May 10 2023-June 10 2023, May 13 2024-May 25 2024.

CONFERENCES & WORKSHOPS ATTENDED

- *Workshop on "Old and New Challenges in Fluid Equations"*, Singularities in fluids and general relativity, National University of Singapore, Dec 16-20 2024.
- *The 1st Asian-Pacific International Conference on Dispersive Equations (APICDE)*, Jimei University, Oct 27-Nov 1 2024.
- *The 19-th international conference of "Hyperbolic problems: theory, numerics and applications"*, Shanghai Jiao Tong University, July 1-July 5 2024.
- *Mathematics of Fluid Dynamics program*, UC Berkeley MSRI, Jan-May 2021 (online due to the COVID-19 pandemic).
- *Long Time Behavior and Singularity Formation in PDEs*, New York University Abu Dhabi, May 2020 and Dec 2020 (online due to the COVID-19 pandemic).
- *2019 Southern California Analysis and PDE Conference*, UCSD, November 2019.
- *Summer School on Mathematical General Relativity and the Geometric Analysis of Waves of Fluids*, MIT, June 2018.

TEACHING

National University of Singapore (Instructor)

2025 Spring	Advanced Partial Differential Equations (Graduate)
2024 Spring	Partial Differential Equations
2023 Spring	Partial Differential Equations

Johns Hopkins University (TA/Grader)

2022 Spring	Honor Analysis II, ODE
2021 Fall	Introduction to Proofs, Graduate Real Analysis
2020 Fall	Honor Analysis I, ODE
2020 Spring	Honor Analysis II, Undergrad PDE
2019 Fall	Honor Analysis I, Graduate Real Analysis
2019 Spring	Honor Analysis II, Calculus II (Engineering)
2018 Fall	Calculus II (Engineering)
2018 Spring	Undergrad PDE
2017 Fall	Undergrad Complex Analysis, Calculus I (Engineering)

University of Science and Technology of China (TA)

2017 Spring	Differential Equations II (Graduate)
2016 Fall	Advanced Real Analysis (Graduate)
2016 Spring	Honor Real Analysis

REFERENCES

- **Zhouping Xin** (leading expert), Executive Director & William M. W. Mong Professor of Mathematics, The Chinese University of Hong Kong.
  Email: zpxin@ims.cuhk.edu.hk
- **Yao Yao** (postdoc mentor), Associate Professor of Department of Mathematics, National University of Singapore.
  Email: yaoyao@nus.edu.sg
- **Hans Lindblad** (Ph.D. advisor), Professor of Department of Mathematics, Johns Hopkins University.
  Email: lindblad@math.jhu.edu
- **Chenyun Luo** (collaborator), Assistant Professor of Department of Mathematics, The Chinese University of Hong Kong.
  Email: cluo@math.cuhk.edu.hk