LU ZHANG

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Department of Applied Physics and Applied Mathematics
Columbia University, 500 W. 120th Street Num. 200, New York, NY 10027

EMPLOYMENT

Columbia University, New York, NY, USA Jul. 2020 - now
Assistant Professor of Applied Mathematics (non-tenure track)

EDUCATION

Southern Methodist University, Dallas, TX, USA Aug. 2017 - May 2020
Ph.D. in Computational and Applied Mathematics
Advisor: Prof. Thomas Hagstrom
Department of Mathematics

Southern Methodist University, Dallas, TX, USA Aug. 2015 - May 2017
M.S. in Computational and Applied Mathematics
Advisor: Prof. Thomas Hagstrom
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RESEARCH INTERESTS

- **Numerical Analysis**: finite element methods, discontinuous Galerkin methods, summation-by-parts finite difference methods
- **Data-Driven Computational Inversion**: inverse problems, imaging, fast algorithms, deep learning
- **Computational Optimization**: optimization under uncertainty, robust optimization
- **Mathematical Biology**: chemotaxis, population dynamics, pattern formation

GRANTS

- **AMS-Simons Travel Grant** ($5,000) Jul. 2022 - Jun. 2024
- **NSF Computational Mathematics** to be submitted in 2022

PUBLICATIONS

- **Journal Papers:**

16. *A high order finite difference method for the elastic wave equation in bounded domains with nonconforming interfaces*, **L. Zhang**, S. Wang. **SIAM J. Numer. Anal.**, 60(3), 1516-1547 (2022)
15. *Energy-based discontinuous Galerkin difference methods for second-order wave equations*, **L. Zhang**, D. Appelö and T. Hagstrom. **Comm. Appl. Math. Comput.**, 4, 855-879 (2022)
14. *Understanding the effects of on- and off-hotspot policing: Evidence of hotspot, oscillating and chaotic activities*, N. Rodriguez, Q. Wang, and **L. Zhang**. **SIAM J. Appl. Dyn. Syst.**, 20(4), 1882-1916 (2021)
13. *Elastic wave propagation in curvilinear coordinates with mesh refinement interfaces by a fourth order finite difference method*, **L. Zhang**, S. Wang and N.A. Petersson. **SIAM J. Sci. Comput.**, 43(2), A1472-A1496 (2021)
12. *An energy-based discontinuous Galerkin method for semilinear wave equations*, D. Appelö, T. Hagstrom, Q. Wang and **L. Zhang**. **J. Comput. Phys.**, 418, 109608 (2020)
11. *Phase transitions and bump solutions of the Keller–Segel model with volume exclusion*, J. A. Carrillo, X. Chen, Q. Wang, Z. Wang and **L. Zhang**. **SIAM J. Appl. Math.**, 80(1), 232-261(2020)

10. *An energy-based discontinuous Galerkin method for the wave equation with advection*, **L. Zhang**, T. Hagstrom and D. Appelö. **SIAM J. Numer. Anal.**, 57(5), 2469-2492(2019)
9. *Convergence analysis of a discontinuous Galerkin method for wave equations in second-order form*, Y. Du, **L. Zhang** and Z. Zhang. **SIAM J. Numer. Anal.**, 57(1), 238-265(2019)
8. *Time-periodic and stable patterns of two-competing Keller–Segel chemotaxis model: Effect of cellular growth*, Q. Wang, J. Yang, and **L. Zhang**. **Discrete Contin. Dyn. Syst. Ser. B**, 22(9), 3547-3574(2017)
7. *On the multi-dimensional advective Lotka–Volterra competition systems*, Q. Wang, and **L. Zhang**. **Nonlinear Anal. Real World Appl.**, 37, 329-349(2017)
6. *Global existence and steady states of a two competing species Keller–Segel chemotaxis model*, Q. Wang, **L. Zhang**, J. Yang and J. Hu **Kinet. Relat. Models**, 8(4), 777-807(2015)

- **Conference Proceedings:**

5. *Discontinuous Galerkin Methods for Electromagnetic Waves in Dispersive Media,* T. Hagstrom, D. Appelö, and **L. Zhang. 2021 International Applied Computational Electromagnetics Society Symposium**, 1-4 (2021)

- **Preprints:**

4. *Coupling deep learning with full waveform inversion*, W. Ding, K. Ren, **L. Zhang**, submitted, **arxiv: 2203.01799**
3. *A discontinuous Galerkin method for nonlienar biharmonic Schrödinger equations*, **L. Zhang**. submitted, **arxiv: 2109.07034**
2. *A local energy-based discontinuous Galerkin for fourth order semilinear wave equations*, **L. Zhang**. submitted, **arxiv: 2109.07033**
1. *An energy based discontinuous Galerkin method with tame CFL numbers for the wave equation*, D. Appelö, **L. Zhang**, T. Hagstrom and F. Li. submitted, **arxiv: 2110.07099**

