Ziyao Xu

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Room B17, Hayes-Healy Hall
Department of Applied and Computational
Mathematics and Statistics (ACMS)
University of Notre Dame

Education

- **Brown University** — Providence, RI, USA
  Ph.D. in Applied Mathematics. Advisor: Chi-Wang Shu. — *Sep. 2019 – May. 2023*
- **Michigan Technological University** — Houghton, MI, USA
  M.S. in Mathematical Sciences. Advisor: Yang Yang. — *Jan. 2017 – May. 2019*
- **China University of Petroleum** — Qingdao, Shandong, China
  B.E. in Petroleum Engineering. — *Sep. 2012 – Jun. 2016*

Professional Experience

- **Binghamton University** — Vestal, NY, USA
  Assistant Professor — *Aug. 18, 2025 – Present*
- **University of Notre Dame** — Notre Dame, IN, USA
  Postdoctoral Research Associate — *Jul. 1, 2023 – Aug. 15, 2025*

Research Interests

- Finite Element Methods
- Finite Difference Methods
- Computational Fluid Dynamics
- Flow and Transport in Porous Media

Preprints

1. Ziyao Xu, Guanyang Liu and Yong-Tao Zhang, *A Conservative and Positivity-Preserving Discontinuous Galerkin Method for the Population Balance Equation*, preprint.
2. Ziyao Xu and Yong-Tao Zhang, *Exponential Time Differencing Runge-Kutta Discontinuous Galerkin (ETD-RKDG) Methods for Nonlinear Degenerate Parabolic Equations*, preprint.
3. Ziyao Xu, Zheng Sun and Yong-Tao Zhang, *Stability and Time-Step Constraints of Exponential Time Differencing Runge–Kutta Discontinuous Galerkin Methods for Advection-Diffusion Equations*, submitted to Journal of Scientific Computing.
4. Yong Liu and Ziyao Xu, *An interior penalty discontinuous Galerkin method for an interface model of flow in fractured porous media*, preprint.

Publications

1. Xinyu Wu, Hui Guo, Ziyao Xu, Lulu Tian and Yang Yang, *A reinterpreted discrete fracture model for wormhole propagation in fractured porous media*, Journal of Computational Physics, accepted.
2. Ziyao Xu and Yong-Tao Zhang, *High-order exponential time differencing multi-resolution alternative finite difference WENO methods for nonlinear degenerate parabolic equations*, Journal of Computational Physics, v529 (2025), 113838.
3. Ziyao Xu and Chi-Wang Shu, *A well-balanced conservative high-order alternative finite difference WENO (A-WENO) method for the shallow water equations*, Advances in Water Resources, v196 (2025), 104898.

4. Ziyao Xu and Dennis Glaser, *An extension of the box method discrete fracture model (Box-DFM) to include low-permeable barriers with minimal additional degrees of freedom*, Advances in Water Resources, v195 (2025), 104869.

5. Ziyao Xu and Chi-Wang Shu, *A high-order well-balanced discontinuous Galerkin method for hyperbolic balance laws based on the Gauss-Lobatto quadrature rules*, Journal of Scientific Computing, v101 (2024), 39.

6. Ziyao Xu and Chi-Wang Shu, *Local characteristic decomposition-free high order finite difference WENO schemes for hyperbolic systems endowed with a coordinate system of Riemann invariants*, SIAM Journal on Scientific Computing, v46 (2024), pp.A1352-A1372.

7. Xinyu Wu, Hui Guo, Ziyao Xu and Yang Yang, *A reinterpreted discrete fracture model for Darcy-Forchheimer flow in fractured porous media*, Advances in Water Resources, v179 (2023), 104504.

8. Ziyao Xu and Chi-Wang Shu, *On the conservation property of positivity-preserving discontinuous Galerkin methods for stationary hyperbolic equations*, Journal of Computational Physics, v490 (2023), 112304.

9. Ziyao Xu, Zhaoqin Huang and Yang Yang, *The hybrid-dimensional Darcy's law: A non-conforming reinterpreted discrete fracture model (RDFM) for single-phase flow in fractured media*, Journal of Computational Physics, v473 (2022), 111749.

10. Ziyao Xu and Chi-Wang Shu, *Third order maximum-principle-satisfying and positivity-preserving Lax-Wendroff discontinuous Galerkin methods for hyperbolic conservation laws*, Journal of Computational Physics, v470 (2022), 111591.

11. Ziyao Xu and Chi-Wang Shu, *High order conservative positivity-preserving discontinuous Galerkin method for stationary hyperbolic equations*, Journal of Computational Physics, v466 (2022), 111410.

12. Hui Guo, Wenjing Feng, Ziyao Xu and Yang Yang, *Conservative numerical methods for the reinterpreted discrete fracture model on non-conforming meshes and their applications in contaminant transportation in fractured porous media*, Advances in Water Resources, v153 (2021), 103951.

13. Ziyao Xu and Yang Yang, *The hybrid dimensional representation of permeability tensor: A reinterpretation of the discrete fracture model and its extension on nonconforming meshes*, Journal of Computational Physics, v415 (2020), 109523.