PRESENTATIONS

- **Invited and Contributed:**

- University of Maryland College Park (Seminar)	Nov. 2022
- 5th Annual Meeting of the SIAM Texas-Louisiana Section, University of Houston	Nov. 2022
- Workshop on New Ideas in Computational Inverse Problems, Banff International Research Station, Banff, Alberta, Canada	Oct. 2022
- Dartmouth College (Seminar)	Oct. 2022
- Karlsruhe Institute of Technology, Germany (Seminar)	Oct. 2022
- 7th Annual Meeting of the SIAM Central States Section, Oklahoma State University	Oct. 2022
- Sayas Numerical Day 2022, University of Maryland, Baltimore County	Sep. 2022
- North American High Order Methods Conference, San Diego State University	Jul. 2022
- 4th Annual Meeting of the SIAM Texas-Louisiana Section, University of Texas Rio Grande Valley, TX	Nov. 2021
- SIAM Conference on Computational Science and Engineering, Virtual	Mar. 2021
- 3nd Annual Meeting of SIAM Texas-Louisiana Section, Virtual	Oct. 2020
- Columbia University in the City of New York (Seminar)	Jan. 2020
- 2nd Annual Meeting of SIAM Texas-Louisiana Section, Southern Methodist University, Dallas, TX	Nov. 2019
- 1st North American High-Order Methods Conference, San Diego State University	Jun., 2019
- Finite Element Rodeo, University of Texas at Austin	Mar. 2019
- Research Day, Southern Methodist University	Mar., 2019
- SIAM TX-LA Sectional Meeting and LSU-UH-TAMU Undergraduate Conference, Louisiana State University	Oct., 2018
- Argonne National Laboratory	Aug. 2018

- 13th World Congress on Computational Mechanics, New York — Jul. 2018
- Research Day, Southern Methodist University — Mar. 2018
- Texas Applied Mathematics and Engineering Symposium, University of Texas at Austin, Austin, TX — Sep. 2017
- Finite Element Rodeo, University of Houston — Mar. 2017

EXPERIENCE

- **Student Research Assistant:**
  - Development of high-order methods for wave propagation, Department of Mathematics, **Southern Methodist University (SMU)**, *Advisor:* Thomas Hagstrom — Aug. 2015 - May. 2020
- **Student Intern:**
  - Developing high-order accurate scheme for seismic problem, Computation Scholar Program in **Lawrence Livermore National Laboratory**, *Mentor:* Anders Petersson — summer 2019
  - Implement Multirate Solver to PETSc Library, Mathematics and Computer Science in **Argonne National Laboratory**, *Mentor:* Hong Zhang — summer 2018

TEACHING

- **Columbia University - Instructor**
  - Introduction to Numerical Methods (APMA E4300) — Spring 2023
  - Numerical Analysis for PDEs (APMA E6302) — Spring 2022
  - Numerical Analysis and Optimization (APMA E4990) — Spring 2021, Fall 2021, Fall 2022
  - Principles of Applied Mathematics (APMA E4001) — Fall 2020
- **Southern Methodist University - Teaching Assistant**
  - Introduction to Scientific Computing (Math 3315) — Spring 2019
  - Boundary Value Problems and Partial Differential Equations (Math 4337) — Spring 2019
  - Introduction to Mathematical Sciences (Math 1307) — Fall 2016, Spring 2017
  - Introduction to Linear Algebra (Math 3353) — Spring 2016
  - Introduction to Calculus for Business and Social Science (Math 1309) — Fall 2016

SUPERVISING

- **Ph.D. students** (Columbia University)
  - Wen Ding. Computational inversion with Wasserstein distances and neural network induced loss functions (with K. Ren) — graduated in Aug. 2022
  - Yin Zhou. An energy-based discontinuous Galerkin method for nonlinear Schrödinger equations with wave operator (with K. Ren) — expected graduate in May. 2025
- **M.S. students** (Columbia University)
  - Steve Li. An energy-based discontinuous Galerkin method for wave equations with random coefficient — expected graduate in May. 2023
  - Kaisun Lin. An energy-based discontinuous Galerkin method for wave equations with random coefficient — expected graduate in May. 2023
- **Undergraduates** (Columbia University)
  - Joonsoo Lee. Finite element analysis — expected graduate in May. 2024

SCHOLARSHIPS AND AWARDS

- **Dean's Dissertation Fellowship**, SMU — Sep. 2019 - May. 2020
- **Travel Award**, North American High Order Methods Conference — Jun. 2019
- **Graduate Student Travel Grant Award**, Dedman College, SMU — Mar. 2019
- **Betty McKnight Speairs Math Award**, Department of Mathematics, SMU — May. 2019
- **Betty McKnight Speairs Math Award**, Department of Mathematics, SMU — May. 2017
- **National Scholarship**, Ministry of Education of the People's Republic of China — Nov. 2013

PROFESSIONAL SERVICE

- **Referee:** SIAM J Sci. Comput., Mathematical Reviews
- **Mini-symposium:**
  - Numerical Methods for Time Dependent PDEs, SIAM Conference on Computational Science and Engineering (with D. Appelö, and T. Hagstrom) — Mar. 2021
  - (In preparation) Inverse Problems and Reduced Order Modeling for Wave Propagation Problems, 17th U.S. National Congress on Computational Mechanics (with D. Appelö, and T. Hagstrom) Jul. 2023
- **Workshop:**
  - (In preparation) Recent Advances and Developments in Computational Mathematics, Columbia University (with Q. Du, and K. Ren) — Jan. 2023
- **Departmental Service at Columbia University**
  - Seminar organizer of the APAM Friday Research Conference — fall 2020, fall 2021, fall 2022
  - Secretary of the Faculty — spring 2021, fall 2021, fall, 2022
- **Ph.D. Thesis Committee**
  - Wen Ding (Advisor: Kui Ren, Columbia University) — Aug. 2022