14. Ziyao Xu, Yang Yang and Hui Guo, *High-order bound-preserving discontinuous Galerkin methods for wormhole propagation on triangular meshes*, Journal of Computational Physics, v390 (2019), pp.323-341.

15. Nattaporn Chuenjarern, Ziyao Xu and Yang Yang, *High-order bound-preserving discontinuous Galerkin methods for compressible miscible displacements in porous media on triangular meshes*, Journal of Computational Physics, v378 (2019), pp.110-128.

16. Hui Guo, Lulu Tian, Ziyao Xu, Yang Yang and Ning Qi, *High-order local discontinuous Galerkin method for simulating wormhole propagation*, Journal of Computational and Applied Mathematics, v350 (2019), pp.247-261.

Conference Proceedings

1. Ziyao Xu and Yang Yang, *The hybrid-dimensional Darcy's law: A non-conforming reinterpreted discrete fracture model (RDFM) for the compressible miscible displacement and multicomponent gas flow in fractured media*, SPE Reservoir Simulation Conference, (2023), SPE-212164-MS.

Presentations(Selected)

- SIAM Southeastern Atlantic Section (SEAS), The University of Tennessee, Knoxville, Mar 21-23, 2025. Presentation: Stability and Time-Step Constraints of Exponential Time Differencing Runge-Kutta Discontinuous Galerkin Methods for Advection-Diffusion Equations.

- The third North American High Order Methods Conference (NAHOMCon), Dartmouth College, Hanover, New Hampshire, June 17-19, 2024.
  Presentation: An Interior Penalty Discontinuous Galerkin (IPDG) Method for an Interface Model of Flow in Fractured Porous Media.
- The 8th Annual Meeting of SIAM Central States Section, Lincoln, Nebraska, October 7-8, 2023.
  Presentation: A high-order well-balanced discontinuous Galerkin method for hyperbolic balance laws with non-hydrostatic equilibria.
- SPE Reservoir Simulation Conference, Galveston, Texas, March 28-30, 2023.
  Poster: The Hybrid-Dimensional Darcy's Law: A Non-Conforming Reinterpreted Discrete Fracture Model (RDFM) for the Compressible Miscible Displacement and Multicomponent Gas Flow in Fractured Media.
- CSCDR Seminar, Umass Dartmouth, North Dartmouth, MA, October 19, 2022.
  Presentation: On the Conservation and Lax-Wendroff Theorem of Positivity-preserving Discontinuous Galerkin Methods for Stationary Hyperbolic Equations.
- 2022 SIAM Annual Meeting, July 11-15, 2022. Co-organizer of MS8, MS23, MS49: Recent Advances in Computational Geosciences.
  Presentation: A Reinterpreted Discrete Fracture Model for Fracture and Barrier Networks on Non-Conforming Meshes.
- Copper Country Workshop on Applied Mathematics, Statistics, and Data Sciences, Michigan Technologycal University, Houghton, MI, July 5-7, 2022.
  Presentation: High Order Conservative Positivity-Preserving Discontinuous Galerkin Method for Stationary Hyperbolic Equations.
- 2021 SIAM Annual Meeting, July 19-24, 2021. Organizer of MS9: Models and Numerical Methods in Computational Geosciences.
  Presentation: The Hybrid-Dimensional Darcy's Law: A Novel Discrete Fracture Model for Fracture and Barrier Networks on Non-Conforming Meshes.
- 2021 SIAM Conference on Mathematical & Computational Issues in the Geosciences, June 21-24, 2021.
  Presentation: The Hybrid-Dimensional Representation of Permeability Tensor: A Reinterpretation of the Discrete Fracture Model and its Extension on Nonconforming Meshes.
- 2019 SIAM Conference on Computational Science and Engineering, Spokane Convention Center, Spokane, WA, February 25 - March 1, 2019. Organizer of MS329: Recent Advances in Discontinuous Galerkin Methods for Partial Differential Equations.
  Presentation: High-Order Bound-Preserving Discontinuous Galerkin Method for Wormhole Propagation Model.

Teaching Experience

- ACMS 30530 Introduction to Probability, Lecturer, University of Notre Dame, Spring 2025
- ACMS 40630/60630 Nonlinear Dynamical Systems, Lecturer, University of Notre Dame, Fall 2023, Fall 2024
- ACMS 20620 Applied Linear Algebra, Lecturer, University of Notre Dame, Spring 2024
- APMA 0350 Applied Ordinary Differential Equations, TA, Brown University, Spring 2021
- APMA 1170 Introduction to Computational Linear Algebra, TA, Brown University, Fall 2020
- MA 2160 Calculus 2, Lecturer, Michigan Technological University, Spring 2018, Spring 2019
- MA 1135 Calculus for Life Sciences, Lecturer, Michigan Technological University, Fall 2018

Honors & awards

- David Gottlieb Memorial Award, Division of Applied Mathematics, Brown University, 2023.
- Outstanding Research Award, Department of Mathematical Sciences, Michigan Technological University, 2019
- The First Prize Scholarship, China University of Petroleum, 2015
- National Scholarship, China, 2013, 2014

Skills

- Programming: Matlab, Julia, Python, C, LaTeX
- Languages: Mandarin (native), English (proficient)